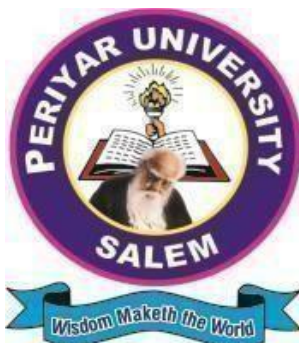


PERIYAR UNIVERSITY

SALEM – 636 011



B.Sc., CLINICAL LABORATORY TECHNOLOGY

SYLLABUS

**(For Candidates admitted in the Colleges affiliated to Periyar University
from 2023-24 onwards)**

**TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK
GUIDELINES BASED REGULATIONS FOR UNDERGRADUATE PROGRAMME**

Duration:	3 Years (UG)
Programme Outcomes:	PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. PO4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from

quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.

PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

**Programme
Specific
Outcomes:**

PSO1 – Placement:

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur:

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations

PSO3 – Research and Development:

Design and implement HR systems and practices grounded in research that complies with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World:

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society:

To contribute to the development of the society by collaborating with stakeholders for mutual benefit

PROGRAM OUTCOME FOR B. Sc., CLINICAL LABORATORY TECHNOLOGY COURSE

Programme:	B.Sc., Clinical Laboratory Technology
Programme Code:	B.Sc., CLT

PO1	Acquire knowledge in Clinical Laboratory and apply the knowledge in their day today life for betterment of self and society
PO2	Develop critical ,analytical thinking and problem solving skills
PO3	Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret and draw conclusion from data
PO4	Address and develop solutions for societal and environmental needs of local, regional and national development
PO5	Work independently and engage in lifelong learning and enduring proficient progress
PO6	Provoke employability and entrepreneurship among students along with ethics and communication skills

PROGRAM SPECIFIC OUTCOMES

PSO1	Comprehend the knowledge in the Clinical, biochemical, analytical, biostatistical and computational areas
PSO2	Ability to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by human kind
PSO3	Acquiring analytical and hands on skills to perform research in multidisciplinary environments
PSO4	Use library search tools and online databases and sources to locate and retrieve scientific information about a topic and techniques related to Clinical Laboratory Technology

2. Eligibility for admission

Candidate for admission to the first year of B.Sc., Degree Course in Clinical Laboratory Technology shall be required to have passed the Higher Secondary Examination with Chemistry and Biology or Chemistry, Botany and Zoology or Biochemistry and Chemistry.

3. Highlights of the Revamped Curriculum

- a. The curriculum is created to improve the relationship between Medical and academia
- b. Every semester, practical based on the course taken that semester will aid students in applying what they have learned
- c. Students will benefit from the introduction of skill based elective courses including, Bioinformatics, Biotechnology, Therapeutic nutrition, Herbal Medicine, Research Methodology and as they keep up with technological advancements in their fields of study
- d. The fourth semester internship will give students a chance to apply what they have learned in class to a real world working experiment
- e. Skill enhancement courses help students venture new platforms in career.
- f. Equip students with employability skills; generate self-employment and small scale entrepreneurs.

4. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	Foundation Course It depicts the overview of entry education and makes the students assimilate with the Clinical Laboratory Technology course. This course will inculcate knowledge of the academic skills, laboratory skills and research	It gives a strong determination to undergo the course. Be committed and interested in learning the subject
I, II, III, IV	Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)	Improve employability Develop the skill as Laboratory Analyst To make students compete with industrial expectations. Incorporating the interest on health, diet, lifestyle diseases will enable the students gain knowledge to get exposed themselves in medical field Research Methodology skills will aid the students gain knowledge on the various instruments used in the field of medical laboratory and research. Entrepreneurial skill training will increase the chance to build their career independently. Learning this skills will encourage the students to enhance

		creativity, innovation and collaboration
		Discipline /subject specific skill will serve as a route for employability
V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	It reinforces additional knowledge inputs along with core course. Students are familiarized with multi-disciplinary, cross disciplinary and inter disciplinary subjects. It broadens the knowledge on immunological aspects, pharmacology and research. Additional Employability skills are facilitated through computational biology and Bioentrepreneurship.
V semester Vacation activity	Internship/ Industrial visit/Field visit	Hand on training in Medical Labs/ Industry/ Research centre enable the students to explore the practical aspects in career path. They gain confident to fix their career.
VI Semester	Project with Viva – voce	Self-learning is enhanced. It serves as a platform to express their innovative ideas in a practical way, which serves as a pathway to enter in the field of research.
VI Semester	Introduction of Professional Competency skill	The revamped curriculum caters the education to all category of learners; Learning multidisciplinary papers, updated in the curriculum will help the students to fix their career in the fields of Medical, pharmaceutical, forensic, nutritional, diagnostic coding ,etc Students are trained in the field of research to bring out the progress in the field of Medical, Agriculture

		,Nutrition ,etc which will be a back bone for health and wealth creation and improve the quality of life
Extra Credits: For Advanced Learners / Honors degree		To cater to the needs of peer learners / research aspirants
Skills acquired from the Courses		Analytical, Laboratory operating, Diagnosing, Predicting, Experimenting, Critical thinking, Problem solving, Communication, Interpersonal, Time management and Multi-tasking Skills

5. Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze(K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate	
	Between various ideas, Map knowledge	
Evaluate(K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create(K6)	Check knowledge in specific or offbeatsituations, Discussion, Debating or Presentations	

6. Suggestive Topics in Core and Allied Component

- Basics of Biochemistry
- Cell Biology
- Human Anatomy & Human Physiology
- Enzymes & Intermediary Metabolism
- Medical Biochemistry
- Microbiology
- Clinical Pathology and Histopathology
- Endocrinology
- Hematology
- Clinical Laboratory Tests & its Interpretations
- Molecular Biology & Genetics
- Bacteriology and Virology
- Analytical Techniques
- Fundamentals of Nutrition

7. Suggestive Elective Courses (Discipline-centric)

- Immunology
- Bioinformatics
- Pharmaceutical Biochemistry
- Biomedical Instrumentation
- Biotechnology
- Research Methodology
- Clinical Laboratory Ethics and Documentation
- Bioentrepreneurship

8. Suggestive Topics in Skill Enhancement Courses (SEC)

- First aid & Safety
- Sociology & Psychology
- Tissue Culture Techniques.
- Nutrition & Dietetics
- Herbs in Medicine
- Concepts of Medical Coding
- Fundamentals of Research Methodology

9. Suggestive Topics in Fundamental Course

- Health and Hygiene

10. Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	12	13	22	18	91
Part IV	4	4	4	6	4	2	24
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	140

11. Curriculum Design for UG Programme in

Clinical Laboratory Technology

FIRST YEAR: SEMESTER I

Part	Course Code	Title of Course	Contact Hr./ Week	Credit	Int. Mark	Ext. Mark	Total Mark
I		Language - I	6	3	25	75	100
II		English - I	6	3	25	75	100
III	23UCLTCT01	Core – I – Basics of Biochemistry	4	4	25	75	100
	23UCLTCT02	Core- II- Cell Biology	3	3	25	75	100
	23UCLTCP01	Core Practical – I Biochemistry Practical	3	3	40	60	100
	23UCLTAL01	Allied Paper I- Fundamentals of Nutrition	4	3	25	75	100
IV	23UCLTSE01	Skill Enhancement Course SEC- 1 First Aid and Safety	2	2	25	75	100
	23UCLTFC01	Foundation Course – Health and Hygiene	2	2	25	75	100
			30	23			800

FIRST YEAR: SEMESTER II

Part	Course Code	Title of Course	Contact Hr./ Week	Credit	Int. Mark	Ext. Mark	Total Mark
I		Language – II	6	3	25	75	100
II		English-II	4	3	25	75	100
IV	NMSDC	Overview of English Language Communication	2	2	25	75	100
III	23UCLTCT03	Core – III Human Anatomy and Human Physiology	4	4	25	75	100
	23UCLTCT04	Core IV- Microbiology	3	3	25	25	100
	23UCLTCP02	Core Practical II- Anatomy & Physiology Practical	3	3	40	60	100
	23UCLTAL02	Allied Paper II- Analytical Techniques	3	3	25	75	100
IV	23UCLTSE02	Skill Enhancement Course SEC II- Sociology & Psychology	2	2	25	75	100
	23UCLTSE03	Skill Enhancement Course SEC-III (Discipline Specific/Generic) Tissue Culture Techniques	1	2	25	75	100
		Disaster Management	2	1	25	75	100
			30	26			800

SECOND YEAR: SEMESTER III

Part	Course Code	Title of Course	Contact Hr./ Week	Credit	Int. Mark	Ext. Mark	Total Mark
I		Language – III	6	3	25	75	100
II		English-III	6	3	25	75	100
III	23UCLTCT05	Core – V Enzymes & Intermediary Metabolism	5	3	25	75	100
	23UCLTCP03	Core Practical III- Intermediary Metabolism Practical	4	3	40	60	100
	23UCLTAL03	Allied Paper III – Bacteriology and Virology	3	3	25	75	100
	23UCLTALP01	Allied Practical I- Microbiology Practical	2	3	40	60	100
IV	23UCLTSE04	Skill Enhancement Course SEC – IV (Entrepreneurial Based) Nutrition and Dietetics	1	2	25	75	100
	SDTC	Digital Skills for Employability	2	2	25	75	100
		Environmental Studies*	1	-	-	-	-
		Health and Wellness		1			
			30	23			800

- Examination will be held in IV Semester

SECOND YEAR: SEMESTER IV

Part	Course Code	Title of Course	Contact Hr./ Week	Credit	Int. Mark	Ext. Mark	Total Mark
I		Language – IV	6	3	25	75	100
II		English-IV	6	3	25	75	100
III	23UCLTCT06	Core – VI Medical Biochemistry	5	4	25	75	100
	23UCLTCP04	Core Practical – IV Medical Biochemistry Practical	3	3	40	60	100
	23UCLTAL04	Allied Paper IV – I Computer Science	3	3	25	75	100
	23UCLTALP02	Allied Practical – II Computer Science Practical	2	3	40	60	100
IV	NMSDC	Digital Skills for Employability	2	2	25	75	100
	23UCLTSE07	Skill Enhancement Course SEC – VII (Discipline Specific/Generic) Fundamentals of Research Methodology	2	2	25	75	100
		Environmental studies	1	2	25	75	100
			30	25			900

THIRD YEAR: SEMESTER V

Part	Course Code	Title of Course	Contact Hr./ Week	Credit	Int. Mark	Ext. Mark	Total Mark
III	23UCLTCT07	Core VII – Endocrinology	6	4	25	75	100
	23UCLTCT08	Core VIII – Hematology	5	4	25	75	100
	23UCLTCT09	Core IX – Clinical Pathology and Histopathology	5	4	25	75	100
	23UCLTCP05	Core Practical V Clinical Laboratory Practical	4	4	40	60	100
	23UCLTCE01 23UCLTCE02	Elective Paper I Immunology/ Bioinformatics (Note choose anyone paper)	3	3	25	75	100
	23UCLTCE03 23UCLTCE04	Elective Paper II Biomedical Instrumentation / Biotechnology (Note: choose anyone paper)	3	3	25	75	100
IV		Value Education	2	2	25	75	100
		Internship / Industrial Training*		2			
	SDTC	Employability Skills	2	2	25	75	100
			30	28			700

- Students undergo Internship in the Summer vacation at the end of Semester IV

THIRD YEAR: SEMESTER VI

Part	Course Code	Title of Course	Contact Hr./ Week	Credit	Int. Mark	Ext. Mark	Total Mark
III	23UCLTCT10	Core X- Clinical Laboratory Tests & its Interpretation	5	4	25	75	100
	23UCLTCT11	Core XI- Molecular Biology and Genetic Engineering	5	4	25	75	100
	23UCLTCE05	Elective Paper – III / Pharmaceutical Biochemistry	5	3	25	75	100
	23UCLTCE06	Research Methodology (Note: choose anyone paper)					
	23UCLTCE07	Elective Paper – IV Clinical Laboratory Ethics and Documentation /	5	3	25	75	100
	23UCLTCE08	Bioentrepreneurship (Note: choose anyone paper)					
		Core Project (Group)	8	4	40	60	100
IV		Professional Competency skill Enhancement Course for Competitive Examination	2	2			
V		Extension Activity (Outside College Hours)	-	1			
IV	NMSDC	Employability Skills	2	2	25	75	100
			30	21			500
		Total Credit		146			

Remarks: English soft skill Two hours will be handled by English Teachers

FIRST YEAR: SEMESTER I
CORE THEORY I : BASICS OF BIOCHEMISTRY

COURSE CODE	23UCLTCT01
CREDIT	4

Learning Objective

- To understand the simple and molecular structure of the different types of biomolecules.
- To identify from a group of molecular formulae, diagrams or models those which correspond to the different types of biomolecules.
- To gain knowledge the physicochemical properties and biological importance of biomolecules.

MODULE-I

Carbohydrates: Introduction and general classification of carbohydrates.

Monosaccharides: Structures, properties and biological functions of monosaccharides. Isomerism - structural and stereo isomerism, interconversion of sugars, muta-rotation.

Oligosaccharides: Dissaccharides - structures, properties and biological functions of maltose, Lactose and Sucrose.

Polysaccharides: Classifications of polysaccharides, Structures, properties and biological functions of Homo-polysaccharides - starch, cellulose, glycogen, pectin and Hetero-polysaccharides -Hyaluronic acid, Chondroitin sulphate, chitin and Heparin.

MODULE-II

Amino acids: Structure, classification, physical, chemical and electrochemical properties, Non-standard aminoacids, Non-protein aminoacids.**Peptides:** Features of peptide bond, naturally occurring peptides – Glutathione, enkaphalins and endorphins.

Proteins: Classification, physical and chemical properties of proteins, structural organization of proteins - Primary, secondary, tertiary and quaternary structures, Forces stabilizing each level of structure.

MODULE-III

Fatty acids: Definition, nomenclature, classification of fatty acids-saturated and unsaturated fatty acids. Essential fatty acids.**Lipids:** Classification of lipids- simple, conjugated and derived lipids, occurrence, structure and physical and chemical properties of phospholipids, glycolipids, sphingolipids and cholesterol.

Lipoproteins: Types and functions of lipoproteins – Chylomicrons, VLDL, LDL and HDL.

MODULE-IV

Nitrogenous bases: - purines and pyrimidines, nucleosides, nucleotides, formation of phosphodiester bonds. **DNA:** - Types of DNA, Structure of DNA – Watson and Crick double helix model, physico-chemical properties and functions of DNA. Special base sequences of DNA – palindromic sequence, cruciforms. **RNA:** - Types and basic structural features of RNA – mRNA, tRNA and rRNA, properties and functions of RNA.

Nucleoproteins: structure and functions of Histones and protamines.

MODULE-V

Vitamins: Definition, Classification of Vitamins- Fat Soluble vitamins- Food source, RDA, biochemical functions and Deficiency Clinical Manifestations

Water Soluble vitamins- Food source, RDA, biochemical functions and Deficiency Clinical Manifestations

Minerals: Definition, Macro Elements- Food Source, RDA, biochemical functions and Deficiency Clinical Manifestations

Micro Elements- Food Source, RDA, biochemical functions and Deficiency Clinical Manifestations

Course No	Course Outcome Details	Program Outcomes
CO1	Summarize structures, isomerism and functions of different types of carbohydrates.	PO1
CO2	Understand the nature of amino acids and proteins with their structure and their roles.	PO1, PO4
CO3	Demonstrate about the lipids and lipoproteins along with their role.	PO1
CO4	Explain the structure and properties of Nucleic acids and Nucleoproteins.	PO1
CO5	Describe about source and importance of Vitamins and Minerals	PO1, PO4

Textbooks

1. Fundamentals of Biochemistry(2005) J.L.Jain, 6th Edition, S. Chand & Co Ltd.,
2. Lehninger's Principles of Biochemistry (2000) Nelson, David I. and Cox, M.M. Macmillan/worth, NY.
3. Biochemistry(2022) U.Satyanarayana and U. Chakrapani, 6th edition, Elsevier.
4. Biochemistry (2022), Pangaj Naik, 6th Edition, Jaypee Brothers Medical Publishers(P) Ltd.

5. Text book of Biochemistry for Medical Students, Vasudevan D M et al., 9th edition, Jaypee Brothers Medical Publishers(P) Ltd.
6. Fundamentals of Biochemistry (2013) J.L.Jain, Sanjay Jain, Nitin Jain, 7th edition, S.Chand & Company Ltd.

WEB RESOURCES

1. [https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010_Spring/Classnotes/AAC_lehninger4e_ch03%20\(Protein\).pdf](https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010_Spring/Classnotes/AAC_lehninger4e_ch03%20(Protein).pdf)

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3	3	1	
CO 2	3			3			3	3	2	
CO 3	3						3	3	1	
CO 4	3						3	3	2	
CO5	3			3			3	3	2	

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER I
CORE THEORY II : CELL BIOLOGY

COURSE CODE	23UCLTCT02
CREDIT	3

Learning Objectives

The main objectives of this course are to

- Provide basic understanding of architecture of cells and its organelles.
- Understand the organization of prokaryotic and eukaryotic genome.
- Educate on the structural organization of bio membrane and transport mechanism
- Impart knowledge on cell cycle, cell division and basics of cells
- Familiarize the concept of mechanism of cell-cell interactions.

Module I:

Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultra-structure of nucleus, mitochondria, RER, SER, golgiapparatus, lysosome, peroxisome and their functions.

