

SENGUNTHAR ARTS AND SCIENCE COLLEGE

(Autonomous)

(Affiliated to Periyar University, Salem and Approved by AICTE, New Delhi)
An ISO 9001:2015 Certified Institution. Recognised under section 2(f) and 12(B) of
the UGC Act, 1956 and Accredited by NAAC with A⁺

TIRUCHENGODE – 637 205, NAMAKKAL DT., TAMILNADU

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SYLLABUS

B.Sc., BIOCHEMISTRY **(CBCS –LOCF)**

(With effect from the Academic Year 2024-25 onwards)

Chairman

CDC

Principal

Correspondent

INTRODUCTION

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 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.

AIM

The syllabus of this program is aimed at preparing the students with the latest developments and put them on the right track to fulfill the present requirements.

ELIGIBILITY FOR ADMISSION

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

PROGRAMME OUTCOMES

REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAME WORK (CBCS) FOR UNDER GRADUATE	
Programme	B.Sc., BIOCHEMISTRY
Programme Code	24UBC
Duration	UG - Three Years
Programme Outcomes (POs)	PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study. PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. PO4: Problem solving: Capacity to extrapolate from what one has learned and applies their competencies to solve different kinds of non- familiar problems, rather than replicate curriculum content knowledge; And apply one's learning to real life situations. PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical

flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and Addressing opposing viewpoints.

PO6: Research-related skills:

A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and- effect relationships; ability to plan, execute and report the results of an experiment or investigation

PO7: Cooperation/Team work:

Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO8: Scientific reasoning:

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9: Reflective thinking:

Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

PO10: Information/digital literacy:

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

Programme Specific Outcomes (PSOs)

Programme Specific Outcomes (PSOs)	PSO-1. To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. PSO-2. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations PSO-3. Design and implement HR systems and practices grounded in research that complies with employment laws, leading the organization towards growth and development. PSO-4. To produce employable, ethical and innovative professionals to sustain in the dynamic business world. PSO-5. To contribute to the development of the society by collaborating with stakeholders for mutual benefit.
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	Pos										PSOs				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	PS01	PS02	PS03	PS04	PS05
CLO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Level of Correlation between POs and PSOs (*Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix*);

1 – Low, 2 – Medium, 3 – High, 0 – No Correlation

I YEAR

S.No	Course Category	Course code	Title of the course	Hrs/ Week		Credit Points	Max Marks		
				L	T/P		CIA	ESE	Total
SEMESTER-I									
1	Part-I Language-I	24S1UFTA01	Tamil-I/Language	6	-	3	25	75	100
2	Part-II English Language-I	24S1UFEN01	English-I	6	-	3	25	75	100
3	Part-III Core-I	24S1UBC01	Nutritional Biochemistry	4	-	4	25	75	100
4	Part-III Core Practical-I	24S1UBCP01	Core Practical – I – Nutritional Biochemistry	-	4	4	40	60	100
5	Part-III Generic Elective	24S1UCHA01	Chemistry for Life Sciences-I	3	-	3	25	75	100
6	Part-III Generic Elective Practical-I	24S1UCHAP01	Chemistry Practical for Physical and Life Sciences-I	-	3	2	40	60	100
7	Part-IV Foundation course –I	24S1UBCF01	FC 1 – Basics of Biochemistry For Beginners – Scope & Applications	2	-	2	25	75	100
8	Part – IV NME-I	24S1UBCN01	Human Health and Nutrition	2	-	2	25	75	100
		24S1UBCN02	Life Style Diseases and Preventions						
		24S1UBCN03	Fundamentals of Human Physiology						
Total				23	07	23	230	570	800

S. No	Course category	Course code	Title of the course	Hrs/ Week		Credit Points	Max Marks		
				L	T/P		CIA	ESE	Total
SEMESTER-II									
1	Part-I Language-II	24S2UFTA02	Tamil-II/Language	6	-	3	25	75	100
2	Part-II English Language-II	24S2UFEN02	English-II	6	-	3	25	75	100
3	Part-III Core-II	24S2UBC02	Cytogenetics	4	-	4	25	75	100
4	Part-III Core Practical-II	24S2UBCP02	Core Practical – II – Cytogenetics	-	4	4	40	60	100
5	Part-III Generic Elective-II	24S2UCHA02	Chemistry for Life Sciences-II	3	-	3	25	75	100
6	Part-III Generic Elective-Practical II	24S2UCHAP02	Chemistry Practical for Physical and Life Sciences-II	-	3	2	40	60	100
7	Part-IV-Skill Enhancement Course (SEC-I)	24S2UBCS01	First Aid	2	-	2	25	75	100
8	Part – IV NME-II	24S2UBCN04	Medicinal Diet	2	-	2	25	75	100
		24S2UBCN05	Biochemistry in Diagnosis						
Total				23	07	23	230	570	800

II YEAR

S.No	Course Category	Course code	Title of the course	Hrs/ Week		Credit Points	Max Marks		
				L	T/P		CIA	ESE	Total
SEMESTER-III									
1	Part-I Language-I	24S3UFTA03	Tamil-III/Language	6	-	3	25	75	100
2	Part-II English Language-II	24S3UFEN03	English-III	6	-	3	25	75	100
3	Part-III Core-III	24S3UBC03	Bio molecules	5	-	5	25	75	100
4	Part-III Core Practical-III	24S3UBCP03	Core Practical – III – Bio molecules	-	5	4	40	60	100
5	Part-III Generic Elective	24S3USTA05	Biostatistics	3	-	3	25	75	100
6	Part-IV Skill Enhancement Course SEC- II	24S3UBCS02	Clinical Laboratory Technology	2	-	2	25	75	100
7	Part-IV Skill Enhancement Course SEC- III	24S3UBCS03	Basics of Forensic science	2	-	2	25	75	100
	Part-IV Skill Enhancement Course SEC- IV	24S3UBCS04	Basics of Biophysics in Biochemistry						
8	Part-IV EVS		EVS	1					
Total				25	05	22	190	510	700

S. No	Course category	Course code	Title of the course	Hrs/ Week		Credit Points	Max Marks		
				L	T/P		CIA	ESE	Total
SEMESTER-IV									
1	Part-I Language-I	24S4UFTA04	Tamil-IV/Language	6	-	3	25	75	100
2	Part-II English Language-II	24S4UFEN04	English-IV	6	-	3	25	75	100
3	Part-III Core-IV	24S4UBC04	Biochemical Techniques	4	-	4	25	75	100
4	Part-III Core Practical-IV	24S4UBCP04	Core Practical – IV – Biochemical Techniques	-	3	3	40	60	100
5	Part-III Generic Elective-IV	24S4UMBA01	Fundamentals of Microbiology	3	-	3	25	75	100
6	Part-III Generic Elective-Practical - III	24S4UMBAP01	Generic Elective- Practical III Fundamentals of Microbiology	-	3	3	40	60	100
7	Part-IV-Skill Enhancement Course (SEC-V)	24S4UBCS05	Medical Coding	2	-	2	25	75	100
8	Part-IV-Skill Enhancement Course (SEC-VI)	24S4UBCS06	Tissue Culture	2	-	2	25	75	100
	Part-IV-Skill Enhancement Course (SEC-VII)	24S4UBCS07	Microbial Techniques						
9	Part-IV EVS	24S4UES01	EVS	1	-	2	25	75	100
Total				24	06	25	255	645	900

III YEAR

S.No	Course Category	Course code	Title of the course	Hrs/ Week		Credit Points	Max Marks		
				L	T/P		CIA	ESE	Total
SEMESTER–V									
1	Part-III Core-V	24S5UBC05	Enzymes	6	-	5	25	75	100
2	Part-III Core–VI	24S5UBC06	Intermediary Metabolism	5	-	4	25	75	100
3	Part-III Core–VII	24S5UBC07	Clinical Biochemistry	6	-	5	25	75	100
4	Part-III Core Practical-V	24S5UBCP05	Core Practical – V – Clinical Biochemistry	-	5	4	40	60	100
5	Part-III Elective-I	24S5UBCE01	Immunology	3	-	2	25	75	100
6	Part-III Elective-II	24S5UBCE02	Biochemical Pharmacology	3	-	2	25	75	100
7	Part-III Elective-III	24S5UBCE03	Research Methodology						
8	Part-IV	24S5UVE01	Value Education	2	-	2	25	75	100
9	Part-IV	24S5UIT01	Internship/Industrial Training(summer vacation at the end of the IV semester activity)	-	-	2			
Total				25	05	26	190	510	700

S. No	Course category	Course code	Title of the course	Hrs/ Week		Credit Points	Max Marks		
				L	T/P		CIA	ESE	Total
SEMESTER–VI									
1	Part-III –Core-VIII	24S6UBC08	Molecular Biology	5	-	3	25	75	100
2	Part-III- Core-IX	24S6UBC09	Human Physiology	5	-	3	25	75	100
3	Part-III Core–X	24S6UBC10	Plant Biochemistry and Plant therapeutics	6	-	4	25	75	100
4	Part-III Elective-IV	24S6UBCE04	Biotechnology	5		3	25	75	100
5	Part-III Elective-V	24S6UBCE05	Bioinformatics	5	-	3	25	75	100
6	Part-III Elective-VI	24S6UBCE06	Bio entrepreneurship						
7	Part-III	24S6UBCPR1	Core Project(Group)	-	2	2	40	60	100
8	Part - IV	24S6UBCPC01	Professional Competency skill Enhancement course	2	-	2	25	75	100
9	Part-V	24S6UEX01	Extension Activity (Outside College Hours)	-	-	1	-	-	-
Total				30	2	21	190	510	700

SEMESTER – I

FIRST YEAR - SEMESTER I

CORE I – NUTRITIONAL BIOCHEMISTRY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UBC01	Core I	Theory	Y	-	-	4	4

Learning Objectives

- ❖ 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, and flavor enhancing substances in food.
- ❖ Study the significance of nutraceuticals.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

CORE I – NUTRITIONAL BIOCHEMISTRY

Unit	Details	No. of Hours
I	Concepts of food and nutrition: Energy content of food, measurement of energy expenditure. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR) - definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA- definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI. The daily energy requirement, importance of energy for various activities. Calorific equivalent of major nutrients. Report on Field visit: Anganwadi(observing Height,weight chart)	12
II	Physiological role of Nutrients: 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 – Kwashiorkor and Marasmus. Obesity-Causes, Anthropometric measurement and diet management. Poster Preparation: Malnutrition and their effects	12
III	Balanced diet: 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. Balanced score card-overview.	12
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 and hazards of food additives.	12
V	Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanin and its benefits. Importance of organic foods. PPT Presentation: Plant specialized metabolites.	12
	TOTAL	60
*Note: Report Writing on Field visit, Poster Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam only		

Text books

- ❖ Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
- ❖ Advances in food biochemistry, FatihYildiz (Editor), CRC Press, Boca Raton, USA, 2010.

Reference books

- ❖ Garrow, JS, James WPT and Ralph A (2000). Human nutrition and dietetics (10thed)Churchill Livingstone.
- ❖ Andreas M.Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1sted) CRC
- ❖ Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives.2nd Ed. Marcel Dekker.
- ❖ Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
- ❖ Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.
- ❖ Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell, UK.
- ❖ M. Swaminadhan (1995) Principles of Nutrition and Dietics. Bappco.
- ❖ Tom Brody (1998). Nutritional Biochemistry (2nded), Academic press, USA.

