

**B.SC.,
BIOCHEMISTRY**

MANONMANIAM SUNDARANAR UNIVERSITY

SYLLABUS

FROM THE ACADEMIC YEAR

2024-2025

onwards

As per
**TAMILNADU STATE COUNCIL FOR HIGHER
EDUCATION, CHENNAI – 600 005**

THE REGULATIONS ON LEARNING OUTCOMES BASED CURRICULUM FRAME WORK FOR UNDERGRADUATE EDUCATION

1. Preamble

Biochemistry is the cross over scientific discipline that integrates the living world and chemistry. It involves the study of the structure of biomolecules and explores the biological processes at molecular level in the living organisms. It is the laboratory science that has several domains like cell biology, molecular biology, clinical biology, enzymology, immunology, physiology, pharmacology etc., It has enlightened many aspects of health and diseases and paved the way for many interdisciplinary technological innovations like metabolomics, genomics and proteomics. There is a continuous demand for biochemists in public and private health care sectors, agriculture, medical and forensic departments. Almost all food, pharmaceuticals, health and beauty care etc required quality control and safety checks for which experts in the field of Biochemistry are always in need. The syllabi for the three year B.Sc., degree programme in Biochemistry was framed in such a way that at the end of the course they could apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

The programme endeavours to provide students a broad based training in biochemistry with a solid background of basic concepts as well as exposing them to the exciting advancements in the field. In addition to theoretical knowledge, significant emphasis has been given to provide hands on experience to the students in the forefront areas of experimental biochemistry. A multidisciplinary approach has been employed to provide the best leverage to students to enable them to move into frontier areas of biological research in the future.

The course defines clearly the objectives and the learning outcomes, enabling students to choose the elective subjects for broadening their skills. The course also offers skills to pursue research in the field of Biological Chemistry and thus would produce best minds to meet the demands of society.

Biochemistry, today is considered as an application oriented integrated basic science. It's an interdisciplinary science that has emerged by the confluence of principles of Chemistry, Physics and Mathematics to Biology. Advances in Biochemistry have immense positive implications on the understanding of biochemical interactions, cellular communications, hormonal mechanisms and the cross talks between them. The research in Biochemistry has been translational and there is a shift from hypothesis driven research to data dependent

research that promises translational, product oriented research. Much of the advancement in Biochemistry is in the advancement of Biotechnology, as a basic science discipline Biochemistry lead to Biotechnological advancement. Considering its pivotal role in biological sciences, it is imperative to strengthen the fundamental concepts of Biochemistry.

TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION	
Programme:	B.Sc Biochemistry
Programme Code:	
Duration:	3 years [UG]
Programme Outcomes:	<p>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</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>

	<p>experiment or investigation</p> <p>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</p> <p>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.</p> <p>PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p>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.</p> <p>PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
<p>Programme Specific Outcomes:</p>	<p>PSO1 – Placement: To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p>PSO 2 - Entrepreneur:</p>

	<p>To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations</p> <p>PSO3 – Research and Development: Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p>PSO4 – Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p>PSO 5 – Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit</p>
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PROGRAM OUTCOMES

PO1	Acquire knowledge in Biochemistry and apply the knowledge in their day to day 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 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 biochemistry
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ELIGIBILITY FOR ADMISSION

Candidate for admission to the first year of B.Sc. Degree Course in Bio-Chemistry shall be required to have passed the Higher Secondary Examination with Chemistry and Biology or Chemistry, Botany and Zoology or Biochemistry and Chemistry or any other Science subject that may be considered as equivalent by the M.S. University.

LIST OF ALLIED COURSES TO BE OFFERED TO B.ScBIOCHEMISTRY APPROVED BY OTHER BOARD (SEMESTER I,II,III and IV)

Chemistry

Microbiology

Biostatistics

Zoology

Botany

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

B.Sc. Biochemistry
(Choice Based Credit System)
(Effective from the academic year 2024 -2025 onwards)

Programme Structure

FIRST YEAR: SEMESTER I

Part I/II/III/IV/V	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part I		Language –I	2	1	0	0	3	6	25	75	100
Part II		English –I	2	1	0	0	3	6	25	75	100
Part III	Core Course 1	Nutritional Biochemistry	3	1	0	0	4	5	25	75	100
	Core Course 2	Core Practical I - Nutritional Biochemistry	0	0	3	0	3	3	40	60	100
	Allied Course 1	Allied – I (Choose any one from the list of approved allied courses)	3	1	0	0	4	4	25	75	100
	Allied Practical 1	Allied Practical - I	0	0	2	0	2	2	40	60	100
Part IV	Skill Enhancement Course (SEC-1)	(Choose any one) a. Health and Nutrition b. Lifestyle Diseases	1	1	0	0	2	2	25	75	100
	Foundation Course	Bridge course – Fundamentals of Biochemistry	1	1	0	0	2	2	25	75	100
Total							23	30			

FIRST YEAR: SEMESTER II

Part I/II/III/IV/V	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part I		Language –II	2	1	0	0	3	6	25	75	100
Part II		English –II	2	1	0	0	3	4	25	75	100
Part III	Core Course 3	Cell Biology	3	1	0	0	4	5	25	75	100
	Core Course 4	Core Practical II - Cell Biology	0	0	3	0	3	3	40	60	100
	Allied Course 2	Allied – II (Choose any one from the list of approved allied courses)	3	1	0	0	4	4	25	75	100
	Allied Practical 2	Allied Practical - II	0	0	2	0	2	2	40	60	100
Part IV	Skill Enhancement Course (SEC-2)	(Choose any one) a. Medicinal Diet b. Hormones in Health and Disease	1	0	0	0	1	2	25	75	100
	Skill Enhancement Course – (SEC-3) Discipline/ Subject specific	First Aid	1	0	0	0	1	2	25	75	100
	Naan Mudhalvan						2	2	25	75	100
Total							23	30			

SECOND YEAR: SEMESTER III

Part I/II/III/IV/V	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part I		Language –III	2	1	0	0	3	6	25	75	100
Part II		English –III	2	1	0	0	3	6	25	75	100
Part III	Core Course 5	Biomolecules	3	1	0	0	4	4	25	75	100
	Allied Course 3	Allied – III (Choose any one from the list of approved allied courses)	3	0	0	0	3	4	25	75	100
	Core Course 6	Core Practical III Biomolecules	0	0	3	0	3	2	50	50	100
	Allied Practical 3	Allied Practical - III	0	0	2	0	2	2	50	50	100
Part IV	Skill Enhancement Course SEC-4	Entrepreneurial Based (Choose any one) a. Medical Laboratory Technology b. Microbial Techniques	1	1	0	0	2	2	25	75	100
	EVS	Environmental Studies	2	0	0	0	2	2	25	75	100
	Naan Mudhalvan		2	0	0	0	2	2	25	75	100
Total							24	30			

List of Approved Allied courses for B.Sc. Biochemistry (for Semester I, II, III & IV)

1. Chemistry
2. Microbiology
3. Biostatistics
4. Zoology
5. Botany

SECOND YEAR: SEMESTER IV

Part I/II/III/IV/V	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part I		Language –IV	2	1	0	0	3	6	25	75	100
Part II		English –IV	2	1	0	0	3	6	25	75	100
Part III	Core Course 7	Biochemical techniques	3	1	0	0	4	4	25	75	100
	Allied Course 2	Allied – IV (Choose any one from the list of approved allied courses)	3	0	0	0	3	4	25	75	100
	Core Course 8	Core Practical IV-Biochemical Techniques	0	0	3	0	3	2	50	50	100
	Allied Practical 4	Allied Practical –IV	0	0	2	0	2	2	50	50	100
Part IV	Skill Enhancement Course SEC-5	Discipline/ Subject specific (Choose any one) a. Basics of Forensic Science b. Tissue Culture	1	1	0	0	2	2	25	75	100
	Value Education		1	1	0	0	2	2	25	75	100
	Naan Mudhalvan		2	0	0	0	2	2	25	75	100
Total							24	30			

THIRD YEAR: SEMESTER V

Part I/II/III/I V/V	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part III	Core Course 9	Enzymes	3	1	0	0	4	5	25	75	100
	Core Course 10	Intermediary Metabolism	3	1	0	0	4	5	25	75	100
	Core Course 11	Clinical Biochemistry	3	1	0	0	4	5	25	75	100
	Elective course 1	(Choose any one) 1A: Immunology 1B: Biochemical pharmacology 1C: Research methodology	3	0	0	0	3	4	25	75	100
	Core Course 12	Core Practical V- Clinical Biochemistry	0	0	4	0	4	5	50	50	100
	Elective course 2	Elective Practical-I Immunoche mical Techniques	0	0	3	0	3	4	50	50	100
	Internship/ Field visit/Industrial visit/Knowledge updating activity*		0	1	0	0	1	-	50	50	100
	Naan Mudhalvan		2	0	0	0	2	2	25	75	100
Total							25	30			

*The students shall submit a report on Internship/Field visit/Industrial visit/Knowledge updation which will be evaluated at the end of 5th semester by the External examiners. For Internship, the students should submit a Certificate of attendance from the concerned industry/laboratory along with report.

THIRD YEAR: SEMESTER VI

5	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part III	Core Course 13	Molecular Biology	3	1	0	0	4	6	25	75	100
	Core Course 14	Human Physiology	3	1	0	0	4	6	25	75	100
	Core Course 15	Plant Biochemistry & Plant therapeutics	3	1	0	0	4	6	25	75	100
	Elective Course 3	(Choose any one) 2A: Biotechnology 2B: Bioinformatics 2C: Bioentrepreneurship	2	1	0	0	3	5	25	75	100
	Core Course 16	Core Project with Viva - Voce	0	1	2	0	3	5	50	50	100
Part IV	Naan Mudhalvan		2	0	0	0	2	2	25	75	100
Part V	Extension activity*						1	-	50	50	100
Total							21	30			

Total Credits: 140

*The students should choose any one of the Extension activities such as NSS/NCC/YRC/RRC/Games and Sports/Youth Welfare activities/Outreach Programmes/Migration awareness. The examination/evaluation will be conducted in the 6th semester.

I YEAR : SEMESTER I
NUTRITIONAL BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core Paper1- Nutritional Biochemistry	Core	3	1	0	0	4	5	25	75	100

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.
- Study the effect of additives, emulsifiers, flavour enhancing substances in food.
- Study the significance of nutraceuticals.

Module I : Concepts of food and nutrition. Basic food groups-energy yielding, body building and functional foods. Units of energy. Calorific and nutritive value of foods. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. 12 Hrs

Module II: Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, , Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.12 Hrs

Module III : Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects .12 Hrs

Module IV : Food additives: Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents,

gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives. 12 Hrs

Module V : Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. International quality standards like ISO and food codex, BRC. Food safety and Standards act,2006. 12 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value	PO1,PO5
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.	PO1
CO3	Classify the food groups and its significance	PO1,PO2
CO4	Understand the effect of food additives	PO1,PO2
CO5	Describe the importance of nutraceuticals and pigments	PO1,PO5,PO6

Text books

- 1.Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
- 2.M.Swaminadhan (1995) Principles of Nutrition and Dietetics. Bappco.
- 3.Tom Brody(1998). Nutritional Biochemistry (2nded), Academic press, USA
- 4.Garrow, JS,James WPT and Ralph A (2000). Human nutrition and dietetics(10thed) Churchill Livingstone.
- 5.Andreas M.Papas(1998). Antioxidant Status, Diet, Nutrition, and Health (1sted) CRC

Reference Books

- 1.Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
- 3.Advances in food biochemistry, FatihYildiz (Editor), CRC Press, Boca Raton, USA, 2010
- 4.Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.
- 5.Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell ,UK.

Web resources

<http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf>

<https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-protein.html>

<https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals>

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	3	3	3
CO 2	3						3	3		3
CO 3	3	2					3	1		3
CO 4	3	2					3	3		3
CO5	3				2	2	3	3		3

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

I YEAR : SEMESTER I

PRACTICAL – I: NUTRITIONAL BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 2 : Practical 1- Nutritional Biochemistry	Core	0	0	3	0	3	3	25	75	100

Learning objectives

The objectives of this course are to

- Impart hands-on training in the estimation of various constituents by titrimetric method
- Prepare Biochemical preparations
- Determine the ash content and extraction of lipid

TITRIMETRY 20hrs

1. Estimation of ascorbic acid in a citrus fruit.
2. Estimation of calcium in milk .
3. Estimation of glucose by Benedict's method in honey.
4. Estimation of phosphorous (Plant source)

BIOCHEMICAL PREPARATIONS 15 Hrs

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.
6. Starch from potato.
7. Casein and Lactalbumin from milk.

