B.Sc. BIOCHEMISTRY

(Effective from the academic year 2024 - 2025)

Vision of the Department:

To be a premier Department by fostering and conducting leading-edge course and providing quality training in updating life science culture, inculcating the idea of research programmes for human welfare, and identifying themselves as the power governing the future's medical trend.

Objectives:

1. To provide knowledge and understanding about Biomolecules.
2. To get an insight about metabolic functions and clinical correlations.
3. To become skillful to conduct biochemical analysis in biological samples.
4. To tap out the talents through extracurricular and co-curricular activities.
5. To get sensitized to social and environmental realities.

Eligibility for admission to B.Sc. Biochemistry:

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.

Allied Subjects:

1. Chemistry
2. Microbiology

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application-oriented content wherever required.

- The core subjects include latest developments in the education and scientific front, practical training, catering to the needs of stakeholders with research aptitude.

- The curriculum is designed to strengthen the industry-academia interface and provide more job opportunities for the students.

- The Internship during the second-year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.

- Project with viva-voce component in the fifth semester enables the students to apply their conceptual knowledge to practical situations. Such innovative provisions of the industrial training/project/internships will give students an edge over the counterparts in the job market.

- State-of art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective and Skill Enhancement Courses, covering conventional topics to the application oriented.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course in Biochemistry** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Biochemistry and its concepts.	• Instil confidence among students • Create interest for the subject
I, II, III & IV	**Skill Enhancement papers** (Discipline centric/ Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Skill training to girls leads to women empowerment
		• Discipline centric skill will improve the technical knowhow of solving real life problems
I, II, III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the state-of art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Emerging topics related to industry are introduced to facilitate advanced learning in the respective domains
II Year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Chemical Companies/Educational institutions, enable the students gain professional experience and become responsible citizens.
V Semester	Project with Viva -voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• 'General Awareness for Competitive Examinations' caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.

SKILLS ACQUIRED FROM THE COURSES	• Knowledge • Problem Solving • Analytical ability • Professional Competency • Professional Communication • Transferrable Skill

TANSCHE BASED PROGRAMME STRUCTURE FOR **B.Sc. BIOCHEMISTRY** (For the candidates admitted from the academic year 2024-2025)									
Sem	**Part**	**Category**	**Paper Code**	**Title**	**Hours/ Week**	**Exam**		**Credits**	**Marks**
						Th	Pr		
I	I	Tamil/Language	ULTAA24	Tamil Paper – I	5	3	-	3	40+60
	II	English	UENGA24	English Paper – I	6	3	-	3	40+60
	III	Core Course 1	UCBCA24	Nutritional Biochemistry	5	3	-	5	40+60
		Core Course 2	UCBCB24	Core Practical I -Nutritional Biochemistry	3	-	6	3	40+60
		Generic Elective 1	UACHA24	Allied I- Chemistry - I	4	3	-	3	40+60
			UACHB24	Allied Chemistry Practical-I	2	-	3	2	40+60
	IV	Skill Enhancement Course - SEC 1	USBC124	SEC: Health and Nutrition	2	-	-	2	100
		Foundation Course FC	UFBC24	FC: Bridge Course in Biochemistry	2	2	-	2	40+60
		Value Education	UVEDA22*	Value Education	1	-	-	-	-
				Total	**30**			**23**	**800**
II	I	Tamil/Language	ULTAB24	Tamil Paper – II	6	3	-	3	40+ 60
	II	English	UENGB24	English Paper – II	5	3	-	3	40+60
	III	Core Course 3	UCBCC24	Cell Biology	5	3	-	5	40+60
		Core Course 4	UCBCD24	Core Practical II – Cell Biology	3	-	3	3	40+60
		Generic Elective 2	UACHC24	Allied II- Allied Chemistry - II	4	3	-	3	40+60
			UACHD24	Allied Chemistry Practical - II	2	-	3	2	40+60
	IV	Skill Enhancement Course SEC 2	USBC224	SEC: Medicinal Diet	2	-	-	2	100
		Skill Enhancement Course SEC 3	USBC324	SEC: First Aid	2	-	-	2	100
		Value Education	UVEDA22**	Value Education	1	-	-	-	-
				Total	**30**			**23**	**800**

III	I	Tamil/Language	ULTAC24	Tamil Paper – III	5	3	-	3	40+ 60
	II	English	UENGC24	English Paper – III	6	3	-	3	40+60
	III	Core Course 5	UCBCE24	Biomolecules	5	3	-	5	40+60
		Core Course 6	UCBCF24	Core Practical III Biomolecules	3	-	6	3	40+60
		Generic Elective 3	UAMBA24	Allied III- Allied Microbiology - I	4	3	-	3	40+60
			UAMBC24*	Practical: Allied Microbiology Practical	2	-	3	2	40+60
	IV	Skill Enhancement Course SEC 4	USBC424	SEC: Tissue culture	1	-	-	1	100
		Skill Enhancement Course SEC 5	USBC524	SEC: Plant Biochemistry & Plant Therapeutics	2	-	-	2	100
		EVS	UNEVS24*	Environmental Studies	1	-	-	-	-
		Value Education	UVEDA22***	Value Education	1	-	-	-	-
				Total	**30**			**22**	**800**