Web Resources

- ❖ <http://old.noise.ac.in/SecHmscicour/english/LESSONO3.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 Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	0	0	2	0	0	0	0	0
CO2	3	0	0	0	0	0	0	0	0	0
CO3	3	2	0	0	0	0	0	0	0	0
CO4	3	2	0	0	0	0	0	0	0	0
CO5	3	0	0	0	2	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	0	3	3
CO3	3	1	0	3	3
CO4	3	3	0	3	3
CO5	3	3	0	3	3
Weightage	15	13	3	15	15
Weighted percentage of Course Contribution to Pos	3	2.6	0.6	3	3

Course coordinator

BOS Chairman

CORE PRACTICAL I –NUTRITIONAL BIOCHEMISTRY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UBCP01	Core Practical -I	Practical	-	-	Y	4	4

Learning Objectives

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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

CORE PRACTICAL I – NUTRITIONAL BIOCHEMISTRY

Unit	Details	No. of Hours
I	TITRIMETRY 1. Estimation of ascorbic acid in a citrus fruit. 2. Estimation of calcium in milk.	15
II	TITRIMETRY 3. Estimation of glucose by Benedict's method in honey. 4. Estimation of phosphorous (Plant source)	15
III	BIOCHEMICAL PREPARATIONS Preparation of the following substances and its qualitative tests 5. Lecithin from egg yolk. 6. Starch from potato. 7. Casein and Lactalbumin from milk.	15
IV	GROUP EXPERIMENT 1. Determination of ash content and moisture content in food sample 2. Extraction of lipid by Soxhlet's method.	15
	TOTAL	60

Text books

- ❖ Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011.
- ❖ Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition. 3rd edition. Chand Publishers.
- ❖ Biochemical Methods, Sadasivam S and Manickam A, 4th edition, New Age International Publishers, 2016
- ❖ Advanced text book of Food and Nutrition, Vol. II, M.S. Swaminathan. 2015

Reference books

- ❖ Bowman and Robert M. 2006. Present Knowledge in Nutrition. 9th edition, International Life Sciences Publishers.
- ❖ Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.
- ❖ An Introduction to Practical Biochemistry, David T. Plummer, 3rd edition, Tata McGraw- Hill Publishing Company Limited, 2001.

Web Resources

- ❖ <https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-forauthors>
- ❖ <http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemist/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf>
- ❖ https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?f?sequen=Ce=1&isAllowed=y
- ❖ https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?f?sequen=Ce=1&isAllowed=y

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	3	0	0	0	0	0	0	0
CO2	3	0	3	0	0	0	0	0	0	0
CO3	3	0	3	0	0	0	0	0	0	0
CO4	3	0	3	0	0	3	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPOs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

FOUNDATION COURSE I– BASICS OF BIOCHEMISTRY FOR BEGINNERS – SCOPE & APPLICATIONS

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UBCF01	FC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ Provide knowledge and overview of entry education and makes the students assimilate with the biochemistry course.
- ❖ Inculcate knowledge of the academic skills, laboratory skills and research
- ❖ Gives a strong determination to undergo the course
- ❖ To become committed and interested in learning the subject
- ❖ Familiarize in preparing reagents in laboratory.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	To become aware of basic knowledge about Biochemistry course	PO1,PO5
CO2	To understand the chemical Characteristics of living matter	PO1
CO3	To describe the importance of water in life	PO1,PO2
CO4	To acquire knowledge on the preparation of lab solutions	PO1,PO2
CO5	To illustrate buffers in body fluids and tissues and measurement of pH.	PO1,PO5, PO6

FOUNDATION COURSE I– BASICS OF BIOCHEMISTRY FOR BEGINNERS – SCOPE & APPLICATIONS

Unit	Details	No. of Hours
I	Overview of Biochemistry: Definition, Importance and significance of Biochemistry, Important discoveries in Biochemistry, scope of Biochemistry in different fields –agriculture, Food industry, medicine, pharmacy, nursing and clinical laboratories etc., Scope of clinical Biochemistry, Scope of Biochemistry in abroad Biochemistry Job opportunities.	5
II	Chemical Characteristics of living organisms: Biological macromolecules and importance of Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus and Sulphur in life's chemistry, Chemical bonding (covalent, ionic, Hydrogen, Van der Waal's, hydrophobic bonds) in Biological macromolecules. Model Preparation: Chemical bonding (Working Model)	5
III	Water and life: Molecular structure of water, Unique physical and chemical properties of water that support life, Effects of water on Biomolecules – hydrogen bonding in water and its importance in maintain the shape, stability and properties of biological macromolecules, Effects of non-polar compounds on water, Preparation of distilled water.	6
IV	Introduction to Biochemistry Lab: Understanding of Lab Protocols, Safety aspects in Biochemical Laboratory. Glossary of technical terms in Biochemistry, Calibration of instruments and pipettes, Concentration units: Mole, mole fraction, Molarity, Equivalent weight, Normality, Molality, percentage. Biochemical reagent preparations for various solutions with respect to different Normality, Molarity, % Solutions (W/V), (V/V) (Problems to be worked out), Use of microscope in laboratory.	7
V	Buffers: Lewis concept of acids and bases. pH scale ,buffers. Henderson – Hassel Balch equation, buffer capacity. Preparation of acidic and basic buffer solutions. Buffers of blood plasma, RBC and Tissue fluids. Measurement of pH: pH indicators, pH meter, different types of electrodes, advantages and disadvantages of different electrodes, principle, working, application, factors affecting and pH determination. Report on pH Measurement of various beverages	7
	TOTAL	30
*Note: Model Preparation related to the above topics are to be considered for Internal Exam Only		

Text books

- ❖ Fundamentals of Biochemistry, J. L. Jain, Sunjay Jain, Nitin Jain, 2013, 7th edition S. Chand & Company Ltd.
- ❖ S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher's third edition 2018
- ❖ J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015
- ❖ David T Plummer, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Edition 2017

Reference books

- ❖ Voet. D, Voet. J. G. and Pratt, C.W, 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.
- ❖ Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd Ed, 2005.
- ❖ Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	0	0	2	0	0	0	0
CO2	2	3	3	0	0	2	0	0	0	0
CO3	2	0	3	2	0	2	0	0	0	0
CO4	2	0	3	0	0	2	0	0	0	0
CO5	2	0	3	0	3	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

GENERIC ELECTIVE -CHEMISTRY FOR LIFE SCIENCES–I

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UCHA01	Generic Elective -I	Theory	Y	Y	-	3	3

Learning Objectives

- ❖ Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
- ❖ Nuclear chemistry and industrial chemistry
- ❖ Importance of specialty drugs
- ❖ Separation and purification techniques.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	State the theories of chemical bonding ,nuclear reactions and its applications	PO1
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.	PO1
CO3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	PO4,PO5, PO6
CO4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.	PO4,PO5, PO6
CO5	Analyse various methods to identify an appropriate method for the separation of chemical components.	PO5, PO6,PO9

GENERIC ELECTIVE -CHEMISTRY FOR LIFE SCIENCES–I

Unit	Details	No.of Hours
I	Chemical Bonding and Nuclear Chemistry: Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences-Stellar energy. Applications of radioisotopes-carbon dating, rock dating and medicinal applications. PPT presentation - Nuclear reactions and Energy	9
II	Industrial Chemistry:Fuels: Fuel gases: Natural gas, water gas, semiwater gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).Silicones: Synthesis, properties and uses of silicones.Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate. Model preparation-Silicone polymer Structure	9
III	Fundamental Concepts in Organic Chemistry: Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Polar effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions-aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.Heterocyclic Compounds: Preparation, properties of pyrrole and pyridine.	9
IV	Drugs and Speciality Chemicals: Definition, structure and uses : Antibiotics Viz., Pencillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Anti pyretics viz. aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.	9
V	Analytical Chemistry: Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography. Poster presentation:Extraction Techniques	9
	Total	45
Note: Model preparation, PPT presentation and Poster presentation related to the above topics are to be considered for internal exam only		

Textbooks

- ❖ V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
- ❖ S.Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur,2006.
- ❖ Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.
- ❖ P.L.Soni,H.M.Chawla, TextBook of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference books

- ❖ P.L.Soni,Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
- ❖ B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
- ❖ Jayashree gosh, Fundamental Concepts of Applied Chemistry;
- ❖ Sultan&Chand, Edition2006.

Mapping with Programme Outcomes: 3Strong,2–Medium,1–Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	0	0	0	0	0
CO2	3	3	3	3	3	0	0	0	0	0
CO3	3	3	3	3	3	0	0	0	0	0
CO4	3	3	3	3	3	0	0	0	0	0
CO5	3	3	3	3	3	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

GENERIC ELECTIVE PRACTICAL CHEMISTRY PRACTICAL FOR PHYSICAL / LIFE SCIENCES I

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UCHAP01	Generic Elective	Practical - I	-	-	Y	3	2

Learning Objectives

- ❖ Basics of preparation of solutions.
- ❖ principles and practical experience of volumetric analysis

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

GENERIC ELECTIVE PRACTICAL CHEMISTRY PRACTICAL FOR PHYSICAL / LIFE SCIENCES I

Unit	Details	No. of Hours
I	1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid.	11
II	3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate.	11
III	5. Estimation of potassium permanganate using standard potassium dichromate. 6. Estimation of hardness of water.	12
IV	7. Estimation of ferrous ion using diphenyl amine as indicator.	11
	Total	45

Reference books

- ❖ V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	0	0	0	0	0	0	0	0
CO2	3	3	0	0	0	0	0	0	0	0
CO3	3	3	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3	3	3	3	3

Course coordinator

BOS Chairman

NME -I – HUMAN HEALTH AND NUTRITION

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UBCN01	NME -1	Theory	Y		-	2	2

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
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 inhealth	PO1,PO4
CO5	Relate the role of proteins and carbohydrates on health	PO1,PO4

NME -I – HUMAN HEALTH AND NUTRITION

Unit	Details	No. of Hours
I	Human Health: Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value. RDA and nutritional significance in the body Chart Preparation: ICMR Recommendation of Various Nutrients	6
II	Vitamins: Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances. Role of antioxidant food in human health.	6
III	Dietary fiber: Sources and functions of dietary fats, role of fats in health and diseases. Dietary fiber and its importance.	6
IV	Minerals: 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. PPT Presentation: Minerals Deficiency	6
V	Proteins & Carbohydrates: 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.	6
	TOTAL	30
*Note: Chart Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam Only		

Text Books

- ❖ J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10th ed), Churchill Livingstone
- ❖ Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall

Reference books

- ❖ S. Davidson and J. R. Passmore (1986) Human Nutrition and Dietetics, (8th ed), Churchill Livingstone
- ❖ M. Swaminathan (1995) Principles of Nutrition and Dietetics, Bappco publishers.

Web Resources

- ❖ <https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages>.
- ❖ [nhp.gov.in/healthy living/healthy diet](http://nhp.gov.in/healthy_living/healthy_diet)
- ❖ www.anme.com.mx/libros/PrinciplesofNutrition.pdf

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	0	0	0	0	0	0	0	0	0
CO2	2	0	0	3	3	0	0	0	0	0
CO3	2	0	0	3	3	0	0	0	0	0
CO4	2	0	0	3	3	0	0	0	0	0
CO5	2	0	0	3	3	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	0	3	0
CO2	3	3	0	3	0
CO3	3	3	0	3	0
CO4	3	3	0	3	0
CO5	3	3	0	3	0
Weightage	15	15	0	15	0
Weighted percentage of Course Contribution to Pos	3	3	0	3	0

Course coordinator

BOS Chairman

NME- I - LIFE STYLE DISEASES AND PREVENTIONS

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UBCN02	NME-I	Theory	Y	-	-	2	2

Learning Objectives

- ❖ Create awareness on life style 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 life style diseases.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Define Life style diseases and describe the contributing factors	PO1
CO2	Enumerate the top lifestyle diseases and its impact on life.	PO1,PO4,PO5
CO3	Elaborate the treatment and prevention measures of common lifestyle diseases.	PO1,PO4,PO5
CO4	Highlight the lifestyle diseases that affects the women's health	PO1,PO4,PO5
CO5	Illustrate the various measures for prevention of lifestyle diseases	PO1,PO4,PO5

NME- I - LIFE STYLE DISEASES AND PREVENTIONS

Unit	Details	No. of Hours
I	Life style diseases: Definition, Factors contributing to lifestyle diseases – Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation, Mobile vision syndrome, computer vision syndrome.	6
II	Impact of life style diseases: Top life style diseases, Impact of Lifestyle diseases on family, society and economy of country PPT Presentation: Life Style diseases	6
III	Diseases: Causes, symptoms, types, preventive measures and treatment of Obesity, cardiovascular diseases, diabetes and cancer.	6
IV	Women's life style diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. Women's health hygiene.	6
V	Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, Exercise in good health maintenance – yoga, swimming, walking, outdoor games, sleep-wakecycle, stress management and meditation. Report Writing on Field Visit to Yoga Center	6
	Total	30
*Note: PPT Presentation & Report writing on Field Visit related to the above topics are to be considered for Internal Exam Only		