Module II:

Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome - prokaryotic and eukaryotic genome. Organization of chromatin – histones, nucleosome concept, formation of chromatin structure. Special types of chromosomes – lamp brush chromosomes, polytene chromosomes.

Module III:

Biomembranes - Structural organization of bilipid layer model and basic functions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.

Module IV:

Cell cycle-Definition and Phases of Cell cycle-Celldivision-Mitosis and Meiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells.

Module V: Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell-cell interactions- Types-gap junctions, tight junctions and Desmosomes

Course Outcome

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.	PO1
CO2	Familiarize the cytoskeleton and chromatin	PO1,PO2
CO3	Illustrate the structure, composition and functions of cell membrane related to membrane transport	PO1,PO2
CO4	Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells.	PO1, PO2
CO5	Relate the structure and biological role of extra cellular matrix in cellular interactions	PO1,PO2

Text books

1. Arumugam.N, Cell Biology.Saras publication (10th ed, paperback), 2019
2. Devasena.T.Cell Biology.Oxford University Press India-ISBN: 9780198075516, 0198075510,2012
3. Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4thed). Garland Science.

Referencebooks

1. S.C,R.Cell Biology.New age Publishers -ISBN-10: 8122416888/ISBN-13: 978-8122416886, 2008
2. Cooper,G.A.The Cell: A Molecular Approach. Sinauer Associates, Inc - ISBN10: 0878931066 /ISBN 13: 9780878931064, 2013
3. ..E.M.F.,D.R,Cell and Molecular Biology. Lippincott Williams & Wilkins Philadelphia - ISBN: 0781734932 9780781734936, 2006

4. Lodish H.A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira.2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.

Web resources

<https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf>

<https://www.medicalnewstoday.com/article/320878.php>

<https://biologydictionary.net /cell>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3	3					3			3
CO 3	3	3					3			3
CO 4	3	3					3	3		3
CO5	3	3					3			3

S- Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER I
CORE PRACTICAL I : BIOCHEMISTRY PRACTICAL

COURSE CODE	23UCLTCP01
CREDIT	3

Learning Objectives

The main objectives of this course are to

- Identify the biomolecules carbohydrates and amino acids by qualitative test
- Determine the quality of Lipids by titrimetric methods
- Learn and Understand the biochemical Analysis and Identification of unknown compounds

I) Qualitative test for 15 Hrs

1) Carbohydrates

a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g) Starch

2) Amino acids

a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine

II) Titrimetric methods 15 Hrs

1) Determination of Saponification value of edible oil

2) Determination of Iodine number of edible oil

3) Determination of Acid number of edible oil

III) Biochemical Preparations 15 hrs

1) Starch from Potato.

2) Casein from Milk

3) Lecithin from Egg Yolk

Course Outcome

CO	On completion of this course, students will be able to	Program outcomes
CO1	Qualitatively analyse the carbohydrates and report the type of carbohydrate based on specific tests	PO1,PO2,PO3
CO2	Qualitatively analyze amino acids and report the type of amino acids based on specific tests	PO1,PO2,PO3

CO3	Determine the Saponification, Iodine and acid number of edible oil	PO1, PO3,PO4
CO4	Prepare Crude Macromolecule like Sataarch, Caesin etc	PO1, PO3,PO4

Text books

1. David T Plummer, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Edition
2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015
3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher's third edition 2018

Reference books

1. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees A Practical book on Biochemistry Everest publishing house 1st Edition, 2019
2. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.
3. Biochemical Tests – Principles and Protocols. Anil Kumar, Sarika Garg and Neha Garg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.
4. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemist 4th edition, Cambridge University press, Britain. 1995.

Web resources

1. <https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html> 14
2. <https://www.pdfdrive.com/analytical-biochemistry-e46164604.html>
3. <https://www.pdfdrive.com/biochemistry-books.html>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3				3	3	3	3
CO 2	2	3	3				3	3	3	3
CO 3	2		3	2			3	3	3	3
CO 4	2		3				3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER I

ALLIED PAPER I : FUNDAMENTALS OF NUTRITION

COURSE CODE	23UCLTAL01
CREDIT	3

Learning Objectives

The objectives of this course are to

- Create awareness about the role of nutrients in maintaining proper health
- Understand the nutritional significance of carbohydrates, lipids and proteins.
- Understand the importance of a balanced diet.

Module I : History of Nutrition- Concepts of food and nutrition. Calorific and nutritive value of foods - Basic food groups-energy yielding, body building and functional foods. Determination of calorific value by Bomb calorimeter.

Module II Basal metabolic rate (BMR) - definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA- definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference, BMI.

Module III: Role and nutritional significance of carbohydrates, lipids and protein- Biological value of proteins and Nitrogen balance Essential and Non essential aminoacids- Protein energy malnutrition – Kwashiorkor and Marasmus, Obesity-Types and preventive measures.

Module IV: Balanced Diet- Limitations of Daily Food- Diet Planning ICMR classification of five food groups and its significance food pyramid. Limitations of Daily food- Junk foods- definition and its adverse effects.

MODULE V

Regulation and Standardisation of Foods: Laws governing the food industry in India- PFA, MFPO

Key Regulations of Food Safety and Standards Authority (FSSA)- packaging and labeling,

signage and customer notices, licensing registration and health and sanitary permits.

Course Outcome

CO	On completion of this course, students will be able to	Program outcomes
CO1	Importance of nutrients to the body	PO1,PO4, PO5
CO2	Understand nutritional requirements and techniques to measure energy expenditure	PO1, PO4, PO5
CO3	Identify and explain nutrients in foods and the specific functions in maintaining health.	PO1, P42, PO5
CO4	Classify the food groups and its significance	PO1,PO4, PO5
CO5	Obtain an insight about Regulation and Standardisation of Foods in Food industry	PO1,PO4,PO5

Text books

1. B.Srilakshmi (2017), Nutrition Science, Sixth edition, New Age International (P) Ltd, New Delhi, India.
2. Michael Zimmerman, 2011, Handbook of Nutrition, Micronutrients in Prevention and Therapy of Disease, 1st edition, Thieme Medical and Scientific Publishers Ltd, Uttar Pradesh, India.
3. Dietetics, B.Srilakshmi, 2019, 8th edition, New Age International (P) Ltd, New Delhi, India.
4. Antia F. P and Philip Abraham, 1997, Clinical Nutrition & Dietetics, 4th edition, Oxford University Press, New Delhi, India.
5. Roach Benyan, 2003, Metabolism and Nutrition, 2nd edition, Elsevier Science Ltd. Philadelphia. United States.
6. Susan G. Dudek, 2007, Nutrition Essentials for Nursing Practice, 9th edition, Lippincot Willeams d Wilkias, Philadelphia, United States.

Reference Books

1. Scrimshaw N. S and Gleason G. R, 1992, Assessment Procedures. Qualitative Methodologies for Planning and Evaluation of Health related Programmes, International Nutrition foundation for Developing Countries, Boston, United States.

2. Advances in food biochemistry, FatihYildiz (Editor), CRC Press, Boca Raton, USA, 2010
3. Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.

Web resources

1. [https://med.libretexts.org/Courses/Dominican_University/DU_Bio_1550%3A_Nutrition\(LoPresto\)/1%3A_Basic_Concepts_in_Nutrition/1.1%3A_Introduction to Nutrition](https://med.libretexts.org/Courses/Dominican_University/DU_Bio_1550%3A_Nutrition(LoPresto)/1%3A_Basic_Concepts_in_Nutrition/1.1%3A_Introduction_to_Nutrition)
2. <https://www.eatrightpro.org/practice/practice-resources/international-nutrition-pilot-project/how-to-explain-basic-nutrition-concepts>
3. <https://mynutrition.wsu.edu/nutrition-basics>
4. <https://www.studocu.com/row/document/east-africa-institute-of-certified-studies/diploma-in-nutrition-and-dietetics/nutrition-notes/11011299>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	2		3	3		3	3		3
CO 2	3	2		3	3		3	3		3
CO 3	3	2		3	3		3	3		3
CO 4	3	2		3	3		3	3		3
CO5	3	2		3	3		3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER I
SKILL ENHANCEMENT COURSE I : FIRSTAID AND SAFETY

COURSE CODE	23UCLTSE01
CREDIT	2

Learning Objectives

The main objectives of this course are to:

- Provide knowledge on the basics of first aid.
- Perform first aid during various respiratory issues.
- Demonstrate the first aid to treat injuries.
- Learn the first aid techniques to be given during emergency.
- Familiarize the first aid during poisoning.

Module I: Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.

Module II: Basics of Respiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma.

Module III: Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones.

Module IV: First aid related to unconsciousness, stroke, fits, convulsions- seizures, epilepsy.

Module V: First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Discuss on the rules of first aid, dealing during emergency and first aid techniques	PO1,PO4,PO5

CO2	Understand the first aid techniques to be given during different types of respiratory problems	PO1.PO4,PO5
CO3	Provide first aid for injuries, shocks and bone injury	PO1.PO4,PO5
CO4	Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions	PO1.PO4,PO5
CO5	Gain expertise in giving first aid for insect bites and chemical poisoning	PO1.PO4,PO5

Text books

- 1) First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput,
Dr.Manjul Mungali1SBN-978-93-92208-19-5
- 2) Indian First Aid Mannual-<https://www.indianredcross.org/publications/FA-manual.pdf>
- 3) Red Cross First Aid/CPR/AED Instructor Manual

Reference books

- 1)<https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online>
- 2)<https://www.firstaidforfree.com/>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2						3	3	3	3
CO 2	2			3	3		3	3	3	3
CO 3	2			3	3		3	3	3	3
CO 4	2			3	3		3	3	3	3
CO5	2			3	3		3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER I
FOUNDATION COURSE I : HEALTH AND HYGIENE

COURSE CODE	23UCLTFC01
CREDIT	2

Learning Objective

Can explain the importance of health and hygiene
Can analyze the importance of food and malnutrition
Can understand the cause of diseases
Will get know about lifestyle diseases
Will get awareness about various Health Services Organizations

Module I:

Scope health and hygiene – Concept of health and disease - Pollution and health hazards; water and airborne diseases. Radiation hazards: Mobile Cell tower and electronic. Role of health education in environment improvement and prevention of diseases. Personal hygiene, oral hygiene and sex hygiene

Module II:

Classification of food into micro and macro nutrients. Balanced diet, Importance of dietary fibres. Significance of breast feeding. Malnutrition anomalies – Anaemia, Kwashiorkar, Marasmus, Rickets, Goiter (cause, symptoms, precaution and treatment).

Module III

Communicable viral diseases- measles, poliomyelitis, swine flu, dengue, chickungunya, rabies, leprosy and hepatitis, COVID. Communicable bacterial diseases- tuberculosis, typhoid, cholera, tetanus, plague, whooping cough, diphtheria, leprosy. Sexually Transmitted Diseases- AIDS, syphilis and gonorrhoea. Health education and preventive measures for communicable diseases.

Module IV

Non-communicable diseases such as hypertension, stroke, coronary heart disease, myocardial infarction. Osteoporosis and rheumatoid arthritis-cause, symptom,precautions. Diabetes- types and their effect on human health. Gastrointestinal disorders- acidity,(Gastro intestinal reflex

disorder-GIRD), peptic ulcer, constipation,. (cause, symptoms, precaution and treatment) Obesity (Definition and consequences). Mental illness (depression and anxiety). Oral cancer and their preventive measures.

Module V

Health Services Organizations: World Health Organization (WHO), United Nations International Children's Emergency Fund (UNICEF) and Indian Red Cross (IRC).

Course Outcome

CO1	Learn about public health and hygiene
CO2	Gain knowledge and understanding of the wider determinants of health and ill-health
CO3	To know awareness of the debates and dilemmas that may arise from the promotion of public health.
CO4	To learn some knowledge and understanding of the roles of people and agencies who undertake work in the promotion of public health
CO5	Gain knowledge on health problems to develop solutions

Text books

1	Mary Jane Schneider (2011) Introduction to Public Health.
2	Muthu, V.K. (2014) A Short Book of Public Health.
3	Detels, R. (2017) Oxford Textbook of Public Health (6th edition).
4	Gibney, M.J. (2013) Public Health Nutrition.
5	Wong, K.V. (2017) Nutrition, Health and Disease.

Reference books

1. S. Lal, (2018), Vikas. *Public Health Management Principles And Practice*, 2nd Edition, CBS Publishers and Distributors Pvt Ltd, ISBN: 978-93-87742-93-2.
2. Mary-Jane Schneider (2016), *Introduction to Public Health*, (5th Edition), Jones & Bartlett Learning,. ISBN-13: 978-1284197594
3. Carolyn D. Berdanier, Johanna T. Dwyer, David Heber (2013), *Handbook of Nutrition and*

Food, (3rd Edition), CRC Press,. ISBN 9781466505711

4. Sue Reed, Dino Pisaniello, Geza Benke, Kerrie Burton. (2013), *Principles of Occupational Health and Hygiene: An Introduction*, (2nd Revised ed. Edition), Allen & Unwin,
5. V. Kumaresan, R. Sorna Raj, (2012) *Public Health and Hygiene*, (1st Edition), Saras Publication.

Mapping with Programme Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	
CLO1	3	3	-	2	3	3	3	3	
CLO2	3	3	-	2	3	3	3	3	3
CLO3	3	3	1	2	3	3	3	3	3
CLO4	3	3	1	2	3	3	3	3	3
CLO5	2	3	2	3	3	3	2	2	3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER II
CORE THEORY III : HUMAN ANATOMY AND HUMAN PHYSIOLOGY

COURSE CODE	23UCLTCT03
CREDIT	4

LEARNING OBJECTIVES:

- To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various organs.
- On successful completion of the course the students should have:
- Understood clearly on various alimentary parts of human body. Learnt more specific on the endocrinal activities

HUMAN ANATOMY:

MODULE I:

I. The Human body as a whole.

Definitions, Subdivision of Anatomy, Terms of location and positions, Fundamental planes, Vertebrate structure of man, Organization of the body cells, Tissues.

II. Anatomy of Nervous system.

Central Nervous system : Spinal cord, Anatomy, Functions, Reflex- Arc, Meninges.

III. Anatomy of Circulatory System

Heart: Size, Location, Coverings, Chambers, Blood supply, Nerve supply, and the blood vessel. Names of arteries and veins

MODULE II

I. Anatomy of the Respiratory system
Organs of the Respiratory system . Respiratory portion - Pleurae and Lungs -
Brief knowledge of parts and position.

II. Anatomy of the Digestive system

Components of digestive system, Mouth , Tongue, Tooth, Salivary glands, Liver, Biliary apparatus, Pancreas - position and their brief functions.

III. Anatomy of the excretory system and reproductive system

Kidneys - Ureters, Urinary Bladder, Urethra Male Reproductive System - testis, Duct system.
Female Reproductive System - Ovaries, Duct system and Accessory glands.

MODULE III

Blood - Composition, properties and function of blood.

RBC - Size, Shape, functions, count, physiological variations of RBC count, Haemoglobin - Function, concentration, physiological variations, WBC - Functions , production, Life span, count, Differential count,

Platelet - Size, shapes, count, production.

ESR and PCV - definition, values, variation factors affecting, significance, Blood volume. Lymph - Lymphoid tissue, formation, circulation, composition, and functions.

MODULE IV

Cardiovascular system.

Cardiac output - Definitions, factors affecting, physiological variations, regulation of heart rate. Pulse - Jugular pulse, radial pulse and triple response.

Heart sounds - Cause, characteristics and significances;

Respiratory system

Functions of respiratory system - Respiratory tract, Respiratory muscles and respiratory organs- lungs, stages of respiration.

Respiratory Physiology - Transportation of oxygen - Direction, pressure gradient, forms of transportation, oxygenation of Hb, Quantity of O₂ transported.

MODULE V

Digestive System

Functions of Digestive system -function of salivary glands, Saliva - properties,

Functions of stomach - properties and functions of gastric juice. Regulation gastric digestion.

Functions of Pancreas - Composition, properties and function of pancreatic juice. Functions of Liver - Properties, composition and function of Bile, Regulation of bile secretion- gall bladder functions and its emptying.

Functions of Small Intestine- Absorption of Nutrients

Functions of large intestine -Regulation of intestinal secretion, composition and functions of success entericus.

Excretory System -

Kidney- vasa recta, cortical and juxta medullary Nephrons - structure and functions.