GROUP EXPERIMENT 10Hrs

8. Determination of ash content and moisture content in food sample
9. Extraction of lipid by Soxhlet's method.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Estimate the important biochemical constituents in the food samples.	PO1,PO3
CO2	Prepare the macronutrients from the rich sources.	PO1,PO3
CO3	Determine the ash and moisture content of the food samples	PO1,PO3
CO4	Extract oil from its sources	PO1,PO3,PO6

Text books

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, NewAge International Publishers, 2011,
2. An Introduction to Practical Biochemistry, David T. Plummer, 3rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.

Reference books

1. Biochemical Methods, Sadasivam S and Manickam A, 4th edition, NewAge International Publishers, 2016
2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
3. Bowman and Robert M. 2006. Present Knowledge in Nutrition. 9th edition, International Life Sciences Publishers.
4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.
5. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition. 3rd edition. Chand Publishers.

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

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

I YEAR : SEMESTER I

Foundation Course - Bridge Course

FUNDAMENTALS OF BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. hours	Marks		
									CIA	External	Total
	Bridge Course – Fundamentals of Biochemistry	Foundation Course	1	1	0	0	2	2	25	75	100

Learning Objectives

The objectives of this course are to

- To give students the basic concepts of biochemistry and its nature of interdisciplinary importance.
- To acquaint with basic laboratory instruments safely and precisely to obtain reproducible results from biochemical experiments.
- To let students, understand the basic concepts of biomolecules, their occurrence in biological system.
- To recognize the scope of biochemistry in various thrust areas.
- To familiarize the role of computers in the biochemical laboratories.

Module I : Molecules of life – Carbohydrates, Lipids, Amino acids, Proteins and Nucleic acids (General classification and examples). Different types of chemical bonds – ionic bond, covalent bond, coordinate bond, hydrogen bond and Vander Waals force. Formation of glycosidic, peptide and phosphodiester linkage. 6 hrs

Module II : Basic concepts of acids, bases, buffers and pH. Methods of expressing concentration – Molarity, Molality, Mass percentage and Parts per million(ppm). Preparation of Molar, Molal, percentage, ppm, Mass percentage solutions (calculation using an example). 6 hrs

Module III : Bioinstruments – Working principles, and major applications – pH meter, Colorimeter, Centrifuges, Incubator, Hot air oven, Microscope, Laminar air flow Chromatography & Electrophoretic units. Safe handling of chemicals and reagents in Biochemistry lab – Prevention, Precaution and First aid of lab hazards. 6 hrs

Module IV : Thrust areas in Biochemistry – Scope and role of a Biochemist in Agriculture, Medical diagnosis, Pharmaceutics, Dairy Science, Food industry, Environmental sector (Water and soil quality management), Forensic science, Development of Natural product, Medical coding and Biological Research. 6 hrs.

Module V : Computational Biology – Basic usage of computers - Bioinformatics, Biostatistics, Diagnostic imaging techniques, Cyberbiosecurity. Structural characterisation of biological compounds. Automation in Forensic lab, Medical diagnostic labs and Biochemical research laboratories. 6hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand and relate the role of biochemistry and its importance in biology and interdisciplinary field.	PO1,PO5
CO2	Identify and explain the use of basic laboratory instruments for analytical purposes.	PO1
CO3	Classify biomolecules, their occurrence in biological system.	PO1,PO2
CO4	recognize the application and need of biochemistry in various thrust areas	PO1,PO2
CO5	Describe the importance of computers in the biochemical laboratories.	PO1,PO5,PO6

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

Text books

1. Biochemistry, U. Sathyanarayana & U. Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Textbook of Medical Biochemistry, M. N. Chatterjea, Rana Shinde, 2002, 8th edition, Jaypee Brothers.
3. L. Veerakumari, 2009, Bioinstrumentation, 1st edition, MJ Publishers.
4. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath, 2002, Biophysical Chemistry, Principles and Techniques, 3rd edition, Himalaya Publishing House.

Reference books

1. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W. H. Freeman and Company.
2. Terrance G. Cooper The tools of Biochemistry, 1977, John Wiley & Sons, Singapore.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1st edition, Narosa Publishing House.
4. B. Godkar. 2020. Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.

Webresources

<https://www.britannica.com/science/biomolecule> <https://en.wikipedia.org/wiki/Biomolecule> <https://www.khanacademy.org/science/biology/macromolecules>

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			2	3	2	2	3
CO 2	2	2	3			2	3	3	3	3
CO 3	2	2	3				3	3	3	3
CO 4	3	2	3			2	3	3	3	3
CO 5	3	2	3			2	3	3	3	3

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

FIRST YEAR : SEMESTER II

CELL BIOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 3: Cell Biology	Core	3	1	-	-	4	5	25	75	100

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 ultrastructure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions 12 Hrs

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. 12 Hrs

Module III: Biomembranes- Structural organization of bilipid layer model and basic functions- transport across cell membranes- uniport, symport and antiport. Passive and active transport. 12Hrs

Module IV: Cell cycle- Definition and Phases of Cell cycle- Cell division- Mitosis and Meiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells. 12 Hrs

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 12 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the structure and function 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 function 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 extracellular matrix in cellular interactions	PO1, PO2

Text books

1. Arumugam, N., Cell Biology. Saras publication (10ed, 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.

Reference books

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 II
PRACTICAL - II :CELL BIOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 4 practical II: Cell Biology	Core practical	-	-	3	-	3	3	40	60	100

Learning Objectives

The main objectives of this course are to

- Learn the parts of microscope
- Investigate the cells under microscope.
- Image the cells using different stains
- Identify the cells, organelles and stages of cell division
- Identify the spotters

I MICROSCOPY AND STAINING TECHNIQUES

1. Study the parts of light and compound microscope
2. Preparation of Slides and Micrometry
3. Examination of prokaryotic and eukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by acetocarmine stain
6. Staining and visualization of mitochondria by Janus green stain

II GROUP EXPERIMENT

7. Identification of different stages of mitosis in onion root tip
8. Identification of different stages of meiosis in onion bulb

III SPOTTERS

9. a) **Cells:** Nerve, plant and Animal cell
- b) **Organelles:** Mitochondria, Chloroplast, Endoplasmic reticulum,
- c) **Mitosis stages** – Prophase, Anaphase, Metaphase, Telophase

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Identify the parts of microscope.	PO1, PO2
CO2	Preparation of Slides	PO1, PO2
CO3	Identify the stages of mitosis & meiosis	PO1, PO2
CO4	Visualize nucleus and mitochondria by staining methods	PO1, PO2
CO5	Identify the spotters of cells, organelles and stages of cell division	PO1, PO2

Text books

1. Rickwood, D and J.R. Harris cell Biology: Essential Techniques, John Wiley 1996.
2. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.
3. Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2nd Edn.

Reference books

- 1) Essential practical handbook of Cell biology, Genetics and Microbiology - A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017
- 2) Cell biology Practical, Dr. Venugupta ISBN 8193651219, Prestige publisher, 1st Jan 2018.
- 3) Cell and Molecular biology, De Robertis, 8th edition, 1st June, 1987

Web resources

1. <http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1>
2. <https://www.microscopemaster.com/organelles.html>
3. <https://www.pdfdrive.com/biochemistry-books.htm>
4. http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%20microscope%20is%20necessary,and%20small%20granules%20and%20vesicles.
5. <http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1>
6. <https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and-genetic-diversity/a/phases-of-meiosis>
7. <https://www.microscopemaster.com/organelles.html>
8. <https://www.pdfdrive.com/biochemistry-books.html>

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

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

SKILL ENHANCEMENT COURSE -SEC

FIRST YEAR: SEMESTER I

HEALTH AND NUTRITION

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Health and Nutrition	SEC	1	1	-	-	2	2	25	75	100

- Learning Objectives
- The main objectives of this course are to
- Gain basic knowledge about health.
- Understand about vitamins.
- Learn about functions of fat on health.
- Understand the types of minerals and its functions
- Know about the importance of carbohydrates and proteins on health

Module I: Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value. 6Hrs

Module II: Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances. 6Hrs

Module III: Sources and functions of dietary fats, role of fats in health and diseases. 6Hrs

Module IV: Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus,

Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc. 6Hrs

Module V: Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications.6Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Programoutcomes
CO1	Understand about the importance of health and diet	PO1
CO2	Discuss about the classification properties and deficiencies of vitamins	PO1
CO3	Understand about sources and functions of fats and lipids on health	PO1.PO4
CO4	Detail about the different typed of minerals and its role in health	PO1,PO4
CO5	Relatetherole of proteins and carbohydrates on health	PO1,PO4

Text books

- 1 S.Davidson and J.R.Passmore (1986) Human Nutrition and Dietetics, (8th ed), Churchill Livingstone
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10th ed), Churchill Livingstone
3. M.Swaminathan (1995) Principles of Nutrition and Dietetics, Bappco

Reference Books

1. Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall

Web Resources

1. <https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages>.
2. nhp.gov.in/healthyliving/healthydiet
3. www.anme.com.mx/libros/PrinciplesofNutrition.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			2			3	3		3
CO 4	3			2			3	3		3
CO5	3			2			3	3		3

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

FIRST YEAR : SEMESTER I
LIFE STYLE DISEASES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Lifestyle Diseases	SEC	2	-	-	-	2	2	25	75	100

Learning Objectives

The objectives of this course are to

- Create awareness on lifestyle diseases among adolescents.
- List out the lifestyle diseases.
- Explain the common lifestyle diseases and their prevention.
- Acquaint the disorders associated with women's health.
- Impart life skills so as to prevent lifestyle diseases.

Module I: Lifestyle diseases: Definition, Factors contributing to lifestyle diseases - Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation.

6Hrs

Module II: Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country. 6 Hrs

Module III : Causes, symptoms, types, preventive measures and treatment of Obesity, cardiovascular diseases, diabetes and cancer. 6 hrs

Module IV: Women's lifestyle diseases : Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. 6 hrs

Module V: Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation. 6Hrs

Course outcomes

CO	On completion of the course the students will be able to	Program Outcomes
CO1	DefineLifestylediseasesanddescribethecontributingfactors	PO1
CO2	Enumeratethetoplifestylediseasesand its impact on life.	PO1,PO4,PO5
CO3	Elaboratethetreatmentandpreventionmeasures of common lifestyle diseases.	PO1,PO4,PO5
CO4	Highlight thelifestylediseaseshataffectsthewomen'shealth	PO1,PO4,PO5
CO5	Illustratethevariousmeasuresforpreventionoflifestylediseases	PO1,PO4,PO5

Textbooks

1. JamesM R,LifestyleMedicine,2ndEdition,CRCPress,2013
2. AkiraMiyazaki,NewFrontiersinLifestyle-RelatedDisease,Springer,2008

Referencebooks

1. Steyn K, Lifestyleandrelatedriskfactorsforchronicdiseases
2. Willett WC,Preventionofchronicdiseasebymeansofdietandlifestyle.
3. Kumar M & R. Kumar,.Guidetopreventionoflifestylediseases.Deep& Deep publications

Web resources

1. <https://youtu.be/jDdL2bMQXfE>
2. <https://youtu.be/7WnpSB14nDM>
3. <https://youtu.be/ollz9MqtW-U>

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
CO 2	2			2	3		3	3		3
CO 3	2			2	3		3	3		3
CO 4	2			2	3		3	3		3
CO 5	2			2	3		3	3		3

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

FIRST YEAR : SEMESTER II

MEDICINAL DIET

Course Code	Course Name	Category		L	T	P	S	Credits	Inst. Hours	Marks		
										CIA	External	Total
	Medicinal Diet	SEC		1	-	-	-	1	2	25	75	100

Learning Objectives

The main objectives of this course are to

- Provide basic knowledge about diet
- Understand of diet modification for GI diseases
- Plan a diet for liver diseases
- Prepare diet chart for Infectious diseases
- Plan a diet for Diabetes , Renal and Cardio-vascular diseases

Module-I :Principles of Therapeutic Diet: Definitions of Normal diet, Therapeutic diet, soft Diet and Liquid diet. Objectives of Diet Therapy. Advantages of using normal diet as the basis for Therapeutic diet. Normal Diet-therapeutic modification of normal diet. 6 Hrs

Module II:Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Malabsorption syndrome 6 Hrs

Module III:Diet Modification in liver and gall bladder in diseases: Etiology, symptoms and dietary treatment in jaundice, hepatitis, cirrhosis of liver and hepatic coma. 6 Hrs

Module IV:Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis.6 Hrs

Module V:Diet Modification in Diabetes , Renal and Cardio-vascular diseases-Diabetes, acute & chronic glomerulonephritis, nephrosis, renal failure, kidney stone and Hypertension.6 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO 1	Possess basic knowledge about diet	PO1
CO2	Sketch diet plan for GI diseases	PO1,PO4,PO5,PO6
CO3	Sketch diet plan for liver diseases	PO1,PO4,PO5,PO6
CO4	Sketch a diet plan for Infectious diseases	PO1,PO4,PO5,PO6
CO5	Prepare diet chart for Diabetes Renaland Cardio-vascular diseases	PO1,PO4,PO5,PO6

Text Books

- 1.M.RaheenaBegum ,AText Book of Foods, Nutrition and Dietetics, Sterling Publishers Pvt.Ltd.
- 2.M.V.RajaGopal ,Sumati.R.,Mudambi, Fundamentals of foods and Nutrition, Wiley Eastern Limited, Year-1990.
- 3.William S.R Nutrition and Diet Therapy, 1985, 5thedition, MoslyCo.St.Louis.