Text Books

- ❖ James M R, Lifestyle Medicine, 2nd Edition, CRC Press, 2013
- ❖ Akira Miyazaki, New Frontiers in Lifestyle-Related Diseases, Springer, 2008

Reference Books

- ❖ Kumar M & R. Kumar, . Guide to prevention of lifestyle diseases. Deep & Deep publications 2004:1-292

Web Resources

- ❖ <https://youtu.be/jDdL2bMQXfE>
- ❖ <https://youtu.be/7WnpSB14nDM>
- ❖ <https://youtu.be/ollz9MqtW-U>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	0	0	0	0	0	0	0	0	0
CO2	2	0	0	2	3	0	0	0	0	0
CO3	2	0	0	2	3	0	0	0	0	0
CO4	2	0	0	2	3	0	0	0	0	0
CO5	2	0	0	2	3	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	0	3	3
CO2	3	3	0	3	3
CO3	3	3	0	3	3
CO4	3	3	0	3	3
CO5	3	3	0	3	3
Weightage	15	15	0	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	0	3.0	3.0

Course coordinator

BOS Chairman

NME I – FUNDAMENTALS OF HUMAN PHYSIOLOGY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S1UBCN03	NME-I	Theory	Y	-	-	2	2

Learning Objectives

- ❖ To educate non-bioscience students about human system
- ❖ To emphasize fundamentals of physiology of human anatomy
- ❖ To provide knowledge on neuronal network.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Describe about digestion and absorption process of bio molecules	PO1,PO2
CO2	Grasp the respiratory system and mechanism of exchange of gaseous.	PO1,PO2
CO3	Gain awareness on cardio vascular system, structure and functioning of heart.	PO1,PO2
CO4	Understand the urine formation and excretion through kidney.	PO1,PO2
CO5	Obtain an imminent knowledge about nervous system.	PO1,PO2

NME I – FUNDAMENTALS OF HUMAN PHYSIOLOGY

Unit	Details	No. ofHours
I	Digestive System: Overview of the digestive system, process of digestion, absorption of carbohydrates, proteins and fats. Model Preparation: Digestive system	6
II	Respiratory System: Overview of the respiratory system, transport and exchange of gases. Model Preparation: Respiratory system	6
III	Cardiovascular System: Overview of cardiovascular system, structure and function of heart.	6
IV	Renal System: Kidney and nephron structure, mechanism of glomerular filtration, tubular reabsorption and secretion.	6
V	Nervous System: Classification of nervous system, Structure of neuron, Actionpotential, signal transmission at synapse, neurotransmitters. PPT Presentation: Nervous System	6
	Total	30
*Note: Model Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam Only		

Text Books

- ❖ Essentials of Medical Physiology by K.Sembulingam and Prema Sembulingam,6th Edition,2012
- ❖ Human Physiology, Chatterjee.C. 11th edition Medical agency allied,Calcutta, 2017.
- ❖ Text book of medical physiology,A.C.Guyton 12th edition.2017

Reference books

- ❖ Principles of Anatomy and Physiology by Tortora and Grabowski,2003,JohnWiley& Sons,Inc.

Web resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	0	0	0	2	0	0	0	0
CO2	3	2	0	3	0	2	0	0	0	0
CO3	3	2	0	3	0	2	0	0	0	0
CO4	3	2	0	0	0	2	0	0	0	0
CO5	3	2	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SEMESTER – II

CORE II – CYTOGENETICS

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UBC02	Core – II	Theory	Y	-	-	4	4

Learning Objectives

- ❖ 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.

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

CORE II – CYTOGENETICS

Unit	Details	No. of Hours
I	Introduction to cell biology: An overview of cells – origin and evolution of cells. Cell theory. Classifications of cell – Prokaryotic and Eukaryotic cells. The ultra-structure of nucleus, mitochondria, RER, SER, Golgi apparatus, Ribosomes lysosome, peroxisome and their functions. Scope of cell biology Model preparation: Prokaryotic and Eukaryotic cell	12
II	Bio membranes: Structural organization of bilipid layer, Fluid mosaic model of biomembrane. Membrane transport - Uniport, symport and antiport. Passive and active transport.	12
III	Cytoskeleton & Organization of Genome: 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
IV	Cell cycle: Cell cycle-Definition and Phases of Cell cycle-Cell division- Mitosis and Meiosis and its significance. Cancer cells – types and characteristics. Apoptosis definition, difference between apoptosis and necrosis. PPT Presentation: Cell division (Animation)	12
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
	Total	60
*Note: Model Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam		

Text Books

- ❖ Arumugam.N, Cell Biology.Saras publication (10thed, paperback), 2019
- ❖ Devasena.T.Cell Biology. Oxford University Press India-ISBN: 9780198075516, 0198075510, 2012
- ❖ Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4”ed). Garland Science.
- ❖ Cooper, G.A.The Cell: A Molecular Approach. Sinauer Associates, Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013

Reference books

- ❖ S.C, R.Cell Biology. New age Publishers -ISBN-10: 8122416888/ISBN-13: 978-8122416886,2008
- ❖ E.M.F., D.R, Cell and Molecular Biology. Lippincott Williams & Wilkins Philadelphia - ISBN: 0781734932 9780781734936, 2006
- ❖ 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 Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	0	0	0	0	0	0	0	0
CO2	3	3	0	0	0	0	0	0	0	0
CO3	3	3	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0
CO5	3	3	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	0	0	3	0
CO2	3	0	0	3	0
CO3	3	0	0	3	0
CO4	3	3	0	3	0
CO5	3	0	0	3	0
Weightage	15	3	0	15	0
Weighted percentage of Course Contribution to Pos	3	0.6	0	3	0

Course coordinator

BOS Chairman

CORE PRACTICAL -II – CYTOGENETICS

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UBCP02	Core Practical - II	Practical	-	-	Y	4	4

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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 celldivision	PO1,PO2

CORE PRACTICAL -II – CYTOGENETICS

Unit	Details	No. of Hours
I	MICROSCOPY AND STAINING TECHNIQUES 1. Study the parts of light and compound microscope	10
II	2. Preparation of Slides and Micrometry 3. Examination of prokaryotic and eukaryotic cell	10
III	4. Visualization of animal and plant cell by methylene blue 5. Visualization of nuclear fraction by aceto carmine stain 6. Staining and visualization of mitochondria by Janus green stain	20
IV	GROUP EXPERIMENT 1. Identification of different stages of mitosis in onion root tip 2. Identification of different stages of meiosis in onion bulb	15
V	SPOTTERS 1. Cells: Nerve, plant and Animal cell 2. Organelles: Mitochondria, Chloroplast, Endoplasmic reticulum 3. Mitosis stages: Prophase, Anaphase, Metaphase, Telophase.	5
	Total	60

Text Books

- ❖ Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2ndEdn.
- ❖ Essential practical handbook of Cell biology ,Genetics and Microbiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017
- ❖ Cell biology Practical, Dr. Venu gupta ISBN8193651219, Prestige publisher, 1st Jan 2018.

Reference books

- ❖ Cell and Molecular biology, De Robertis, 8th edition, 1st June, 1987
- ❖ Rickwood, D and J.R.Harris Cell Biology: Essential Techniques, John wikey1996.
- ❖ Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.

Web Resources

- ❖ <http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1>
- ❖ <https://www.microscopemaster.com/organelles.html>
- ❖ <https://www.pdfdrive.com/biochemistry-books.htm>
- ❖ http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%20microscope%20is%20necessary, and%20small%20granules%20and%20vesicles.

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	0	0	0	0	0	0	0
CO2	2	3	2	0	0	0	0	0	0	0
CO3	2	3	2	0	0	0	0	0	0	0
CO4	2	3	2	0	0	0	0	0	0	0
CO5	2	3	2	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SKILL ENHANCEMENT COURSE I– FIRST AID

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UBCS01	SEC I	Theory	Y	-	-	2	2

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

SKILL ENHANCEMENT COURSE I– FIRST AID

Unit	Details	No. of Hours
I	Basic Principles and Techniques of First Aid: 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. Report on Field visit to Govt. Hospital.	6
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
III	Common Medical Aid: First aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones. Diarrhoea and Dysentery causes, symptoms, signs and treatment.	6
IV	Anaphylactic Shock: First aid related to unconsciousness, stroke, fits, convulsions-seizures, epilepsy. Creativity: Demonstration performance	6
V	Injuries: First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning. PPT Presentation: First aid in poisonous bites	6
	Total	30
*Note: Report writing on Field visit, PPT presentation & creativity related to the above topics are considered for Internal Exam Only		

Text Books

- ❖ Indian First Aid Manual-<https://www.indianredcross.org/publications/FA-manual.pdf>.2016 seventh edition
- ❖ Red Cross First Aid/CPR/AED Instructor Manual 2021:1-446

Reference books

- ❖ First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr.Manjul Mungali 1SBN-978-93-92208-19-5 2022

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	0	0	0	0	0	0	0	0	0
CO2	2	0	0	3	3	0	0	0	0	0
CO3	2	0	0	3	3	0	0	0	0	0
CO4	2	0	0	3	3	0	0	0	0	0
CO5	2	0	0	3	3	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

GENERIC ELECTIVE - CHEMISTRY FOR LIFE SCIENCES II

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UCHA02	Generic Elective-II	Theory	Y	-	-	3	3

Learning Objectives

- ❖ Nomenclature of coordination compounds and carbohydrates.
- ❖ Amino Acids and Essential elements of biosystem
- ❖ Understand the concepts of kinetics and catalysis
- ❖ Provide fundamentals of electrochemistry and photochemistry

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.	PO1,PO2
CO2	Explain the preparation and property of carbohydrate.	PO1,PO2
CO3	Enlighten the biological role of transition metals, amino acids and nucleic acids.	PO1,PO2
CO4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	PO1,PO2
CO5	Outline the various type of photochemical process.	PO1,PO2

GENERIC ELECTIVE - CHEMISTRY FOR LIFE SCIENCES II

Unit	Details	No. of Hours
I	Co-ordination Chemistry and Water Technology: Definition of terms – IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ - Chelation – Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques - BOD and COD. PPT Presentation: Structure and Function of Chlorophyll and Hemoglobin.	9
II	Carbohydrates: Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose inter conversion. Preparation and properties of sucrose, starch and cellulose.	9
III	Amino Acids and Essential elements of biosystem: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification - structure - Colour reactions - Biological functions - nucleosides - nucleotides – RNA and DNA - structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg. Model preparation-DNA and RNA	9
IV	Electrochemistry: Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells -fuel cells-corrosion and its prevention. Poster presentation-Building a Simple Battery	9
V	Photochemistry: Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence and Photo sensitization and photosynthesis (definition with examples).	9
	Total	45
Model preparation, PPT presentation and poster presentation related to the above topics are to be considered for internal exam only		

Text Books

- ❖ V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
- ❖ S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
- ❖ Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
- ❖ P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference books

- ❖ Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
- ❖ P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
- ❖ P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007
- ❖ B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
- ❖ B.K,Sharma, Industrial Chemistry; GOEL publishing house ,Meerut, sixteenth edition, 2014.