Mechanism of urine formation - GFR, Plasma fraction, EFP, Factors affecting GFR,

Determination of GFR, Selective reabsorption - sites for reabsorption, substances

reabsorbed, Mechanism of reabsorption, Glucose, Urea, H₂O, aminoacids, etc., TMG,

Tubular load, Renal Threshold Percentage of reabsorption for different substances, Selective secretion- Properties and composition of normal urine

Course Outcome

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand the anatomy of Nervous and Circulatory system	PO1, PO5
CO2	Learn the structure of vital organs like lungs, kidney and reproductive organs	PO1, PO5
CO3	Acquire knowledge of blood composition, composition, and Function	PO1, PO2 PO5
CO4	Explain the exchange of gases, design of blood vessels and cardiac cycle.	PO1, PO2, PO5
CO5	Elaborate the structure and functions of digestive system, structure of nephron and mechanism of urine formation and role of kidney in maintenance of pH.	PO1. PO2, PO5

Text books

1. K.Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7th edition, Jaypee Brothers Medical Publishers (P) Ltd.
2. Chatterjee & Shinde, 2012, Human Physiology, 8th edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. T.S. Ranganathan, 2000, A text book of Human Anatomy, 3rd edition, S. Chand & Company Put Ltd, Coimbatore, India.
4. Farhana, 2021, A Practical Book of Human Anatomy, 1st edition, Saunders's & Co Prism Publishers, Bangalore, India.
5. Choudhari, 1993, Concise Medical Physiology, 1st edition, New Central Books, Calcutta, India.
6. M. Ester & Greisheimer, 1945, Physiology and Anatomy, 5th edition, J.B. Lippin Cott Company, Philadelphia, United States.
7. Text book of Physiology- Dr. Saratha Subramaniam

Reference Books

- Guyton & Hall, 2011, Textbook of Medical Physiology, 12th edition. Saunders Elsevier, Philadelphia, United States.
- Peter, Jonathan, Marios, & Albert, 2019, Abraham's & McMinn's Clinical Atlas of Human Anatomy, 8th edition, Elsevier, Amsterdam, Netherlands.
- Human anatomy and physiology—Elaine N. Marieb, 3rd edition, Benjamin/Cummings (a Pearson education company), 1995.

Website Reference

<https://openstax.org/details/books/anatomy-and-physiology>

<https://open.umn.edu/opentextbooks/textbooks/169>

<https://libguides.cbu.edu/anatomy/books>

<https://libproxy.cbu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&d&b=nlebk&AN=1882225&site=ehost-live&scope=site>

<https://libproxy.cbu.edu/login?url=https://www.r2library.com/Resource/Title/1455704180>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	2			3		3	2	2	3
CO 2	3	2			3		3	2	2	3
CO 3	3	3			3		3	2	2	3
CO 4	3	3			3		3	2	2	3
CO5	3	3			3		3	2	2	3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER II
CORE THEORY IV : MICROBIOLOGY

COURSE CODE	23UCLTCT04
CREDIT	3

Learning Objectives

- To presents the Morphological characteristics of Micro organisms, their cultivation methods, identification. Life cycle, economic importance and microbial diseases.
- To enable the students to learn the basic functions and components of microorganisms and their economic uses
- To Understand the structure and types of microorganisms
- To Learn the economical uses of microorganisms
- To Learnt about the pathogenesis of various microbes in the environment

MODULE -I

Historical introduction - with special reference to the contribution of Louis Pasteur, Joseph Lister Robert Koch,, Edward Jenner and Alexander Fleming; Importance of microbiology in laboratory medicine. Microscopy- Light microscope, Dark-ground microscope, Fluorescent microscope, Phase contrast microscope, and Electron microscope;

MODULE-II

Classification of microorganisms; Observation of micro- organism - Wet preparations, Staining preparations; Anatomy of Bacterial cell; Morphological Classification of bacteria with example.

MODULE- III

Microbial diseases: - Normal human micro flora; host - parasitic interaction; epidemics; exo Endotoxins.

Air borne diseases: - Aetiology, symptoms and prevention of Tuberculosis, Diphtheria, Polio - myelitis and Influenza,

Food and Waterborne diseases:- Aetiology, symptoms and pathogenesis of Typhoid, Cholera, Bacillary dysentery and Hepatitis.

Direct contact disease: - Aetiology and symptoms of Rabies

MODULE-IV

Water microbiology: - Microbes in water, Bacteriological examination of water; sewage and its treatment; purification of drinking water.

Soil microbiology: - Symbiotic and Non- symbiotic Nitrogen fixing organisms: Rhizosphere

Food microbiology ; Microbiology of food borne diseases- Botulism, Salmonellas, Staphylococcal poisoning, Pseudomonas poisoning and Mycotoxins.

MODULE- V

Sterilisation -Definition, Physical agents employed with example, Sterilisation controls; Disinfection- Definition, Classification of Chemical methods of disinfection, its mechanism; Testing of disinfectants;

Antibiotics-Definition, Classification, Modes of action, Antibiotic susceptibility testing.

Course Outcomes

CO1	Remember and recall the historical events which paved the development of microbiology
CO2	Understand and differentiate the different types of microscopes and Microbes
CO3	Evaluate the success of understanding the microbial diseases
CO4	Apply the knowledge to enumerate the microorganisms from natural environment.
CO5	Analyze the sterilization techniques and antibiotics

Text Books

- Ananthanarayan & Paniker, 2022, Textbook of Microbiology, 12th edition, Universities Press, Hyderabad, India.
- R. C. Dubey & D. K. Maheswari, 2010, A Text Book of Microbiology, 4th edition, S Chand, New Delhi, India.
- J. Willey, K. Sandman, & D. Wood, 2019, Prescott's Microbiology, 11th edition, McGrawHill, New York City, United States.
- J. C. Pommerville, 2018, Fundamentals of Microbiology, 11th edition, Jones & Barlett Learning, Massachusetts, United States.
- E. Alcamo, 2001, Fundamentals of Microbiology, 6th edition, Addison Wesley Longman, Inc. California, United States.

Reference Books

- C. J. Alexopoulos, C. W. Mims, & M. Blackwell, 2000, Introductory Mycology, 5th edition John Wiley and Sons, Chichester, United Kingdom.
- R. C. Dubey & D. K. Maheswari, 2010, A Text Book of Microbiology, 4th edition, S Chand, New Delhi, India.
- M. J. Pelczar, E. C. S. Chan, & N. R. Kreig, 2009, Microbiology, 5th edition, McGrawHill Book Company, Singapore.
- L. M. Prescott, J. P. Harley, & D. A. Klein, 2008, Microbiology, 7th edition, McGraw Hill, New York City, United States.

Website Reference

1. <https://openstax.org/details/books/microbiology>
2. <https://open.umn.edu/opentextbooks/textbooks/404>
3. <https://open.oregonstate.education/generalmicrobiology/>
4. <https://www.pdfdrive.com/bensons-microbiological-applications->

<laboratory-manual-in-general-microbiology-e34434101.html>

5. <https://www.pdfdrive.com/dairy-microbiology-handbook-the-microbiology-of-milk-and-milk-products-e183669501.html>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3	2		3
CO 2	3			2	3		3	2		3
CO 3	3	3	3	2			3	2		3
CO 4	3		3	2	3		3	2		3
CO5	3	3	3	3	3		3	2		3

S-Strong (3) M-Medium (2)

L-Low (1)

FIRST YEAR: SEMESTER II
CORE PRACTICAL II : ANATOMY AND PHYSIOLOGY PRACTICAL

COURSE CODE	23UCLTCP02
CREDIT	3

Human Anatomy

I Demonstration of Major organs through Models and Permanent Slides

1. Respiratory System
2. Cardiovascular System
3. Digestive System
4. Urogenital System
5. Nervous System
6. Skeletal and Muscular System
7. Structure of Eye and Ear

Human Physiology

Part-A Major:

1. Estimation of Haemoglobin by Sahli's method
2. Determination of ESR
3. Determination of PCV & Absolute values
4. Total WBC Count
5. Total RBC Count
6. Differential count of WBC

Part-B Minor:

1. Determination of bleeding time
2. Determination of clotting time
3. Blood grouping and Rh typing
4. Measurement of Body Temperature
5. Measurement of Blood Pressure
6. Measurement of Pulse Rate

Part-C Spotters:

1. Parts of microscope
2. BP Apparatus
3. Identification of different type of WBC
4. ECG pattern

Text book Reference :

1. K.Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7th edition, Jaypee Brothers Medical Publishers (P) Ltd.

2. Chatterjee & Shinde, 2012, Human Physiology, 8th edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. T.S. Ranganathan, 2000, A text book of Human Anatomy, 3rd edition, S. Chand & Company Pvt Ltd, Coimbatore, India..
4. Text book of Physiology- Dr.Saratha Subramaniam

Reference Books

Guyton & Hall, 2011, Textbook of Medical Physiology, 12th edition. Saunders Elsevier, Philadelphia, United States.

Peter, Jonathan, Marios, & Albert, 2019, Abrahams' & McMinn's Clinical Atlas of Human Anatomy, 8th edition, Elsevier, Amsterdam, Netherlands.

Human anatomy and physiology–Elaine N. Marieb, 3rd edition, Benjamin/Cummings (a Pearson education company), 1995.

Website Reference

<https://openstax.org/details/books/anatomy-and-physiology>

<https://open.umn.edu/opentextbooks/textbooks/169>

<https://libguides.cbu.edu/anatomy/books>

<https://libproxy.cbu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1882225&site=ehost-live&scope=site>

<https://libproxy.cbu.edu/login?url=https://www.r2library.com/Resource/Title/1455704180>

FIRST YEAR: SEMESTER II
ALLIED PAPER II : ANALYTICAL TECHNIQUES

COURSE CODE	23UCLTAL02
CREDIT	3

LEARNING OBJECTIVES:

This course focus on the biochemical techniques includes spectrophotometry, centrifugation, electrophoresis; radioactivity etc., learning these techniques will be very useful for operating instruments and become the basic knowledge in their future.

MODULE –I

Light Microscopy, Dark field Microscopy, Phase contrast Microscopy, Fluorescence Microscopy, Electron Microscope-SEM, TEM. PH and Buffers, Measurement of PH – glass electrode, Ion selective and gas sensing electrodes, Clark oxygen electrode, and their applications, Biosensors.

MODULE-II

Basic principles of sedimentation, Types of Rotors, Types of Centrifugation: Ultra centrifuge, Analytical and Preparative centrifuges and applications. Molecular weight and density determination, Sub cellular fractionation, Ultra-filtration; Principle, instrumentation and application..

MODULE-III

Principle, Working mechanism and applications of Colorimeter, UV - Visible and FTIR spectroscopy, Flame and Flameless spectrophotometer, Basic principles of NMR, ESR, Atomic Absorption Spectroscopy, Luminometry, X-Ray Crystallography.

MODULE-IV

Chromatographic techniques – General principle; adsorption and partition chromatography. Techniques and application of paper, column, thin layer, Ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC, HPTLC.

MODULE-V

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility – paper, Agarose, SDS-PAGE electrophoresis, Isoelectric focusing, 2D PAGE, blotting techniques, capillary electrophoresis. Pulse field Electrophoresis, Isotachophoresis.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explains the Microscope and its significance	PO1,PO2,PO6
CO2	. Describe types of rotors and identify the centrifugation technique for the separation of biomolecules.	PO1,PO2, PO6
CO3	State Beer's Law and illustrates the instrumentation and uses of colorimeter and spectrophotometer	PO1,PO2, PO6
CO4	Explain the different types of Chromatography	PO1,PO2, PO6
CO5	Enumerate various methods Electrophoresis	PO1,PO2, PO6

Text Books

- Wilson & Walker, 2006, Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge, United Kingdom.
- Upadhyay A, Upadhyay K & Nath N, 2002, Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Mumbai, India.
- Upadhyay A & Nath N, 2001, Biophysical Chemistry – Principles and techniques, Himalaya Publishers, Mumbai, India.
- Brown S. B, 1980, An Introduction to spectroscopy for Biochemist, Academic Press, New York, London.
- Cooper T. G, 1977, The Tools of Biochemistry, Wiley, New York City, United States.

Reference Books

- Marimuthu R, 2021, Microscopy and Microtechnique, Repro Books Ltd, Mumbai, India.
- Charles R, Cantor I & Schimmel P. R, 2004, Biophysical Chemistry, Part II, W.H. Freeman & Co, New York City, United States.
- Daniel M, 2007, Basic Biophysics for Biologist, Student Edition, Rajasthan, India.
- Campbell I. D, 2012, Biophysical Techniques, Oxford University Press, Oxford, United Kingdom.
- Varco J. S, 2001, Clinical Biochemistry: Techniques and instrumentation – A practical course, World Scientific, Singapore.

Web Source

1. <https://www.britannica.com/science/chromatography>
2. <https://www.youtube.com/watch?v=xgxFBQZYXlE>
3. <https://www.youtube.com/watch?v=7onjVBsQwQ8>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3				2	3	3	3	3
CO 2	2	3				2	3	3	3	3
CO 3	2	3				2	3	3	3	3
CO 4	2	3				2	3	3	3	3
CO 5	2	3				2	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER II
SKILL ENHANCEMENT COURSE II : SOCIOLOGY AND PSYCHOLOGY

COURSE CODE	23UCLTSE02
CREDIT	2

Learning Objective

To develop understanding about basic concepts of sociology and Psychology and its application in personal and community life, health, and illness and self empowerment.

MODULE I

Introduction- Definition, nature and scope of sociology

Social structure- Basic concept of society, community, association and institution- Individual and society, Major health problems in urban, rural and tribal communities

MODULE II

Culture- Nature, characteristic and evolution of culture- Diversity and uniformity of culture- Difference between culture and civilization- Culture and socialization- Transcultural society- Culture, Modernization and its impact on health and disease

Family and Marriage- Family – characteristics, basic need, types and Functions, Importance of family Influence of marriage and family on health and health practices

MODULE III

Social organization and disorganization

Social organization – meaning, elements and types- Social norms, moral and values

Social disorganization – definition, causes, Control and planning

Major social problems – poverty, housing, food supplies, illiteracy, prostitution, dowry, Child labour, child abuse, delinquency, crime, substance abuse, HIV/AIDS, COVID-19

Fundamental rights of individual, women and children- Social welfare programs in India

Clinical sociology

Introduction to clinical sociology- Use of clinical sociology in crisis intervention

MODULE IV

Introduction- Meaning of Psychology, Development of psychology – Scope, branches and methods of psychology, Relationship with other subjects, Applied psychology to solve everyday issues.

Biological basis of behaviour –Body mind relationship, Genetics and behaviour, Inheritance of behaviour, Brain and behaviour, Psychology and sensation – sensory process– normal and abnormal.

MODULE V

Mental health and mental hygiene- Concept of mental health and mental hygiene- Characteristic of mentally healthy person- Warning signs of poor mental health- Promotive and preventive mental health strategies and services- Defense mechanism and its implication

Frustration and conflict – types of conflicts and measurements to overcome- Dealing with ego

Self-empowerment- Dimensions of self-empowerment, Self-empowerment development
Importance of women's empowerment in society Professional etiquette and personal grooming

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Describe the scope and significance of sociology, social change and its importance	PO1, PO2, PO4
CO2	Describe culture, family and marriage and its impact on health and disease	PO1, PO2, PO4
CO3	Explain social organization, disorganization, social problems, clinical sociology and its application in the hospital	PO1, PO2, PO4
CO4	Describe scope, branches and significance of psychology and biology of human behaviour	PO1, PO2, PO4
CO5	Explains the mentally healthy person, defense mechanisms and selfempowerment	PO1, PO2, PO4

Textbooks

Sociology

1. Bottomore.T.B., Sociology: A guide to problems and Literature,1971,Random House
2. Gisbert P. Fundamentals of sociology,3rd Edition,2004,Orient Longman publications
- 3.Neil J.Smelser,Handbook of sociology,1988.sage publication
4. Johnson R.M,Systematic Introduction to Sociology,1960,Allied Publishers
5. C.N.ShankarRao., Introduction to Sociology, 2008, S.CHAND & Company Publications.
6. C.N.ShankarRao., Sociology of India, S.CHAND & Company Publications.

Psychology

1. Clifford T. Morgan, Richard a. King, John R. Weis and John Schopler,—Introduction to Psychology – 7th Edition. Tata McGraw Hill Book Co. New Delhi, 1993.
2. Baron.A. Robert, Psychology, Pearson Education Vth Ed.,2002
3. David Krech And Richard S Crutehfield And Egerton L Ballachey: Individual AndSociety
- 4.Kuppuswamy B :Elements Of Social Psychology
5. Cooper B Joseph And James L Mc Gaugh: Integrating Principles Of Social Psychology
6. Shelley E. Taylor. Health Psychology Third Edition. McGraw Hill International Editions, 1995.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3		3		2		3	2	2
CO 2	2	3		3		2		3	2	2
CO 3	2	3		3		2		3	2	2
CO 4	2	3		3		2		3	2	2
CO 5	2	3		3		2		3	2	2

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER II
SKILL ENHANCEMENT COURSE III : TISSUE CULTURE TECHNIQUE

COURSE CODE	23UCLTSE03
CREDIT	2

Learning Objectives

The objectives of this course are to

- Introduce the tools and techniques used in tissue culture technique.
- Acquire knowledge on preparation of growth medium for culture techniques.
- Impart knowledge on procedures involved gene transfer.
- Acquaint with the process of tissue culture technique.
- Understand the importance of plant and animal tissue culture for the production and evaluation of bioactive compounds

Module I: Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques.

Module II : Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.

Module III : Methods of gene transfer in plants and animals - direct and indirect gene transfer methods

Module IV : Cell culture technique - Explants selection, sterilization and inoculation.

Module V : Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview - Applications of animal cell culture

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Introduction to plant tissue culture	PO1, PO2, PO3
CO2	Brief knowledge on preparation of tissue culture media	PO1, PO2
CO3	Understanding on different methods of gene transfer	PO1, PO2, PO3

CO4	Gain knowledge on plant and animal cell culture techniques	PO1,PO2,PO3
CO5	Study of applications of genetically modified plants and animals.	PO1,PO2,PO3

Text books

- 1.Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing Corporation.
- 2, Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
- 3.Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants
- 4.Grierson and Covey, S.N.1988. Plant Molecular biology.Blackie.
- 5.Chawla, H.S., —Introduction to Plant Biotechnology, 3rd Edition, Science Publishers, 2009.