Sem	Part	Category	Paper Code	Title	Hours/ Week	Exam		Credits	Marks
IV	I	Tamil/Language	ULTAD24	Tamil Paper – IV	6	3	-	3	40+60
	II	English	UENGD24	English Paper – IV	5	3	-	3	40+60
	III	Core Course 7	UCBCG24	Biochemical Techniques	5	3	-	5	40+60
		Core Course 8	UCBCH24	Core Practical IV- Biochemical Techniques	3	-	6	3	40+60
		Generic Elective 4	UAMBB24	Allied IV- Allied Microbiology - II	4	3	-	4	40+60
			UAMBC24	Practical: Allied Microbiology Practical	2	-	3	2	40+60
	IV	Skill Enhancement Course SEC 6	USBC624	SEC: Bioinformatics	2	-	-	2	100
		Skill Enhancement Course SEC 7	USBC724	SEC: Biochemical Pharmacology	1	-	-	1	100
		EVS	UNEVS24	Environmental Studies	1	2	-	2	40+60
		Value Education	UVEDA22 ****	Value Education	1	-	-	-	-
Total					**30**			**25**	**900**

V	III	Core Course 9	UCBCI24	Enzymes	5	3	-	4	40+60
		Core Course 10	UCBCJ24	Intermediary Metabolism	6	3	-	4	40+60
		Core Course 11	UCBCK24	Clinical Biochemistry	5	3	-	4	40+60
		Core Course 12	UCBCL24	Core Practical V - Clinical Biochemistry	5	-	6	4	40+60
		Discipline Specific Elective 1	UEBCA24	Elective: Medical Lab Technology	5	3	-	3	40+60
			UEBCB24	Elective: Research Methodology					
		Discipline Specific Elective 2	UEBCC24	Elective Practical-Medical Lab Technology	3	-	3	3	40+60
			UEBCD24	Elective Practical - Lab Course in Molecular Biology					
	IV	Value Education	UVEDA22 *****	Value Education	1	-	-	-	-
		Summer Internship/Industrial Training	UIBC24	Internship	-	-	-	2	40+60
Total					**30**			**24**	**700**
VI	III	Core Course 13	UCBCM24	Molecular Biology	5	3	-	3	40+60
		Core Course 14	UCBCN24	Physiology	5	3	-	3	40+60
		Core Course 15	UCBCO24	Biotechnology	5	3	-	4	40+60
		Core Course 16	UCBCP24	Project	3	-	3	2	40+60
		Discipline Specific Elective 3	UEBCE24	Elective: Medical Coding	5	3	-	3	40+60
			UEBCF24	Elective: Bioenterpreunership					
		Discipline Specific Elective 4	UEBCG24	Elective: Immunology	4	3	-	3	40+60
			UEBCH24	Elective: Basics of Forensic Science					
	IV	Professional Competency SEC 8	UPBC24	General Awareness for Competitive Examinations	2	2	-	2	40+60
		Value Education	UVEDA22	Value Education	1	2	-	2	40+60
	V	Extension Activity	-	Extension Activity (90 hours)	-	-	-	1	-
Total					**30**			**23**	**800**
Grand Total					**180**			**140 +2***	**4800/ 4600**

- Any one course of the following to be completed during III semester (15 hours teaching and 15 hours activities):
  i) Fundamentals of Computer and MS Office (Computer Science & B.C.A)
    - Advanced Excel
    - Multimedia Using Flash
    - Photoshop
  ii) Health and Fitness (Physical Education)

Methods of Evaluation						
S. No.	**Category**	**Assessment Tool**	**Maximum Marks**	**Exam Theory**	**Weightage**	
1	Core Courses/Generic & Discipline Specific Electives	I Continuous Assessment (ICA)	50	1 ½ h	35	40
		II Continuous Assessment (IICA)	50	1 ½ h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	100	3 h		60
2	Foundation Course/Professional Competency SEC/	I Continuous Assessment (ICA)	30	1 h	35	40
		II Continuous Assessment (IICA)	30	1 h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	60	2 h		60
3	EVS	Continuous Assessment (IICA)	25	1 h		40
		Innovative Component (IC)	25	-		
		End Semester Examination	60	2 h		60

Activity-based Assessment for Skill Enhancement Courses:
Activity 1 for Unit I: (Nature of Activity) – 20 marks
Activity 2 for Unit II: (Nature of Activity) – 20 marks
Activity 3 for Unit III: (Nature of Activity) – 20 marks
Activity 4 for Unit IV: (Nature of Activity) – 20 marks
Activity 5 for Unit V: (Nature of Activity) – 20 marks

Nature of Activity – Field visit/Industrial visit/Project (individual or group)/Exhibits/Model making/Hands on training/Lab practice/Product making/Extempore/Block and Tackle/Debate/Report writing/Case study/Interpretation of data or results/Transcription/Quiz

(LMS)/Problem solving/ Designing/Role play/Start-up proposal/Research proposal/Poster presentation/Oral presentation (live or video recorded)/Survey (Field or Online)/Group discussion/Problem solving/Problem formulation/Interviews/Concept mapping/Mind mapping /Promoting public awareness etc.

Record of Assessment will be maintained by the course instructors and verified by the Head of the department.

Taxonomy Levels of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview
Application (K3)	Suggest idea/concept with examples, suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

PROGRAMME OUTCOMES (PO)

On completion of the UG Programme, the students will be able to:

PO1: Attain knowledge and understand the principles and concepts in the respective discipline.

PO2: Acquire and apply analytical, critical and creative thinking, and problem-solving skills.

PO3: Effectively communicate general and discipline-specific information, ideas and opinions.

PO4: Appreciate biodiversity and enhance eco-consciousness for sustainable development of the society.

PO5: Emulate positive social values and exercise leadership qualities and team work.

PO6: Pursue higher knowledge, qualify professionally, enhance entrepreneurial skills and contribute towards the needs of the society.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On Completion of the **B.Sc. BIOCHEMISTRY** programme, the student will be able to

PSO1: Acquire knowledge about the principles and theories related to Biochemistry

PSO2: Attain skills to tackle issues and apply knowledge to find solutions for the problem

PSO3: Bring economically challenged, socially backward young women to be competent with today's modern world for their sustenance

PSO4: Create an awareness of resources and enhance eco - consciousness for sustainable development of society

PSO5: Function effectively as a member or leader in a team and demonstrate professional ethics, Community living and Nation building initiatives

PSO6: Build a critical thinking skill and use them to update scientific knowledge throughout life.