Web Resources

- ❖ <https://www.academic.oup.com>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	0	0	0	0	0	0	0	0
CO2	3	3	0	0	0	0	0	0	0	0
CO3	3	3	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0
CO5	3	3	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

GENERIC ELECTIVE PRACTICAL - CHEMISTRY PRACTICAL FOR PHYSICAL LIFE SCIENCES II

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UCHAP02	Generic Elective	Practical- II	-	-	Y	3	2

Learning Objectives

- ❖ Identification of organic functional groups
- ❖ Different types of organic compounds with respect to their properties.
- ❖ Determination of elements in organic compounds.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.	PO1,PO2
CO2	Design, carry out, record and interpret the results of volumetric titration.	PO1,PO2
CO3	Apply their skill in the analysis of water/hardness.	PO1,PO2
CO4	Analyze the chemical constituents in allied chemical products	PO1,PO2

GENERIC ELECTIVE PRACTICAL - CHEMISTRY PRACTICAL FOR PHYSICAL LIFE SCIENCES II

Unit	Details	No. of Hours
I	Functional group tests [phenol, acids (mono & di) Aromatic primary amine, amides (mono & di), aldehyde and glucose].	12
II	Detection of elements (N, S, Halogens).	11
III	To distinguish between aliphatic and aromatic compounds.	11
IV	To distinguish - Saturated and unsaturated compounds.	11
	Total	45

Reference books

- ❖ V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	0	0	0	0	0	0	0	0
CO2	3	3	0	0	0	0	0	0	0	0
CO3	3	3	0	0	0	0	0	0	0	0
CO4	3	3	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

NME - II – MEDICINAL DIET

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UBCN04	NME – II	Theory	Y	-	-	2	2

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	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 Renal and Cardio-vascular diseases	PO1,PO4,PO5, PO6

. NME - II – MEDICINAL DIET

Unit	Details	No. of Hours
I	Principles of Therapeutic Diet: Definitions of Normal diet, Balanced 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. Diet for bone health. Chart Preparation: Diet Plan for good health	6
II	Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Mal absorption syndrome.	6
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
IV	Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis.	6
V	Diet Modification in Diabetes, Renal and Cardio-vascular diseases: Diabetes, acute & chronic glomerular nephritis, nephrosis, renal failure, kidney stone and Hypertension. PPT Presentation: Diet Modification in various disease	6
	Total	30
*Note: Chart Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam Only		

Text Books

- ❖ M.Raheena Begum, A Text Book of Foods, Nutrition and Dietetics, Sterling Publishers Pvt. Ltd.2019
- ❖ M.V.Raja Gopal, Sumati.R.,Mudambi, Fundamentals of foods, Nutrition and Diet Therapy New Age International, Publishers, 2020.
- ❖ Nutrition and Diet Therapy, Self – Instructional Approaches Peggy Stanfield, Y.H. Hui1985, 5thedition, John and Bartlett Publishers,2010.

Reference books

- ❖ Rodwell Williams Nutrition and Diet Therapy, 1985, the C.V Mosly St. Louis.
- ❖ M.V.Krause & M.A.Mohan, Food Nutrition and Diet Therapy, 1992 by W.B Saunders Company, Philadelphia, London.
- ❖ Davidson and Passmore, Human Methods and Diabetics, 1976 the English Language

Book Society and Churchill.

Web Resources

❖ <https://archive.org/details/practicalclinica0000haro/page/4/mode/2up>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	0	0	0	0	0	0	0	0	0
CO2	2	0	0	2	3	2	0	0	0	0
CO3	2	0	0	2	3	2	0	0	0	0
CO4	2	0	0	2	3	2	0	0	0	0
CO5	2	0	0	2	3	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	0	3	0
CO2	3	3	0	3	0
CO3	3	3	0	3	0
CO4	3	3	0	3	0
CO5	3	3	0	3	0
Weightage	15	15	0	15	0
Weighted percentage of Course Contribution to Pos	3.0	3.0	0	3.0	0

Course coordinator

BOS Chairman

NME - II – BIOCHEMISTRY IN DIAGNOSIS

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S2UBCN05	NME-II	Theory	Y	-	-	2	2

Learning Objectives

- ❖ To understand the different types of diagnostic tests in biochemistry.
- ❖ To learn the common techniques to collect, preserve and processing the biological samples.
- ❖ To gain knowledge on the enzyme assays.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Summarize the use of standard precautions applied in clinical laboratory and during the collection, processing, preservation and transportation of biological specimens for analysis.	PO1,PO2,PO4
CO2	Gain knowledge of the normal composition of blood and their analysis along with their significance in maintaining good health.	PO1,PO2,PO4
CO3	Become skilled at performing clinical urine tests for diagnostic purposes and identify abnormal constituents of urine.	PO1,PO2,PO4
CO4	Describe physical, chemical and microscopic examination of stool and analysis of its constituents using standard procedures.	PO1,PO2,PO4
CO5	Become aware with the variations in the levels of biochemical components of blood and their relationship with various diseases and also get acquainted with the role of enzymes in diagnosis of a variety of diseases.	PO1,PO2,PO4

NME - II – BIOCHEMISTRY IN DIAGNOSIS

Unit	Details	No. of Hours
I	Approaches to Clinical Biochemistry: Collection of clinical specimens, preservatives for blood and urine, transport of biological samples. Quality Control: Concepts of accuracy, precision, sensitivity and reproducibility. Report making on Field Visit to Govt. Hospital	6
II	Hematology: Composition and functions of blood, Haemoglobin, PCV, ESR, RBC count, WBC count, Platelet count, Differential count, ESR and PCV.	6
III	Physical Examination of Urine: Volume, colour, odour, appearance, specific gravity and pH. Chemical examination of urine: Qualitative tests for Reducing sugar, protein, ketone bodies, Bile pigment, bilesalt, Urobilinogen, and mucin. Microscopic Examination of urine.	6
IV	Stool Examination: Collection of fecal specimens, preservation, physical examination:-volume, colour, odour and appearance. Chemical examination: - reducing sugar, occult blood test, detection of steatorrhea. Microscopic examination of stool.	6
V	Estimation of Biochemical Components in Blood: Glucose, GTT, Glycosylated hemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine. Determination of Enzyme Activity: SGOT, SGPT and LDH. PPT Presentation: Estimation of Uric acid	6
	Total	30
Note: Report writing on Field Visit and PPT presentation related to the above topics are to be considered for internal exam only		

Text Books

- ❖ Medical Biochemistry by MNChatterjee, RanaShinde, 8th edition, 2013, Jaypee publications.
- ❖ Practical Clinical Biochemistry, HaroldVarley, 4th edition, CBS Publication and Distributors, NewDelhi.

Reference books

- ❖ KanaiL.Mukherjee, Medical Laboratory Technology Vol.I. Tata Mc Graw Hill 1996, NewDelhi.
- ❖ Sabitri Sanyal, Clinical pathology, B.I. Churchill Livingstone (P)Ltd, NewDelhi.2000.

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	0	0	0	0	0	0	0	0	0
CO2	2	0	0	2	3	2	0	0	0	0
CO3	2	0	0	2	3	2	0	0	0	0
CO4	2	0	0	2	3	2	0	0	0	0
CO5	2	0	0	2	3	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution To Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SEMESTER – III

SECOND YEAR - SEMESTER III

CORE III – BIOMOLECULES

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S3UBC03	Core III	Theory	Y	-	-	5	5

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

CORE III – BIOMOLECULES

Unit	Details	No. of Hours
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). Chart Preparation: Carbohydrates	15
II	Amino acids -Classification based on composition of side chain and nutritional significance. General structure of amino acids. 3 - And 1- letter abbreviations. Modified amino acids in protein non - protein 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. Color reactions of amino acids.	15
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), triple helix (collagen). Tertiary structure – with reference to myoglobin. Quaternary structure with reference to hemoglobin. Model Preparation: Protein Structure	15
IV	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, acetyl number, polensky number, Reichert –Meissl number along with their significance. Compound lipids - Structure and functions of phospholipids and glycolipids. Derived lipids - Structure and functions of cholesterol, bile acids and bile salts.	15
V	Nucleic acids - Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Types of DNA: A, B, C, Z DNA, structure and biological significance, superhelicity. Types of RNA: mRNA, tRNA, rRNA, hnRNA, snRNA, Secondary and tertiary structure of tRNA. Properties of DNA-Hypochromic and hyperchromic effect, melting temperature, viscosity. Denaturation and annealing. PPT Presentation: DNA & RNA	15
	TOTAL	75
*Note: Chart Preparation, Model Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam only		

Text books

- ❖ Biochemistry, U.Sathyanarayana & U.Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt.Ltd.
- ❖ Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, 2013, 7th edition Chand & Company Ltd.
- ❖ Text book of Medical Biochemistry, MNChatterjea, Rana Shinde, 2002, 8th edition, Jaypee Brothers.

Reference books

- ❖ David Nelson, Michael M.Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company.
- ❖ Voet. D, Voet.J.G. And Pratt, C.W, 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.
- ❖ 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 Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	0	0	0	0	0	0	0	0
CO2	3	0	0	0	0	0	0	0	0	0
CO3	3	0	0	0	0	0	0	0	0	0
CO4	3	0	0	2	0	0	0	0	0	0
CO5	3	0	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	0	0	3	0
CO2	3	0	0	3	0
CO3	3	0	0	3	0
CO4	3	2	0	3	0
CO5	3	0	0	3	0
Weightage	15	2	0	15	0
Weighted percentage of Course Contribution to Pos	3	0.11	0.6	3	0

Course coordinator

BOS Chairman

CORE PRACTICAL III –BIOMOLECULES

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S3UBCP03	Core Practical -III	Practical	-	-	Y	5	4

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Qualitatively analyses 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

CORE PRACTICAL III- BIOMOLECULES

Unit	Details	No. of Hours
I	QUALITATIVE TEST : 1. Carbohydrates : a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g) Starch	20
II	QUALITATIVE TEST : 2. Amino acids a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine	20
III	TITRIMETRIC METHODS : 1. Determination of Saponification value of edible oil 2. Determination of Iodine number of edible oil 3. Determination of Acid number of edible oil	20
IV	GROUP EXPERIMENT: 1. Isolation of DNA from plant/animal source. 2. Isolation of RNA from rich source.	15
	TOTAL	75

Text books

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

Reference books

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

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	0	0	0	0	0	0	0
CO2	2	3	3	0	0	0	0	0	0	0
CO3	2	0	3	2	0	0	0	0	0	0
CO4	2	0	3	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

**SKILL ENHANCEMENT COURSE II–
CLINICAL LABORATORY TECHNOLOGY**

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S3UBCS02	SEC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ Impart knowledge on specimen collection and disposal of waste.
- ❖ Acquaint knowledge on collection, preservation and transfusion of blood.
- ❖ Quantify the bio molecules 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

SKILL ENHANCEMENT COURSE II– CLINICAL LABORATORY TECHNOLOGY

Unit	Details	No. of Hours
I	Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste-Noninfectious waste, biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines. Report Writing: Hospital Visit and document preparation	6
II	Determination of Blood group and Rh factor -Basic blood banking procedures- cross matching, screening test. Blood transfusion and hazards. Workshop: Blood Group Prediction	6
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
IV	Immuno diagnostics -Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA, Skin test – Montaux and Lepramin test. RDTs PPT Presentation: Immunological diagnosis	6
V	Assay of clinically important enzymes-ALT, ALP, AST, LDH, CK Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance.	6
	TOTAL	30
*Note: Report Writing, Workshop & PPT Preparation related to the above topics are to be considered for Internal Exam Only		

Text books

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

Reference books

- ❖ Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.

Web Resources

- ❖ <https://www.youtube.com/watch?v=QNYIX5Ne9lQ>
- ❖ <https://www.slideshare.net/doctorrao/agglutination-tests-and-immunoassays>
- ❖ <https://microbenotes.com/introduction-to-precipitation-reaction/>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	0	0	0	0	0
CO2	2	3	0	0	0	2	0	0	0	0
CO3	2	3	0	0	0	2	0	0	0	0
CO4	2	3	0	0	0	2	0	0	0	0
CO5	2	3	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SKILL ENHANCEMENT COURSE III BASICS OF FORENSIC SCIENCE

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S3UBCS03	SEC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

SKILL ENHANCEMENT COURSE III– BASICS OF FORENSIC SCIENCE

Unit	Details	No. of Hours
I	Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis. Report Writing: Hospital Visit and document preparation	6
II	Blood – grouping and typing of fresh blood samples including enzyme .Cases of disputed paternity and maternity problems, DNA profiling. Workshop: Blood Group Prediction	6
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.	6
IV	Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids. PPT Presentation: Drug abuse	6
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	6
	TOTAL	30
*Note: Report Writing, Workshop & PPT Preparation related to the above topics are to be considered for Internal Exam Only		

Text books

- ❖ Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E.
- ❖ Forensics by Embar-Seddon, Ayn and Pass. Allan D.
- ❖ Forensic Medicine by Adelman, Howard C & Kobilinsky, Lawrence Page 24 of 63

Reference books

- ❖ An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.