Reference books

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, ariasPublications. 1995.
 - 2.Stewart Jr., C.N., —Plant Biotechnology and Genetics: Principles, Techniques and ApplicationsWiley-Interscience, 2008.
 - 3.Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and SpecializedApplications. Wiley-Blackwell, 2010.6th Edition.
 - 4.Davis, J. M. (2008). Basic Cell Culture. Oxford University Press. New Delhi.
 - 5.Davis, J. M. (2011).Animal Cell Culture.John Willy and Sons Ltd. USA.6Freshmen R. I.(2005).Culture of Animal Cells.John Willy and Sons Ltd. USA.
 - 6.Butler, M. (2004). Animal Cell Culture and Technology.Taylor and Francis.Keywork USA. 7.Verma, A. S. and Singh, A. (2014).Animal Biotechnology. Academic Press, ELSEVIER, USA
- Web Resources**
- <https://www.britannica.com/science/tissue-culture>
- https://en.wikipedia.org/wiki/Plant_tissue_culture
- <https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3				3	3	3	3
CO 2	2	3					3	3	3	3
CO 3	2	3	3				3	3	3	3
CO 4	2	3	3				3	3	3	3
CO 5	2	3	3				3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III
CORE THEORY V : ENZYMES AND INTERMEDIARY METABOLISM

COURSE CODE	23UCLTCT05
CREDIT	3

Learning objectives

The main objectives of this course are to

- Provide fundamental knowledge on enzymes and their properties, coenzymes in catalysis
- Illustrate the pathways of carbohydrate metabolism.
- Explain the pathways of oxidation and biosynthesis of lipids.
- Detail the catabolism of amino acids and synthesis of specialized products from amino acids.
- Acquaint the metabolism of nucleic acids and its regulation

MODULE-I

Enzymes: Introduction, International classification of enzymes, six main classes of enzymes. Factors affecting enzyme activity, Coenzymes, Metallo enzymes, metal activated enzymes, Ribozymes. Enzyme specificity, Units of enzyme activity – IU and Katal. Active site- concept of ES complex.

Diagnostic Importance of enzymes, Enzyme pattern in disease and Therapeutic use of enzymes

MODULE-II

Carbohydrate metabolism- Fate of Dietary Carbohydrate- Glycolysis, Oxidation of pyruvate to acetyl Co A, TCA Cycle-, Glycogenesis and Glycogenolysis , Gluconeogenesis, Pentose phosphate pathway (HMP Shunt).

MODULE-III

Transamination, Deamination, Decarboxylation-

Fate of dietary proteins- Urea cycle- Diseases and Disorder

Biosynthesis of proteins, , Metabolic nitrogen pool.

MODULE-IV

Metabolism of Lipids- Fate of dietary lipids, Biosynthesis of saturated Fatty acids. Oxidation of fatty acids, alpha oxidation, beta oxidation and omega oxidation. Biosynthesis of Triglycerides and Phospholipids. Ketone bodies and Ketosis- Biosynthesis of cholesterol, Degradation of cholesterol, Fatty liver

MODULE-V

Metabolism of Nucleic acids –

Metabolism of purines-. Introduction,-de novosynthesis- salvage pathway,
Catabolism of purines- Regulation of purine metabolism.

Metabolism of pyrimidines – Introduction- de novo synthesis, salvage
pathway, Catabolism of pyrimidines- Regulation of pyrimidine metabolism.

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Elaborate the major classes of enzymes, role of coenzymes on action and the enzyme markers used for diagnostic studies	PO1, PO3
CO2	Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism.	PO1
CO3	Sketch the oxidation and biosynthesis of fatty acids, Triglycerides, phospholipids and cholesterol with suitable examples	PO1,
CO4	Explain catabolism of amino acids, synthesis of nonessential amino acids and Urea cycle.	PO1
CO5	Describe the metabolism of nucleic acids with necessary illustrations and its regulation.	PO1

Textbooks

- U.Sathyanarayana & U. Chakrapani, 2022, Biochemistry, 6th edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
- Pangaj Naik, 2022, Biochemistry. 6th edition Jaypee Brothers Medical Publishers(P) Ltd
- Vasudevan D M et al., —Textbook of Biochemistry for Medical Students, 9th edition, Jaypee Brothers Medical Publishers(P) Ltd

Reference Books

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M.Cox, 2008, 5th edition, W.H. Freeman and Company.
2. Robert K. Murray, Daryl K. Granner, Victor W. Rodwell, 2006, Harper's Illustrated Biochemistry, 27th edition, McGraw Hill Publishers.

Web sources

<https://nptel.ac.in/courses/104/105/104105102/>

<http://www.nptelvideos.in/2012/11/biochemistry-i.html>

https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3				3			3
CO 2	3		3				3			3
CO 3	3		3				3			3
CO 4	3		3				3			3
CO 5	3		3				3			3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III
CORE PRACTICAL III : INTERMEDIARY METABOLISM PRACTICAL

COURSE CODE	23UCLTCP03
CREDIT	3

Learning Objectives

- Introduce the methods of sample collection (blood & urine) for analytical purpose.
- Understand the estimation procedure for various important biomolecules.
- Help students learn the routine qualitative analysis of urine sample for diagnostic purpose.

Sample Collection Procedures

1. Collection and Preservation of Urine samples
2. Venipuncture and collection of blood samples
3. Separation of serum and Plasma by Centrifugation.

I Qualitative Analysis

1. Physical examination of Urine
2. Reactions of Normal Urine
3. Abnormal Constituents of Urine

II Quantitative Analysis

1. Estimation of blood sugar (Fasting, PP, Random)
2. Estimation of serum Total Proteins
3. Estimation of Urea (Serum and Urine)
4. Estimation of Creatinine (Serum and Urine)
5. Estimation of Uric acid (Serum and Urine)

Demonstration

1. Paper chromatography
2. Thin layer Chromatography
3. Paper Electrophoresis

Text books

1. Manickam, S.S.(2018).Biochemical Methods(3rd ed.).New age International PvtLtdpublishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408
2. Plummer, D.T. An Introduction to Practical Biochemistry. Tata Mc GrawHill-ISBN: 97800708416
3. Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBSPublishers, India.

4. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58(Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.
5. Biochemistry Practical Manual, Soundravally Rajendiran, Pooja Dhiman, Elsevier
6. Practical Textbook of Biochemistry for Medical Students, DM Vasudevan, Subir Kumar Das, 3rd edition, Jaypee Health Science Publishers
7. Practical Biochemistry with Clinical Correlation, Poonam Agarwal, CBS Publishers and Distributors Pvt Ltd.

Referencebooks

1. Singh, S.K. (2005). Introductory Practical Biochemistry (2nd ed.). Alpha Science International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026
2. Ashwood, B. a. (2001). Tietz, Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346 / ISBN 13: 978072168634

Web resources

1. <https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors>
2. <http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf>
3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y
4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y *

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	3			3	3	3	3	3
CO 2	3	3	3			3	3	3	3	3
CO 3	3	3	3			3	3	3	3	3
CO 4	3	3	2			3	3	3	3	3
CO 5	3	3	3			3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III
ALLIED PAPER III : BACTERIOLOGY AND VIROLOGY

COURSE CODE	23UCLTAL03
CREDIT	3

Learning Objectives

- Learn the biology of bacteria and viruses related with infectious diseases
- Identify common infectious agents and the diseases that they cause
- To learn the basic functions and components of microorganisms and their economic uses.

MODULE I

General characteristics, epidemiology, pathogenicity, Laboratory diagnosis and treatment of diseases caused by

Gram positive bacteria- *Staphylococcus aureus*, *Streptococcus pyogenes*, *Corynebacterium diphtheria*.

Gram negative bacteria: - *E.coli*, *Shigella dysenteriae*, *Neisseria gonorrhoea* and *Pseudomonas aeruginosa*.

MODULE II

General characteristics, epidemiology, pathogenicity, Laboratory diagnosis and treatment of diseases caused by

Clostridium sp, *Klebsiella*, *Proteus*, *Salmonella*, *Haemophilus influenzae*, and. Acid fast bacteria- *Mycobacterium leprae* and *M. tuberculosis*

Spirochetes- *Borrelia burgdorferi* and *Leptospira mayottensis*, *Rickettsiae prowazekii* and *Chlamydiae trachomatis*

MODULE III

Morphology of viruses, classification and cultivation of viruses 2. Bacteriophage 3. Pox virus 4. Herpes virus -HSV-I & II 5. Myxovirus -H1N1, Avian flu, Mumps and Measles 6. Corona virus —SARS Polio virus 8. Rabies virus 9. Hepatitis virus (A, B & C) 10. Arbo virus Chikungunya, Dengue & Rubella 11. Retro virus -HIV

MODULE IV

Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract. Antibacterial substance: Lysozyme, Complement, Properdin, Antiviral substances, Phagocytosis.

MODULE V

Staining- Principles of staining, simple staining, negative staining, Differential staining, Gram and acid-fast staining, flagella staining, capsule and endospore Staining. Staining of yeast (methylene blue), lactophenol cotton blue, staining of mold (*Penicillium*, *Aspergillus*), Agaricus.

Cultivation of bacteria– Types of growth media (natural, synthetic, complex, enriched, selective- definition with example), culture methods (streak plate, spread plate, pour plate, stabculture, slant culture, liquid shake culture, anaerobiosis) - aerobic and Anaerobic bacteria.

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Understand the features of Gram negative and Gram Positive bacteria	PO1,PO4
CO2	Understand the features of spirochetes and micro organisms	PO1,PO4
CO3	Enumerate the morphology of the virus	PO1,PO4,
CO4	Explains the Normal Microflora of the human body	PO1,PO4,
CO5	Identify the microbes by staining methods and Culture microbes by various methods	PO,PO4,

Textbooks

1. Ananthanarayan & Paniker, 2022, Textbook of Microbiology, 12th edition, Universities Press,Hyderabad, India.
2. R. C. Dubey & D. K. Maheswari, 2010, A Text Book of Microbiology, 4th edition, S Chand,New Delhi, India.
3. J. Willey, K. Sandman, & D. wood, 2019, Prescott's Microbiology, 11th edition, McGrawHill, New York City, United States.
4. J. C. Pommerville, 2018, Fundamentals of Microbiology, 11th edition, Jones & BarlettLearning, Massachusetts, United States.

Reference Books

1. C. J. Alexopoulos, C. W. Mims, & M. Blackwell, 2000, Introductory Mycology, 5th editionJohn Wiley and Sons, Chichester, United Kingdom.
2. M. J. Pelczar, E. C. S. Chan, & N. R. Kreig, 2009, Microbiology, 5th edition, McGrawHill.Book Company, Singapore.

Web Reference

1. <https://openstax.org/details/books/microbiology>
2. <https://open.umn.edu/opentextbooks/textbooks/404>

3. <https://open.oregonstate.edu/generalmicrobiology/>
4. <https://www.pdfdrive.com/bensons-microbiological-applications-laboratory-manual-in-general-microbiology-e34434101.html>
5. <https://www.pdfdrive.com/dairy-microbiology-handbook-the-microbiology-of-milk-and-milk-products-e183669501.html>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3			3			3		3	3
CO 2	3			3			3		3	3
CO 3	3			3			3		3	3
CO 4	3			3			3		3	3
CO 5	3			3			3		3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III
ALLIED PRACTICAL I : MICROBIOLOGY PRACTICAL

COURSE CODE	23UCLTALP01
CREDIT	3

Learning objectives

The objectives of this course are to

- Study the growth of bacteria
 - Know the parts & uses of microscope
 - Learn staining methods to identify microbes
 - Learn different types of culture methods
-
1. Handling and Maintenance of bright field microscopy
 2. Microscopy- Light, Dark Ground, Fluorescent, Electron
 3. Motility determination — hanging drop method
 4. Preparation of sterile container
 5. Preparation of Culture media
 6. Inoculation of Culture media
 7. Study of Colonial morphology
 8. Staining Techniques- Simple Staining, Gram staining, Acid — fast Staining, Spore Staining, Negative staining
 9. Media Preparation- Liquid media, Solid media, Agar deep, Agar slant, Agar plate
 10. Pure Culture Technique- Streak plate method, Pour plate method, Spread plate method
 11. Bacterial identification -Esch.coli, Klebsiella, Pseudomonas, Vibrio cholerae, Corynebacterium, diphtheriae, Staphylococcus aureus.

Textbooks

1. Ananthanarayan & Paniker, 2022, Textbook of Microbiology, 12th edition, Universities Press, Hyderabad, India.
2. R. C. Dubey & D. K. Maheswari, 2010, A Text Book of Microbiology, 4th edition, S Chand, New Delhi, India.
3. J. Willey, K. Sandman, & D. Wood, 2019, Prescott's Microbiology, 11th edition, McGrawHill, New York City, United States.
4. J. C. Pommerville, 2018, Fundamentals of Microbiology, 11th edition, Jones & Barlett Learning, Massachusetts, United States.

Reference Books

1. C. J. Alexopoulos, C. W. Mims, & M. Blackwell, 2000, Introductory Mycology, 5th edition John Wiley and Sons, Chichester, United Kingdom.
2. M. J. Pelczar, E. C. S. Chan, & N. R. Kreig, 2009, Microbiology, 5th edition, McGrawHill. Book Company, Singapore.

Web Reference

<https://openstax.org/details/books/microbiology>

<https://open.umn.edu/opentextbooks/textbooks/404>

<https://open.oregonstate.education/generalmicrobiology/>

<https://www.pdfdrive.com/bensons-microbiological-applications-laboratory-manual-in-general-microbiology-e34434101.html>

<https://www.pdfdrive.com/dairy-microbiology-handbook-the-microbiology-of-milk-and-milk-products-e183669501.html>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3			3			3		3	3
CO 2	3			3			3		3	3
CO 3	3			3			3		3	3
CO 4	3			3			3		3	3
CO 5	3			3			3		3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III
SKILL ENHANCEMENT COURSE IV : NUTRITION AND DIETETICS

COURSE CODE	23UCLTSE04
CREDIT	2

Learning Objectives

To understand and learn about the concepts and importance of nutrition in overall metabolism of the body and related life style disorder

MODULE I

Concept of different food groups, recommended dietary allowances for Indian's, basis for requirement, computation of allowance.

Nutrition in pregnancy - nutritional requirements, complications of pregnancy,
Nutrition in Lactation – special foods during lactation, nutritional requirements during lactation,
Nutrition in infants – Rate of growth, weight as the indicator, premature infant, feeding premature infants, low birth weight, nutritional allowances, supplementary feeding, weaning foods.

MODULE II

Nutrition in Preschool Children – Growth and development of preschool children, prevalence of malnutrition (Vitamin A, infection, anaemic, IDD) in preschool age, nutritional requirements, supplemental foods.

Nutrition in School Age – Early and middle childhood, physiological development, food habits, nutritional needs and feeding, RDA, Foods habits

Nutrition During Adolescence – Physical growth, physiological and psychological problems associated with pubertal changes, nutritional needs,

MODULE III

Nutrition During Adulthood – Nutrition and work efficiency, basis for requirements, RDA.

Nutrition for Old Age – socio economic and psychological factors – nutritional requirements, factors affecting food intake, clinical needs and malnutrition, institutionalized changes in old age. Advances in geriatric nutrition.

Fluid and electrolyte balance during prolonged exercise, nutritional requirements in sports, dietary intake before, during and after exercise

MODULE IV

Diet therapy – Definition, Principles, classification of therapeutic diets. Routine Hospital diet – Regular diet, Light diet, soft diet, clear diet, full fluid diet. Professional code and ethics for dietetician, Indian dietetic Association.

Modification of Diet for fever, Infection, Diarrhea, constipation, Gastritis and peptic ulcer.

MODULE V

Dietary Management in Diabetes Mellitus, Acute and Chronic Cardiac disease, Hypertension, Atherosclerosis, Congestive heart failure, Sodium restricted diet.

Dietary management in kidney disease – nephrosis, acute renal failure, acute and chronic glomerulonephritis, kidney transplant and dialysis.

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Understand the nutrition requirement in Pregnancy, Lactation and in infants	PO4, PO5, PO6
CO2	Explains the nutrition requirement in preschool and school age children and for adolescents	PO4, PO5, PO6
CO3	Explains the nutrition for during adulthood, and for old age	PO4, PO5, PO6
CO4	Understand the diet therapy and diet modification	PO4, PO5, PO6
CO5	Understand the diet management during abnormal conditions	PO4, PO5, PO6

Textbooks

- Vinodhni Reddy, Prahlad Rao, Govintha Sastry and Kashinath, —Nutrition Trends in India, NIN, Hyderabad, 1993.
- Sahills, E.M. Olson, A.J. and Shike, Lea and Febiger, —Modern Nutrition in Health and Diseases, Frances, J. Zeman, Nutrition and Dietetics, 1983.
- B. Srilakshmi, —dietetics, New Age International Pvt. Ltd., 2003.
- B. Srilakshmi, —Nutrition Science, New Age International Pvt. Ltd., 2003.
- Townsend, C.E and Roth, R.A (1999) Nutrition and Diet Therapy, 7th edition, Delman Publishers. Gopalan, C. and et al (1996), Nutritive value of Indian foods.
- Mohar, L.K and Stump, S.E. (2000) Food, Nutrition and Diet Therapy, 10th edition, W.B. Saunders Company.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2			3	3	3	3		3	3
CO 2	2			3	3	3	3		3	3
CO 3	2			3	3	3	3		3	3
CO 4	2			3	3	3	3		3	3
CO 5	2			3	3	3	3		3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III
SKILL ENHANCEMENT COURSE V : HERBS IN MEDICINE

COURSE CODE	23UCLTSE05
CREDIT	2

Learning Objective

- The student can analyses the importance of herbal medicine
- can learn the role of herbal medicines for health
- Can explain about Tribal medicine
- can analyses the role of traditional medicine for today's health
- can demonstrate the use of medicinal herbs to health

MODULE I

Ethnomedicine – definition, history and its scope – Inter disciplinary approaches in ethnobotany – Collection of ethnic information.