PO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	H	H	H	M	M	L
PO2	H	H	H	H	M	L
PO3	H	H	H	H	H	L
PO4	H	M	H	H	H	H
PO5	M	M	H	H	H	H
PO6	L	L	H	H	H	H

(HIGH - 3, MODERATE - 2, LOW - 1)

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	14	22	18	93
Part IV	4	4	3	5	2	4	22
Part V	-	-	-	-	-	1	1
Other	-	-	2	-	-	-	2
Total	23	23	24	25	24	23	**142**

*****Part I, II, and Part III components will be separately considered for CGPA calculation and classification for the undergraduate programme and the other components. IV, V must be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

<table>
<tr><td>Title of the Course</td><td colspan="8">NUTRITIONAL BOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core paper I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>5</td><td>Course Code</td><td colspan="2">UCBCA24</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at giving an overall view of the
• 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 flavors enhancing substances in food.
• Study the significance of nutraceuticals.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3 & K4)
Food and Nutrition
1.1 Concepts of food and nutrition.
1.2 Basic food groups – energy yielding, body building and functional foods.
1.3 Modules of energy, calorific and nutritive value of foods, measurement of calories by bomb calorimeter.
1.4 Basal metabolic rate (BMR) – definition, determination of BMR and factors affecting BMR.
1.5 Respiratory quotient (RQ) of nutrients and factors affecting the RQ.
1.6 SDA – Definition and determination- anthropometric measurement and indices – height, weight, chest and waist circumference BMI.</td></tr>
<tr><td></td><td colspan="8">UNIT II (12 hours) (K1, K2, K3 & K4)
Macromolecules physiological and nutritional significance
2.1 Physiological role and nutritional significance of carbohydrates, lipids and protein.
2.2 Evaluation of proteins by nitrogen balance method.
2.3 Biological value of proteins - digestibility coefficient.
2.4 Protein energy ratio and net protein utilization.
2.5 Protein energy malnutrition: kwashiorkor and marasmus.
2.6 Obesity – types and preventive measures.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Balanced diet
3.1 Balanced diet and food pyramid.
3.2 Example of low and high- cost balanced diet for infants and children.
3.3 Example of low and high- cost balanced diet for adolescents and adults.
3.4 Example of low and high- cost balanced diet for elderly people.
3.5 ICMR classification of five food groups and its significance.
3.6 Junk foods – definition and its adverse effects.</td></tr>
</table>

	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **Food additives** 4.1 Structure, chemistry function and application of food preservatives. 4.2 Structure, chemistry, function and application of food emulsifying agents. 4.3 Structure, chemistry, function and application of food buffering agents, stabilizing agents and sweeteners. 4.4 Structure, chemistry, function and application of food bleaching, starch modifiers and antimicrobials. 4.5 Food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agents and antioxidants. 4.6 Safety assessment of food additives.
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **Nutraceuticals and Functional foods** 5.1 Nutraceuticals and functional foods: definition, properties and functions. 5.2 Food supplements. 5.3 Dietary supplements - prebiotics and probiotics. 5.4 Functional foods. 5.5 Food as medicine. 5.6 Natural pigments from plants – carotenoids, anthocyanins and its benefits.

Extended Professional Component (is apart of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinations NET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

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

Reference books	1. Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker. 2. George, A.B. 1996. Encyclopedia of Food and Colour Additives. Vol. III. CRC Press. 3. Fatih Yildiz, 2010 Advances in food biochemistry, CRC Press. 4. Boca Raton, USA, 2010. Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006. 5. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell, UK. 6. Tom Brady, 1999, Nutritional Biochemistry. 2nd edition, Elsevier Science Publications.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf 3. https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-protein.html. 4. https:// www.nhsinform.scot/healthy-living/food-and-nutrition/ eating well/ vitamins- and-minerals 5. https://journals.physiology.org/doi/full/10.1152/advan.00132.2011 6. https://www.news-medical.net/life-sciences/What-is Nutritional-Biochemistry.aspx

Course Outcomes:

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

CO1: Cognizance of basic food groups viz. (K1, K2, K3, K4)

CO2: Identify and explain nutrients in foods and the specific functions in maintaining health. (K1, K2, K3, K4)

CO3: Classify the food groups and its significance. (K1, K2, K3, K4)

CO4: Understand the effect of food additives. (K1, K2, K3, K4)

CO5: Describe the importance of nutraceuticals and pigments. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	H	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

Title of the Course	**CORE PRACTICAL – I: NUTRITIONAL BIOCHEMISTRY**						
Paper No.	**Core paper II**						
Category	**Core practical**	**Year**	I	**Credits**	3	**Course Code**	**UCBCB24**
		Semester	I				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
Prerequisites	Higher Secondary Chemistry and Biology						
Objectives of the course	The course aims at giving an overall view of the • 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 Outline	**I. TITRIMETRY (20 hours) (K1, K2, K3 & K4)** 1. Estimation of ascorbic acid in citrus fruit. 2. Estimation of calcium in milk. 3. Estimation of glucose by Benedict's method in honey. 4. Estimation of phosphorous.						
	II.BIOCHEMICAL PREPARATIONS (15 hours) (K1, K2, K3 &K4) **Preparation of the following substances and its qualitative tests:** 1. Lecithin from egg yolk. 2. Starch from potato 3. Casein and lactalbumin from milk.						
	III. GROUP EXPERIMENT (10 hours) (K1, K2, K3 &K4) 1. Determination of ash content and moisture content in food sample. 2. Extraction of lipid by Soxhlet's method.						