Web Resources

❖ <https://www.youtube.com/watch?v=QNYIX5Ne9lQ>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	0	0	0	0	0
CO2	2	3	0	0	0	0	0	0	0	0
CO3	2	3	0	0	0	0	0	0	0	0
CO4	2	3	0	0	0	0	0	0	0	0
CO5	2	3	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SKILL ENHANCEMENT COURSE IV– BASICS OF BIOPHYSICS IN BIOCHEMISTRY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S4UBCS04	SEC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ Identify and describe the biophysical phenomena in the human body.
- ❖ Understand the principles and applications of various biophysical techniques.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Understand the electrical conductivity of cardiac tissues.	PO1,PO2
CO2	Explain the biophysical principles behind nerve conduction, including ion movement.	PO1,PO2
CO3	Identify different types of hearing impairments.	PO1,PO2
CO4	Describe the applications of fiber optics in various medical fields.	PO1,PO2, PO6
CO5	Compare different imaging modalities in terms of resolution, contrast, and clinical applications.	PO1,PO2, PO6

SKILL ENHANCEMENT COURSE IV– BASICS OF BIOPHYSICS IN BIOCHEMISTRY

Unit	Details	No. of Hours
I	Biophysics of Muscles: Muscle contractility & motility, mechanical properties of muscles, biomechanics of cardiovascular systems, respiratory pressure. Electrocardiogram (ECG) and its characteristics. Model Preparation: ECG	6
II	Biophysics of Nerves: Mechanism of nerve conduction, resting and action potential, generator potential, biophysics of neural spikes, voltage clamp experiments, synaptic conduction. Electrical events in a cardiac cycle, electrical potential of the brain. EEG	6
III	Biophysics of Ears: Physical aspects of hearing, pressure amplification in the ear, the cochlea and basilar membrane as sound frequency analyzer. Hearing defects and aids. Audiometry.	6
IV	Biophysics of Fiber optics: Principles of endoscopy and other uses of fiber optics in medical science. LASERS and Cryotopes, colonoscopy, Biometry. PPT Presentation: Biometry	6
V	Biophysics of Imaging Techniques: Basic principles and uses: X-rays, CT, USG, Eco cardiograph, MRI, PET, SPET.	6
	TOTAL	30
*Note: Model Preparation & PPT Preparation related to the above topics are to be considered for Internal Exam Only		

Text books

- ❖ “Basics of Radiobiological Principle” by Thayalan, Jaypee Brothers Medical Publisher, New Delhi 2003
- ❖ Howell- Fulton, “Physiology and Biophysics”, T.C. Iwch & H.D. Palton, W.B.Saunders Co.
- ❖ Biophysics by Vasantha Pattabhi and N. Gautham, Narosa publishing house, New Delhi ,2002

Reference books

- ❖ Bulter I.A.V. And Noble D.Eds. (1976), Progress in Biophysics and Molecular Biology (all volumes) pergamon, Oxford.

- ❖ Cantor C.R. and Schimmel P.R. (1980), Biophysical chemistry, W.A.Fremman and Co.
- ❖ Casey E.J (1967), Biophysics, concepts and mechanisms. Affiliated East west press.

Web Resources

- ❖ <https://www.biophysics.org/>
- ❖ <https://link.springer.com/journal/249>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	0	0	0	0	0	0	0	0
CO2	3	3	0	0	0	2	0	0	0	0
CO3	3	3	0	0	0	2	0	0	0	0
CO4	3	3	0	0	0	2	0	0	0	0
CO5	3	3	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SEMESTER – IV

CORE IV – BIOCHEMICAL TECHNIQUES

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S4UBC04	Core – IV	Theory	Y	-	-	4	4

Learning Objectives

- ❖ Introduce the basic principles, types and applications of various sedimentation techniques.
- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Describe types of rotors and identify the centrifugation Technique for the separation of biomolecules.	PO1
CO2	Demonstrate the principles, operational procedure and Applications of planar and column chromatography.	PO1,PO2
CO3	Specify the factors and explain the separation of DNA and Protein using electrophoretic technique.	PO1,PO2
CO4	State Beer's Law and illustrates the instrumentation and Uses of colorimeter and spectrophotometer.	PO1, PO2
CO5	Enumerate various methods of measurement of Radioactivity and safety aspects of radioactive isotopes.	PO1,PO2

CORE IV – BIOCHEMICAL TECHNIQUES

Unit	Details	No. of Hours
I	Centrifugation: Centrifugation - Basic principles, RCF, Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, Rate zonal and Isopycnic techniques, construction, working and applications of analytical ultracentrifuge – Determination of molecular weight (Derivation excluded).	12
II	Chromatography: Chromatography - adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography and affinity chromatography. Model Preparation: Paper Chromatography	12
III	Electrophoresis: 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.	12
IV	Colorimetry & Spectrophotometry: Basics of Electromagnetic radiations- Energy, wavelength, wave number 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 –enzyme assay, structural studies of proteins and nucleic acids.	12
V	Radioactivity: Radioactivity - Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization -Geiger Muller Counter. Methods based upon excitation - Solid & Liquids scintillation counters. Autoradiography. Biological applications and safety aspects of radioisotopes. PPT Presentation: Radioactivity	12
	Total	60
*Note: Model Preparation & PPT Presentation related to the above topics are to be considered for Internal Exam		

Text Books

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

Cambridge University Press, 4th edition.

Reference books

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

Web Resources

- ❖ <https://www.britannica.com/science/chromatography>
- ❖ <https://www.youtube.com/watch?v=xgxFBQZYXIE>
- ❖ <https://www.youtube.com/watch?v=7onjVBsQwQ8>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	2	0	0	0	0
CO2	2	3	0	0	0	2	0	0	0	0
CO3	2	3	0	0	0	2	0	0	0	0
CO4	2	3	0	0	0	2	0	0	0	0
CO5	2	3	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3	3	3	3	3

Course coordinator

BOS Chairman

CORE PRACTICAL -IV – BIOCHEMICAL TECHNIQUES

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S4UBCP04	Core Practical - IV	Practical	-	-	Y	3	3

Learning Objectives

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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

CORE PRACTICAL -IV – BIOCHEMICAL TECHNIQUES

Unit	Details	No. of Hours
I	COLORIMETRY 1. Estimation of amino acid by Ninhydrin method. 2. Estimation of protein by Biuret method.	9
II	COLORIMETRY 3. Estimation of DNA by Diphenylamine method. 4. Estimation of RNA by Orcinol method.	9
III	COLORIMETRY 5. Estimation of Phosphorus by Fiske and Subbarow method.	9
IV	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.	9
V	DEMONSTRATION 1. Separation of serum and plasma from blood by centrifugation. 2. Separation of serum proteins by SDS-PAGE.	9
	Total	45

Text Books

- ❖ J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015.
- ❖ S. Sadasivam A.Manickam Biochemical Methods Newage International Pvt Ltd publishers 3rd edition 2018.
- ❖ Keith Wilson and John Walker Principles and techniques of Practical Biochemistry Cambridge University Press 2010, 7th edition.

Reference books

- ❖ Cell and Molecular biology, De Robertis, 8th edition, 1st June, 1987.
- ❖ S. K. Sawhney and Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2nd edition, 2005.
- ❖ David T. Plummer, 2001, An Introduction to Practical Biochemistry, 3rd edition, Tata

McGraw- Hill publishing company limited.

- ❖ 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 Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	0	3	0	0	2	0	0	0	0
CO2	2	0	3	0	0	2	0	0	0	0
CO3	2	0	3	0	0	0	0	0	0	0
CO4	2	0	3	0	0	2	0	0	0	0
CO5	2	0	3	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SKILL ENHANCEMENT COURSE V– MEDICAL CODING

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S4UBCS05	SEC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ 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)

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

SKILL ENHANCEMENT COURSE V– MEDICAL CODING

Unit	Details	No. of Hours
I	Medical Coding: Introduction to Medical coding, coding theory, Health care Common Procedure Coding, First Aid and CPR. PPT Presentation: Medical Coding	6
II	Medical Terminology: Introduction to Medical Terminology, specialization I & II, Diagnostic coding, factors affecting diagnostic coding.	6
III	Medical Records: Documenting medical records- Importance of Documentation, Types of dictation formats. Report Writing: Hospital Visit and report Writing	6
IV	Human Anatomy & Coding: Introduction to Human Anatomy and Coding, ICD-10- CM classification system.	6
V	CPT Coding: Introduction to CPT coding, types of CPT coding Medical Law and Ethics. PPT Presentation: CPT Coding	6
	Total	30
*Note: Report writing on Field visit and PPT presentation related to the above topics are considered for Internal Exam Only		

Text Books

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

Reference books

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	3	0	0	0	0
CO2	2	3	0	0	0	3	0	0	0	0
CO3	2	3	0	0	0	3	0	0	0	0
CO4	2	3	0	0	0	3	0	0	0	0
CO5	2	2	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
Weightage	15	15	10	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	2.0	3.0	3.0

Course coordinator

BOS Chairman

SKILL ENHANCEMENT COURSE VII–TISSUE CULTURE

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S4UBCS06	SEC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Introduction to plant tissue culture	PO1,PO2,PO3
CO2	Brief knowledge on preparation of tissue culture media	PO1,PO2
CO3	Understanding on different methods of gene transfer	PO1,PO2,PO3
CO4	Gain knowledge on plant and animal cell culture techniques	PO1,PO2,PO3
CO5	Study of applications of genetically modified plants and animals.	PO1,PO2,PO3

SKILL ENHANCEMENT COURSE VI– TISSUE CULTURE

Unit	Details	No. of Hours
I	Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques.	6
II	Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures PPTPreparation: Maintenance of cultures	6
III	Methods of gene transfer in plants and animals - direct and indirect gene transfer Methods.	6
IV	Cell culture technique - Explants selection, sterilization and inoculation.	6
V	Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview - Applications of animal cell culture Model Presentation: Animal Cloning	6
	Total	30
Model preparation, PPT presentation and poster presentation related to the above topics are to be considered for internal exam only		

Text Books

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

Reference books

- ❖ Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias

Publications. 1995.

- ❖ Stewart Jr., C.N., “Plant Biotechnology and Genetics: Principles, Techniques and Applications” Wiley- Interscience, 2008.
- ❖ Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010.6th Edition.
- ❖ Davis, J. M. (2008). Basic Cell Culture. Oxford University Press. New Delhi.
- ❖ Davis, J. M. (2011).Animal Cell Culture. John Willy and Sons Ltd. USA.
- ❖ Freshmen R. I. (2005).Culture of Animal Cells. John Willy and Sons Ltd. USA.
- ❖ Butler, M. (2004). Animal Cell Culture and Technology. Taylor and Francis.Keywork USA.
- ❖ 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 Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	0	0	0	0	0	0	0
CO2	2	3	0	0	0	0	0	0	0	0
CO3	2	3	3	0	0	2	0	0	0	0
CO4	2	3	3	0	0	2	0	0	0	0
CO5	2	3	3	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SKILL ENHANCEMENT COURSE VI– MICROBIAL TECHNIQUES

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S4UBCS07	SEC	Theory	Y	-	-	2	2

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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	PO1,PO2,PO6

SKILL ENHANCEMENT COURSE VI– MICROBIAL TECHNIQUES

Unit	Details	No. of Hours
I	Bacterial growth: 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
II	Microscopy: Principle, types - Compound microscope, electron microscope- TEM, SEM, use of oil immersion objective. Model Preparation: Microscope	6
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
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
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. Food borne Pathogens. PPT Presentation: Food microbiology	6
	Total	30
Model preparation, PPT presentation and poster presentation related to the above topics are to be considered for internal exam only		

Text Books

- ❖ 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
- ❖ Food Microbiology: Fundamentals and Frontiers, 5th Edition by Editor(s): Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill
- ❖ Text book of microbiology by Ananthanarayan and Panicker's
- ❖ Textbook of microbiology by P.C. Trivedi Sonali Pandey Seema Bhadauria5.