Reference books

- 1.Rodwell Williams Nutrition and Diet Therapy, 1985,the C.V MoslySt.Louis.
- 2.M.V.Krause&M.A.Mohan ,Food Nutrition and Diet Therapy, 1992 by W.B Saunders Company, Philadelphia, London.
- 3.Davidson and Passmore ,Human Methods and Diabetics, 1976 the English Language Book Society and Churchill.

Web sources

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
CO 2	2			2	3	2	3	3		3
CO 3	2			2	3	2	3	3		3
CO 4	2			2	3	2	3	3		3
CO 5	2			2	3	2	3	3		3

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

FIRST YEAR: SEMESTER II
HORMONES IN HEALTH AND DISEASE

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Hormones in Health and Disease	SEC	1	-	-	-	1	2	25	75	100

Learning Objectives

The main objectives of this course are to

- Provide basic knowledge about endocrine glands and hormones
- Understand the importance of hormonal effects
- Interpret about the biological effects of each hormone
- Explain the prevention and management of endocrine disorders

Unit I: The Endocrine glands, Hormones - Definition, Classification, Mechanism of hormone action - Class I and Class II hormones. 6 Hrs

Unit II: Hypothalamic & Pituitary hormones. Biological effects of Vasopressin and Oxytocin, Growth hormone, FSH, LH, TSH, ACTH and Prolactin. Hyper and Hypopituitarism. 6 Hrs

Unit III: Biosynthesis, transport, normal levels and biological effects of Thyroid hormones. Hypo and hyperthyroidism. Role of parathyroid hormone, calcitonin and calcitriol in maintaining calcium and phosphorus homeostasis. Hypo and Hyper parathyroidism. 6 Hrs

Unit IV: Hormones of the Pancreas, Synthesis, secretion, structure and Biological action of Insulin and Glucagon. Diabetes mellitus. 6 Hrs

Unit V: Chemical nature, circulating levels and biological effects Glucocorticoids, Mineralocorticoids and Adrenal medullary hormones. Pathophysiology of adrenal gland secretions. Biological effects of gonadal hormones. 6 Hrs

Course Outcomes

On completion of the course, the students will be able to

CO. No.	Hormones in Health and disease	Program outcomes
CO1	recall the structural organization of endocrine systems	PO1
CO2	relate the of the pituitary gland and hypothalamus in clinical domain	PO1,PO2
CO3	interpret the role of thyroid function and understand the thyroid related disorders	PO1,PO4,PO5,PO6
CO4	assess the importance of pancreatic hormones and evaluate its effect on carbohydrates, lipids and protein metabolism	PO1,PO4,PO5,PO6
CO5	explain the organization of adrenals and gonads	PO1,PO4,PO5,PO6

Reference Books

1. Shlomo Melmed et al., Williams Text Book of Endocrinology, 13th edition, Saunders, 2015.
2. Robert K Murray et. al., Harper's Illustrated Biochemistry, 31st edition-McGraw Hill, 2018.
3. Nelson and Cox. Lehninger Principles of Biochemistry. Freeman, 7th ed., 2017.
4. Andrew Day, Philip Mayne, Clinical Chemistry in diagnosis and treatment, 6th edition, Hodder Arnold Publication, 1994.
5. W.J. Marshall, S. K. Bengert, M. Lapsley, Clinical Chemistry, 8th edition, Elsevier, 2016.

Web Resources

1. <https://www.slideshare.net/shibu989/hypopituitarism-96746917>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6761896/>
3. <https://www.webmd.com/diabetes/endocrine-system-facts>

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	2	3	3	3
CO3	3	3	3	3	2	2	3	3	3	3
CO4	2	3	3	3	2	3	2	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3

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

FIRST YEAR: SEMESTER II

FIRST AID

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	First Aid	SEC (Discipline)	1	-	-	-	1	2	25	75	100

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.6 Hrs

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. 6 Hrs

Module III: Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones. 6Hrs

Module IV: First aid related to unconsciousness, stroke, fits, convulsions- seizures, epilepsy 6Hrs

Module V: First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning .6Hrs

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 Mungali
ISBN-978-93-92208-19-5
- 2) Indian First Aid Manual-<https://www.indianredcross.org/publications/FA-manual.pdf>
- 3) Red Cross First Aid/CPR/AED Instructor Manual

Web resources

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

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
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)

ALLIED COURSE OFFERED BY BIOCHEMISTRY

FIRST YEAR : FIRST SEMESTER

ALLIED BIOCHEMISTRY I

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Allied Biochemistry I	(Theory)Allied I	3	1	-	-	4	4	25	75	100

Learning objectives

The objectives of this course are to

- Introduce the structure and classification of carbohydrates
- Comprehend the metabolism of carbohydrates
- Study the classification and properties of amino acids
- Elucidate the various levels of organization of Proteins
- Study functions and deficiency diseases of vitamins

Module I: Definition and classification of carbohydrates, linear and cyclic forms (Haworth projection) for glucose, fructose and mannose and disaccharides (maltose, lactose, sucrose). General properties of monosaccharides and disaccharides. Occurrence and significance of polysaccharides. 12Hrs

Module II: Metabolism- Catabolism and Anabolism. Carbohydrate metabolism- Glycolysis, TCA cycle, HMP shunt and glycogen metabolism and energetics 12Hrs

Module III: Amino acids -Classifications, physical properties -amphoteric nature, isoelectric point and chemical reactions of carboxyl, amino and both groups. Amino acid metabolism- transamination, deamination and decarboxylation. 12Hrs

Module IV : Proteins- classification - biological functions, physical properties- ampholytes, isoelectric point, salting in and salting out, denaturation, nature of peptide bond. Secondary structure, α -helix and β -pleated sheet, tertiary structure, various forces involved- quaternary structure. 12Hrs

Module V: Vitamins- Fat (A, D, E and K) and water soluble vitamins (B complex and C)- sources, RDA, biological functions and deficiency diseases 12 Hrs

Course Outcome

CO	On completion of this course, students will be able to	Programme Outcome
CO1	Classify the structure of carbohydrates and its properties	PO1
CO2	Explain the metabolism of carbohydrates and its significance	PO1
CO3	Classify amino acids and its properties	PO1
CO4	Explain the classification and elucidate the different levels of structural organization of proteins	PO1
CO5	Identify the disease caused by the deficiency of vitamins	PO1

Text Books

- 1 Satyanarayan, U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.
2. Jain J.L. (2007) Fundamentals of Biochemistry, S. Chand publishers 311

Reference books

1. David L. Nelson and Michael M. Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.
2. Voet, D & Voet, J.G (2010) Biochemistry, (4th ed), John Wiley & Sons, Inc.
3. Lubert Stryer (2010) Biochemistry, (7th ed), W.H. Freeman
4. Satyanarayan, U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.
5. Jain J.L. (2007) Fundamentals of Biochemistry, S. Chand publishers 311

Web sources

1. onlinecourses.swayam2.ac.in/cec20_bt12
2. onlinecourses.swayam2.ac.in/cec20_bt19

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

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

FIRST YEAR : SEMESTER I

ALLIED BIOCHEMISTRY PRACTICAL -I

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	AlliedBiochemistry Practical I	Allied Practical I	-	-	2	-	2	2	25	75	100

Learning objectives

- Identify carbohydrates by qualitative test
- Estimate biomolecules volumetrically
- Estimate protein quantitatively

I Qualitative analysis of carbohydrates- 25Hrs

- Monosaccharides-Glucose, Fructose
- Disaccharides- Lactose, Maltose, Sucrose
- Polysaccharides-Starch

II Volumetric analysis 15 Hrs

- Estimation of ascorbic acid using 2,6dichlorophenolindophenol as link solution
- Estimation of Glucose by Benedicts method
- Estimation of Glycine by Sorenson Formal titration

III Quantitative analysis(Demonstration Expt)5 hrs

a)Colorimetric estimation of protein by Biuret method

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Qualitatively analyze and report the type of carbohydrate based on specific tests	PO1,PO2,PO3
CO2	Quantitatively estimate the carbohydrates, amino acids and ascorbic acid	PO1,PO2,PO3
CO3	Estimate protein by colorimetric method	PO1,PO2,PO3

Text books

- 1.Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011,
2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.
3. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, New Age International Publishers, 2016

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

S-Strong (3) M – Medium(2) L -Low(1)

FIRST YEAR ; SEMESTER II**ALLIED BIOCHEMISTRY II**

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Allied Biochemistry II	Allied II	3	1	-	-	4	4	25	75	100

Learning objectives

The objectives of this course are to

- Impart knowledge on the classification, properties and characterization of lipids.
- Comprehend the metabolism of Lipids
- Acquaint with the structure, properties and functions of nucleic acids
- Learn about the enzyme kinetics and inhibition
- Study the importance of Hormones

Module I :Lipids–Bloor’s classification of lipids- simple lipids, fatty acids (saturated and unsaturated), compound lipids, derived lipids.Properties of lipids- reduction, oxidation, halogenation,saponification and rancidity .Classification andfunctions of phospholipids, Cholesterol – structure and biological importance.12 Hrs

Module II :Lipid metabolism- Oxidation of fatty acids(Palmitic acid) – Beta oxidation-Role of carnitine,energetics , alpha oxidation and omega oxidation.Biosynthesis of saturated fatty acids.12 Hrs

Module III :Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure, various types, properties- absorbance, effect of temperature. Different types of RNA, structure and function, Genetic code. 12 Hrs

Module III :Enzymes - Nomenclature, IUB system of enzyme classification,active site, specificity, isoenzymes, units of enzyme activity factors affecting enzyme activity- substrate concentration, pH, temperature. Enzyme Kinetics- Michaelis and Menten equation. Lineweaver- Burk plot. Enzyme inhibition, competitive, uncompetitive and andnon competitive inhibition 12 Hrs

Module V: Hormones -classification,Biological functions of Insulin, Thyroid and Reproductive hormones . 12Hr

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Elaborate on classification, structure, properties, functions and characterization of lipids	PO1
CO2	Discuss the metabolism of lipids and its importance	PO1
CO3	Explain about structure, properties and functions of nucleic acids	PO1
CO4	Derive Michaelis Menten equation and concepts of enzyme inhibition	PO1,PO3
CO5	Classify the Hormones and its biological functions	PO1,PO4

Text books

- 1.Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.
- 2.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers

Reference books

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.
2. Voet.D&Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.
3. LubertStryer (2010) Biochemistry,(7th ed), W.H.Freeman

Web sources

- 1.onlinecourses.swayam2.ac.in/cec20_bt12
- 2 onlinecourses.swayam2.ac.in/cec20_bt19

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

S - Strong (3)

M - Medium (2)

L -Low(1)

FIRST YEAR: SEMESTER II
ALLIED BIOCHEMISTRY : PRACTICAL II

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Allied Biochemistry Practical II	Allied Practical II	-	-	2	-	2	2	25	75	100

Learning objectives

The objectives of this course are to

- Identify amino acids by qualitative test
- Prepare biomolecules from its sources
- Estimate phosphorus quantitatively

I. Qualitative analysis of amino acids

a) Arginine b)Cysteine c) Tryptophan d)Tyrosine e) Histidine

II. Biochemical preparations

- a) Preparation of casein from milk.
b)Preparation of starch from potato.
c)Preparation of albumin from egg.