Extended Professional Component (is apart of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and othe be solved (To be discussed during the Tutorial hours)

Recommended Text books	1. J. Jayaraman, 2011, Laboratory manual in Biochemistry, 2nd Edition, New Age International Publishers. 2. An Introduction to Practical Biochemistry, David T. Plummer, 3rd edition, Tata McGrawHill Publishing Company Limited, 2001.

Reference books	1. Sadasivam S and Manickam A, 2016, Biochemical Methods, 4th Edition, New Age International Publishers. 2. Swami Nathan M. S, 2018, Essentials of Food and Nutrition, Vol. I & II, The Bangalore Press. 3. Bowman and Robert M, 2006, Present Knowledge in Nutrition, 9th Edition, International Life Sciences Publishers. 4. Indrani T. K, 2003, Nursing Manual of Nutrition and Therapeutic Diet, 1st Edition, Jaypee Brothers medical publishers. 5. Martha H. and Marie A, 2012, Biochemical, Physiological, and Molecular Aspects of Human Nutrition, 3rd Edition, Chand Publishers.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors 3. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/ Dr.%20Jagarti% 20Jha/Techniques%20In%20Biochemistry%20Lab.pdf 4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y 5. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y 6. https://sites.google.com/ignou.ac.in/bscbch-biochemistry/virtual-lab?authuser=0

Course Outcomes:

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

CO1: Estimate the important biochemical constituents in the food samples. (K1, K2, K3, K4)

CO2: Prepare the macronutrients from the rich sources. (K1, K2, K3, K4)

CO3: Determine the ash and moisture content of the food samples. (K1, K2, K3, K4)

CO4: Extract oil from its sources. (K1, K2, K3, K4)

CO5: Ability to apply the principle and techniques to analyze nutrients in food molecules. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	M	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	M	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	M	M	M	H	L
CO3	H	H	H	H	M	M
CO4	H	H	M	M	H	H
CO5	H	M	H	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="8">SKILL ENHANCEMENT COURSE: HEALTH AND NUTRITION</td></tr>
<tr><td>Paper No.</td><td colspan="8">Skill Enhancement Course SEC - 1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">USBC124</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">1</td><td>1</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The main objective of the course is to,
Gain basic knowledge about health.
Understand about vitamins.
Learn about functions of fat on health.
Understand the types of minerals and its functions.
Know about the importance of carbohydrates and proteins on health.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNIT I (6 hours)
Health and Health care
Health- definition, factors affecting human health, importance of health care of children, importance of health care of adults, importance of health care of elderly people, balanced diet and calorific value.</td></tr>
<tr><td colspan="8">Unit II (6 hours)
Vitamins
Vitamins-definition and sources, classification of vitamins, properties of vitamins, functions of vitamins, deficiency symptoms of vitamins and recommended daily allowances of vitamins.</td></tr>
<tr><td colspan="8">UNIT-III: (6 hours)
Fats
Fat – definition and sources, classification of fat, functions of dietary fat, role of fat in health, fat related diseases and properties of fats.</td></tr>
<tr><td colspan="8">UNIT-IV: (6 hours)
Minerals
Minerals – role of minerals on human health, sources, biological functions, its importance in biological systems and deficiency disorders of calcium, sources, biological functions, its importance in biological systems and deficiency disorders of potassium, sources, biological functions, its importance in biological systems and deficiency disorders of phosphorus and iodine, sources, biological functions, its importance in biological systems and deficiency disorders of zinc and iron, sources, biological functions, its importance in biological systems and deficiency disorders of copper and selenium.</td></tr>
<tr><td colspan="8">UNIT-V: (6 hours)
Role of proteins and carbohydrates
Role of proteins in human health, role of carbohydrates in human health, functions of proteins and carbohydrates, dietary sources and calorific value of proteins and carbohydrates, deficiency disorders – kwashiorkor and marasmus, supplementation programs in India and their indications.</td></tr>
</table>

Extended Professional Component (is apart of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text books	1 Davidson and Passmore J. R, 1986, Human Nutrition and Dietetics, 8th Edition, Churchill Livingstone. 2. Garrow J. S, Philip. W, James T, Ralph A, 2000, Human Nutrition and Dietetics, 10th Edition, Churchill Livingstone. 3. Dr. Swaminathan M, 1995, Principles of Nutrition and Dietetics, 2nd Edition, Bappco Publishers.
Reference books	1. Margaret Mc Williams, 2012, Food Fundamentals, 10th Edition, Prentice Hall. 2. Geoffrey P. Webb, 2019, Nutrition- Maintaining and Improving Health, 5th Edition, CRC press, Taylor & Francis group. 3. Patricia Trueman, 2021, Nutritional Biochemistry. 6th Edition, MJP publishers, Darya Ganj, New Delhi. 4. Sari Edelstein, 2006, Nutrition in public health. 2nd Edition, Jones and Barflett publishers, Sudbury, Mississauga, Canada. **5.** Mary. B Grosvenor, Lori A. Smolin, Laura R. and Christopher, 2021, Visualizing Nutrition- Everyday choices, 5th Edition, Wiley publications, Hoboken, New Jersey.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.universalclass.com/articles/health/nutrition/nutritional-needs- for different ages. 3. www.anme.com.mx/libros/PrinciplesofNutrition.pdf 4. https://journals.lww.com/nutritiontodayonline/pages/default.aspx 5. https://www.newfoodmagazine.com/core_topic/health-nutrition/ 6. https://www.healthline.com/nutrition

Course Outcomes:

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

CO1: Understand about the importance of health and diet.