- ❖ Prescott's Microbiology, 10th Edition by Authors: Joanne Willey, Linda Sherwood and Christopher J. Woolverton

Reference books

- ❖ Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
- ❖ Bailey & Scott's Diagnostic Microbiology, 14th Edition by Author: Patricia Title
- ❖ Medical Microbiology, 7th Edition Authors: Patrick R. Murray, Ken S. Rosenthal and Michael A. Pfaller
- ❖ Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierce

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	0	0	0	0	0
CO2	2	3	0	0	0	0	0	0	0	0
CO3	2	3	0	0	0	2	0	0	0	0
CO4	2	3	0	0	0	2	0	0	0	0
CO5	2	3	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

SEMESTER – V

THIRD YEAR - SEMESTER V

CORE V – ENZYMES

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S5UBC05	Core V	Theory	Y	-	-	6	5

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Identify the major classes of enzymes, differentiate between a chemical catalyst and a biocatalyst and define the units of enzymes.	PO1
CO2	Explain the mechanism of enzyme catalysis and the role of coenzymes in enzyme action.	PO1,PO2
CO3	Illustrate the steady state kinetics, interpret MM plot and LB plot based on kinetics data, and determine K_m and V_{max} .	PO1,PO3
CO4	Distinguish the types of inhibition along with its importance in biochemical reactions.	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

CORE V – ENZYMES

Unit	Details	No. of Hours
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. Multienzyme complexes - Pyruvate dehydrogenase complex.	18
II	Mechanism of enzyme catalysis - Acid Base catalysis,covalent catalysis,electro static catalysis,metal ion catalysis, proximity and orientation effect. Coenzymes -Definition, types, co-enzymatic forms of vitamins- NAD/NADP,FAD, FMN, Coenzyme A TPP,PLP, lipoic acid and biotin. Mechanism of action of Chymotrypsin and Lysozyme. Isoenzyme with reference to LDH and CK.	18
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 Km and V max andtheirdeterminationusing the plots.	18
IV	Enzyme inhibition - Reversible and irreversible inhibition-types of reversible inhibitors, competitive, non-competitive, un-competitive inhibitors. Graphical representation by L-B plot,(Kineticderivationsnotrequired),DeterminationofKmandVmaxint he presence and absence of inhibitors. Allosteric enzymes - Sigmoidal curve, positiveandnegativemodulators	18
V	Applications of enzymes -Immobilized enzymes - methods of immobilizationadsorption,covalentbonding,crosslinking,encapsulation,entrapmentandapplications of immobilized enzymes. Biosensors – e.g. Glucose sensors. Enzyme data Repositories. Enzyme Engineering : Artificial Enzymes and Antioxidant Enzymes Commercial production of amylase and protease.	18
	TOTAL	90

Text books

- ❖ Biochemistry, U.Sathyanarayana & U.Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt.Ltd.
- ❖ Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, 2013, 7th edition Chand & Company Ltd.
- ❖ Lehninger AL, Nelson DL and Cox MM, Lehninger principles of biochemistry (7th ed.), New York: W.H. Freeman, 2017.
- ❖ Rodwell VW, Bender DA, Botham KM, et al., Harper's illustrated biochemistry (31st ed.), London: McGraw Hill, 2018.

Reference books

- ❖ David Nelson, Michael M.Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company.
- ❖ Zubay G.L., et al., 1995, Principles of Biochemistry, 1st edition, Wm C. Brown Publishers.
- ❖ Devlin TM, Textbook of biochemistry with clinical correlations (7th ed.), New York: John Wiley & Sons, 2010.

Web Resources

- ❖ Enzymes - <https://nptel.ac.in/courses/102/102/102102033/>
- ❖ <https://nptel.ac.in/content/storage2/courses/102101007/downloads/PPT/LEC-07-PPT.pdf>
- ❖ Enzymes Assay - <https://nptel.ac.in/courses/104/105/104105032/>
- ❖ <https://www.britannica.com/science/biomolecule> <https://en.wikipedia.org/wiki/Biomolecule> <https://www.khanacademy.org/science/biology/macromolecules>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	0	0	0	0	0	0	0	0
CO2	3	0	0	0	0	0	0	0	0	0
CO3	3	0	0	0	0	0	0	0	0	0
CO4	3	0	0	2	0	0	0	0	0	0
CO5	3	0	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	0	0	3	0
CO2	3	0	0	3	0
CO3	3	0	0	3	0
CO4	3	2	0	3	0
CO5	3	0	0	3	0
Weightage	15	2	0	15	0
Weighted percentage of Course Contribution to Pos	3	0.11	0.6	3	0

Course coordinator

BOS Chairman

CORE VI –INTERMEDIARY METABOLISM

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S5UBC06	Core – VI	Theory	Y	-	-	5	4

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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 nonessential amino acids and specialized products from amino acids and specialized products from amino acids.	PO1
CO5	Describe the metabolism of nucleic acids with necessary illustrations and its regulation.	PO1

CORE VI – INTERMEDIARY METABOLISM

Unit	Details	No. of Hours
I	Definition, importance, Division of metabolism, Bioenergetics-High energy compounds: Role of high energy compounds, free energy hydrolysis of ATP and other organophosphates, ATP-ADP cycle. Standard free energy change of a chemical reaction. 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, uncouplers of oxidative phosphorylation, substrate level phosphorylation with examples.	15
II	Metabolism of carbohydrates - Glycolysis, TCA Cycle, Amphibolic nature and integrating role of TCA cycle. Anaplerosis, Pentose Phosphate Pathway (HMP shunt), Gluconeogenesis, Glycogenesis, Glycogenolysis and its regulation, glyoxylate cycle, Entner-Duodoroff pathway and Cori cycle.	15
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, Ketone bodies: Formation, Utilisation and excretion. Biosynthesis of saturated fatty acids and unsaturated fatty acids, Biosynthesis and degradation of triglycerides, phospholipids and cholesterol. Transport of lipids: VLDL, LDL, HDL and Chylomicrons.	15
IV	Metabolism of amino acid- Metabolic nitrogen pool, Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination and decarboxylation, Biogenic amines, Urea cycle and its regulation.	15
V	Metabolism of nucleotides-Biosynthesis of purines and pyrimidines, -denovo synthesis and salvage pathways, Degradation of purines and pyrimidines, Conversion of ribonucleotide to deoxyribonucleotide. Inhibitors of nucleic acid.	15
	TOTAL	75

Text books

- ❖ 1, U.Sathyanarayana & U.Chakrapani, 2015, Biochemistry, 4th Elsevier India Pvt.Ltd.,
- ❖ 2. M.N. Chatterjea and Rana Shinde, 2002, Text book of Medical Biochemistry, 5th edition Jaypee Brothers Medical Publishers Pvt. Ltd.

Reference books

- ❖ Lehninger Principles of Biochemistry, David L. Nelson, Michael M.Cox, 2008, 5th edition, W.H. Freeman and Company.
- ❖ Robert K. Murray, Daryl K. Granner, Victor W. Rodwell, 2006, Harper's Illustrated Biochemistry, 27th edition, McGraw Hill Publishers.
- ❖ Principles of Biochemistry Voet.D, Voet. J.G, and Pratt C.W., 2010, 4th edition, John Wiley & Sons, Inc.,
- ❖ Principles of Biochemistry, Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, 2nd Edition, Wm.C. Brown Publishers.
- ❖ Biochemistry, Garret, R. H. and Grisham, C. M. 2005, 3rd Edition. Thomson Learning INC.

Web Resources

- ❖ <https://nptel.ac.in/courses/104/105/104105102/>
- ❖ <http://www.nptelvideos.in/2012/11/biochemistry-i.html>
- ❖ https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2					3			3
CO2	3						3			3
CO3	3						3			3
CO4	3						3			3
CO 5	3						3			3

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPOs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S5UBC07	Core –VII	Theory	Y	-	-	6	5

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment.	PO1,PO3,PO6
CO2	Analyze the lipid 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

CORE VII – CLINICAL BIOCHEMISTRY

Unit	Details	No. of Hours
I	Specimen collection and processing (Blood, urine, faeces). Anti-coagulant preservatives for blood and urine. Disorders of carbohydrate metabolism: 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, hypoglycemia, hyperglycemia. glycated hemoglobin. Inborn errors of carbohydrate metabolism, glycosuria, Fructosuria, Pentosuria, Galactosemia and Glycogen storage diseases.	18
II	Disorders of Lipid Metabolism: Lipid Profile, Atherosclerosis, Fatty liver and hyperlipidemia. Hypercholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach's disease, Niemann-Pick disease, lipotropic agents. Disorders in Protein Metabolism: Clinical features of Phenylketonuria, Alkaptonuria, Albinism.	18
III	Liver Function Tests: Bilirubin metabolism and jaundice, Estimation of conjugated and total bilirubin in serum (Diazotization method). Detection of bilirubin and bile salts in urine (Fouchet's test and Hay's Sulphur test). Thymol turbidity test, prothrombin time, serum enzymes in liver disease serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). Kidney Function Tests: 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.	18
IV	Gastric Function test: Composition of gastric juice, collection of gastric contents, examination of gastric residuum, Errors in collection of gastric juice collection fractional test meal (FTM), stimulation test- alcohol and histamine stimulation, Tubeless gastric analysis.	18
V	Clinical enzymology: Enzymes of diagnostic importance- LDH, creatine kinase, transaminases, phosphatases, Isoenzymes of lactate dehydrogenase.	18
	TOTAL	90

Text books

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

Reference books

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

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3		3			2	3	2	2	3
CO2	3		3			2	3	2		3
CO3	3		3			2	3	3	2	3
CO4	3		3			2	3	3	2	3
CO 5	3		3			2	3	3	2	3

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPOs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

CORE PRACTICAL V- CLINICAL BIOCHEMISTRY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S3UBCP03	Core Practical -V	Practical	-	-	Y	5	4

Learning Objectives

- ❖ Isolate nucleic acids from plant and animal sou 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
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

CORE PRACTICAL V- CLINICAL BIOCHEMISTRY

Unit	Details	No. of Hours
I	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)	15
II	1. Estimation of uric acid (serum & urine) 2. Estimation of cholesterol by Zak's method 3. Estimation of Glucose by Ortho Toluidine method	15
III	4. Estimation of Protein by Lowry's method 5. Estimation of Hemoglobin by Shali's/Drabkins method 6. Assay of SGPT and SGOT	15
IV	7. Qualitative analysis of A) Normal constituents of urine a) Urea, b) Creatinine, c) Phosphorus, d) Calcium B) Abnormal constituents a) Calcium b) Sugar (Glucose, fructose, pentose) c) Protein d) Aminoacids (Tyrosine, Histidine, Tryptophan) e) Ketone bodies f) Bile pigments with clinical significance.	15
V	DEMONSTRATION EXPERIMENTS 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	15
	TOTAL	75

Text books

- ❖ Manickam, S.S.(2018).Biochemical Methods(3rd ed.).New age International PvtLtd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408
- ❖ Plummer, D.T. An Introduction to Practical Biochemistry. Tata Mc GrawHill- ISBN: 97800708416
- ❖ Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.
- ❖ B. Godkar. 2020. Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.
- ❖ Kanai L Mukerjee. 1996. Medical Lab Technology, Vol I& II, 1st edition, Tata Mcgraw Hill, Pennsylvania

- ❖ Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58 (Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.

Reference books

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

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3					3	3	3	3
CO2	3	3					3	3	3	3
CO3	3	3	3			3	3	3	3	3
CO4	3	3	2				3	3	3	3
CO5	3	3	3			3	3	3	3	3

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPOs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

ELECTIVE I - IMMUNOLOGY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S5UBCE01	ELECTIVE -I	Theory	Y	-	-	3	2

Learning Objectives

- ❖ 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.