III Group Experiment

Determination of Iodine/ Saponification number of an edible oil(Demonstration) .

Course Outcome

CO	On completion of this course, students will be able to	Programme Outcome
CO1	Qualitatively analyze the amino acids and report the type of amino acids based on specific tests	PO1,PO2,PO3
CO2	Prepare the macronutrients from the rich sources.	PO1,PO2,PO3
CO3	Check the quality of edible oil	PO1,PO2,PO3

Text books

- 1.Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, NewAge International Publishers, 2011,
2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.

Reference books

1. Biochemical Methods, Sadasivam S and Manickam A, 4th edition, NewAge International Publishers, 2016
2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.

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

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

SECOND YEAR : SEMESTER III BIOMOLECULES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 5: Biomolecules	Core	3	1	-	-	4	4	25	75	100

Learning objectives

The main objectives of this course are to:

- Introduce the structure, properties and biological significance of carbohydrates
- Comprehend the classification, functions and acid base properties of amino acids
- Elucidate the various levels of organization of Proteins.
- Impart knowledge on the classification, properties and characterization of lipids.
- Acquaint with the classification, structure, properties and functions of nucleic acids

Module I: Carbohydrates-Classification and biological significance, physical properties - stereo isomerism, optical isomerism, anomers, epimers and mutarotation. Monosaccharides:

Occurrence, linear and cyclic structure, Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and keto groups. Disaccharides: Structure and properties of reducing disaccharides (lactose and mannose), non-reducing disaccharide (sucrose). Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance of starch, glycogen and cellulose. Heteropolysaccharides - Structure and biological significance of mucopolysaccharides - hyaluronic acid, chondroitin sulphate and heparin. (structural elucidation not needed). 12 hrs

Module II : Amino acids -Classification based on composition of side chain and nutritional significance. General structure of amino acids. 3 - and 1- letter abbreviations. General structure of amino acids. Physical properties of amino acids, isoelectric point, titration curve (alanine, lysine, glutamic acid), optical activity. Chemical reactions due to carboxyl group, amino group and side chains. Colour reactions of amino acids. 12Hrs

Module III : Proteins-Classification based on shape, composition, solubility and functions. Properties of proteins - Ampholytes, isoelectric point, salting in and salting out, denaturation and renaturation, UV absorption. Levels of Organization of protein structure- Primary structure, Formation and characteristics of peptide bond, phi and psi angle, Secondary structure- α helix (egg albumin), β - pleated sheath (keratin) Tertiary structure – with reference to myoglobin. Quaternary structure with reference to haemoglobin. 12 Hrs

Module IV : Lipids- Lipids: Bloor's classification, chemical nature and biological functions. Fatty acids: classification, nomenclature, structure and properties of fatty acids. Simple and mixed triglycerides: structure and general properties, Characterization of fats- iodine value, saponification value, acid number along with their significance. Compound lipids- Structure and function of phospholipids and glycolipids. Derived lipids- Structure and function of cholesterol, bile acids and bile salts. 12Hrs

Module V : Nucleic acids-Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Types of DNA: A, B, Z DNA, structure and biological significance, superhelicity. Types of RNA: mRNA, tRNA, rRNA. Secondary and tertiary structure of tRNA. 12Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Classify, illustrate the structure and explain the physical and chemical properties of carbohydrates.	PO1

CO2	Indicate the classification, structure, properties and biological functions of amino acids.	PO1
CO3	Explain the classification and elucidate the different levels of structural organization of proteins.	PO1
CO4	Elaborate on classification, structure, properties, functions and characterization of lipids	PO1, PO4
CO5	Describe the structure, properties and functions of different types of nucleic acids	PO1

Textbooks

1. Biochemistry, U. Sathyanarayana & U. Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Fundamentals of Biochemistry, J.L. Jain, Sunjay Jain, Nitin Jain, 2013, 7th edition S. Chand & Company Ltd.
3. Textbook of Medical Biochemistry, MN Chatterjea, Rana Shinde, 2002, 8th edition, Jaypee Brothers.

Reference books

1. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W. H. Freeman and Company.
2. Voet D., Voet J.G. and Pratt, C. W., 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.
3. Zubay G.L., *et al.*, 1995, Principles of Biochemistry, 1st edition, Wm C. Brown Publishers.

Web resources

<https://www.britannica.com/science/biomolecule> <https://en.wikipedia.org/wiki/Biomolecule> <https://www.khanacademy.org/science/biology/macromolecules>

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						3			3
CO 3	3						3			3
CO 4	3			2			3	2		3
CO 5	3						3			3

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

SECOND YEAR : SEMESTER III
PRACTICAL – III : BIOMOLECULES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core Paper-6 practical III Biomolecules	Core Practical	-	-	3	-	3	2	50	50	100

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
- Isolate nucleic acids from plant and animal source

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 an edible oil

2) Determination of Iodine number of an edible oil

3) Determination of Acid number of an edible oil

III. Group Experiments 15 hrs

1) Isolation of DNA from plant/animal source.

2) Isolation of RNA from rich source.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Qualitatively analyze 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	Isolate the nucleic acid from biological sources	PO1,PO3
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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. 6 edition, 2006.
5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 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 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	2			3	3	3	3
CO 4	2		3				3	3	3	3

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

SECOND YEAR : SEMESTER IV
BIOCHEMICAL TECHNIQUES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core Paper 7 - Biochemical techniques	Core	3	1	-	-	4	4	25	75	100

Learning objectives

The objectives of this course are to

- Introduce the basic principles, types and applications of various sedimentation technique.
- Provide an understanding of the underlying principles of chromatographic techniques
- Demonstrate experimental skills in various electrophoretic techniques.
- Appraise the use of colorimetric and spectroscopic techniques in biology
- Impart knowledge about the measurement of radioactivity and safety aspects of radioactive isotopes.

Module I : Centrifugation - Basic principles, RCF, Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, Ratezonal and Isopycnic techniques, construction, working and applications of analytical ultracentrifuge. 9 Hrs

Module II: Chromatography - adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography and affinity chromatography. 9 Hrs

Module III : Electrophoresis - General principles, factors affecting electrophoretic mobility. Tiselius moving boundary electrophoresis. Electrophoresis with paper and starch. Principle, instrumentation and applications of agarose gel electrophoresis and SDS-PAGE. 9 Hrs

Module IV: Basics of Electromagnetic radiations- Energy, wavelength, wavenumber and frequency. Absorption and emission spectra, Lambert – Beer Law, Light absorption and transmittance. Colorimetry-Principle, instrumentation and applications. Visible and UV spectrophotometry – Principle, instrumentation and applications. Principles and applications of NMR spectroscopy. 9 hrs

Module V: Radioactivity - Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization -Geiger MullerCounter. Methods based upon excitation - Solid & Liquid scintillation counters. Autoradiography. Biological applications and safety aspects of radioisotopes.9 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Describe types of rotors and identify the centrifugation technique for the separation of biomolecules.	PO1,PO2,PO6
CO2	Demonstrate the principles, operational procedure and application of planar and column chromatography.	PO1,PO2, PO6
CO3	Specify the factors and explain the separation of DNA and protein using electrophoretic technique.	PO1,PO2, PO6
CO4	State Beer's Law and illustrate the instrumentation and uses of colorimeter and spectrophotometer.	PO1,PO2, PO6
CO5	Enumerate various methods of measurement of radioactivity and safety aspects of radioactive isotopes.	PO1,PO2, PO6

Textbooks

1. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath, 2002, Biophysical Chemistry, Principles and Techniques, 3rd edition, Himalaya Publishing House.
2. L. Veerakumari, 2009, Bioinstrumentation, 1st edition, MJ Publishers.
3. Keith Wilson & John Walker, 2000, Practical Biochemistry-Principles and techniques, Cambridge University Press, 4th edition.

Reference books

1. Terrance G. Cooper The tools of Biochemistry, . 1977, , John Wiley & Sons, Singapore.
2. Gurumani, Research Methodology for Biological Sciences, 2011, 1st edition, MJ Publishers.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1st edition, Narosa Publishing house.

Web Resources

1. <https://www.britannica.com/science/chromatography>
2. <https://www.youtube.com/watch?v=xgxFBQZYXIE>
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)

SECOND YEAR : SEMESTER IV

PRACTICAL IV - BIOCHEMICAL TECHNIQUES

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
	Core paper 8-Practical IV- Biochemical techniques	Core Practical	-	-	3	-	3	2	50	50	100

Learning objectives

The objectives of this course are to:

- Acquaint the students with colorimetric estimations of biomolecules.
- Equip skills on various separation techniques.
- Impart knowledge about the estimation of minerals and vitamins.

I Colorimetry

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of DNA by Diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Estimation of Phosphorus by Fiske and Subbarow method.

II Chromatography

1. Separation and identification of sugars and amino acids by paper chromatography.
2. Separation and identification of amino acids and lipids by thin layer chromatography.

III Demonstration

1. Separation of serum and plasma from blood by centrifugation.
2. Separation of serum proteins by SDS-PAGE.
3. Separation of DNA by Agarose gel electrophoresis

IV Preparation of solution

1. Preparation of Normal and Molar solutions

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Estimate the amount of biomolecules by Colorimetric method.	PO1,PO3,PO6
CO2	Quantify the amount of minerals by Colorimetric method	PO1,PO3,PO6
CO3	Separate and identify sugars, lipids and amino acids by chromatography	PO1,PO3
CO4	Operate centrifuge for the separation of serum and plasma	PO1,PO3,PO6
CO5	Demonstrate the separation of proteins electrophoretically	PO1,PO3,PO6

Text books

1. J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015.
2. S. Sadasivam A. Manickam Biochemical Methods New Age International Pvt Ltd publishers third edition 2018.
3. Keith Wilson and John Walker Principles and techniques of Practical Biochemistry Cambridge University Press 2010, Seventh edition.

Reference books

1. S. K. Sawhney and Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd 2nd edition, 2005.
2. David T. Plummer, 2001, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw- Hill publishing company limited.
3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition, 1988.

Web resources

<https://www.pdfdrive.com/biochemistry-books.html>

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				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)

THIRD YEAR: SEMESTER V

ENZYMES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 9 - Enzymes	Core	3	1	-	-	4	5	25	75	100

Learning objectives

The main objectives of this course are to

- Provide fundamental knowledge on enzymes and their properties.
- Understand the mechanism of action of enzymes and the role of coenzymes in catalysis.
- Introduce the kinetics of enzymes and determine the K_m and V_{max} .
- Explain the effect of inhibitors on enzyme activity
- Understand the role of enzymes in clinical diagnosis and industries.