MODULE II

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

MODULE III

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – *Aegle marmelos*, *Ficus benghalensis*, *Curcuma domestica*, *Cynodon dactylon* and *Sesamum indicum*.

MODULE IV

Traditional knowledge and utility of some medicinal plants in Tamil Nadu *Solanum trilobatum*, *Cardiospermum halicacabum*, *Vitex negundo*, *Adathodavasica*, *Azadirachta indica*, *Gloriosa superba*, *Eclipta alba*, *Aristolochia indica* and *Phyllanthus fraternus*.

MODULE V

Plants in day today life – *Ocimum sanctum*, *Centella asiatica*, *Cassia auriculata*, *Aloevera*. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and Vegetables - Greens (Moringa, *Solanum nigrum* Cabbage).

Course Outcomes

CO1	demonstrate the ability to acquire basic knowledge on ethanobotany
CO2	To understand the role of herbal medicine
CO3	To know the diagnosis and treatment of diseases by tribal medicine
CO4	To understand the knowledge and utility of some medicinal plants
CO5	To understand the role of traditional medicine

Textbooks

- R.K.Sinha & Shweta Sinha (2001), Ethnobiology. Surabhe Publications – Jaipur.
- D.C. Pal & S.K. Jain NayaPrakash, (1998), Tribal medicine, Bidhan Sarani, Calcutta
- S.K. Jain (2001) Contribution to Indian Ethnobotany – S.K. Jain, 3rd edition, scientific publishers, B.No.91, Jodhpur, India.
- Andrew Chevallie, (2000) Encyclopedia of Herbal Medicine
- James Green (2000). The Herbal Medicine-Maker's Handbook: A Home Manual

Reference books

- Steven Horne and Thomas Easley (2016), Modern Herbal Dispensatory: A Medicine Making Guide
- M.C. Joshi (2007) Handbook of Indian Medicinal Plants Hardcover.
- Neelesh Malviya and Sapna Malviya (2019). *Herbal Drug Technology*, (1st Edition), CBS Publishers and Distributors, ISBN: 9789387964334.
- Rageeb Md. Usman, Vaibhav M. Darvhekar, Vijay Kumar D, and Akhila S.A, (2019).
- *Practical Book of Herbal Drug Technology*, (1st Edition), Nirali Prakashan Publishers,

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	1		3	3	3		2	3	3	2
CO 2	1		3	3	3		2	3	3	2
CO 3	1		3	3	3		2	3	3	2
CO 4	1		3	3	3		2	3	3	2
CO 5	1		3	3	3		2	3	3	2

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV
CORE THEORY VI : MEDICAL BIOCHEMISTRY

COURSE CODE	23UCLTCT06
CREDIT	4

Learning Objective

- To realize the diagnostic importance of various metabolic disorders.
- to know the clinical aspects of various metabolic disorders.
- To understand the significance of diagnostic biochemistry.

MODULE I

Disorders of carbohydrate metabolism :

Normal sugar level in blood, and regulation of blood glucose concentration.

Hypoglycemia - Definition and causes. Hyperglycemia- Definition and causes.

Diabetes mellitus: Introduction, aetiology, types of diabetes mellitus,

Complication of diabetes mellitus-Diabetic ketoacidosis, Diabetic coma,

Clinical Diagnosis of Diabetes.- Urine testing , random blood sugar and GTT.

Renal threshold- Glycosuria, Types and diagnosis, Fructosuria, pentosuria,

Galactosemia, and Glycogen storage diseases.

MODULE II

Disorders of Lipid Metabolism:

Plasma lipids and lipoproteins - Introduction.

Hyperlipoproteinemia - Type I, II, III, IV, V and alpha- lipoproteinemia. Hypolipoproteinemia - A - beta lipoproteinemia, Hypo- beta - lipoproteinemia, Tangiers disease and LCAT (Lecithin Cholesterol Acyl Transferase) deficiency;

Artherosclerosis. Fatty liver and hyper lipidemia,

Hypercholesterolemia, and Hypocholesterolemia,

Lipidosis and Xanthomatosis. Taysh's diseases, Niemann - Pick disease.

MODULE III

Disease of Aminoacid Metabolism;

Plasma proteins. Abnormalities: Total plasma (serum) proteins, Fibrinogen, Albumin, Pre albumin, and Globulins.

Abnormal Non- protein Nitrogen: Urea, Uric acid, Creatinine, and Ammonia, Prophyria.

Aminoacid Metabolism: Cystinuria, Phenylketonuria, Maple Syrup Disease, Alkalptonuria, Albinism, and Hartnup disease.

Disorders of Purine and Pyrimidine metabolism:

Disorders of purine metabolism: Normal level of uric acid in blood and urine, miscible uric acid pool. Hyperuricemia and Gout; Hypouricemia - Xanthinuria and Xanthinolithiasis.

Disorders of Pyrimidine metabolism: Orotic aciduria

MODULE IV

Gastric, Pancreatic and Intestinal Functions Tests

Gastric function tests:- Introduction, The Insulin Stimulation test, determination of Gastrin in serum and Tubeless gastric analysis.

Pancreatic function Tests: Introduction, serum amylase and lipase; direct stimulation test, indirect stimulation test,

Intestinal function: Introduction, Test used in the diagnosis of malabsorption- determination of total faecal fat (fat balance test), test of monosaccharide absorption (xylose excretion test) and determination of total protein (Lowry's method).

MODULE V

Liver disease and liver function tests: Introduction, bilirubin metabolism and jaundice, Liver function tests, Estimation of conjugated and total bilirubin in serum (Diazo method), detection of bilirubin and bile salts in urine (Fouchet's test and Hay's sulphur test), Thymol turbidity test, Prothrombin time. Serum enzymes in liver disease- serum Transaminases- SGPT, SGOT and Lactate dehydrogenases (LDH).

Kidney Function test: Introduction, physical examination of urine, elimination tests, Clearance tests- Inulin clearance test, Creatinine clearance and Urea clearance tests, Renal blood flow and filtration fraction.

Thyroid Function Tests- Hypothyroidism, Hyperthyroidism-Determination of T3, T4, TSH, FT3, FT4, TBG, Disorder associated with Thyroid dysfunction

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment.	PO1,PO3,PO6
CO2	Understand the metabolic disorder of amino acids and different deficiency state	PO1,PO3,PO6
CO3	Analyze the lipid profile, purine and pyrimidine metabolic disorder	PO1,PO3,PO6
CO4	Detail about the composition of gastric juice and special test for diagnosis.	PO1,PO3,PO6
CO5	Describe the liver and kidney functions, Thyroid function Tests and specific diagnostic methods used for biological sample	PO1,PO3,PO6

Textbooks

- Pangaj Naik, 2022, Biochemistry. 6th edition Jaypee Brothers Medical Publishers(P) Ltd
- U.Sathyanarayana & U. Chakrapani, 2022, Biochemistry, 6th edition, Elsevier India Pvt.

Ltd., Books & Allied Pvt. Ltd.

- Vasudevan D M et al., —Textbook of Biochemistry for Medical Students, 9th edition, Jaypee Brothers Medical Publishers(P) Ltd
- MN Chatterjee and Rana Shinde, Text Book of Medical Biochemistry, Jaypee Brothers Medical Publishers (P) LTD, New Delhi, 8th Edition, 2012
- Ambika Shanmugam's Biochemistry for medical students, 8th edition, published by Wolters Kluwer India Pvt. Ltd.

Reference Books

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, 2008, 5th edition, W. H. Freeman and Company.
2. Robert K. Murray, Daryl K. Granner, Victor W. Rodwell, 2006, Harper's Illustrated Biochemistry, 27th edition, McGraw Hill Publishers.

Web Resources

1. <https://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate-metabolism>
2. <https://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests>
3. https://onlinecourses.nptel.ac.in/noc20_ge13/preview

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3			2	3	2	2	3
CO 2	3		3			2	3	2	2	3
CO 3	3		3			2	3	3	2	3
CO 4	3		3			2	3	3	2	3
CO 5	3		3			2	3	3	2	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV
CORE PRACTICAL IV : MEDICAL BIOCHEMISTRY PRACTICAL

COURSE CODE	23UCLTCP04
CREDIT	3

Learning Objectives

- To Understand the estimation procedure for various important biomolecules.
- To learn the routine qualitative analysis of urine sample for diagnostic purpose.

I Qualitative Analysis

1. Estimation of Glucose in Urine
2. Analysis of Vitamins
Test for Vitamin A
Test for Vitamin C
Test for Riboflavin in Milk
3. Analysis of Minerals
Test for Calcium
Test for Iron
Test for Phosphorous

Quantitative Analysis

1. Estimation of serum Cholesterol
2. Estimation of Albumin in serum
3. Calculation of A/G ratio
4. Estimation of serum calcium
5. Estimation of Phosphorous
6. Estimation of Proteins in urine
7. Estimations of Chloride in urine

Demonstration

Glucose Tolerance Test with Graph (Normal and Abnormal)

Text books

- Manickam, S.S.(2018).Biochemical Methods(3rd ed.).New age International PvtLtd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408
- Plummer, D.T. An Introduction to Practical Biochemistry. Tata Mc GrawHill-ISBN: 97800708416
- Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBSPublishers, India.
- Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58(Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.
- Biochemistry Practical Manual, Soundravally Rajendiran, Pooja Dhiman,

Elsevier

- Practical Textbook of Biochemistry for Medical Students, DM Vasudevan, Subir Kumar Das, 3rd edition, Jaypee Health Science Publishers
- Practical Biochemistry with Clinical Correlation, Poonam Agarwal, CBS Publishers and Distributors Pvt Ltd.

Referencebooks

2. Singh, S.K. (2005). Introductory Practical Biochemistry (2nd ed.). Alpha Science International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026
2. Ashwood, B. a. (2001). Tietz, Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346 / ISBN 13: 978072168634

Web resources

<https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors>

2. <http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf>

3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y *

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	3			3	3	3	3	3
CO 2	3	3	3			3	3	3	3	3
CO 3	3	3	3			3	3	3	3	3
CO 4	3	3	3			3	3	3	3	3
CO 5	3	3	3			3	3	3	3	3

S-Strong (3) M-Medium (2)

L-Low (1)

SECOND YEAR: SEMESTER IV
ALLIED PAPER IV : COMPUTER SCIENCE

COURSE CODE	23UCLTAL04
CREDIT	3

Learning Objectives

- The major objective in introducing the Computer Skills course is to impart training for students in Microsoft Office which has different components like MS Word, MS Excel and Power point.
- The course is highly practice oriented rather than regular class room teaching.
- To acquire knowledge on editor, spread sheet and presentation software.

MODULE I

Introductory concepts: Hardware and Software - Memory unit – CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems - Introduction to Programming Languages.

MODULE II

Word Processing: File menu operations - Editing text – tools, formatting, bullets and numbering - Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, printing – Preview, options, merge.

MODULE III

Spreadsheets: Excel – opening, entering text and data, formatting, navigating; Formulas – entering, handling and copying

MODULE IV

Charts – creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.

MODULE V

Power point: Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition – Animation effects, audio inclusion, timers.

Course Outcomes

CO1	Understand the basics of computer systems and its components.
CO2	Understand and apply the basic concepts of a word processing package.
CO3	Understand and apply the basic concepts of electronic spreadsheet software.

CO4	Understand and apply the basic concepts of database management system.
CO5	Understand and create a presentation using PowerPoint tool.

Textbooks

Peter Norton, —Introduction to Computers| –Tata McGraw-Hill.

Reference Books

Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, —Microsoft 2003|, Tata McGraw- Hill.

Websources

Web content from NDL / SWAYAM or opensource web resources

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	1		2				3	3	1	3
CO 2	1		2				3	3	1	3
CO 3	1		2				3	3	1	3
CO 4	1		2				3	3	1	3
CO 5	1		2				3	3	1	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV
ALLIED PRACTICAL II : COMPUTER SCIENCE PRACTICAL

COURSE CODE	23UCLTALP02
CREDIT	3

Learning Objectives

- To enable the students in crafting professional word documents, excelspread sheets, power point presentations using the Microsoft suite of office tools.
- To familiarize the students in preparation of documents and presentations with office automation tools.

1. Word

Word Orientation : The instructor needs to give an overview of Microsoft word & Importance of MS Word as word Processor, Details of the four tasks and features that wouldbe covered Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

- **Task 1 : Using word** to create project certificate. Features to be covered:-Formatting Fontsin word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
- **Task 2 : Creating project** abstract Features to be covered:-Formatting Styles, Insertingtable, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Track Changes.
- **Task 3 : Creating a Newsletter** : Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs

2. Excel

Excel Orientation :The instructor needs to tell the importance of MS Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered Excel Accessing, overview of toolbars, saving excel files, Using help and resources { ComdexInformation Technology course tool kit Vikas }

- **Task1: Creating a Scheduler** - Features to be covered: Gridlines, Format Cells,Summation, auto fill, Formatting Text
- **Task 2 : Calculations** - Features to be covered:- Cell Referencing, Formulae in excel – average, standard deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
- **Task 3 : Performance Analysis** - Features to be covered:- Split cells, freeze panes, groupand outline, Sorting, Boolean and logical operators, Conditional formatting

MS Power Point

- **Task1 :**Students will be working on basic power point utilities and tools which

help them create basic power point presentation. Topic covered includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows

- **Task 2** :This session helps students in making their presentations interactive. Topics covered includes: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts
- **Task 3** :Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered includes :- Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide

Course Outcomes:

CO1	Understand to perform documentation
CO2	Understand to perform accounting operations
CO3	Understand to perform presentation skills

Textbooks

Peter Norton, —Introduction to Computers—Tata McGraw-Hill.

Reference Books

Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, —Microsoft 2003—, Tata McGraw- Hill.

Websources

Web content from NDL / SWAYAM or opensource web resources

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	1		2				3	3	1	3
CO 2	1		2				3	3	1	3
CO 3	1		2				3	3	1	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV
SKILL ENHANCEMENT COURSE VI : CONCEPTS OF MEDICAL CODING

COURSE CODE	23UCLTSE06
CREDIT	2

Course objectives

The objectives of this course are to

- Understand the basic concept of Medical coding
- Familiarize the student about medical terminology
- Understand about the classification of diseases based on WHO/AHA
- Understand about the CPT code used for diseases as per American Medical Association(AMA)

Module I: Introduction to Medical coding, coding theory, Health care Common Procedure Coding,First Aid and CPR

Module II: Introduction to Medical Terminology, specialization I & II, Diagnostic coding,factors affecting diagnostic coding.

Module III: Documenting medical records- Importance of Documentation, Types of dictation formats.

Module IV: Introduction to Human Anatomy and Coding, ICD-10- CM classification system.

Module- V : Introduction to CPT coding, types of CPT coding Medical Law and Ethics. 6hrs

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Explaining the basic concept of coding and its application. Possess the knowledge about the First aid and CPR	PO1,PO2, PO6
CO2	Possess the knowledge about medical terminology used in Medical coding industry	PO1,PO2, PO6
CO3	Possess the knowledge about the ICD-10 CM international classification of diseases based on WHO	PO1,PO2, PO6
CO4	Possess the knowledge about the CPT codes used for diseases as per American Medical Association (AMA)	PO1,PO2, PO6
CO5	Understand CPT coding and its types	PO1,PO2, PO6

Text books

1. Understanding Medical Coding, A comprehensive guide Sandra L Johnson RobinLinker
2. Buck's Step – by – step Medical Coding Elsevier reference

Reference books

1. Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CMcoding guidelines made easy2017.
2. Besty J Shiland- Medical terminology and anatomy for ICD-10.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3				3	3		2	3
CO 2	2	3				3	3		2	3
CO 3	2	3				3	3		2	3
CO 4	2	3				3	3		2	3
CO5	2	2				2	3		2	3

S - Strong (3)

M - Medium (2)

L -Low (1)

SECOND YEAR: SEMESTER IV
SKILL ENHANCEMENT COURSE VII : FUNDAMENTALS OF RESEARCH
METHODOLOGY

COURSE CODE	23UCLTSE07
CREDIT	2

Learning Objectives

- To familiar with Introduction, types and methods of research
- Students should be able to identify the overall process of designing a research study from its inception to its report
- Students should understand a general definition of research design
- Students should know the primary characteristics of quantitative research and qualitative research
- Students should be able to identify a research problem stated in a study

MODULE I

Objectives, Motivation to perform research. Types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical). Research methods vs methodology. Literature- review and its consolidation; Library research; field research; laboratory research.

MODULE II

Basic concepts of Statistical sampling methods, Sample Size, Sampling Frame, Sampling Error, Characteristics of a good sample, Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages)

MODULE III

Research Question & Investigation Question, Hypothesis, Qualities of a good Hypothesis, Features of a good research design, Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

MODULE IV

Layout of a Research Paper, Journals in Life Science, Impact factor of Journals, Ethical issues related to publishing: Plagiarism and Self- Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

MODULE V

Methods to search required information effectively, Reference Software such as Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Softwares for detection of Plagiarism.