CO2: Discuss about the classification properties and deficiencies of vitamins.

CO3: Understand about the sources and functions of fats and lipids on health.

CO4: Details about the different types of minerals and its role in health.

CO5: Relate the role of proteins and carbohydrates on health.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	M	H	M	M	L
CO4	H	H	M	M	L	H
CO5	M	H	H	L	M	L

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	M	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">FC: BRIDGE COURSE IN BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Foundation Course</td></tr>
<tr><td>Category</td><td>Foundation Course</td><td>Year
Semester</td><td>I
I</td><td>Credits</td><td>2</td><td>Course Code</td><td>UFBC24</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
2</td><td>Tutorial
-</td><td colspan="2">Lab Practice
-</td><td colspan="3">Total
2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objective of the course is to,
• To give students the basic concepts of biochemistry and its nature of interdisciplinary importance.
• To acquaint with basic laboratory instruments safely and precisely to obtain reproducible results from biochemical experiments.
• To let students, understand the basic concepts of biomolecules, their occurrence in biological system.
• To recognize the scope of biochemistry in various thrust areas.
• To familiarize the role of computers in the biochemical laboratories.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (6 hours) (K1, K2, K3 & K4)
Molecules of life
1.1 General classification and examples - Carbohydrates and Lipids,
1.2 General classification and examples - Amino acids
1.3 General classification and examples - Proteins and Nucleic acids.
1.4 Different types of chemical bonds – ionic bond, covalent bond.
1.5 Coordinate bond, hydrogen bond and Vander Waals force.
1.6 Formation of glycosidic, peptide and phosphodiester linkage.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
Basic concepts of acids, bases, buffers and pH
2.1 Methods of expressing concentration – Molarity
2.2 Molality.
2.3 Mass percentage.
2.4 Parts per million(ppm).
2.5 Preparation of Molar, Molal (calculation using an example).
2.6 Percentage, ppm, Mass percentage solutions (calculation using an example).</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
Bioinstruments
3.1 Working principles and major applications – pH meter, Colorimeter.
3.2 Working principles and major applications - Centrifuges, Incubator.
3.3 Working principles and major applications - Hot air oven, Microscope, Laminar air flow.
3.4 Working principles and major applications - Chromatography & Electrophoretic units.</td></tr>
</table>

	3.5 Safe handling of chemicals and reagents in Biochemistry lab. 3.6 Prevention, Precaution and First aid of lab hazards.
	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Thrust areas in Biochemistry** 4.1 Scope and role of a Biochemist in Agriculture, Medical diagnosis. 4.2 Scope and role of a Biochemist in Pharmaceutics, Dairy Science. 4.3 Scope and role of a Biochemist in Food industry, Environmental sector (Water and soil quality management), 4.4 Scope and role of a Biochemist in Forensic science, Development of Natural product. 4.5 Scope and role of a Biochemist in Medical coding. 4.6 Scope and role of a Biochemist in Biological Research.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **Computational Biology** 5.1 Basic usage of computers - Bioinformatics, Biostatistics. 5.2 Diagnostic imaging techniques, Cyberbiosecurity. 5.3 Structural characterization of biological compounds. 5.4 Automation in Forensic lab. 5.5 Medical diagnostic labs. 5.6 Biochemical research laboratories.

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations NET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Sathyanarayana U and Chakrapani U, 2013, Biochemistry, 5th Edition, Elsevier, India. 2. Chatterjea MN and RanaShinde, 2002, Textbook of Medical Biochemistry, 8th Edition, Jaypee Brothers. 3. Veerakumari L,2009, Bioinstrumentation, 1stedition, MJP Publishers. 4. Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath, 2002, Biophysical Chemistry, Principles and Techniques, 3rd Edition, Himalaya Publishing House.
ReferenceBooks	1. David L.Nelson, Michael M.Cox, 2005, Principles of Biochemistry, 4th Edition, W. H. Freeman and Company. 2. Terrance G. Cooper, 1977, The tools of Biochemistry, John Wiley & Sons, Singapore. 3. Saroj Dua, Neera Garg, 2010, Biochemical Methods of Analysis, 1st Edition, Narosa Publishing House.

	4. Godkar B, 2020, Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd Edition, Bhalani Publishers.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.pharmaguideline.com/2021/10/methods-of-expressing-concentration.html#google_vignette 3. https://microbenotes.com/ph-meter-principle-parts-procedure-types-uses-examples/https://youtu.be/a_m76KUab9s 4. https://www.labmanager.com/handling-and-storing-chemicals-2944.

Course Outcomes:

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

CO1: Understand and relate the role of biochemistry and its importance in biology and interdisciplinary field.

CO2: Identify and explain the use of basic laboratory instruments for analytical purposes.

CO3: Classify biomolecules, their occurrence in biological system.

CO4: Recognize the application and need of biochemistry in various thrust areas.

CO5: Describe the importance of computers in the biochemical laboratories.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	M	H	H	H
CO 2	H	H	H	M	H	H
CO 3	M	L	H	M	M	H
CO 4	H	H	H	L	M	M
CO 5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	L	H	L	H	M	H
CO3	H	L	H	H	H	H
CO4	H	H	H	M	H	M
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">CELL BIOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core paper III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td>Course Code</td><td>UCBCC24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• The course aims at giving an overall view of the
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
Architecture of cells
1.1 Architecture of cells – structural organization of prokaryotic cells.
1.2 Structural organization of eukaryotic cells.
1.3 Structural organization of microbial, plant and animal cells.
1.4 The ultra-structure and functions of nucleus, mitochondria and golgi apparatus.
1.5 The ultra-structure and functions of endoplasmic reticulum (rough and smooth).
1.6 The ultra-structure and functions of lysosomes and peroxisome.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3 & K4)
Genomic organization of cells.
2.1 Cytoskeleton- structure, composition and functions of microfilament, microtubules and intermediary filaments.
2.2 Organization of prokaryotic genome.
2.3 Organization of eukaryotic genome.
2.4 Organization of chromatin- histones, nucleosome concept.
2.5 Formation of chromatin.
2.6 Special types of chromosomes- lamp brush chromosomes, polytene chromosomes.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Bio-membranes
3.1 Bio membranes- Structural organization of lipid bilayer.
3.2 Functions of lipid bilayer.
3.3 Transport across cell membrane.
3.4 Uniport, symport and antiport.
3.5 Active transport.
3.6 Passive transport.</td></tr>
</table>