Module I : Introduction to enzymes : Nomenclature and Classification based on IUB with examples, enzyme as catalyst-Activation energy, Enzyme specificity-absolute, Group, linkage and stereo specificities. Concept of Active site, Lock and key hypothesis and induced fit theory, Enzyme expression Units-IU, turnover number, katal and specific activity. 12 Hrs

Module II : Mechanism of enzyme catalysis -

AcidBasecatalysis,covalentcatalysis,electrostaticcatalysis,metal ion catalysis. Coenzymes -Definition, types, co-enzymatic forms of vitamins- NAD/NADP,FAD, FMN, Coenzyme A TPP,PLP, lipoic acid and biotin. Multienzyme complexes - Pyruvate dehydrogenase complex. Isoenzyme with reference to LDH and CK.12 Hrs

Module III:Enzymekinetics --Definition of kinetics, Factorsaffectingenzymeactivity - temperature, pH, substrate and enzyme concentration, activators-cofactors, Derivation of Michaelis-Menton equation for unisubstrate reactions , Lineweaver - Burk plot, Eadie -Hofsteepplot Significance of K_m and V_{max} andtheir determinationusing the plots.12 Hrs

Module IV:Enzyme inhibition - Reversible and irreversible inhibition-types of reversible inhibitors, competitive, non-competitive, un-competitive inhibitors. Graphical representation by L-B plot,(Kineticderivationsnotrequired),Determinationof K_m and V_{max} inthe presence and absence of inhibitors. Allosteric enzymes - Sigmoidal curve, positiveandnegativemodulators12 Hrs

Module V: Applications of enzymes -Immobilized enzymes - methods of immobilization- adsorption,covalentbonding,crosslinking,encapsulation,entrapmentandapplications of immobilized enzymes. Biosensors – e.g. Glucose sensors. Industrial applications of enzymes –Food, textile and pharmaceutical industries.12Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Identifythe major classes of enzymes,differentiatebetweenachemicalcatalyst and a biocatalyst and define the units of enzymes.	PO1
CO2	Explain the mechanismofenzymecatalysis and the role of coenzymes in enzyme action.	PO1,PO2
CO3	Illustrate the steady state kinetics,, interpretMMplotandLBplotbasedonkineticsdata, and determine K_m and V_{max} .	PO1,PO3
CO4	Distinguish the types of inhibition along with itsimportanceinbiochemicalreactions.	PO1,PO3
CO5	Comprehend the various methods for production of immobilized enzymes and discuss the application of enzymes in clinical diagnosis and various industries.	PO1,PO2,PO6

Textbooks

1. U. Sathyanarayana & U. Chakrapani, 2013, Biochemistry, 4th edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Dr. G.R. Agarwal, Dr. Kiran Agarwal & O.P. Agarwal, 2015, Textbook of Biochemistry (Physiological Chemistry), 18th edition, Goel Publishing House,
3. T. Devasena, 2010, Enzymology, 1st edition, Oxford University Press.

Reference books

1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd edition, East West Press Pvt. Ltd.
2. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition, W. H. Freeman and Company,
3. Voet D., Voet J. G. and Pratt, C. W., 2004, Principles of Biochemistry, 4th edition, John Wiley & Sons, Inc.
4. Zubay G. L., *et al.*, 1995, Principles of Biochemistry, 1st edition, Wm C. Brown Publishers.

Web resources

[www.biologydiscussion.com/notes/enzymes-](http://www.biologydiscussion.com/notes/enzymes-notes)
[notes https://www.britannica.com/science/protein/The-mechanism-of-enzymatic-](https://www.britannica.com/science/protein/The-mechanism-of-enzymatic-action)
[action https://www.youtube.com/watch?v=oVJ2LJxO6tU](https://www.youtube.com/watch?v=oVJ2LJxO6tU)

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
CO 4	3		2				3			3
CO 5	3	2				2	3	3	3	3

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

THIRD YEAR : SEMESTER V

INTERMEDIARY METABOLISM

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
	Core paper:10 Intermediary metabolism	Core	3	1	-	-	4	5	25	75	100

Learning Objectives

The main objectives of this course are to

- Review the basic concepts of free energy transformation and describe biological oxidation.
- 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 : Bioenergetics- Concepts of Free energy, Enthalpy and Entropy; High energy compounds; Role of high energy compounds, free energy hydrolysis of ATP and other organophosphates, ATP-ADP cycle.

Biological Oxidation: Electron transport chain -its organization and function. Inhibitors of ETC. Oxidative phosphorylation, P/O ratio, Peter Mitchell's chemiosmotic hypothesis. Mechanism of ATP synthesis, Inhibitors and uncouplers of oxidative phosphorylation, substrate level phosphorylation with examples. 15 Hrs

Module II: Metabolism of carbohydrates -Glycolysis, TCA Cycle, Amphibolic nature and integrating role of TCA cycle. Anaplerosis, Pentose Phosphate Pathway (HMP shunt), Gluconeogenesis, Glycogenesis, Glycogenolysis, glyoxylate cycle, Entner-Duodoroff pathway and Cori cycle. 15 Hrs

Module III: Metabolism of lipids -Oxidation of fatty acids - α , β and ω -oxidation of saturated fatty acids, Oxidation of fatty acids with odd number of carbon atoms and unsaturated fatty acids, Ketogenesis, Biosynthesis of saturated fatty acids and unsaturated fatty acids, Biosynthesis and degradation of triglycerides, phospholipids and

cholesterol. 15 Hrs

Module IV: Metabolism of amino acid- Metabolic nitrogen pool, Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination and decarboxylation, Biogenic amines, Urea cycle. 15 Hrs

Module V: Metabolism of nucleotides-Biosynthesis of purines and pyrimidines, - denovo synthesis and salvage pathways, Degradation of purines and pyrimidines, Conversion of ribonucleotide to deoxyribonucleotide 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	State the concepts of bioenergetics and illustrate the mechanism of flow of electrons and the production of ATP.	PO1, PO2
CO2	Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism.	PO1,
CO3	Sketch the oxidation and biosynthesis of fatty acids, phospholipids, triglycerides and cholesterol with suitable examples	PO1
CO4	Explain catabolism of amino acids, synthesis of non essential amino acids and specialized products from amino acids.	PO1
CO5	Describe the metabolism of nucleic acids with necessary illustrations and its regulation.	PO1

Textbooks

1. U. Sathyanarayana & U. Chakrapani, 2015, Biochemistry, 4th Elsevier India Pvt. Ltd.,
2. M.N. Chatterjea and Rana Shinde, 2002, Textbook of Medical Biochemistry, 5th edition Jaypee Brothers Medical Publishers 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.
3. Principles of Biochemistry
Voet. D, Voet. J. G, and Pratt C. W., 2010, 4th edition, John Wiley & Sons, Inc.,
4. Principles of Biochemistry, Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, 2nd Edition, Wm. C. Brown Publishers.
5. Biochemistry, Garret, R. H. and Grisham, C. M. 2005,

3rdEdition.ThomsonLearningINC.

Web resources

1. <https://nptel.ac.in/courses/104/105/104105102/>
2. <http://www.nptelvideos.in/2012/11/biochemistry-i.html>
3. 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	2					3			3
CO 2	3						3			3
CO 3	3						3			3
CO 4	3						3			3
CO 5	3						3			3

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

THIRD YEAR : SEMESTER V CLINICAL BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 11 : Clinical Biochemistry	Core	3	1	-	-	4	5	25	75	100

Learning objectives

The main objectives of this course are to

- Comprehend the basic concepts and disorders of carbohydrate metabolism
- Explain the disorders of lipid metabolism.
- Elucidate the liver function test and kidney function test.
- Designate the gastric function test.

- Familiarize the clinical enzymology.

Module I :Disordersofcarbohydratemetabolism: Maintenance of blood glucose by hormone with special reference to insulin and glucagon. Abnormalities in glucose metabolism: Diabetes mellitus;types, causes, biochemical manifestations, diagnosis and treatment, glycated hemoglobin. Inborn errors of carbohydrate metabolism, glycosuria, Fructosuria,Pentosuria, Galactosemia andGlycogenstoragediseases.15 hrs

Module II:Disorders of Lipid Metabolism: Lipid Profile,Atherosclerosis,Fattyliverandhyperlipidemia.Hypercholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach’s disease, Niemann-Pick disease, lipotropic agents 15 Hrs

Module III :LiverFunctionTests: Bilirubin metabolism and jaundice, Estimation of conjugated and total bilirubininserum(Diazomethod).Detectionofbilirubinandbilesaltsinurine(Fouchet’s test andHay’s Sulphur test).Thymolturbiditytest,prothrombintime,serumenzymesinliverdisease serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). 15 Hrs
KidneyFunctionTests: Measurement of urine pH, volume, specific gravity, osmolality, sediments in urine, inulin, urea and creatinine clearance tests. Concentration and dilution tests. Phenol red test. Levels of plasma protein and its significance related to kidney function. Proteinuria. 15Hrs

Module IV :GastricFunction test:Composition of gastric juice, collection of gastric contents,examination of gastric residuum, fractional test meal (FTM), stimulation test-alcohol and histamine stimulation, Tubeless gastric analysis1.5 Hrs

Module V:Clinical enzymology: Enzymes of diagnostic importance- LDH, creatine kinase, transaminases, phosphatases, Isoenzymes of lactate dehydrogenase.15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Programoutcomes
CO1	Explaintheconceptsof hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment.	PO1,PO3,PO6
CO2	Analyzethelipid profile and different deficiency state.	PO1,PO3,PO6
CO3	Describe the liver and kidney functions and specific diagnostic methods used for biological sample.	PO1,PO3,PO6

CO4	Detail about the composition of gastric juice and special test for diagnosis.	PO1,PO3,PO6
CO5	Elaborate the enzyme markers used for diagnostic studies.	PO1,PO3,PO6

Text books

1. MN Chatterjee and Rana Shinde, Text Book of Medical Biochemistry, Jaypee Brothers Medical Publishers (P) LTD, New Delhi, 8th Edition, 2012
2. Ambika Shanmugam's Biochemistry for medical students, 8th edition, Published by Wolters Kluwer India Pvt. Ltd.

Reference books

1. Philip D. Mayne, Clinical Chemistry in diagnosis and treatment, ELBS Publication, 6th edition, 1994.
2. Thomas M. Devlin (2014) Text book of Biochemistry with clinical correlations (7th ed). John Wiley and sons.
3. Tietz Fundamentals of clinical chemistry and molecular Diagnostics (2014) (7th ed) Saunders.

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		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)

THIRD YEAR : SEMESTER V

IMMUNOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Elective Course IA Immunology	Elective	3	-	-	-	3	4	25	75	100

Learning Objectives

The objective of this course are to

- Introduce the structure and functions of lymphoid organs and cells of the immune system
- Illustrate the structure and classification of antibodies and adaptive immune response
- Impart knowledge on the types of immunity and uses of vaccines
- Provide an understanding of immune related diseases and transplantation
- Study the Ag-Ab interaction and immunological techniques to identify antigens and antibodies

Module I :Structure and function of primary lymphoid organs (thymus ,bone marrow), secondary lymphoid organs (spleen, lymph node), Cells involved in immune system-Functions-Phagocytosis -Inflammation 15 Hrs

Module II: Antigens - Nature, Immunogens, haptens ,cross reactions - Immunoglobulin- types- structure and function. Cells involved in antibody formation, Clonal selection theory, Co-operation of T-cell with B-cell. Differentiation of T and B lymphocyte - Humoral and cell mediated immunity. Monoclonal antibody – Production and application in biology. 15Hrs

Module III- Immunity and its types-Innate, Acquired, active and passive.- Natural and Artificial - Commonly used toxoid vaccines, killed vaccines, live attenuated vaccines, rDNA Vaccines, DNA and subunit vaccines 15Hrs

Module IV: Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), Auto- immune diseases with examples. Organ specific and systemic autoimmunity. SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC, graft Vs host reaction, immunosuppressive Agents. 15Hrs

Module V: Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immuno diffusion, SID and DID -Oudin Procedure, Oakley Fulthrope Procedure, Radio immunodiffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test-Wasserman's reaction, RIA, ELISA. 15Hr

Course Outcomes

CO	On completion of this course, students will be able to	Programoutcomes
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.Kuby, J. (2018). Immunology(5th ed). W.H. Freeman - ISBN-10 : 1319114709 / ISBN-13 : 978-1319114701
2. Rao, C. V. (2017). Immunology (3rd ed.). Chennai: Alpha Science Int. Ltd - ISBN-10 : 1842652559/ ISBN 13:978-1842652558
- 3.Tizard(1995). An Introduction to Immunology. Harcourt Brace College Publications

References Books

- 1.Kenneth M. Murphy, Paul Travers, Mark Walport - (2007), Janeway's Immunobiology, 7thedition, Garland Science.
2. Abul K. Abbas, Andrew H. Lichtman, Jordan S. Pober - (1994), Cellular and molecular immunology, 2ndedition, 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: 9780323549431eBook ISBN: 9780323639095
4. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - (2006),Roitt's Essential Immunology, 11th edition, Wiley-Blackwell

Web resources

- 1.https://onlinecourses.nptel.ac.in/noc22_bt40/preview
- 2.https://onlinecourses.swayam2.ac.in/cec20_bt05/preview
- 3.<https://youtu.be/8uahFPl6ny8>

Mapping with ProgramOutcomes

	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

BIOCHEMICAL PHARMACOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Elective Course IB Biochemical Pharmacology	Elective	3	-	-	-	3	4	25	75	100

Learning Objectives

The objectives of this course are to

- Introduce the basic concepts of pharmacology.
- Explain the metabolism of drugs and factors responsible for metabolism.
- Acquaint the adverse response and side effects of drugs .
- Familiarize important drugs used for common metabolic disorders.
- Provide an understanding about the action of antibiotics .