Course Outcomes

CO1	This course aims to inculcate a clear idea of research among students, understand the existing social issues in research, frame hypothesis, design the wet lab procedures and interpret the results.
CO2	Learn about Introduction, types and methods of research
CO3	Acquiring the skills of scientific reading, writing and presentations of research
CO4	Analyze the mechanism of separation and imaging techniques
CO5	Learn the statistical analysis of biological data

Textbooks

Research Methods for the Biosciences. Holmes, Moody & Dine. Oxford University Press.
Experimental Design for the Life Sciences. Ruxton & Colegrave. Oxford University Press
Robert A. Day (1998), How to Write & Publish a Scientific Paper. Oryx Press; 5 editions
Frank D. Bell (1995), Basic Biostatistics: Concepts for the Health Sciences. William C. Brown

Reference Book

1. Judith Bell. Doing your research, A guide for first-time researchers in education, health, and social science. 4th edition. Open University press. McGraw Hill education (2005).

Websources

<https://explorable.com/quantitative-research-design>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3		3	3	3	3	3	3
CO 2	2	3	3		3	3	3	3	3	3
CO 3	2	3	3		3	3	3	3	3	3
CO 4	2	2	3		3	3	3	2	3	3
CO5	2	2	3		3	3	3	2	3	3

S - Strong (3)

M - Medium (2)

L -Low (1)

THIRD YEAR: SEMESTER V
CORE THEORY VII : ENDOCRINOLOGY

COURSE CODE	23UCLTCT07
CREDIT	4

Learning Objective

- To explain the role of endocrine system in maintaining homeostasis, integrating growth and development.
- To discuss molecular, biochemical, and physiological effects of hormones on cells.
- To explain the consequences of under and overproduction of hormones.

MODULE – I

Introduction to Endocrine System: Hormones as messengers, classification of hormones, -circulating and local hormones, receptors of hormones, mechanism of action

Second messengers: - Role of cAMP, cGMP, IP₃, DAG, Ca²⁺ ions and calmodulin in hormonal action.

Others: Local hormones in tissues – Prostaglandins and related compounds, Local hormones in blood – Kinins.

MODULE – II

Hypothalamus and Pituitary Gland: Hypothalamic hormones, Pituitary gland- Location of gland, chemical nature, secretion, circulation, biological functions, disorders of Adenohypophyseal and neurohypophyseal hormones.

MODULE– III

Thyroid and Parathyroid Glands: Location of gland, Chemical nature, secretion, circulation, biological function, disorder of thyroid and parathyroid hormones.

Pancreas: Chemical nature, secretion, circulation, biological function, disorder of Insulin and Glucagon.

MODULE– IV

G.I. Tract Hormones: Chemical nature, secretion, circulation, biological function, disorders of Gastrin, Secretin and Cholecystokinin.

Adrenal gland: – Location of gland, Chemical nature, secretion, circulation, biological function, disorders of adrenal medullary and Cortical hormones.

MODULE– V

Gonadotropic Hormones:

Male reproductive system, functions of testis, spermatogenesis site and stage factors influencing semen, Endocrine functions of testis -Androgens - Testosterone - structure and functions

Female Reproductive system- Female sex hormones- , Actions of estrogen, progesterone, puberty, Ovulation, Menstrual cycle, physiological changes during pregnancy, functions of placenta, parturition, Mammary glands & lactation- Composition of milk and factors controlling lactation, Menopause.

Course Outcomes

Course No	On completion of this course, students will be able to	Programme outcome
CO1	Gain knowledge about the basic terminologies, classification and mechanism of action of hormones and to demonstrate various types of second messengers and Prostaglandins.	PO1
CO2	Understand hypothalamic and pituitary hormones.	PO1
CO3	Learn various functions of thyroid, parathyroid and pancreatic hormones along with their mechanism of action.	PO1
CO4	Demonstrate the biological functions and dysfunction of various GI tract hormones as well as adrenal gland hormones.	PO1
CO5	Understand about the male and female reproductive hormones and also gain the knowledge about some local hormones.	PO1

Textbooks

1. Essentials of Medical Physiology K. Sembulingam and Prema Sembulingam, 6th Edition, 2012
2. Fundamentals of Biochemistry, J.L. Jain, S. Chand publications, 2004.
3. Textbook of Biochemistry, Edward Staunton West, Wilbert R. Todd, Howard S. Mason, John T. VanBruggen, 4th edition, Oxford & IBH publishing Co.Pvt.Ltd., 1996.
4. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edn, W.H. Freeman and Company.
5. Principles of Biochemistry: Mammalian Biochemistry -Emil Smith, Robert Hill, Robert Legman, Robert Lefkowitz, Philip Handler, Abraham white, 7th Edition, McGraw Hill & Co.

Web sources

1. <http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		2				2	3	2	3
CO 2	3		2				2	3	2	3
CO 3	3		2				2	3	2	3
CO 4	3		2				2	3	2	3
CO5	3		2				2	3	2	3

S - Strong (3)

M - Medium (2)

L -Low (1)

THIRD YEAR: SEMESTER V
CORE THEORY VIII : HEMATOLOGY

COURSE CODE	23UCLTCT08
CREDIT	4

Learning Objective

To enable the students to acquire knowledge about the composition of blood and the laboratory methods to identify the various disorders related to it.

To understand the Methods for the determination of blood cells and staining techniques.

Techniques of bone marrow aspiration, Various diseases related to it.

MODULE I

Introduction, Blood Collection, Anticoagulants used in Hematology, Normal Values in Hematology, Basic Hematological Techniques- RBC count, Hemoglobin estimation, Packed cell volume, WBC counts- Total and differential, Absolute eosinophil count, Platelet count, Erythrocyte sedimentation rate, Reticulocyte count.

Preparation of blood films, Stains used in Haematology, Morphology of red cells, Morphology of Leukocytes and platelets.

Bone marrow- Techniques of aspiration, preparation and staining of films, Bone marrow biopsy, Preparation of buffy coat smears

MODULE II

Structure and functions of Hemoglobin, Laboratory methods used in the investigation of anaemia- B12 and folate assay, Schilling Test, Serum iron and iron bonding capacity

Laboratory methods used in the investigation of hemolytic anaemias- Osmotic fragility, Investigation of G6PD deficiency, Test for sickling, Estimation of Hb-F, Hb-A2, Plasma hemoglobin and Haptoglobin, demonstration of naemosiderin in urine, Hemoglobin electrophoresis, Test for auto immune hemolytic anaemias, Measurements of abnormal Hb pigments.

MODULE III

Investigation of Hemorrhagic disorders

Mechanism of coagulation, Collection and anticoagulatis used in coagulation studies, Bleeding time and Clotting time, Other coagulation studies- PT, KPTT, TGT etc., Assay of clotting factors.

MODULE IV

Test for blood fibrinolytic activity and detection of FDP Platelet function tests, Demonstration of LEcells Cytochemistry

MODULE V

Automation in haematology, Electronic cell counter- Principle and working of cell counter, Flow cytometry- Volume Histograms, Platelet indices.

Organisation and quality control in haematology laboratory

Preparation of glassware and disposal of the waste in the laboratory

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Acquire knowledge about the composition of blood	PO1, PO2, PO3, PO6
CO2	Explain the Laboratory methods used in investigation of anaemia	PO1, PO2, PO3, PO6
CO3	Explain the Investigation of Hemorrhagic disorders	PO1, PO2, PO3, PO6
CO4	Understands the Platelets function tests	PO1, PO3, PO4
CO5	Describe the hematology laboratory and the practices	PO1, PO3

Textbooks

- Todd and Sanford, clinical diagnosis by laboratory method
- .Culling -Histopathology techniques.
- Dycie and Lewis -Practical haematology.
- .Ramani Sood.Laboratory technology*Methods and interpretations 4 th Ed. J.P. Bros, New Delhi,1996.
- Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi.
- Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2nd edition, JaypeeBrothers Medical Publishers Pvt Ltd, New Delhi, India.
- Dycie and Lewis, 2016, Practical haematology, 12th edition, Elsevier, Amsterdam,Netherlands.
- Wintrobe's Clinical Hematology, 2014,13th edition, Lippincott Williams & Wilkins
- Ramani Sood, 1995, Colour Atlas of Practical Pathology and Microbiology, 2nd edition,Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

Reference books

1. Dycie and Lewis, 2016, Practical haematology, 12th edition, Elsevier, Amsterdam,Netherlands.

2. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2nd edition, JaypeeBrothers Medical Publishers Pvt Ltd, New Delhi, India.
3. Harold Varley, 2005, Practical Clinical Biochemistry, 4th edition, CBS Publication and Distributors, New Delhi, India
4. Mukherjee .L.K, 2017, Medical Laboratory Technology, vol.1-3, 3rd edition, TataMcgraw Hill, New Delhi India.

Websource

1. <https://app.pulsenotes.com/medicine/haematology/notes>
2. <https://www.studocu.com/en-gb/document/university-of-nottingham/cardiovascular-respiratory-and-haematology/revision-notes-haematology-1-6/132921>
3. <https://geekymedics.com/tag/haematology/>
4. chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/ln_hematology_mlt_final.pdf
5. Chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.hematology.org/-/media/files/ntc_hematology_may_1_2013.pdf

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3			2	3	3	3	2
CO 2	3	2	3			2	3	3	3	2
CO 3	3	2	3			2	3	3	3	2
CO 4	3	2	3			2	3	3	3	2
CO5	3	2	3			2	3	3	3	2

S - Strong (3)

M - Medium (2)

L -Low (1)

THIRD YEAR: SEMESTER V
CORE THEORY IX : CLINICAL PATHOLOGY AND HISTOPATHOLOGY

COURSE CODE	23UCLTCT09
CREDIT	4

Learning Objectives

- To provides precise information of techniques for pathological and clinical analysis.
- To students will have the knowledge about the histopathology, clinical pathology and methods of analysis of various specimens.
- To understand the instruments and techniques in histopathology, examination of urine, stool, serum analysis and calculi analysis, Maintenance of slides and Microphotography

MODULE I

Clinical Pathology- Urine examination- Physical, Chemical, Microscopic. Stool examination

MODULE II

Examination of body fluids, cell counts

Ascitic fluid, pleural fluid, synovial fluid, pericardial fluid, urinary calculi.

Semen analysis

CSF (Cerebro Spinal Fluid)- Composition and Analysis

MODULE III

Histopathology- Introduction, Receiving specimens in Laboratory, Grossing Techniques.

Various fixatives- Mode of action, Indications, Preparation, Decalcification of calcified tissue before sectioning- Processing of tissues for routine paraffin sections and other methods of embedding

MODULE IV

Instruments used in Histopathology:

- a) Tissue Processor b) Knife sharpener c) Automatic slide stainer d) Microtome, knives e) Freezingmicrotome; Cryostat f) Instruments for grossing g) Electric saw.

Frozen section techniques: Co2 Freezing, Cryostat and freezingmicrotome.

Techniques and principles of sections cuttings and routine staining, andspecial stains.

Mounting Techniques, various mo lining.

Use of Electron microscope, polarisers and technique of preparing slides.

MODULE V

Laboratory Organisation

Reception of organization, dispatch report, Maintenance of records and filing slides, coding the lesions of cases. Familiarisation with computer- Microphotography technique, Follow up programme, quality control of techniques, Museum Technology- preservation, Coding- ICDS-Classification

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Acquire knowledge about the clinical pathology	PO1, PO3, PO6
CO2	Understands the analysis of various body fluids, CSF, semen analysis	PO1, PO3, PO6
CO3	Explain about the techniques of histopathology	PO1, PO3, PO6
CO4	Explain the Instruments used in histopathology and Frozen section technique	PO1, PO3, PO6
CO5	Describe the Good Laboratory Organization and Practices	PO1, PO3, PO6

Text books

- Todd and Sanford, clinical diagnosis by laboratory method
- .Culling -Histopathology techniques.
- Dycie and Lewis -Practical haematology.
- .Ramani Sood.Laboratory technology*Methods and interpretations 4 th Ed. J.P. Bros, New Delhi,1996.
- Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi.
- Mukherjee K. L, 2017, Medical Laboratory Technology, Procedures Manual for Routine Diagnostic Tests, 3rd edition, McGraw Hill Education, Tennessee, United States.
- Harold Varley, 2005, Practical Clinical Biochemistry, 4th edition, A manual of laboratory Diagnostic tests Fischback c) Practical clinical Biochemistry, CBS, Karnataka, India.
- Burtis, 2012, Tietz's Text book of Clinical Chemistry and Molecular Diagnostics, 5th edition, Elsevier, Amsterdam, Netherlands.
- Kalpan, 2003, Clinical chemistry – Theory, Analysis, Correlation, 4th edition,

CBS Publishers and Distributors Pvt. Ltd, Bangalore, India.

Reference books

1. West & Todd, 1966. Text Book of Biochemistry, 4th Edition, Macmillan, New York City, United States.
2. Sood Ramnik, 2015, Text book of Medical Laboratory Technology, 2nd edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.
3. Thomas M. Devlin, 2010, Text book of Biochemistry with clinical correlation, 7th edition, John Wiley & Sons, New Jersey, United States.
4. Harold Varley, 2005, Practical Clinical Biochemistry, 4th edition, A manual of laboratory Diagnostic tests Fischback c) Practical clinical Biochemistry, CBS, Karnataka, India.

Websource

- <https://www.studocu.com/en-gb/document/university-of-nottingham/clinical-laboratory-sciences-i/complete-lecture-notes-clinical-laboratory-sciences-cls/132920>
- https://www.academia.edu/32040390/LECTURE_NOTES_For_Medical_Laboratory_Students
- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf
- <https://www.studypool.com/documents/4702704/medical-laboratory-technology-lecture-notes>
- <https://documents.in/download/for-medical-laboratory-technology-students-lecture-notes-for-medical-laboratory>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3			2	3	3	3	2
CO 2	3	2	3			2	3	3	3	2
CO 3	3	2	3			2	3	3	3	2
CO 4	3	2	3			2	3	3	3	2
CO5	3	2	3			2	3	3	3	2

S - Strong (3)

M - Medium (2)

L -Low (1)

THIRD YEAR: SEMESTER V
CORE PRACTICAL V : CLINICAL LABORATORY PRACTICAL

COURSE CODE	23UCLTCP05
CREDIT	4

Learning Objectives

- To Understand the estimation procedure for various important biomolecules.
- To learn the routine qualitative analysis of urine sample for diagnostic purpose.

I Examination of Urine sample

1. Physical Examination
2. Chemical Examination- Protein, Reducing sugar, Ketone bodies, Bile pigment, Bile salt, Blood, Urobilinogen and Porphobilinogen
3. Microscopic examination
4. Screening of Inborn errors of Metabolism in urine

II Estimations in Serum

1. Estimation of SGOT
2. Estimation of SGPT
3. Estimation of serum amylase
4. Estimation of Bilirubin
5. Estimation of HDL
6. Estimation of Calcium

III Stool Examination

1. Physical examination
2. Chemical Examination- Occult blood, Reducing sugar
3. Microscopic Examination- ova, cysts, crystals and fat globules

IV Semen Analysis

V CSF Examination

Text books

- Manickam, S.S.(2018).Biochemical Methods(3rd ed.).New age International PvtLtd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408
- Plummer, D.T. An Introduction to Practical Biochemistry. Tata Mc GrawHill-ISBN: 97800708416

- Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.
- Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58(Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.
- Biochemistry Practical Manual, Soundravally Rajendiran, Pooja Dhiman, Elsevier
- Practical Textbook of Biochemistry for Medical Students, DM Vasudevan, Subir Kumar Das, 3rd edition, Jaypee Health Science Publishers
- Practical Biochemistry with Clinical Correlation, Poonam Agarwal, CBS Publishers and Distributors Pvt Ltd.

Referencebooks

3. Singh, S.K. (2005). Introductory Practical Biochemistry (2nd ed.). Alpha Science International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026
2. Ashwood, B. a. (2001). Tietz, Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346 / ISBN 13: 978072168634

Web resources

<https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors>

2. <http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf>

3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistry.pdf?sequence=1&isAllowed=y

4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistry.pdf?sequence=1&isAllowed=y *

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	3			3	3	3	3	3
CO 2	3	3	3			3	3	3	3	3
CO 3	3	3	3			3	3	3	3	3
CO 4	3	3	3			3	3	3	3	3
CO 5	3	3	3			3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

THIRD YEAR: SEMESTER V
ELECTIVE PAPER I : IMMUNOLOGY

COURSE CODE	23UCLTCE01
CREDIT	3

Learning Objective

- To learn about the general concepts of immune system and immune organs
- To understand the properties of antigens and antibodies and the concept of antigen-antibody interactions
- To know about the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology and immunological disorders

MODULE I

Introduction to Immunology: Immunity, types of immunity, mechanism of immunity, Hematopoiesis, cells and organs of the immune system. Humoral and cell mediated immune response, primary and secondary immune response.

MODULE II

Immunogens and Antigens: Immunogenicity, antigenicity, factors that influencing antigenicity, antigenic specificity, epitopes of an antigen, haptens, adjuvants. **Antibodies:** Structure, Classes, Subclasses, Properties of Immunoglobins, Antigenic determinants – isotypic, allotypic and idiotypic determinants. Production and applications of Monoclonal antibodies.

MODULE III

Antigen - Antibody Interactions: Antigen – antibody binding, strength of binding, Primary binding tests: - Radioimmunoassay, Immunofluorescence assays, Immunoenzyme assays- ELISA. Secondary binding tests: - Agglutination, Precipitation, Immunodiffusion, Immunoelectrophoresis. Complement fixation.