	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **Cell cycle** 4.1 Cell cycle- definition and phases of cell cycle. 4.2 Cell division- Mitosis. 4.3 Cell division – Meiosis. 4.4 Significance of mitosis and meiosis. 4.5 Cancer cells- definition and its characteristics. 4.6 Types of cancer cells.
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **Extracellular matrix** 5.1 Extracellular matrix – structure of collagen and laminin. 5.2 Structure of fibronectin and proteoglycans. 5.3 Biological role of extracellular matrices (collagen, laminin, fibronectin & proteoglycans). 5.4 Structure and role of cadherin, selectins and integrins. 5.5 Cell – cell interactions. 5.6 Types of cell junctions – gap junction, tight junction and desmosomes.

Extended Professional Component (is apart of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text books	1. Arumugam. N, 2019, Cell biology, 10th Edition, Sara's publication. 2. Devasena. T, 2012, Cell Biology, Oxford University Press India- ISBN: 9780198075516, 0198075510. 3. Bruce Albert's and Dennis Bray, 2013, Essential Cell Biology, 4th Edition, Garland Science, NY, US.
Reference books	1. Rastogi S. C, 2008, Cell Biology, 2nd Edition, New age Publishers - ISBN-10: 8122416888/ISBN-13: 978- 8122416886. 2. Cooper G. A, 2013, The cell: A Molecular Approach, Sinauer Associates, Inc-ISBN10: 0878931066 / ISBN 13: 9780878931064. 3. De Robertis E. M. F, 2006, Cell and Molecular Biology, 7th Edition, Lippincott Williams &Wilkins Philadelphia - ISBN: 0781734932 9780781734936. 4. Lodish H.A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Plough and Matsudaira, 2007, Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA. 5. Verma P.S and Agarwal V.K, 2005, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & company Ltd, 7361 Ram Nagar, New Delhi.

Website and e-learning source	1.	https://www.youtube.com/@biochemistryauxiliumcollege
	2.	https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf
	3.	https://www.medicalnewstoday.com/article/320878.php
	4.	https://biologydictionary.net /cell
	5.	https://microbenotes.com/category/cell-biology/
	6.	https://www.britannica.com/science/cell-biology

Course Outcomes:

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

CO1: Explain the structure and functions of components of prokaryotic and eukaryotic cells, especially the organelles. (K1, K2, K3, K4)

CO2: Familiarize the cytoskeleton and chromatin. (K1, K2, K3, K4)

CO3: Illustrate the structure, composition and functions of cell membrane related to membrane transport. (K1, K2, K3, K4)

CO4: Elaborate the phases of cell cycle and cell division- mitosis and meiosis and characteristics of cancer cells. (K1, K2, K3, K4)

CO5: Relate the structure and biological role of extracellular matrix in cellular interactions. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	M	H	M	M	L
CO4	H	L	H	M	L	H
CO5	H	H	M	M	M	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	M	H	H	H	H	H
CO2	H	M	M	H	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	M	H	M	M	H

Title of the Course	**CORE PRACTICAL II - CELL BIOLOGY**						
Paper No.	**Core paper IV**						
Category	**Core practical**	**Year**	I	**Credits**	3	**Course Code**	**UCBCD24**
		Semester	II				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
Prerequisites	Higher Secondary Chemistry and Biology						
Objectives of the course	The main objective of the course is to 1. Learn the parts of microscope 2. Investigate the cells under microscope 3. Image the cells using different stains 4. Identify the cells, organelles and stages of cell division.						
Course Outline	**I MICROSCOPY AND STAINING TECHNIQUES:** 1. Study the parts of light and compound microscope. 2. Preparation of slides and micrometry. 3. Examination of prokaryotic and eukaryotic cell. 4. Visualization of animal and plant cell by methylene blue. 5. Visualization of nuclear fraction by acetocarmine stain. 6. Staining and visualization of mitochondria by Janus green stain.						
	II GROUP EXPERIMENT 1. Identification of different stages of mitosis in onion root tip. 2. Identification of different stages of meiosis in onion bulb.						
	III SPOTTERS: 1. **(**a) Cells: nerve, plant and animal cell. (b) Organelles: mitochondria, chloroplast, endoplasmic reticulum. (c) Mitosis stages: prophase, anaphase, metaphase, telophase.						