Module I: Drugs – classification based on sources, routes of drug administration - Oral/Enteral, Parenteral and Local application. Absorption of drugs, factors influencing drug absorption, distribution and excretion of drugs. 15 Hrs

Module II: Drug metabolism - Phase I and Phase II reactions, role of cytochrome P₄₅₀ , non-microsomal reactions of drug metabolism. Factors influencing drug metabolism. Therapeutic index. 15 Hrs

Module III: Drug allergy, Drug tolerance - IC 50, LD50 of a drug, Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance - biochemical mechanism. 15 Hrs

Module IV : Therapeutic Drugs - Analgesics and Non-steroidal anti-inflammatory drugs (NSAIDs) – Aspirin and Acetaminophen. Insulin, Oral antidiabetic drugs - Sulfonylureas, Biguanides. Antihypertensive drugs - ACE inhibitors, Calcium channel blockers. Anti-cancer agents – Antimetabolites. 15 Hrs

Module V: Antibiotics - Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracyclines and chloramphenicol. 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Classify the different routes of drug administration, describe the absorption, distribution, metabolism and excretion of drugs.	PO1
CO2	Illustrate the metabolism of drugs, classify the microsomal and non-microsomal reactions and explain the role of cytochromes.	PO1
CO3	List out the various adverse response and side effects of drugs.	PO1,PO2,PO4
CO4	Justify the use of synthetic drugs and elucidate its pharmacological actions and its adverse effects for different disease.	PO1,PO4
CO5	Highlight the importance and explain the mode of action of important antibiotics.	PO1,PO4

Text Books

1. N.Murugesh, A concise text book of Pharmacology –Sathya Publishers.
2. Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & Company Ltd.
3. S C Metha, Ashutosh Kar, Pharmaceutical Pharmacology –New Age International (P) Limited, Publishers.

References Books

1. Lippincott's illustrated Reviews- Pharmacology by Mary J.Mycek, Richard A.Harvey, Pamela C. Champe, Lippincott – Raven publishers, New Delhi.
2. David . E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt.Ltd.
3. R.S. Satoskar, S. B. Elsevier Pharmacology and pharmacotherapy. - ISBN-10 : 9788131248867 / ISBN-13 : 978-8131248867 ,2017.
4. Tripathi, K.Essentials of Medical Pharmacology. Jaypee Publishers- ISBN-10 : 9350259370 / ISBN-13 : 978-9350259375.2018.

Web Resources

<https://slideplayer.com/slide/3728296/64/video/What+is+bioremediation%3F.mp4>

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						3			3
CO 3	3	2		2			3	2		3
CO 4	3			2			3	2		3
CO 5	3			2			3	2		3

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

THIRD YEAR : SEMESTER V
RESEARCH METHODOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Elective Course IC Research Methodology	Elective	3	-	-	-	3	4	25	75	100

Learning objectives

The objectives of the course are to:

- 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. 15 Hrs

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 15 Hrs

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 - students "t" test, chi-square test. Dunnet's test 15Hrs

ModuleIV: 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 15 hrs.

ModuleV: 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.15 Hrs

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

Text Books

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, 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.

Web Resources

1. <https://explorable.com/research-methodology>
2. <http://www.scribbr.com>

3. <http://www.open.edu>

4. <http://www.macmillan.ihe.com>.

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	3	3
CO 3	3	2	3				3	3	3	3
CO 4	3	2	3				3	3	3	3
CO 5	3		3	2			3	3	33	3

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

THIRD YEAR : SEMESTER V

CLINICAL BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	Ext erna l	Total
	Core paper 12: Practical V- Clinical Biochemistry	Core Practi cal V	0	0	4	0	4	5	50	50	100

Learning Objectives

The objectives of this course are to

- Introduce the methods of sample collection (blood & urine) for analytical purpose.
- Impart practical knowledge on the assay of activity of various diagnostically important enzymes
- Understand the estimation procedure for various important biomolecules.
- Help students learn the routine qualitative analysis of urine sample for diagnostic purpose.
- Train students on various hematological tests and its significance.

1. Collection and preservation of blood and urine samples.

2. Estimation of creatinine by Jaffe's method (serum & urine)

3. Estimation of urea by diacetyl monoxime method (serum & urine)

4. Estimation of uric acid (serum & urine)
5. Estimation of cholesterol by Zak's method
6. Estimation of Glucose by Ortho Toluidine method
7. Estimation of Protein by Lowry's method
8. Estimation of Hemoglobin by Shali's/Drabkins method
9. Assay of SGPT, SGOT and Alkaline phosphatase
10. Qualitative analysis of normal constituents of urine

Urea, Creatinine, Phosphorus, Calcium

Abnormal constituents

- a) Sugar (Glucose, fructose, pentose); b) Protein; c) Blood; d) Ketone bodies; e) Bile salts; f) Bile pigments with clinical significance. 80 Hrs

DEMONSTRATION EXPERIMENTS (10 Hrs)

HEMATOLOGY

- a. RBC Counting
- b. Total and differential count of white blood cells
- c. Packed cell volume
- d. Erythrocyte sedimentation rate
- e. Blood clotting time
- f. Blood grouping

CO	On completion of this course, students will be able to	Programme outcome
CO1	Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose.	PO1, PO2
CO2	Assay the activity of various clinically important enzymes and relate their clinical importance.	PO1, PO2
CO3	Estimate the important biomolecules in biological samples and relate their clinical significance	PO1, PO2, PO3, PO6
CO4	Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results	PO1, PO2, PO3
CO5	Perform the routine haematological tests.	PO1, PO2, PO3, PO6

Text Books

1. Manickam, S.S. (2018). Biochemical Methods (3rd ed.). Newage International Pvt Ltd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408

2. Plummer, D. T. (n.d.). *An Introduction to Practical Biochemistry*. Tata McGraw Hill-ISBN: 97800708416
3. Alan H Gowenlock. 1998. *Varley's Practical Clinical Biochemistry*, 6th edition, CBS Publishers, India.
4. B. Godkar. 2020. *Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback*, 3rd edition, Bhalani Publishers.
5. Kanai L Mukerjee. 1996. *Medical Lab Technology, Vol I& II*, 1st edition, Tata McGraw Hill, Pennsylvania.
6. Ranjna Chawla. 2014. *Practical Clinical Biochemistry Methods and interpretations 58 (Paperback)*. 4th edition, Jaypee Brothers Medical Publishers, New York.

Reference books

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://rajswashthya.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
CO 2	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
CO 5	3	3	3			3	3	3	3	3

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

THIRD YEAR : SEMESTER V
IMMUNOCHEMICAL TECHNIQUES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Elective course 2: Elective Practical I – Immunochemical Techniques	Elective Practical I	0	0	3	0	3	4	50	50	100

Learning Objectives

The objectives of this course are to

- Introduce the principles of immunology such as agglutination, precipitation, flocculation.
- Impart practical knowledge on the assay of antigens and antibodies of diagnostic importance.
- Help students learn the advanced immunoanalytical techniques like Immunodiffusion and Immune electrophoresis.
- Train students on various routine immunological tests using card, slide and tube methods and its significance.

1. Dot ELISA technique
2. Widaltest - Slide and Tube method
3. VDRL Slide test
4. Mantoux test
5. HBsAg Card test
6. HIVCard test

Demonstration Experiments

7. Immunodiffusion - Ouchterlonytechnique
8. Immuno electrophoresis

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	relate the principle and methods of identification of antigens and antibodies	PO1,PO2
CO2	develop skills in the technique of separation of proteins by SDS-PAGE and Western Blotting	PO1,PO2
CO3	appraise hands on skill in the isolation and quantification of specific immunoglobulins in serum	PO1,PO2,PO3,PO6
CO4	apply hands on skills in immunotechniques in clinical laboratories and blood banks	PO1,PO2,PO3
CO5	analyse the clinical data using wide range of immunological methods for diagnosis of bacterial or viral infections	PO1,PO2,PO3,PO6

Reference books

1. David T. Plummer. An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company, 3rd edition, 2017.
2. Varley, H., Gowenlock, A.H. and Hill, Practical Clinical Biochemistry, M. William, CBS Publishers; 6th Edition, 2006.
3. Estridge, Reynold and Walter, Basic Medical Laboratory Techniques - 4th edition, Delmar Publishers, 2000.
4. Kanai L Mukherjee, Medical Lab Technology - Vol I-III. Tata McGraw Hill Education India, 3rd edition, 2010.
5. RamnikSood, Textbook of Medical Lab Technology, Jaypee Brothers Medical Publishers (P) Ltd., 6th edition, 2009.
6. T. N. Pattabiraman, Laboratory Manual and Practical Biochemistry, All India Publishers & Distributors, 4th edition, 2015.

Web resources

1. <https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors>
2. <http://rajswashthya.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_biochemistryp.pdf?sequence=1&isAllowed=y
4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistryp.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
CO 2	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
CO 5	3	3	3			3	3	3	3	3

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

THIRD YEAR: SEMESTER VI MOLECULAR BIOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core Paper 13 Molecular Biology	Core	3	1	-	-	4	6	25	75	100

Learning Objectives

The objectives of this course are to

- Provide insights into the central dogma of molecular biology and explain the mechanism of DNA replication.
- Elaborate the mechanism of transcription and reverse transcription.
- Highlight the characteristics of genetic code and describe the process of protein synthesis.
- Introduce the concept of regulation of gene expression in prokaryotes
- Familiarize the different types of mutations and explain the mechanism of DNA repair.

Module I: Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimental evidences by Griffith's transforming principle, Avery, McLeod and McCarthy's experiment, and Hershey and Chase Experiment. Replication in prokaryotes: Modes of replication, Meselson and Stahl's experimental proof for semiconservative replication.

Mechanism of Replication – Initiation, events at Ori C, Elongation - replication fork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitors of replication. 15 Hrs

Module II: Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Post-transcriptional modifications; inhibitors of transcription. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription. 15 Hrs

Module III: Genetic Code and its characteristics, Wobble hypothesis. Translation: Adaptor role of tRNA, Activation of amino acids, Initiation, elongation and termination of protein synthesis, post-translational modifications and inhibitors of protein synthesis. 15 Hrs

Module IV: Regulation Of Gene Expression In Prokaryotes - Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, regulation of lac operon and trp operon. 15 Hrs

Module V: Mutation: Types - Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations. DNA repair: Direct repair, Photoreactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair. 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and modes of replication.	PO1
CO2	Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA.	PO1
CO3	Decipher the genetic code and summarize the process of translation.	PO1
CO4	Comprehend the principles of gene expression and explain the concept of operon in prokaryotes.	PO1, PO2
CO5	Distinguish the types of mutations and explain the various mechanisms of DNA repair.	PO1, PO2

Textbooks

- 1.Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition,AnebooksIndia.
- 2.David Friefelder,1987, Molecular Biology, 2nd edition, Narosa PublishingHouse.
- 3.Dr.P.S.VermaandDr.V.K.Agarwal,2013,Cellbiology, Genetics,MolecularBiology,EvolutionandEcology,1stedition,S.Chand&Compan yPvt.Ltd.