MODULE IV

Immunization: Vaccine and its types.

Major Histocompatibility Complex: Classification and role of MHC in immune

response. **Hypersensitivity:** Types – I to V. **Transplantation Immunology:** mechanism of graft acceptance and rejection,

MODULE V

Complement System: Classical and Alternative pathway, **Auto immunity:** - History and types of auto immune disorders. Immunodeficiency disorders: - Causes, symptoms, mechanism of HIV infection, HIV replication, transcription and diagnostic methods.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Associate structure and function of the organs involved in our body's natural Defence	PO1
CO2	Classify antigens and antibodies and the role of lymphocytes in defending the host	PO1,PO2
CO3	Describe the types of immunity and the uses of vaccines	PO1, PO4
CO4	Understand the immune related diseases and mechanism of transplantation	PO1,PO2
CO5	Examine the immunological tests and relate it to the immune status of an Individual	PO1,PO3

Text Books

1. Immunology and Immunotechnology - M. Rajasekara Pandian & B. Senthil Kumar, PanimaPublishing Corp, New Delhi, 2007.
2. ImmunologyRoitt. Brostoffand David Mole, 4th edition, 1998 MosbyTimes Mirror Int Pub Ltd.
3. Immunology, An introduction: Tizard K, Saunders college Publishing (1984).
4. Essential Immunology. Roitt. I.M. (1988). Blackwell Scientific Publishers.
5. Immunology, Kuby Richard. A. Goldsby, Thomas. J.Kint, Barbara. A. Osborne, 4th Edition, 2000, W.H. Freemanand Company, New York.
- 6 Kuby, J. (2018). Immunology (5th ed). W.H. Freeman - ISBN-10: 1319114709 / ISBN-13: 978-1319114701

6. Rao, C. V. (2017). Immunology (3rd Ed.). Chennai: Alpha Science Int. Ltd - ISBN-10:1842652559/ ISBN 13:978-1842652558
7. Tizard (1995). An Introduction to Immunology. Harcourt Brace College Publications

References Books

1. Kenneth M. Murphy, Paul Travers, Mark Walport - (2007), Janeway's Immunobiology, 7th edition, Garland Science.
2. Abul K. Abbas, Andrew H. Lichtman, Jordan S. Pober - (1994), Cellular and molecular immunology, 2nd edition, B. Saunders Company.
3. Basic Immunology Functions and Disorders of the Immune System, 6th Edition - January 25, 2019 Authors: Abul Abbas, Andrew Lichtman, Shiv Pillai, ISBN: 9780323549431 eBook ISBN: 9780323639095
4. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - (2006), Roitt's Essential Immunology, 11th edition, Wiley-Blackwell

Websites

1. http://www.hss.gov.yk.ca/pdf/im_manual_section14.pdf
2. https://onlinecourses.nptel.ac.in/noc22_bt40/preview
3. https://onlinecourses.swayam2.ac.in/cec20_bt05/preview
4. <https://youtu.be/8uahFPl6ny8>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3		2				3			3
CO 3	3			2			3	3		3
CO 4	3	2					3	1		3
CO 5	3		3				3	3	3	3
S-Strong (3) M-Medium (2) L-Low (1)										

THIRD YEAR: SEMESTER V
ELECTIVE PAPER I : BIOINFORMATICS

COURSE CODE	23UCLTCE02
CREDIT	3

Learning Objectives

The objective of this course is to

- Impart knowledge on bioinformatics and applications
- Learn about biological databases
- Understand the local and global sequence alignment
- Provide insights on BLAST and Microarray
- Familiarize about structural genomics and visualization tools

Module I: Introduction to Bioinformatics – Bioinformatics and its applications. – Genome, Metabolome - Definition and its applications. Metabolome - Metabolome database- E.coli metabolome database, Human Metabolome database. Transcriptome - Definition and applications.

Module II : Biological Databases - definition, types and examples – Nucleotide sequence database (NCBI, EMBL, Genbank, DDBJ) Protein sequence database- SwissProt, TrEMBL, Structural Database - PDB, Metabolic database-KEGG.

Module III: Sequence Alignment-Local and Global alignment-Dot matrixanalysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment

Module IV: BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, resultformat. DNAMicroarray-Procedure and applications.

Module V: Structural genomics-Whole genome sequencing (Shotgun approach),Comparative

genomics-tools for genome comparison, VISTA servers and precomputedtools. Molecular visualization tools. RASMOL, Swiss PDB viewer. Nutrigenomics-Definition and applications

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Introduce the fundamentals of Bioinformatics and its applications Genome, metabalome & Transcriptome.	PO1
CO2	Classify biological database and to correlate the different file formats used by nucleic acid, protein database, structural and metabolic database.	PO1,PO2. PO3
CO3	Develop algorithms for interpreting biological data.	PO1,PO2
CO4	Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes	PO1.PO2, PO3
CO5	Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method.	PO1.PO2

Textbooks

1. Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang Editors
2. Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and AnalyticalTools By: Supratim Choudhuri (Author)
3. Bioinformatics by Saras publication
4. Introduction to Bioinformatics by Arthur Lesk

Reference Books

1. Computation in BioInformatics Multidisciplinary Applications S Balamurugan, Anand T.Krishnan, Dinesh Goyal, Balakumar Chandrasekaran
2. Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences Navneet Sharma PhD Pharmaceutics, Himanshu Ojha, Pawan Raghav, Ramesh K. Goyal

Websources

. <https://nptel.ac.in/courses/102/106/102106065/>

2. <http://www.digimat.in/nptel/courses/video/102106065/L65.html>
3. <https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes>

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3		2	3
CO 2	3	3	3				3		3	
CO 3	3	3					3		3	
CO 4	3	3	3				3		3	
CO5	3	3					3		3	

S-Strong (3) M-Medium (2) L-Low (1)

THIRD YEAR: SEMESTER V
ELECTIVE PAPER II : BIOMEDICAL INSTRUMENTATION

COURSE CODE	23UCLTCE03
CREDIT	3

Learning Objective

- Provide insights about the blood pressure and its measurement.
- Elaborate the mechanism of instruments related to respiration.
- Highlight the importance of imaging techniques.
- Acquaint students about the basics of medical assisting devices.
- Familiarize about the life saving therapeutic equipments.

Module I: Measurement of blood pressure – sphygmomanometer. Cardiac output – Cardiac rate – Heart sound – Stethoscope, ECG – EEG – EMG – ERG- CPR- PFT

Module II: Monitoring of inspired/expired anaesthetic gases, capnograph, inhalators, nebulizers, aspirators, infant respirator, Plethysmography.

Module III: Medical imaging: X-ray machine - Radio graphic and fluoroscopic techniques – Computed tomography – MRI – PET, Ultrasonography – Endoscopy – Thermography.

Module IV: Assisting equipments: Pacemakers – Defibrillators – Ventilators.

Module V: Therapeutic equipments: Nerve and muscle stimulators –EMV & NCV- Principles and application, NMR & MRI- Principles and advantages Diathermy – Heart – Lung machine – Audio meters – Dialyzers.

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome

CO1	Illustrate the functions of instruments used for measuring blood pressure.	PO1,PO2, PO5
CO2	Elaborate the devices required for monitoring of respiratory gases.	PO1,PO2, PO5
CO3	Understand the operation of the imaging and sonographic instruments.	PO1,PO2, PO5
CO4	Differentiate between the action of pacemakers, defibrillators and ventilators.	PO1,PO2, PO5
CO5	Demonstrate the function of therapeutic equipments	PO1,PO2, PO5

Textbooks

1. M. Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies.
2. L.A. Geddes and L. E. Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons.
4. C.Rajarao and S.K.Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities (India) Ltd, Orient Longman Ltd.

Reference

- Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', 2nd Edition, Pearson Education, 2002.
- R.S.Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw Hill Publishing CoLtd.,

Websource

<https://youtu.be/GkUCmb0cKwo?list=PLCZ9KmODEcu138IIVeHClJ4nskArYr1Dg>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3			3		3	3	3	3
CO 2	2	3			3		3	3	3	3
CO 3	2	3			3		3	3	3	3
CO 4	2	3			3		3	3	3	3
CO 5	2	3			3		3	3	3	3

S-Strong (3) M-Medium (2) L-Low

THIRD YEAR: SEMESTER V
ELECTIVE PAPER II : BIOTECHNOLOGY

COURSE CODE	23UCLTCE04
CREDIT	3

Learning Objective

- Impart knowledge on gene manipulation and gene transfer technologies
- Make the students understand the procedures involved in plant tissue culture.
- Acquire knowledge on animal cell culture and stem cell technology.
- Improve the employability skills of students by providing knowledge in recent techniques such as PCR, blotting, ELISA etc.
- Understand the application of fermentation technology.

Module I: Recombinant DNA technology

Recombinant DNA technology - Principles of gene cloning: restriction endonucleases and other enzymes used in manipulating DNA molecules. Ligation of DNA molecules, DNA ligase, linkers and adapters, homopolymer tailing, end labeling and construction maps of PBR322, λ bacteriophage.

Module II: Plant Tissue culture

Plant tissue culture- basic requirements for culture, M S medium, callus culture, protoplast culture. Vectors – Ti plasmid (cointegration vector and binary vector), viral vectors- TMV, CaMV and their applications. Transgenic plants – pest resistant, herbicide resistant and stress tolerant plants.

Module III: Animal Tissue culture

Animal cell lines and organ culture - culture methods and applications. Transgenic animals: transgenic mice- Production and its applications. Stem cell technology: definition, types, and applications.

Module IV: Molecular Techniques

PCR –Principle, types and its application in clinical diagnosis and forensic science. Southern blotting, Northern blotting and DNA finger printing Technique-principle and their applications.

Module V: Fermentation technology

Fermentation technology – Fermentors - general design, fermentation processes - Media used, downstream processing. Production and applications of ethanol, Streptomycin and Proteases. Production of edible vaccines.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonuclease	PO1,PO3
CO2	Get acquainted with the use of cloning and vectors in plant tissue culture.	PO1,PO2,PO3
CO3	Understand the methods for production of proteins using recombinant DNA technology and their applications, basics of tissue culture, transgenesis, stem cell technology, risks, and safety aspects and patenting in biotechnology	PO1,PO3
CO4	Gain knowledge about the importance of gene and gene manipulation technologies	PO1,PO3
CO5	Know the concept fermentation technology and its applications.	PO1,PO3

Textbooks

1. James D. Watson, Amy A. Caudy, Richard M. Myers, Jan Witkowski (2006) Recombinant DNA: Genes and Genomes - a Short Course (3rd ed), W.H. Freeman & Co
2. Satyanarayana U (2008), Biotechnology, Books & Allied (P) Ltd.
3. Cassida L (2007) Industrial Microbiology, New Age International

Reference books

1. Reed G (2004) Prescott and Dunn's Industrial Microbiology, CBS Publishers & Distributors
2. Biotechnology: applying the genetic revolution- David P. Clark, Pazdernik N. J., Elsevier (2009).

3. Click B.R. and Pasternark J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology

Websource

NPTEL Certification course - Gene Therapy by

Sachin Kumar <https://nptel.ac.in/courses/102/103/102103041/>

Coursera Certification course –Vaccines

[https://futureoflife.org/background/benefits-risks-](https://futureoflife.org/background/benefits-risks-biotechnology/)

[biotechnology/](https://futureoflife.org/background/benefits-risks-biotechnology/)

[https://www.sciencedirect.com/topics/neuroscience/gene](https://www.sciencedirect.com/topics/neuroscience/gene-tic-engineering)

[tic-engineering](https://www.sciencedirect.com/topics/neuroscience/gene-tic-engineering)

[http://www.biologydiscussion.com/biotechnology/techniques-](http://www.biologydiscussion.com/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683)

[biotechnology/important- techniques-of-biotechnology-3-](http://www.biologydiscussion.com/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683)

[techniques/15683](http://www.biologydiscussion.com/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683)

[https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-](https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1)

[7503-1347-6ch1](https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1)

https://www.slideshare.net/zeal_eagle/fermentation-technology

https://www.slideshare.net/zeal_eagle/fermentation-technology

[https://www.slideshare.net/Chepkitwai/blotting-techniques-](https://www.slideshare.net/Chepkitwai/blotting-techniques-6129300)

[6129300](https://www.slideshare.net/Chepkitwai/blotting-techniques-6129300)

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3		3	3	3	3	3	3
CO 2	3		3		3	3	3	3	3	3
CO 3	3		3		3	3	3	3	3	3
CO 4	3		3		3	3	3	3	3	3
CO5	3		3		3	3	3	3	3	3

S-Strong (3) M-Medium (2)

L-Low (1)

THIRD YEAR: SEMESTER VI

CORE THEORY X : CLINICAL LABORATORY TESTS AND ITS INTERPRETATION

COURSE CODE	23UCLTCT10
CREDIT	4

Learning Objectives

- To know the various clinical laboratory tests and its interpretation.
- To gain knowledge in clinical chemistry tests, microbiology and blood bank.
- To understand: Biochemical constituents and enzymes that are used as marker for various diseases, Serodiagnostic procedures, Skin tests, Haemogram and blood bank

MODULE I

CLINICAL TESTS

MODULE I:

Biochemistry- Normal range and Clinical Interpretations of Glucose Tolerance Test and Sugar Profile- Fasting glucose, PP, Random, Glycosylated Hb, Microalbuminuria.

Kidney function Profile- Urea, Uric acid, Creatinine

Liver Profile- Direct Bilirubin, Indirect Bilirubin, SGOT, SGPT, ALP

Lipid Profile- Total cholesterol, HDL- C, Triglycerides, LDL- C, VLDL-C, CHO/ HDL Ratio, LDL/ HDL Ratio

Cardiac Markers- CK, LDH, AST

Protein Test- Total Protein test, Albumin, Globulin, A/G Ratio, Serum protein electrophoresis.

MODULE II

Biochemistry- Normal range and Clinical Interpretations of

Enzymes - Liver, Cardiac and Skeletal Enzymes,

Biliary Tract Enzyme,- Gamma Glutamyl transferase, 5' Nucleotidase,

Digestive Enzymes of Pancreatic origin- Amylase, Lipase, Trypsin,

Other enzymes- Acid Phosphatase, Prostate Specific Antigen,

Cancer- Carcinogens, Molecular basis & Tumour Marker enzymes

Minerals- Calcium, Phosphorous, Iron, Ferritin, Copper

Electrolytes - Sodium, Potassium, Chloride and Bicarbonate,

Hormones

LH, FSH, TSH, Estrogen, Progesterone, Prolactin, Free Testosterone, Estradiol, Insulin

MODULE III

Hematology and Pathology

Complete Hemogram- Hb, Packed cell volume, Total WBC Count, Differential count, Hematocrit, MCV, MCH, MCHC, Platelets, ESR.

Complete Urine Analysis, Complete Motion Analysis, Semen Analysis, CSF Analysis

MODULE IV.

Microbiology

Infective syndrome and their diagnostic, procedures - Respiratory tract infection, Intestinal infection, Urinary tract infection, Meningeal infection, Wound infections, Reproductive system infection and pyrexia.

Immunology- CEA, IgA, IgM, Ig G, Ig E, Serodiagnostic procedures - Precipitation tests, VDRL test, Khan test, Immunodiffusion test, Agglutination test - Widal test (Slide & tube method), Brucella agglutination test, Weil Felix test. Cold agglutination test, ASO test, RA test, CRP test, Complement fixation test- Wasserman test, Immunofluorescence test, FTA test, ELISA, HIV test, Hepatitis markers, Antinuclear antibodies (ANA), - 6 Profiles, Lepospiral Ig G and IgM, TORCH test, Immunoelectroblot technique - Western blot test, Skin tests - Mantoux test, Casoni test, Lepramin test, Fries test

MODULE V

Blood bank - Blood group & Rh factor, Coomb's test - Direct/ Indirect.

Coagulation studies - Prothrombin time (PT), Partial Thromboplastin (PTT). D - Dimer, Plasma Fibrinogen,

Inborn errors of metabolism - 1. Benedict's test for reducing substances, 2. Test for Phenyl ketonuria, 3. DNPH test for presence of ketoacids, 4. Cyanonitroprusside test for Cystinuria and Homocysteine, 5. Cetrinide V for mucopolysaccharides. Paper chromatography

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand the Biochemical Parameter diagnostic tests and its clinical interpretations	PO1, PO3, PO6
CO2	Understand the Enzyme marker for various diseases and the hormone tests	PO1, PO3, PO6
CO3	Explain the procedures of complete hemogram, Urine, Motion, Semen and CSF analysis	PO1, PO3, PO6
CO4	Understands the procedure various Infections diagnostics tests	PO1, PO3, PO6
CO5	Explains the procedures for screening of Inborn errors of metabolism	PO1, PO3, PO6

Textbooks

1. Ramani Sood. Laboratory technology (Methods and interpretations) 4th Ed. J.P. Bros, New Delhi, 1996.
2. Practical Clinical Biochemistry- Harold Varley Clinical Biochemistry - Teitz. Metabolic Disease and Control - Bonde
3. Interpretation of Diagnostic Tests - A Synopsis of Laboratory-Medicine- Jacques Wallach, 5th Eds. Little Brown & Co., London, 1992.
4. Clinical Chemistry in Diagnosis & Treatment. Joan Zilva & PR. Pannall. P.G Publishing Pvt Ltd., New Delhi.
5. Biochemistry Practical Manual, Soundravally Rajendiran, Pooja Dhiman, Elsevier
6. Practical Textbook of Biochemistry for Medical Students, DM Vasudevan, Subir Kumar Das, 3rd edition, Jaypee Health Science Publishers
7. Practical Biochemistry with Clinical Correlation, Poonam Agarwal, CBS Publishers and Distributors Pvt Ltd.
8. Todd and Sanford, Clinical diagnosis by laboratory method
9. Culling -Histopathology techniques.
10. Dycie and Lewis -Practical haematology.
11. Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3		3	3	3	3	3	3
CO 2	3		3		3	3	3	3	3	3
CO 3	3		3		3	3	3	3	3	3
CO 4	3		3		3	3	3	3	3	3
CO5	3		3		3	3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

THIRD YEAR: SEMESTER VI
CORE THEORY XI: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

COURSE CODE	23UCLTCT11
CREDIT	4

Learning Objectives

- To describe the general principles of gene organization and expression in both Prokaryotes and eukaryotic organism.
- To explain various level of gene regulation and its functions.
- To impart the practical knowledge on nucleic acid isolation, digestion and ligation
- To acquaint the students to versatile techniques employed recombinant DNA technology and its applications genetic engineering.