Extended Professional Component (is apart of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

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

Reference books	1. Sadasivam S and Manickam A, 2016, Biochemical Methods, 4th Edition, New Age International Publishers. 2. Dr. Swaminathan M, 2018, Essentials of Food and Nutrition, Vol. I & II, The Bangalore Press. 3. Bowman and Robert M, 2006, Present Knowledge in Nutrition, 9th Edition, International Life Sciences Publishers. 4. Indrani T K, 2003, Nursing Manual of Nutrition and Therapeutic Diet, 1st Edition, Jaypee Brothers medical publishers. 5. Martha H. and Marie A, 2012, Biochemical, Physiological, and Molecular Aspects of Human Nutrition, 3rd Edition, Chand Publishers.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.microscopemaster.com/organelles.html 3. http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%20microscope%20is%20necessary, and%20small%20granules%20and%20vesicles. 4. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1 5. https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and-genetic diversity/a/phases-of-meiosis 6. https://www.microscopemaster.com/organelles.html 7. https://www.pdfdrive.com/biochemistry-books.html

Course Outcomes:

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

CO1: Identify the parts of microscope. (K1, K2, K3, K4)

CO2: Preparation of slides. (K1, K2, K3, K4)

CO3: Identify the stages of mitosis and meiosis. (K1, K2, K3, K4)

CO4: Visualize nucleus and mitochondria by staining methods. (K1, K2, K3, K4)

CO5: Identify the spotters of cells, organelles and stages of cell division. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	L	M	H	L	H
CO3	M	H	M	M	M	L
CO4	H	M	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	M	H	H	H	M	M
CO4	H	M	M	L	H	H
CO5	H	H	H	L	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: MEDICINAL DIET</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC – II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USBC224</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objective of the course is to,
Provide basic knowledge about diet.
Understand of diet modification for GI diseases.
Plan a diet for liver diseases.
Prepare diet chart for infectious diseases.
Plan a diet for diabetes, renal and cardio-vascular diseases.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (6 hours)
Principles of therapeutic diet
Principles and definition of normal diet and therapeutic diet, soft diet and liquid diet, objectives of diet therapy, advantages of using normal diet, normal diet as the basis for therapeutic diet, therapeutic modifications of normal diet.</td></tr>
<tr><td></td><td colspan="7">Unit II (6 hours)
Diet Modification in gastrointestinal diseases
Diet modification in gastrointestinal diseases, peptic ulcer, diarrhea, lactose intolerance, constipation, and malabsorption syndrome.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (6 hours)
Diet for Liver and Gall bladder diseases
Diet modifications in liver diseases, diet modifications in gall bladder diseases, etiology, symptoms and dietary treatment in jaundice, etiology, symptoms and dietary treatment in hepatitis, etiology, symptoms and dietary treatment in cirrhosis of liver, etiology, symptoms and dietary treatment in hepatic coma.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (6 hours)
Diet for infectious diseases
Infectious diseases, diet modifications in infectious diseases, fever, typhoid, tuberculosis, viral hepatitis.</td></tr>
<tr><td></td><td colspan="7">UNIT-V: (6 hours)
Diet for Diabetes, Renal and Cardiovascular diseases
Diet modifications in diabetes, diet modifications in cardiovascular diseases, acute and chronic glomerulonephritis, nephrosis, renal failure and kidney stone, hypertension.</td></tr>
</table>

Extended Professional Component (is apart of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text books	1. Raheena Begum M, 2019, A Text Book of Foods, Nutrition and Dietetics, 1st Edition, Sterling Publishers Pvt.Ltd. 2. Raja. M V, Gopal, Sumati. R and Mudambi, 1990, Fundamentals of foods and Nutrition, Wiley Eastern Limited. 3. William S. R, 1985, Nutrition and Diet Therapy, 5th Edition, Mosly Co. St. Louis.
Reference books	1. Rodwell Williams, 1985, Nutrition and Diet Therapy, 7th Edition, Mosly Co. St. Louis. 2. Krause M V & Mohan M A, 1992, Food Nutrition and Diet Therapy, 2nd Edition, W.B Saunders Company, Philadelphia, London. 3. Davidson and Passmore, 1976, Human Methods and Diabetics, 3rd Edition, The English Language Book Society. 4. Indrani T. K, 2017, Manual of nutrition & Therapeutic diet, 2nd Edition, Jaypee Brothers: Medical publisher(P) Ltd, Fountain plaza, 3rd floor, Egmore, Chennai, Tamil Nadu. 5. Vimala. V, 2020, Advances in Diet Therapy, 2nd Edition, New age International Ltd, Bengaluru, Karnataka.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages. 3. www.nhp.gov.in/healthy living/healthy diet 4. www.anme.com.mx/libros/PrinciplesofNutrition.pdf 5. https://draxe.com/nutrition/liver-cleanse/ 6. https://link.springer.com/chapter/10.1007/978-3-030-27920-2_12

Course Outcomes:
On completion of the course, the students should be able to
CO1: Possess basic knowledge about diet. (K1, K2, K3, K4)
CO2: Sketch diet plan for GI diseases. (K1, K2, K3, K4)
CO3: Sketch diet plan for liver diseases. (K1, K2, K3, K4)
CO4: Sketch a diet plan for infectious diseases. (K1, K2, K3, K4)
CO5: Prepare diet chart for diabetes, renal and cardio-vascular diseases. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	L	H	L	H
CO3	H	M	H	M	M	L
CO4	H	H	M	M	L	H
CO5	M	H	H	L	M	L

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	M	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: FIRST AID</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC – III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USBC324</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objectives of this course are to:
• Provide knowledge on the basics of first aid.
• Perform first aid during various respiratory issues.
• Demonstrate the first aid to treat injuries.
• Learn the first aid techniques to be given during emergencies.
• Familiarize the first aid during poisoning.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Introduction to first aid
Aims and important rules of first aid. Importance of first aid in dealing with emergency. Types of a first aid kit. Content of a first aid kit. First aid technique – Dressing and Bandages. First aid technique fast evacuation technique, transport techniques</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
First aid for Respiratory Disturbances
Basics of Respiration – CPR. First aid during difficult breathing. First aid during drowning, choking. First aid during strangulation and hanging. First aid during swelling within the throat. First aid during suffocation by smoke or gases and asthma.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
First aid for Wounds and Fractures
Common medical aid- first aid for wounds. First aid for cuts, head injuries. First aid for chest abdominal injuries. First aid for shocks, burns. First aid for amputations. First aid for fractures, dislocation of bones.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (15 hours) (K1, K2, K3 & K4)
First aid for CNS Disturbances
First aid related to unconsciousness. First aid related to stroke. First aid related to fits. First aid related to convulsions. First aid related to seizures. First aid related to epilepsy.</td></tr>
<tr><td></td><td colspan="7">UNIT-V: (18 hours) (K1, K2, K3 & K4)
First aid to Poisoning
First aid in poisonous bites (Insects and snakes). First aid in honey bee stings. First aid in animal bites poisoning. First aid in disinfectant poisoning. First aid in acid poisoning. First aid in alkali poisoning.</td></tr>
</table>