Referencebooks

- 1.Karp,G.,2010,CellandMolecularBiology:ConceptsandExperiments,6thedition,JohnWiley& Sons.Inc.
- 2.DeRobertis,E.D.P.andDeRobertis,E.M.F.,2010,CellandMolecularBiology,8thedition,LippincottWilliamsandWilkins,Philadelphia.
- 3.James.D.Watson,2013,MolecularBiologyoftheGene7thedition,BenjaminCummings.
- 4.GeorgeM.Malacinski,1992,Freifelder'sEssentialsofMolecularBiology,4thedition,Narosa publishingHouse.

Web resources

1. www.mednotes.net/notes/biology
2. <https://www.onlinebiologynotes.com/repair-mechanism-of-mutation/>
3. <https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/>

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						3			3
CO 3	3						3			3
CO 4	3	2					3			3
CO 5	3	2					3	1		3

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

THIRD YEAR : SEMESTER VI

HUMAN PHYSIOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 14: Human Physiology	Core	3	1	-	-	4	6	25	75	100

Learning Objectives

The main objectives of this course are to

- Aid in understanding the physiology of respiratory and circulatory systems
- Explain the structure and physiology of the nervous and muscular system
- Explicate the functions of digestive and excretory system of the body.
- Impart knowledge about the process of reproduction.
- Emphasize the importance of various endocrine factors that regulate metabolism, growth, homeostasis and reproduction.

Module I: Respiratory System- Overview of respiratory system, Types of respiration, Transport of respiratory gases, Exchange of respiratory gases in lungs and tissues - Chloride Shift & Bohr's effect, Circulatory System- Structure and functions of the Heart. Arterial and venous system, Cardiac cycle, Pace maker, Blood pressure and Factors affecting blood pressure. 15Hrs

Module II: Nervous system- Structure of neuron, synaptic transmission, reflex action, neurotransmission- Resting membrane and Action potential. Neurotransmitters- acetyl choline, Noradrenaline, Dopamine, Serotonin, Histamine, GABA, Substance P. Muscular system- structure and types of muscles - skeletal, smooth and cardiac muscles, muscle proteins- types and functions, mechanism of muscle contraction. 15Hrs

Module III: Digestive system- composition, functions of saliva, gastric, pancreatic, intestine and bile secretions, structure of digestive system, Digestion and absorption of carbohydrates, lipids, proteins. Excretory system- Structure of nephron, mechanism of urine formation. Role of kidneys in the maintenance of acid-base balance. 15Hrs

Module IV: Reproductive system:- Oogenesis, spermatogenesis, capacitation and transport of sperm- blood testis barrier. Fertilization, early development, Implantation, Placentation and Parturition. 15Hrs

Module V: Endocrinology- endocrine glands and their secretions, Classification of hormones, structure and functions of Insulin, thyroxine. Steroid hormones- Corticosteroids, Sex hormones – testosterone and estrogen. 15Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the exchange of gases, design of blood vessels and cardiac cycle.	PO1
CO2	Summarize the events in transmission	PO1

	nerve impulses and mechanism of muscle contraction.	
CO3	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
CO4	Describe the process of Oogenesis, Spermatogenesis, Fertilization, and Parturition.	PO1, PO2
CO5	Understand the role of different hormones that regulate metabolism, growth, glucose homeostasis and reproductive function.	PO1, PO2

Textbooks

1. K. Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7th edition, Jaypee Brothers Medical Publishers (P) Ltd.
2. Chatterjee. C.C., 1988, Human Physiology - Voll & II, 1st edition, Medical Allied Agency.
3. Animal Physiology - Mariakuttikanand Arumugam, Saras publication, 2017.

Reference books

1. Text book of medical biochemistry physiology - MN. Chatterjee and Rana shinde, 7th edition, Jaypee brothers - medical publishers, 2007.
2. Meyer, Meyer & Meij, 2002, Human Physiology, 3rd edition, A.I.T.B.S Publishers.
3. Guyton and Hall, 2011, Textbook of Medical Physiology, 12th edition, W.B. Saunders Company.
4. Textbook of Medical Physiology - Guyton & Hall, 12th edition, Saunders Publishers, 2010
5. Human anatomy and physiology - Elaine N. Marieb, 3rd edition, Benjamin/Cummings (a Pearson education company), 1995.

Web resources

- <https://www.youtube.com/watch?v=6qnSsV2syUE>
- https://www.youtube.com/watch?v=9_h0ZXx1lFw
- <https://slideplayer.com/slide/9431799/>

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

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

THIRD YEAR SEMESTER VI

PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 15: Plant Biochemistry and Plant Therapeutics	Core	3	1	-	-	4	6	25	75	100

Learning Objectives

The main objectives of this course are to

- Convey the knowledge of photosynthesis.
- Detail the structure and types of secondary metabolites.
- Impart the idea on various plant hormones.
- Emphasize the effects of free radicals and the importance of antioxidants
- Understand the role of medicinal plants in treating diseases.

Module I: Photosynthesis- Photosynthesis apparatus, pigments of photosynthesis, photo chemical reaction, photosynthetic electron transport chain, path of carbon in photosynthesis- Calvin cycle, Hatch – lack pathway (4 ways) CAM path way, significance of photosynthesis.

15Hrs

Module II: Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of

phenolics, tannins, lignins, terpenes and alkaloids. Medicinal properties of secondary metabolite. Free radicals, role of antioxidants in prevention of disease, phytochemicals as antioxidants. 15Hrs

Module III: Plant hormones Structure and function of plant hormones such as ethylene, cytokinins, auxins, Abscisic acid, Florigin and Gibberellins. 15Hrs

Module IV: Nitrogen and Sulphur metabolism - Biochemistry of nitrogen fixation- nitrogenase, nitro reductase, nitrate reductase. NIF genes, Nitrate assimilation. Sulphate activation - reduction and sulphite reduction. 15Hrs

Module V: Plant therapeutics: Bioactive principles in herbs, plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties. 15Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Gain knowledge on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis	PO1
CO2	Learn in detail about the structure, types, sources, biosynthesis and functions of secondary metabolites.	PO1, PO3
CO3	Understand the structure and functions of plant hormones.	PO1
CO4	Discuss about free radicals, types and its harmful effects. Role of enzymatic and non-enzymatic antioxidant in defence mechanism, prevention in disease.	PO1, PO2, PO3
CO5	Identify the plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	PO1, PO2, PO3

Text books

1. Singh M. Pand Panda. H2005. Medicinal Herbs with their formulations, Daya publishing house, Delhi
2. Plant Physiology- Devlin N. Robert and Francis H. Witham, CBS Publications
3. Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W.
4. Anderson and John Brardall, Black well Scientific Publications, 1994.

Referencebooks

1. Khan, I. A. and Khanum, A. 2004. Role of biotechnology in medicinal and aromatic plants, Vol. 1 and Vol. 10, Ukka 2 publications, Hyderabad.
2. Plant Biochemistry and Molecular Biology – Hans Walter Heldt, Oxford University, 4th Edition, 2010
3. Plant biochemistry (2008), Caroline bowsher, Martin steer, Alyson Tobin, garland science.
4. Plant physiology and development (sixth edition) by Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy publisher; Oxford university press

Web resources

- 1 <https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/anintroductory-chapter-secondary-metabolites>
- 2 <https://www.toppr.com/guides/biology/plant-growth-and-development/plantgrowth>

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

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

THIRD YEAR: SEMESTER VI BIOTECHNOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	Ext erna l	Total
	Elective Course2 A - Biotechnology	Elective	2	1	0	0	3	5	25	75	100

Learning objectives

The main objectives of this course are to

- 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. 15 Hrs

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. 15 Hrs

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. 15 Hrs

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. 15 Hrs

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. 15 Hrs

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

Text Books

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 Pasternak J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology

Web Sources

- 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-biotechnology/>
<https://www.sciencedirect.com/topics/neuroscience/genetic-engineering>

<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/bk978-0-7503-1347-6ch1>
https://www.slideshare.net/zeal_eagle/fermentation-technology
https://www.slideshare.net/zeal_eagle/fermentation-technology
<https://www.slideshare.net/Chepkitwai/blotting-techniques-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

BIOINFORMATICS

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	Ext ernal	Total
	Elective Course 2 B - Bioinformatics -	Elective	2	1	0	0	3	5	25	75	100

Learning Objectives

The objective of this course are 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. 15 Hrs

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 15 Hrs

Module III : Sequence Alignment-Local and Global alignment-Dot matrix analysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment 15 Hrs

Module IV : BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNAMicroarray-Procedure and applications. 15 Hrs

Module V: Structural genomics-Whole genome sequencing (Shotgun approach), Comparative genomics-tools for genome comparison, VISTA servers and precomputed tools. Molecular visualization tools. RASMOL, Swiss PDB viewer. Nutrigenomics-Definition and applications 15 Hrs

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, metabolome & Transcriptome.	PO1
CO2	Classify biological database and to correlate the different file formats 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 shotgun method.	PO1, PO2

Text books

1. Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang Editors
2. Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools 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

Web resources

1. <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 VI

BIOENTREPRENEURSHIP

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Elective Course 2C - Bioentrepreneurship	Elective	2	1	-	-	3	5	25	75	100

Learning Objectives

The objective of this course are to

- 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 15 Hrs

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. 15 Hrs

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 15 Hrs

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. 15 Hrs

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. 15 Hrs

Course Outcomes

After completion of the course the students will be able to

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

Text books

- 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-introductionto-entrepreneurship/>

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
CO 2	2				2	3	3			3
CO 3	2				2	3	3			3
CO 4	2				2	3	3		3	3
CO 5	2				2	3	3			3

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

THIRD YEAR: SEMESTER VI

PROJECT

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Core paper 16 Project	Core	-	1	2	-	3	5	50	50	100

SKILL ENHANCEMENT COURSE - SEC

(Discipline/Subject/ Entrepreneurial)

SECOND YEAR : SEMESTER III

MEDICAL LABORATORY TECHNOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Medical Laboratory Technology	SEC (Entrepreneurial Based)	1	1	0	0	2	2	25	75	100

Learning Objectives

The main objectives of this course are to

- Impart knowledge on specimen collection and disposal of waste.
- Acquaint knowledge on collection, preservation and transfusion of blood.
- Quantify the biomolecules in biological sample
- Understand the significance of various tests and their interpretation in diseased conditions
- Acquaint knowledge on enzymes, hormones and Immunoglobulins as markers for diagnosis.

Module I :Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste-Non infectious waste , biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines 6 Hrs

Module II : Determination of Blood group and Rh factor -Basic blood banking procedures-cross matching, screening test. Blood transfusion and hazards.6 Hrs

Module III :Estimation of blood sugar – Enzymatic method,HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral ,vitamin and CSF analysis.6 Hrs

Module IV : Immuno diagnostics -Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA,, Skin test – Montaux and Lepramin test.6 Hrs

Module V :.Assay of clinically important enzymes- Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance6 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Collect&preserve of biological samples.	PO1,PO2
CO2	Estimate the various constituents in biological sample	PO1,PO2,PO6
CO3	Perform the routine procedures adopted in blood bank	PO1,PO2.PO6
CO4	Analyze and interpret the values for both normal and disease conditions.	PO1,PO2,PO6
CO5	Assay the enzymes and hormones &interpret clinical implications	PO1,PO2,PO6

Text Books

- 1 Kanai L Mukherjee and Anuradha Chakravarthy Medical Laboratory Technology IVthedition,Vol I,2022
- 2.Ramnik Sood,Text Book of Medical Laboratory Technology,Jaypee Publishers, 2006
- 3.Tietz, N. (2018) Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th edition,W.B. Saunders Company

Web Resources

- 1 <https://www.youtube.com/watch?v=QNYIX5Ne9IQ>
- 2 <https://www.slideshare.net/doctorrao/agglutination-tests-and-immunoassys>
- 3 <https://microbenotes.com/introduction-to-precipitation-reaction/>

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
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
CO5	2	3				2	3	3	3	3

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

SECOND YEAR : SEMESTER III MICROBIAL TECHNIQUES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Microbial techniques	SEC (Entrepreneurial Based)	1	1	-	-	2	2	25	75	100

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
- Study food preservation methods

Module – I: Growth of bacteria- Definition, growth phases, factors affecting growth (pH, temperature, and oxygen), cell count (hemocytometer, Bacterial cell- Bacillus subtilis), fungal cell (Saccharomyces) and human blood cell.6 Hrs