MODULE I

Replication: Experimental evidence to prove DNA as genetic material, Semiconservative replication, experimental evidence for semiconservative replication, replication in prokaryotes and eukaryotes, enzymes involved in replication, mechanism of replication, inhibitors of DNA replication.

MODULE II

Transcription: Basic features of RNA synthesis, E.Coli RNA polymerases, initiation, chain elongation and termination of transcription, RNA processing. Inhibitors of transcription.

Translation: Genetic code and its features, tRNA and amino acyl tRNA synthetases. Initiation, elongation and termination of translation, post translational modifications, Inhibitors of protein synthesis.

MODULE III

DNA Damage and Repair: Types of mutation: - Base substitution, insertion, deletion, inversion, duplication, translocation, mutagens. DNA Repair mechanisms: - Excision repair, mismatch repair, photoreactivation, direct demethylation, double strand break repair. Regulation of DNA repair: - SOS repair.

MODULE IV

Introduction to Genetic Engineering: Introduction to rDNA technology, DNA manipulative enzymes: - Nucleases, Ligases, Polymerases, DNA modifying enzymes,

Topoisomerases. Restriction- modification system: Restriction endonucleases and its types.

MODULE V

Techniques in Genetic Engineering: Isolation and purification of genomic DNA, plasmid DNA and λ phage. Molecular probes: - Types and its uses. Methods of nucleic acid labeling. Blotting techniques: - southern, northern and western blotting. DNA sequencing methods. PCR: - Procedure, important considerations of PCR for primer designing, Applications of PCR.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand the replication process	PO1,PO3, PO6
CO2	Comprehend basic principles and mechanism of transcription	PO1,,PO3,PO6
CO3	Understand translation process and post translational modification of proteins	PO1,PO3,PO6
CO4	Get an idea about the role of DNA manipulative enzymes and restriction enzymesused in rDNA technology	PO1,PO3,PO6
CO5	Obtain knowledge about advance techniques in genetic engineering	PO1,PO3,PO6

Textbooks

- Text Book of Cell and Molecular Biology Dr. Ajay Paul, 2015, Arunabha Sen, Books & Allied (P)Ltd.,
- Molecular biology, 3rd edition, Henrylodish et al.
- Genes – IX, Benjamin Lewin, Oxford University.
- Molecular biology of gene, James D. Watson, Nancy H.Hopkins, Jeffrey W.Roberts,Joan.
- Argetsinger Steitz, Alan M. Weiner, 4th edition, The Benjammin Cummings Publishing Company,Inc.2002.
- Friefelder's essentials of molecular biology, 4 th Edition, George M Malacinski, Narosa publishingHouse, 2006
- Molecular Biology byDavid C Clark., Elsevier Academic press, 2005
- Genetic Engineering -Smitha Rastogi, Neelam Pathak, 2009, Oxford Universitypress.

- Principles of gene manipulation, Old and Primrose, Blackwell Science. Genetic engineering and its applications, P. Joshi, Botania Publishers & Distributors. Recombinant DNA: A short course, Watson et al, Scientific American Books.
- Gene Cloning and DNA analysis, T.A Brown, Blackwell Science Publishers, 2001.
- Biotechnology Fundamentals & Applications, S.S.Purohitt, Agrobios Publishers, 2001.
- Text book of Biotechnology by R.C. Dubey, 2009, S.Chand & Co Ltd.

Web sources

https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental_molecular_biology.pdf

<https://nptel.ac.in/courses/102103013/>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2		3			3	3	3		3
CO 2	2		3			3	3	3		3
CO 3	2		3			3	3	3		3
CO 4	2		3			3	3	3		3
CO5	2		3			3	3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

THIRD YEAR: SEMESTER VI
ELECTIVE PAPER III: PHARMACEUTICAL BIOCHEMISTRY

COURSE CODE	23UCLTCE05
CREDIT	3

Learning Objective

- To provide an in-depth knowledge about sources of drugs, pharmacokinetics and pharmacodynamics.
- To learn adequate scientific knowledge about pharmaceutical manufacturing process.
- To gain a better understanding of drug discovery, design and its development.

MODULE I

Introduction: Sources of drugs, routes of drug administration, dosage forms, drug dosage.

Bioavailability: - Bioavailability of drugs, Factors affecting bioavailability, Bioequivalence. Combined effect of drugs: - Synergism, antagonism.

MODULE II

Pharmacokinetics: Absorption, distribution of drugs, half-life, c_{max} , t_{max} , factors influencing drug absorption and distribution. Drug elimination: - Renal excretion, fecal excretion, biliary excretion, pulmonary excretion and other routes of excretion.

MODULE III

Pharmacodynamics: Drug receptors: - Concept and theory, Drug - receptor interactions, Receptor mediated and non-receptor mediated drug action, Mechanism of phase I and Phase II metabolic reactions, factors affecting drug metabolism, significance of drug metabolism. Placebo effects, Factors modifying drug action.

MODULE IV

Adverse Drug Reactions and Toxicology: Pharmacologic ADRs, Non-pharmacological ADRs, disease-related ADRs, multiple drug reactions. Acute poisoning: - General principles and management. Drug dependence, drug tolerance and intolerance.

MODULE V

Drug Discovery and Development: Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing. Preclinical

research, clinical research, overview of DCGI, NPPA, CDSCO, FDA, ICMR and FSSAI.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand drug dosage, routes of administration and about bioavailability of drugs	PO1,PO3
CO2	Understand about basic principles involved in pharmacokinetics.	PO1,,PO3
CO3	Understand about the drug receptor interactions and gain knowledge on metabolism.	PO1,PO3
CO4	Describe the general principles of adverse drug reactions and acute poisoning.	PO1,PO3
CO5	Advance the knowledge on drug discovery process and ethical issues in drugdiscovery process and in preclinical toxicological studies.	PO1,PO3

Textbooks

1. Pharmaceutical Pharmacology - S C Metha and Ashutosh Kar, 2011, New age Internationalpublishers.
2. Text book of Medical Pharmacology - Padmaja Udayakumar, 2nd Edition, CBS Publishers &Distributors, New Delhi, Bangalore.
3. Oxford Text bookof Clinical Pharmacologyand Drug Therapy, D. G Grahme Smith and K.Aronson.
4. Pharmacologyand Pharmatherapeutics – R.S.Satoskar, S.D.Bhandhakarand.
5. Lippincotts Illustrated review Pharmacology, Mary.J.Mycek, Richards, Pamela.

Websources

<http://en.bookfi.net/s/?q=biochemistry&e=1&t=0>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2		3				2	2	2	3
CO 2	2		3				2	2	2	3
CO 3	2		3				2	2	2	3

CO 4	2		3				2	2	2	3
CO5	2		3				2	2	2	3

S-Strong (3) M-Medium (2)

L-Low (1)

THIRD YEAR: SEMESTER VI
ELECTIVE PAPER III: RESEARCH METHODOLOGY

COURSE CODE	23UCLTCE06
CREDIT	3

Learning Objectives

- Introduce the components of research.
- Acquaint on the experimental design and literature survey
- Analyse the data and find out the significance statistically
- Highlight the importance of computation in research.
- Provide mechanics of writing a research report hands-on experience in designing and working on small projects.

Module I:

Characteristics and types of Research, Research Methods versus Methodology, Research designs in Biochemistry: experimental, *in vitro*, *in vivo*, *in situ*, clinical trials. Identification and criteria of selecting a research problem (Hypothesis); Formulation of objectives; Research plan and its components.

Module II:

Experimental design - Objective, Design of work, Guidelines for design of experiments, Literature Search - Databases for literature search, Material and methods, Designing biological experiments, Compilation and documentation of data.

Module III:

Statistical Analysis: Measures of variation - standard deviation, Non-linear regression, Standard error. Analysis of variance for one-way and two-way classified data and multiple comparison procedures. Significance - student's *t*-test, chi-square test. Dunnett's test.

Module IV:

Computer and its role in research: Basics of MS word, MS Excel: tabulation, calculation and data analysis, preparation of graphs, histograms and charts. Use of statistical software SPSS. Power Point: preparation of presentations and scientific poster designing.

Module V:

Scientific writing for journals - Preparation of Abstract, Impact factor, h-index, i-10 index, citation index, Dissertation/Thesis writing: format, content and chapterization, writing style, drafting titles & sub-titles, captions and legends. Writing results, discussion and conclusions. Bibliography and references, referencing style - Harvard and Vancouver systems, Appendices and acknowledgement; Ethical issues in research; Intellectual property right and plagiarism.

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Explain the types of research and formulate and plan the research.	PO1,PO3
CO2	Design experimental setup, review the literature, compile and document the data.	PO1,PO3
CO3	Analyze and validate the experimental data using statistical tools	PO1,PO2,PO3
CO4	Interpret the data using computational tools.	PO1,PO2,PO3
CO5	Compile and draft a research report, present results findings and publish ethically.	PO1,PO3,PO4

Textbooks

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to ResearchMethodology, RBSA Publishers.
2. Kothari, C.R., Research Methodology: Methods and Techniques. 2004, New Age International.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications.2 volumes.
4. Gurumani.N, Research Methodology for biological Sciences, 2014, MJP Publishers.

Reference books

1. Dr. Prabhat Pandey, Dr.Meenu Mishra Pandey, Research Methodology: Tools and Techniques 2015
2. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Scientific Thesis Writing and Paper Presentation. MJP Publishers. 2010
7. Research Methodology (2 Vols-Set), Suresh C. Sinha and Anil K. Dhiman, Vedams Books (P) Ltd. 2002.

Websites

<https://explorable.com/research-methodology>

<http://www.scribbr.com>

<http://www.open.edu>

<http://www.macmillan.in>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2		3				3	3	3	3
CO 2	2		3				3	3	3	3
CO 3	2	2	3				3	3	3	3
CO 4	2	2	3				3	3	3	3
CO 5	2		3	2			3	3	3	3

S- Strong (3) M-Medium (2)

L-Low (1)

THIRD YEAR: SEMESTER VI
ELECTIVE PAPER IV: CLINICAL LABORATORY ETHICS AND DOCUMENTATION

COURSE CODE	23UCLTCE07
CREDIT	3

Learning Objective

To enable the he students aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.

To enable the students learn about the , report submission and maintenance of a laboratory.

MODULE I

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice (GLP), Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

MODULE II

Ethics in Medical laboratory Practice, Ethics in relation to Pre - Examination procedures, Examination procedures, reporting of results.

Laboratory Quality Control- definition., Sample collection-sample handling and preservation-, Receiving specimens, storage and maintenance.

Sample analysis: Introduction, factors affecting sample analysis, reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, Levey Jennings Chart,

MODULE III

Laboratory organization management – Personal safety measures-Laboratory

Safety measures in. Handling equipments, Sample spills, Biohazards, Biomedical waste Management, infectious waste-Radioactive materials and radiation producing equipment- safety measures.

MODULE IV

Sterilization- Principles and methods of sterilization, physical and chemical methods. Disinfectants - modes of action, testing of disinfectants. Basic solutions and reagents in laboratory. Coagulants and Anticoagulants used in a laboratory

MODULE V

Data maintenance- Maintenance of Medical Lab record - Entering dates, table contents, essential parts of reports formal and informal reports. Referral range for clinical tests, Maintenance of equipments-calibration. Procurement of equipment and Inventory Control. Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit Documentation

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Understand the Ethics of Clinical laboratory Professionals	PO1,PO3,PO6
CO2	Understands the Ethics in Medical laboratory Practice, Quality control, Sample collection and analysis	PO1,PO3,PO6
CO3	Explain the Laboratory organization management and safety measures	PO1,,PO3,PO6
CO4	Understands the sterilization in the Clinical laboratory	PO1,PO3PO6
CO5	Understands the Maintenance of Medical Lab data and records and documentation	PO1,PO3,PO6

Textbooks

Harold Varley, 2005, Practical Clinical Biochemistry, 4th edition, CBS Publication and Distributors, New Delhi, India.

Teitz, 2007, Fundamentals of Clinical Chemistry, 6th edition, Elsevier Publications, Amsterdam, Netherlands.

Bishop, 2013, Clinical Chemistry, 7th edition, Wiley Publications, New Jersey, United States.

Ramani Sood, 1995, Colour Atlas of Practical Pathology and Microbiology, 2nd edition, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi, India.

Reference books

Henry, 2011, Clinical Diagnosis and Management by Laboratory Methods, 22nd edition, Elsevier Publications, Amsterdam, Netherlands

Web source

1. <https://revisesociology.com/2017/06/16/experiments-sociology-revision-notes/>
2. <https://revisesociology.com/2020/07/26/laboratory-experiments-sociology/>
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_sciences_students/In_sociology_final.pdf
4. <https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf>
5. <https://www.degruyter.com/document/doi/10.1515/tjb-2016-0234/html?lang=en>
6. <https://www.studocu.com/in/document/bharathiar-university/analytical-biochemistry/automation-in-clinical-laboratory/23443549>
7. <https://www.jprog.com/public/HI7%20Manuals/CH13%20Clinical%20Lab%20Automation.PDF>
8. <https://www.science.gov/topicpages/l/laboratory+automation+system>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3		3	3	3	3	3	3
CO 2	3		3		3	3	3	3	3	3
CO 3	3		3		3	3	3	3	3	3
CO 4	3		3		3	3	3	3	3	3
CO 5	3		3		3	3	3	3	3	3

S- Strong (3) M-Medium (2)

L-Low (1)

THIRD YEAR: SEMESTER VI
ELECTIVE PAPER IV: BIOENTREPRENEURSHIP

COURSE CODE	23UCLTCE08
CREDIT	3

Learning Objective

- Impart knowledge on bio entrepreneurship and the types of industries
- Learn about business plan, proposal and funding agencies
- Understand the market strategy and the role of information technology in expansion of business
- Provide insights on legal requirement and accounting to establish as Bio entrepreneurship
- Familiarize about business bio incubators centres

MODULE I

Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; Introduction to Trademarks, Copyrights and patents.

MODULE II

Business Plan, Budgeting and Funding Idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start-up and make in India Initiative; dispute resolution skills; external environment changes; avoiding/managing crisis; Decision making ability.

MODULE III

Market Strategy- Basics of market forecast for the industry; distribution channels –franchising, policies, promotion, advertising, branding and market; Introduction to information technology

for business administration and Expansion.

MODULE IV

Legal Requirements, Finance and Accounting; Registration of company in India; Ministry of Corporate Affairs (MCA); basics in accounting: introduction to concepts of balance sheet, profit and loss statement, double entry, bookkeeping; finance and break-even analysis; difficulties of entrepreneurship in India.

MODULE V

Role of knowledge centres such as universities, innovation centres, research institutions (public & private) and business incubators in Entrepreneurship development; quality control and quality assurance; Definition, role and importance of CDSCO, NBA, GLP, GCP, GMP.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand the concept and scope for entrepreneurship	PO1
CO2	Identify various operations involved in a venture creation	PO1.PO5,PO6
CO3	Gather funding and launching a winning business	PO1.PO5,PO6
CO4	Nurture the organization and harvest the rewards	PO1.PO5,PO6
CO5	Illustrate about the Business incubator centres and Bio entrepreneurship	PO1.PO5,PO6

Textbooks

1. Adams, D. J. (2008). Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion - ISBN 10: 1904842364 / ISBN 13: 9781904842361
2. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303
3. Onetti, A (2015). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge - ISBN 10: 1138616907 / ISBN 13: 9781138616905
4. Kapeleris, D. H. (2006). Innovation and entrepreneurship in biotechnology:

Concepts, theories & cases - ISBN-13: 978-1482210125, ISBN-10: 1482210126

Reference books

1. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management New Himalaya. New Himalaya House Delhi: pub - ISBN : 9789350440810 9350440814
2. Ono, R. D. (1991). The Business of Biotechnology, From the Bench of the Street. Butterworth-Heinemann - ISBN 10: 1138616907 / ISBN 13: 9781138616905
3. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press - ISBN-10 : 812243049X , ISBN-13 : 978-8122430493

Web sources

1. <http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/>
2. <https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introduction-to-entrepreneurship/>

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2				2	3	3	2		3
CO 2	2				2	3	3	2		3
CO 3	2				2	3	3	2		3
CO 4	2				2	3	3	2	3	3
CO 5	2				2	3	3	2		3

S-Strong (3) M-Medium (2) L-Low (1)