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

ELECTIVE I - IMMUNOLOGY

Unit	Details	No. of Hours
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. Complement system - characteristic features and functions.	9
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.	9
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. Immunity to infection - Bacteria, Viruses, and Protozoa.Flow Cytometry - Immunological applications.	9
IV	Hypersensitivity – Immediate (Type I) 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. HLA Immune response genes -HLA Molecule , AIDS.Immunogenecity and factors affecting immunogenecity. Haemolytic disease of new born (HDN).	9
V	Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immuno diffusion, SID and DID -Oudin Procedure, Oakley Fulthroe Procedure, Radio immunodiffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test-Wasserman's reaction, RIA, ELISA.	9
	TOTAL	45

Text books

- ❖ “Basics of Radiobiological Principle” by Thayalan, Jaypee Brothers Medical Publisher, New Delhi 2003
- ❖ Murphy K, Mowat A, Weaver CT, Janeway’s Immunobiology (8th ed), Garland Science, London & New York, 2012.
- ❖ Punt J, Stranford S, Jones P and Owen J, Kuby immunology (8th ed.), New York: W.H. Freeman, 2018.

Reference books

- ❖ Bulter I.A.V. And Noble D.Eds. (1976), Progress in Biophysics and Molecular Biology (all volumes) pergamon, Oxford
- ❖ Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - (2006),Roitt's Essential Immunology, 11th edition, Wiley-Blackwell.
- ❖ Immunology - Janis Kuby.
- ❖ Cantor C.R. and Schimmel P.R. (1980), Biophysical chemistry, W.A.Fremman and Co.
- ❖ Casey E.J (1967), Biophysics, concepts and mechanisms. Affiliated East west press.

Web Resources

- ❖ <https://www.biophysics.org/>
- ❖ <https://link.springer.com/journal/249>
- ❖ https://onlinecourses.nptel.ac.in/noc22_bt40/preview
- ❖ https://onlinecourses.swayam2.ac.in/cec20_bt05/preview

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	0	0	0	0	0	0	0	0
CO2	3	3	0	0	0	2	0	0	0	0
CO3	3	3	0	0	0	2	0	0	0	0
CO4	3	3	0	0	0	2	0	0	0	0
CO5	3	3	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

ELECTIVE II – BIOCHEMICAL PHARMACOLOGY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S5UBCE02	ELECTIVE –II	Theory	Y	-	-	3	2

Learning Objectives

- ❖ 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 .

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

ELECTIVE II – BIOCHEMICAL PHARMACOLOGY

Unit	Details	No. of Hours
I	Definition and Scope of pharmacology. Historical perspective and milestones in drug discovery key players in drug discovery. 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.	9
II	Drug metabolism - Phase I and Phase II reactions, role of cytochrome P ₄₅₀ , non- microsomal reactions of drug metabolism. Factors influencing drug metabolism. Therapeutic index. Factors affecting drug bioavailability.	9
III	Drug allergy, Drug tolerance - IC ₅₀ , LD ₅₀ of a drug, Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance - biochemical mechanism.	9
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.	9
V	Antibiotics - Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracyclines and chloramphenicol. Introduction to immune modulators and chemotherapy of Cancer.	9
	TOTAL	45

Text books

- ❖ Biochemistry, U.Sathyanarayana & U.Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt.Ltd.
- ❖ Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & Company Ltd.
- ❖ S C Metha, Ashutosh Kar, Pharmaceutical Pharmacology –New Age International (P) Limited, Publishers.
- ❖ Hilal-Dandan, R., & Brunton, L. (2013). Goodman and Gilman Manual of Pharmacology and Therapeutics, 2 (pp. 852-854). McGraw Hill Professional, Philadelphia.
- ❖ Goodman, L. S. (1996). Goodman and Gilman's the pharmacological basis of therapeutics (Vol. 1549, pp. 1361-1373). New York: McGraw-Hill.

Reference books

- ❖ David . E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt.Ltd.
- ❖ R.S. Satoskar, S. B. Elsevier Pharmacology and pharmacotherapy. - ISBN-10: 9788131248867 / ISBN-13 : 978-8131248867 ,2017.
- ❖ Tripathi, K.Essentials of Medical Pharmacology. Jaypee Publishers- ISBN-10: 9350259370 / ISBN-13 : 978-9350259375.2018.
- ❖ Trevor, A. J., Katzung, B. G., & Kruidering-Hall, M. (2018).Pharmacology:Examination & board review. McGraw-Hill Education.

Web Resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	0	0	0	0	0	0	0	0	0
CO2	3	0	0	0	0	0	0	0	0	0
CO3	3	0	0	0	0	0	0	0	0	0
CO4	3	0	0	2	0	0	0	0	0	0
CO5	3	0	0	0	0	0	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	0	0	3	0
CO2	3	0	0	3	0
CO3	3	0	0	3	0
CO4	3	2	0	3	0
CO5	3	0	0	3	0
Weightage	15	2	0	15	0
Weighted percentage of Course Contribution to Pos	3	0.11	0.6	3	0

Course coordinator

BOS Chairman

ELECTIVE III - RESEARCH METHODOLOGY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S5UBCE03	ELECTIVE -III	Theory	Y	-	-	3	2

Learning Objectives

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

Course Outcomes		
Course Outcomes	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

ELECTIVE III - RESEARCH METHODOLOGY

Unit	Details	No. of Hours
I	Characteristics and types of Research, Research Methods versus Methodology, Research designs in Biochemistry: experimental, <i>in vitro</i> , <i>in vivo</i> , <i>in situ</i> , clinical trials. Identification and criteria of selecting a research problem (Hypothesis); Formulation of objectives; Research plan and its components.	9
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	9
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	9
IV	Computer and its role in research: Basics of MS word, MS Excel: tabulation, calculation and data analysis, preparation of graphs, histograms and charts. Use of statistical software SPSS. Power Point: preparation of presentations and scientific poster designing	9
V	Scientific writing for journals - Preparation of Abstract, Impact factor, h-index, i-10 index, citation index, Dissertation/Thesis writing: format, content and chapterization, writing style, drafting titles & sub-titles, captions and legends. Writing results, discussion and conclusions. Bibliography and references, referencing style - Harvard and Vancouver systems, Appendices and acknowledgement; Ethical issues in research; Intellectual property right and plagiarism.	9
	TOTAL	45

Text Books

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

Reference Books

- ❖ 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.
- ❖ Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
- ❖ Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
- ❖ Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010
- ❖ Research Methodology (2 Vols-Set) ,Suresh C. Sinha and Anil K. Dhiman, Vedams Books (P) Ltd.2002.

Web Resources

- ❖ <https://explorable.com/research-methodology>
- ❖ <http://www.scribbr.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)

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	0	0	3	0
CO2	3	0	0	3	0
CO3	3	0	0	3	0
CO4	3	2	0	3	0
CO5	3	0	0	3	0
Weightage	15	2	0	15	0
Weighted percentage of Course Contribution to Pos	3	0.11	0.6	3	0

Course coordinator

BOS Chairman

SEMESTER – VI

CORE VIII –MOLECULAR BIOLOGY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S6UBC08	Core -VIII	Theory	Y	-	-	5	3

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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 and 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

CORE VIII – MOLECULAR BIOLOGY

Unit	Details	No. of Hours
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. Enzymes in DNA replications: DNA polymerase, Primase, Ligase, Helicase, Topoisomerases, Single stranded DNA binding proteins. Bidirectional replication, Inhibitors of replication. Models of replication-theta, rolling circle and D loop model.	15
II	Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Transcription activator and repressor. Post-transcriptional modifications; inhibitors of transcription. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription.	15
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
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
V	Mutation: -Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations. Types of gene mutations: Base substitution, Frame shift mutation, -insertion, deletion, missense, nonsense mutation. DNA repair: Direct repair, Photoreactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair.	15
	TOTAL	75

Text books

- ❖ Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition, An eBooks India.
- ❖ David Friefelder, 1987, Molecular Biology, 2nd edition, Narosa Publishing House.
- ❖ Dr.P.S.Verma and Dr.V.K.Agarwal, 2013, Cell biology, Genetics, Molecular

Reference books

- ❖ Karp, G., 2010, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
- ❖ De Robertis, E.D.P. and De Robertis, E.M.F., 2010, Cell and Molecular Biology, 8th edition, Lippincott Williams and Wilkins, Philadelphia.
- ❖ James. D. Watson, 2013, Molecular Biology of the Gene 7th edition, Benjamin Cummings.
- ❖ George M. Malacinski, 1992, Freifelder's Essentials of Molecular Biology, 4th edition, Narosa publishing House.

Web Resources

- ❖ www.mednotes.net/notes/biology
- ❖ https://www.onlinebiologynotes.com/repair-mechanism-of_mutation/
- ❖ <https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3						3			3
CO2	3						3			3
CO3	3						3			3
CO4	3	2					3			3
CO 5	3	2					3	1		3

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPOs	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

CORE IX –HUMAN PHYSIOLOGY

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S6UBC09	Core -IX	Theory	Y	-	-	5	3

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme Outcomes
CO1	Explain the exchange of gases, design of blood vessels and cardiac cycle.	PO1
CO2	Summarize the events in transmission of nerve impulses mechanism of muscle contraction.	PO1
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

CORE IX – HUMAN PHYSIOLOGY

Unit	Details	No. of Hours
I	Respiratory System – Overview of respiratory system, Structure and functions of lung, Types of respiration, Transport of respiratory gases, Exchange of respiratory gases in lungs and tissues – Chloride Shift & Bohr's effect, Lung surfactant. Circulatory System-Structure and functions of the Heart. Arterial and venous system, Cardiac cycle, Pace maker, Electrocardiogram (ECG) Blood pressure and Factors affecting blood pressure.	15
II	Nervous system- Structure of neuron, synaptic transmission, reflex action, neurotransmission- Resting membrane and Action potential. neurotransmitters- acetylcholine, Nor adrenaline, 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.	15
III	Digestive system- The anatomy of the human alimentary canal, composition, functions of saliva, gastric pancreatic intestine and bile secretions, structure of digestive system, Digestion, absorption of carbohydrates, lipids, proteins. Excretory system – Structure of nephron, mechanism of urine formation, Concentration and acidification of Urine. Role of kidneys in the maintenance of acid base balance.	15
IV	Reproductive system: Oogenesis, spermatogenesis, capacitation and transport of sperm- blood testis barrier. Fertilization, early development, Implantation, Placentation and Parturition.	15
V	Mutation: - Endocrinology- Classification of hormones, endocrine glands and their secretions, structure and functions of Insulin, thyroxine. Steroid hormones - Corticosteroids, Sex hormones – testosterone and estrogen, menstrual cycle.	15
	TOTAL	75

Text books

- ❖ K.Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7th edition, Jaypee Brothers Medical Publishers (P) Ltd.
- ❖ Chatterjee.C.C., 1988, Human Physiology – Vol I & II, 1st edition, Medical Allied Agency.
- ❖ Animal Physiology – Mariakuttikan and Arumugam, Saras publication, 2017.