Module -II:Microscopy- Principle, types - Compound microscope, electron microscope-TEM, SEM, use of oil immersion objective.6 Hrs

Module III :Stains and 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.6 Hrs

Module IV:Cultivation of bacteria– Types of growth media (natural, synthetic, complex, enriched, selective- definition with example), culture methods (streak plate, spread plate, pour plate, stab culture, slant culture, liquid shake culture, anaerobiosis) - aerobic and Anaerobic bacteria.6 Hrs

Module V:Food microbiology- Microbiological examination of food: microscopic examination and culture, phosphatase test of Pasteurized milk. Preservation of food- High temperature (boiling, pasteurization, appreciation), low temperature (freezing), dehydration, osmotic pressure, chemical preservations, radiation. Microorganisms as food SCP.6 Hrs

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Understand the growth of bacteria and to perform cell count	PO1,PO2
CO2	Acquire knowledge of microscope and its uses	PO1,PO2
CO3	Identify the microbes by staining methods	PO1,PO2, PO6
CO4	Culture microbes by various methods	PO1,PO2, PO6
CO5	Preserve foods at high and low temperature	PO,PO2, PO6

Text books

1. Sherris Medical Microbiology, 7th Edition by Authors: Kenneth Ryan, C. George Ray, Nafees Ahmad, W. Lawrence Drew, Michael Lagunoff, Paul Pottinger, L. Barth Reller and Charles R. Sterling
2. Food Microbiology: Fundamentals And Frontiers, 5th Edition by Editor(s):Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill
3. Text book of microbiology by Ananthanarayan and Panicker's

4. Textbook of microbiology by P.C. Trivedi Sonali Pandey Seema Bhadauria
 5. Prescott's Microbiology, 10th Edition by Authors: Joanne Willey, Linda Sherwood and Christopher J. Woolverton

Reference books

1. Bailey & Scott's Diagnostic Microbiology, 14th Edition by Author: Patricia Title
2. Medical Microbiology, 7th Edition Authors: Patrick R. Murray, Ken S. Rosenthal and Michael A. Pfaller
3. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierce

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

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

**SECOND YEAR : SEMESTER IV
 BASICS OF FORENSIC SCIENCE**

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Basics of Forensic Science	SEC (Discipline/Subject specific)	1	1	-	-	2	2	25	75	100

Learning Objectives

The main objectives of this course are to

- Gain knowledge on the basic practices of forensic analysis.
- Perform investigation using fresh blood.
- Carry out the analysis using body fluids
- Investigate the presence of forms of drugs and poisons in body fluids.

- Execute the identification test on multiple samples.

Module I: Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis. 6Hrs

Module II: Blood – grouping and typing of fresh blood samples including enzyme .Cases of disputed paternity and maternity problems, DNA profiling.6Hrs

Module III: Analysis of body fluids- Analysis of illicit liquor including methyl and ethyl alcohol in body fluids and breathe. Chemical examination, physiology and pharmacology of Insecticides and pesticides. 6Hrs

Module IV: Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids. 6Hrs

Module V: Identification tests- Identification of hair, determination of species origin, sex, site and individual identification from hair. Classification and identification of fibers. Examination and identification of saliva, milk, urine and faecal matter 6Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Gain knowledge on basics of forensic science and method for collection and preservation of samples	PO1,PO2,PO6
CO2	Assess the paternity ,maternity problems and DNA profiling	PO1,PO2
CO3	Identify the presence of alcohol ,insecticides and pesticides in body fluids	PO1,PO2
CO4	Detail on the test performed to identify the presence of drugs and poisons in body fluids	PO1,PO2
CO5	Identify species and sex from the available body fluids	PO1,PO2

Reference books

1. An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.
2. Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E.
4. Forensics by Embar-Seddon, Ayn and Pass. Allan D.
5. Forensic Medicine by Adelman, Howard C &Kobilinsky, Lawrence Page 24 of 63

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

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

SECOND YEAR : SEMESTER IV

TISSUE CULTURE

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	Ext ernal	Total
	Tissue Culture	SEC (Discipline/Subject specific)	1	1	0	0	2	2	25	75	100

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 6 Hrs

Module II :Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.6 Hrs

Module III : Methods of gene transfer in plants and animals - direct and indirect gene transfer methods.6 Hrs

Module IV : Cell culture technique - Explants selection, sterilization and inoculation. 6 Hrs

Module V : Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview-Applications of animal cell culture 6 Hrs

Course outcomes

CO	On completion of this course, students will be able to	Programoutcomes
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.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, arias Publications. 1995.
- 2.Stewart Jr., C.N., "Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley-Interscience, 2008.
- 3.Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010. 6th Edition.
- 4.Davis, J. M. (2011). Animal Cell Culture. John Willy and Sons Ltd. USA.
5. Freshmen R. I. (2005). Culture of Animal Cells. John Willy and Sons Ltd. USA.

6.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
CO5	2	3	3				3	3	3	3

S - Strong (3)

M - Medium (2)

L -Low (1)

SUBJECT SPECIFIC SUBSTITUTE COURSE - SEC

(Only for students who reappear/absent in Naan Mudhalvan course examination for Semesters II to VI with retrospective effect from the academic year of implementing Naan Mudhalvan courses)

First Year : Semester II

BIOMEDICAL INSTRUMENTATION

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks
									External/ Total
	Biomedical Instrumentation	SEC-Subject specific course	2	-	-	-	2	2	100

Course objectives

The objectives of this course are to

- 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. 6 Hrs

Module II: Monitoring of inspired/expired anaesthetic gases, capnograph, inhalators, nebulizers, aspirators, infant respirator, Plethysmography. 6 Hrs

Module III: Medical imaging: X-ray machine - Radio graphic and fluoroscopic techniques – Computed tomography – MRI – PET, Ultrasonography – Endoscopy – Thermography. 6 Hrs

Module IV: Assisting equipments: Pacemakers – Defibrillators – Ventilators 6 Hrs

Module V: Therapeutic equipments: Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers. 6 Hrs

Text books

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 books

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

WebResources

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

Second Year : Semester III

FOOD CHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks
									External/ Total
	Food Chemistry	SEC-Subject specific course	2	-	-	-	2	2	100

Course objectives

The objectives of this course are to

- Provide insights about the sources of food.
- Elaborate the detection of common food adulterants
- Familiarize about the life saving methods to save victims from food poisoning.
- Highlight the importance of food additives and preservatives.
- Acquaint students about the beverages and oils.

Module I: Sources of food. Food adulteration – Common food adulterants, Detection of adulterated Foods by Simple analytical techniques.

Module II: Food Poisons - Natural poisons, pesticides. Chemical poisons - First aid for Poison consumed victims.

Module III: Food additives - artificial sweetener- Saccharin. Food flavors, Food colors, taste makers

Module IV: Beverages - soft drinks - soda - fruit juices - alcoholic beverages.

Module V: Oils - Sources of oils - Production of refined vegetable oils - Preservation.

Text books

1. Swaminathan M., Food Science and Experimental foods, Ganesh and Company.
2. Jayashree Ghosh, Fundamental concepts of Applied chemistry, S. Chand & Co. Publishers.
3. Thangamma Jacob, Text Books of applied chemistry for Home Science and Allied Sciences, Macmillan.
4. Davidson's Principles and Practice of Medicine – Sir Stanley Davidson, 21st edition, Elsevier Publishers, 2010

Second Year : Semester IV

DIETARY MANAGEMENT

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks
									External/ Total
	Dietary Management	SEC-Subject specific course	2	-	-	-	2	2	100

Course objectives

The objectives of this course are to

- To focus on the promotion of good health through nutrition and the primary prevention of nutrition related problems.
- To deal with nutritional epidemiology.
- To be aware of public policies relevant to nutrition.

Module I: Introduction to diet Management, Balanced diet, Food groups, the planning of balance diet, Importance of diet management.

Module II: Diet for Gastro intestinal tract disorders, Gastritis, Peptic ulcer, Symptoms, clinical findings, treatment, dietary modification, Adequate nutrition, amount of food, and intervals of feeding, Chemically and mechanically irrigating foods, Four stage diet (Liquid, soft, convalescent, liberalized diet).

Module III: Diet for Diabetes mellitus, Incidence and predisposing factors, Symptoms-types and tests for detection, Metabolism in diabetes, Dietary treatment & meal management, Hypoglycemic agent, insulin and its types, Complication of diabetes.

Module IV: Diet for Obesity and Cardiovascular diseases, Role of nutrition in cardiac efficiency, Incidence of Atherosclerosis, Obesity - Dietary treatment, Sodium restricted diet, Level of sodium restriction, Sources of sodium, danger of severe sodium restriction.

Module V: Diet in Cancer, Precautions, Diet plan for avoiding cancer, Food sources rich in antioxidants, Foods rich in fibre, Food supplements during cancer therapy.

Reference books

1. Mahan L. K., Escott- Stump, S. and Raymond J. L. (2012): "Krause's Food and the Nutrition Care Process", 13th Edition, Elsevier.
2. Ross, A.C., Caballero B., Cousins R. J., Tucker K.L. and Ziegler T. (2014) Modern Nutrition in Health and Disease. Wolters Kluwer Health/ Lippincott Williams and Wilkins. Ed 11th
3. Garrow, J. S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics. 10th Edition, Churchill Livingstone.
4. Nix Staci (2013) William's Basic Nutrition and Diet Therapy. Elsevier Ed. 14th

Third Year : Semester V
CLINICAL NUTRITION

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks
									External/Total
	Clinical Nutrition	SEC-Subject specific course	2	-	-	-	2	2	100

Course objectives

- Acquaint the basic concept of Nutrition in health.
- Understand the need for Balanced diet.
- Obtain an insight on Nutrition requirements during different stages of life.
- Familiarize the student to deal with Nutritional allergies and intolerance.

Module I: Definition of Nutrition, Nutrients, & Energy. Adequate, optimum and good nutrition, malnutrition. Clinical signs of Nutritional imbalance.

Module II: Overview of Balanced diet, Collecting and analyzing Nutritional information – Physical examination, Anthropometric measurements.

Module III: Nutrition Deficiency disorders- Protein calorie malnutrition, Vitamin A deficiency, Iron deficiency, Iodine deficiency disorders, Osteoporosis.

Module IV: Common food allergies, food intolerance – lactose intolerance. Cardiovascular diseases-atherosclerosis, and myocardial infarction, foods that increase LDL and HDL. Saturated and Unsaturated fats, role of MUFA and PUFA in preventing heart diseases.

Module V: Nutritional intolerance - Gastro intestinal disorders- Diarrhea, Constipation, Gastritis, Peptic ulcer, Inflammatory Bowel disease, GERD. Outline of Enteral Nutrition and Parenteral Nutrition.

Reference books

1. Garrow, JS , James WPT and Ralph A (2000) . Human nutrition and Dietetics (10th ed) Churchill Livingston.
2. Handbook of Food and Nutrition –Dr. M. Swaminathan, BappcoPublisher,2014.
3. Nutrition Science- B.Srilakshmi,7th edition, New age International Publisher, 2017.
4. William’s Basic Nutrition and Diet Therapy – Staci Nix McIntosh,First South Asian Edition, Elsevier Publisher, 2016.
5. Nutrition essentials and diet therapy-Packenpaugh,11thedition,Saunders Publishers, 2009.
6. Davidson’s Principles and Practice of Medicine – Sir Stanley Davidson, 21st edition, Elsevier Publishers, 2010

Third Year : Semester VI
MEDICAL CODING

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks
									External/ Total
	Medical Coding	SEC-Subject specific course	2	-	-	-	2	2	100

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, Healthcare Common Procedure Coding, First Aid and CPR 6Hrs

Module- II: Introduction to Medical Terminology, specialization I & II, Diagnostic coding, factors affecting diagnostic coding 6Hrs

Module III: Documenting medical records- Importance of Documentation, Types of dictation formats 6Hrs

Module IV: Introduction to Human Anatomy and Coding, ICD-10- CM classification system 6Hrs

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

Text books

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

Reference books

1. Terry Tropin M Shai, RHIA, CCS-P, AHIMA ICD-10-CM coding guidelines made easy 2017.
4. Besty J Shiland- Medical terminology and anatomy for ICD-10.



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