Reference books

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

Web Resources

- ❖ https://www.youtube.com/watch?v=6qnSsV2syUEhttps://www.onlinebiologynotes.com/repair-mechanism-of_mutation/
- ❖ https://www.youtube.com/watch?v=9_h0ZXx1lFw
- ❖ <https://slideplayer.com/slide/9431799/>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3						3	2		3
CO2	3						3	2		3
CO3	3						3	2		3
CO4	3	3					3	2		3
CO 5	3	3					3	2		3

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S6UBC10	CORE - X	Theory	Y	-	-	6	4

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

CORE X– PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS

Unit	Details	No. of Hours
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.	18
II	Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and alkaloids. Role of secondary metabolites in mankind and chemical defense.	18
III	Plant hormones Structure and function of plant hormones such as ethylene, cytokinins, auxins, Abscicic acid and Gibberellins. Plant growth inhibitors and retardants.	18
IV	Free radicals, types, production, free radical induced damages, lipid peroxidation, reactive oxygen species, antioxidant defense system, enzymatic and non-enzymatic antioxidants, role of antioxidants in prevention of disease, phytochemicals as antioxidants.	18
V	Plant therapeutics: plants and Bioactive compounds used in traditional medicine ,Ayurvedha, Siddha - Tulasi, Turmeric, Neem, Aloe vera and amla. Bioactive principles in herbs, plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	18
	Total	90

Text Books

- ❖ Singh M. Pand Panda. H2005. Medicinal Herbs with their formulations, Daya publishing house, Delhi
- ❖ Plant Physiology- Devlin N. Robert and Francis H. Witham, CBS Publications
- ❖ Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W. Anderson and John Brardall, Black well Scientific Publications, 1994.
- ❖ "Plant Defense: Warding off Attack by Pathogens, Herbivores and Parasitic Plants" Richard S. S. Jones, Wiley-Blackwell, 2011
- ❖ Peter J. Lea Richard. C. Lee good, Plant Biochemistry and Molecular Biology, 1999, 2 nd edition.

John Wiley & Sons, NY.

Reference books

- ❖ Plant Biochemistry and Molecular Biology – Hans Walter Heldt, Oxford University, 4th Edition, 2010
- ❖ Plant biochemistry (2008), Caroline bowsher, Martin steer, Alyson Tobin, garlandscience.
- ❖ Plant physiology and development (sixth edition) by Lincoln Taiz ,Eduardo Zeiger , Ian Max Moller and Angus Murphy publisher ; Oxford university press.
- ❖ Buchanan. B, Gruissem. W, Jones.W, Plant Biochemistry and Molecular Biology (2nd edition) ,Wiley-Blackwell, (2002).

Web resources

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

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	3	0	0	0	0
CO2	2	3	0	0	0	3	0	0	0	0
CO3	2	3	0	0	0	3	0	0	0	0
CO4	2	3	0	0	0	3	0	0	0	0
CO5	2	2	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
Weightage	15	15	10	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	2.0	3.0	3.0

Course coordinator

BOS Chairman

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S6UBCE04	ELECTIVE - IV	Theory	Y	-	-	5	3

Learning Objectives

- ❖ 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.

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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

ELECTIVE IV– BIOTECHNOLOGY

Unit	Details	No. of Hours
I	Recombinant DNA technology - Principles of gene cloning: restriction endonucleases and other enzymes used in manipulating DNA molecules. Separation of DNA by gel electrophoresis. Ligation of DNA molecules, DNA ligase, linkers and adapters, homopolymer tailing, end labeling and construction maps of PBR322, λ bacteriophage.	15
II	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, Delay of fruit ripening, Plant based vaccines.	15
III	Introduction, History , Basic concepts in animal cell 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
IV	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
V	Fermentation technology – Fermentors - general design, fermentation processes - Media used, downstream processing. Production and applications of ethanol, Streptomycin and Proteases. Production of edible vaccines.	15
	Total	75

Text Books

- ❖ Trivedi, P.C.2000. Applied Biotechnology: Recent Advances.

PANIMA Publishing Corporation

- ❖ Ignacimuthu. 19915. Applied Plant Biotechnology. Tata McGraw – Hill.
- ❖ Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.
- ❖ Grierson and Covey, S.N.1988. Plant Molecular biology.Blackie.
- ❖ Chawla, H.S., “Introduction to Plant Biotechnology”, 3rd Edition, Science Publishers, 2009.

Reference books

- ❖ Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias
- ❖ Reed G (2004) Prescott and Dunn’s Industrial Microbiology, CBS Publishers & Distributors
- ❖ Brown, T.A., (2010). Gene Cloning and DNA Analysis 15th ed., Wiley-Blackwell publishing (Oxford, UK), ISBN: 978-1-4051-8173-0.

Web Sources

- ❖ NPTEL Certification course - Gene Therapy by Sachin Kumar
<https://nptel.ac.in/courses/102/103/102103041/>
- ❖ https://www.slideshare.net/zeal_eagle/fermentation-technology
- ❖ https://www.slideshare.net/zeal_eagle/fermentation-technology
- ❖ <https://www.slideshare.net/Chepkitwai/blotting-techniques-15129300>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO15	PO7	PO8	PO9	PO10
CO1	2	3	3	0	0	0	0	0	0	0
CO2	2	3	0	0	0	0	0	0	0	0
CO3	2	3	3	0	0	2	0	0	0	0
CO4	2	3	3	0	0	2	0	0	0	0
CO5	2	3	3	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S15UBCE05	ELECTIVE - V	Theory	Y	-	-	5	3

Learning Objectives

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

Course Outcomes		
Course Outcomes	On completion of this course, students will able to	Programme 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 used by nucleic acid, protein database, structural and metabolic database.	PO1,PO2,PO3
CO3	Develop algorithms for interpreting biological data.	PO1,PO2
CO4	Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes	PO1,PO2,PO3
CO5	Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method.	PO1,PO2

ELECTIVE V- BIOINFORMATICS

Unit	Details	No. of Hours
I	Introduction to Bioinformatics, definition, Historical background – scope of 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
II	Biological Databases - definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Genebank, DDBJ) Protein sequence database- SwissProt, TrEMBL, Structural Database-PDB,Metabolic database-KEGG	15
III	Sequence Alignment-Local and Global alignment- An outline of multiple sequence alignment and phylogenetic trees. Dot matrixanalysis, Amino acid substitution matrices (PAM, BLOSUM). Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm.Heuristic methods of sequence alignment.	15
IV	BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNAMicroarray-Procedure and applications..	15
V	Structural genomics-Whole genome sequencing (Shotgun approach), Comparative genomics-tools for genome comparison, VISTA servers and precomputed tools. Molecular visualization tools. protein structure analysis : visualization with RASMOL, Swiss PDB viewer. Nutrigenomics-Definition and applications	15
	Total	75

Text Books

- ❖ Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang Editors
- ❖ Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools By: SupratimChoudhuri(Author)
- ❖ Orengo, C., Jones, D., & Thornton, J. (Eds.). (2003). Bioinformatics: genes, proteins and computers. Taylor & Francis.
- ❖ Mount, D.W., (2001). Bioinformatics: Sequence and Genome Analysis 1st ed., Cold Spring Harbor Laborator Press (New York), ISBN: 0-879159-1508-7.

Reference books

- ❖ Computation in BioInformatics Multidisciplinary Applications S Balamurugan, Anand T. Krishnan, Dinesh Goyal, Balakumar Chandrasekaran
- ❖ Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences
- ❖ Navneet Sharma PhD Pharmaceutics, Himanshu Ojha, Pawan Raghav, Ramesh K. Goyal
- ❖ . Introduction to Bioinformatics- Lesk, A.M. Oxford University Press

Web resources

- ❖ <https://nptel.ac.in/courses/102/1015/10210150155/>
- ❖ <http://www.digimat.in/nptel/courses/video/10210150155/L155.html>
- ❖ <https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes>

Mapping with Programme Outcomes: 3 Strong, 2 – Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO15	PO7	PO8	PO9	PO10
CO1	2	3	0	0	0	0	0	0	0	0
CO2	2	3	0	0	0	0	0	0	0	0
CO3	2	3	0	0	0	2	0	0	0	0
CO4	2	3	0	0	0	2	0	0	0	0
CO5	2	3	0	0	0	2	0	0	0	0

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

ELECTIVE VI- BIOENTREPRENEURSHIP

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S6UBCE06	ELECTIVE - VI	Theory	Y	-	-	5	3

Learning Objectives

- ❖ 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

Course Outcomes		
Course Outcomes	On completion of this course, students will be able to	Programe outcomes
CO1	Understand the concept and scope for entrepreneurship	PO1
CO2	Identify various operations involved in a venture creation	PO1.PO5,PO15
CO3	Gather funding and launching a winning business	PO1.PO5,PO15
CO4	Nurture the organization and harvest the rewards	PO1.PO5,PO15
CO5	Illustrate about the Business incubator centres and Bio entrepreneurship	PO1.PO5,PO15

ELECTIVE VI- BIOENTREPRENEURSHIP

Unit	Details	No. of Hours
I	Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; Introduction to Trademarks , Copyrights and patents	15
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
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
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
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
	Total	75

Text Books

- ❖ Adams, D. J. (2008). Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion - ISBN 10: 19048423154 / ISBN 13: 97819048423151
- ❖ Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303
- ❖ Onetti, A. &. (2015). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge - ISBN 10: 113815115907 / ISBN 13: 978113815115905

- ❖ Kapeleris, D. H. (20015). Innovation and entrepreneurship in biotechnology: Concepts, theories & cases - ISBN-13: 978-1482210125, ISBN-10: 1482210125

Reference books

- ❖ Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management New Himalaya. New Himalaya House Delhi:pub - ISBN : 9789350440810 9350440814
- ❖ Ono, R. D. (1991). The Business of Biotechnology, From the Bench of the Street. Butterworth-Heinemann - ISBN 10: 113815115907 / ISBN 13: 978113815115905
- ❖ Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press - ISBN-10 : 812243049X ,ISBN-13 : 978-8122430493

Web resources

- ❖ <http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/>
- ❖ <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 15	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)

Mapping with Programme: Specific Outcomes:

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course coordinator

BOS Chairman

PROFESSIONAL COMPETENCY SKILL ENHANCEMENT

SKILL BASED PAPER FOR COMPETITIVE EXAMINATION

Subject Code	Subject	Category	L	T	P	Hours	Credit
24S6UBCS08	SBC	Theory	Y	Y	-	2	2

Learning Objective

- ❖ To develop quantitative aptitude skills required for business and managerial decision making.
- ❖ To enhance logical and analytical thinking abilities
- ❖ To strengthen data interpretation and problem-solving competencies.
- ❖ To prepare students for competitive examinations, placement tests, and managerial aptitude assessments.

Course Outcomes		
Course Outcomes	On completion of this Course, Students will able to	Programme Outcomes
CO1	Apply numerical and arithmetic concepts to solve real life problems.	PO1, PO3, PO4, PO5, PO8
CO2	Analyze quantitative information involving percentages, profit and loss, interest, partnership, and financial calculations.	PO1, PO3, PO4, PO5, PO8
CO3	Derive calculations involved in simple compound interests.	PO1, PO3, PO4, PO5, PO8
CO4	Demonstrate problems on stocks, arrangement of numbers	PO1, PO3, PO4, PO5, PO8
CO5	Interpret and evaluate data presented in tables, charts, graphs	PO1, PO3, PO5, PO8, PO10

Unit	Details	No. of Hours
1	Numbers, HCF and LCM, Averages, Problems on numbers	6
2	Percentage, Profit and Loss, Ratio and Proportion	6
3	Simple Interest, Compound Interest, Partnership	6
4	Permutations and Combinations, Probability	6
5	Tabulation, Bar graphs, Pie Charts, Line Graph	6
Total		30

Text Books

- ❖ R.S. Aggarwal, *Quantitative Aptitude for Competitive Examinations*, S. Chand Publications.

References

- ❖ Arun Sharma, *How to Prepare for Quantitative Aptitude*, McGraw Hill.
- ❖ Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, McGraw Hill.

Mapping with programme outcomes and programme specific outcome

	Pos										PSOs				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	PS01	PS02	PS03	PS04	PS05
CO1	3	0	3	3	2	0	0	2	0	0	3	3	3	2	1
CO2	3	0	3	3	3	0	0	2	0	0	3	3	3	3	1
CO3	3	0	3	3	3	0	0	2	0	0	3	3	3	3	1
CO4	3	0	3	3	2	0	0	2	0	0	3	3	3	2	1
CO5	3	0	3	3	3	0	0	3	0	2	3	3	3	3	2
Total	15	0	15	15	13	0	0	11	0	2	15	15	15	13	6
Average	3.0	0.0	3.0	3.0	2.6	0.0	0.0	2.2	0.0	0.4	3.0	3.0	3.0	2.6	1.2

Course coordinator

BOS Chairman