Recommended Text	1. Gauri Goel, Kumkum Rajput, Manjul Mungali, 2020, First aid and health, SBPD Publishing House. 2. Red Cross First Aid/CPR/AED Instructor Manual. 3. Jayashree Ghosh, 2020, A Textbook of Pharmaceutical Chemistry, 3rd Edition, Vikas Publishing House Ltd. 4. Chatwal R.D, 2018, A Textbook of Pharmaceutical Chemistry, 5th Edition, Himalaya Publishing House.
Reference Books	1. Rai P.V**,** 2012, Manual of FIRST AID: Management of General injuries, Sports injuries and Common Ailments, 1st Edition, Jaypee Publishers. 2. Sudha Vidyasagar, 2023, Manipal Manual of Emergency Medicine and Critical Care Paperback, CBS Publishers.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online 3. https://www.firstaidforfree.com/ 4. https://www.mountsinai.org/health-library/injury/poisoning-first-aid 5. https://nhcps.com/lesson/cpr-first-aid-first-aid-basics/ 6. https://emedicine.medscape.com/article/1344081-overview?form=fpf

Course Outcomes:

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

CO1: Discuss on the rules of first aid, dealing during emergency and first aid techniques (K1, K2, K3 & K4)

CO2: Understand the first aid techniques to be given during differenttypes of respiratory problems (K1, K2, K3 & K4)

CO3: Provide first aid for injuries, shocks and bone injury. (K1, K2, K3 & K4)

CO4: Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions. (K1, K2, K3 & K4)

CO5: Gain expertise in giving first aid for insect bites and chemical poisoning.(K1, K2, K3 & K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	H	M	H	H
CO 2	H	H	H	H	H	H
CO 3	H	H	H	H	H	H
CO 4	H	H	H	H	H	H
CO 5	H	H	H	M	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Title of the Course	BIOMOLECULES						
Paper No.	Core Paper V						
Category	Core	Year	I	Credits	5	Course Code	UCBCE24
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice			Total	
	4	1	-			5	

Prerequisites	Higher Secondary Chemistry and Biology
Objectives of the course	The main objectives of this course are to: • Introduce the structure, properties and biological significance of carbohydrates • Comprehend the classification, functions and acid base properties of amino acids • Elucidate the various levels of organization of Proteins. • Impart knowledge on the classification, Properties and characterization of lipids. • Acquaint with the classification, structure, properties and functions of nucleic acids
Course Outline	**UNIT I (15 hours) (K1, K2, K3 & K4)** **Carbohydrates** 1.1 Classification and biological significance, physical properties - stereoisomerism, optical isomerism, anomers, epimers and mutarotation 1.2 Monosaccharides: Occurrence, linear and cyclic structure, Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and keto groups. 1.3 Disaccharides: Structure and properties of reducing disaccharides (lactose and mannose), non-reducing disaccharide (sucrose). 1.4 Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance of starch, glycogen and cellulose. 1.5 Heteropolysaccharides - Structure and biological significance 1.6 Mucopolysaccharides - Hyaluronic acid, Chondroitin sulphate and Heparin. (Structural elucidation not needed).
	UNIT-II: (15 hours) (K1, K2, K3 & K4) **Aminoacids** 2.1 Classification based on composition of side chain and nutritional significance. 2.2 General structure of amino acids. 3 - and 1- letter abbreviations 2.3 Modified amino acids in protein and non - protein amino acids. 2.4 Physical properties of amino acids, isoelectric point, titration curve (alanine, lysine, glutamic acid), optical activity 2.5 Chemical properties of amino acids 2.6 Colour reactions of amino acids due to carboxyl group, amino group and side chains.
	UNIT-III: (15 hours) (K1, K2, K3 & K4) **Proteins** 3.1 Classification based on shape, composition, solubility and functions 3.2 Properties of proteins - Ampholytes, Isoelectric point, salting in and salting out, denaturation and renaturation, UV absorption.

	3.3 Levels of Organization of protein structure- Primary structure, Formation and characteristics of peptide bond, phi and psi angle 3.4 Secondary structure-α helix (egg albumin), β- pleated sheath (keratin), triple helix (collagen). 3.5 Tertiary structure – with reference to myoglobin 3.6 Quaternary structure with reference to haemoglobin
	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Lipids** 4.1 Lipids: Bloor's classification, chemical nature and biological functions. 4.2 Fatty acids: classification, nomenclature, structure and properties acids 4.3 Simple and mixed triglycerides: structure and general properties 4.4 Characterization of fats- iodine value, saponification value, acid number, acetyl number, Polanski number, Reichert –Meissl number along with their significance 4.5 Compound lipids – Structure and functions of phospholipids and glycolipids 4.6 Derived lipids Structure and functions of cholesterol, Bile acids and bile salts.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **Nucleic acids** 5.1 Nucleic acids-Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance 5.2 Watson and Crick double helical model of DNA 5.3 Types of DNA: A, B, Z DNA, structure and biological significance 5.4 Types of RNA: mRNA, t-RNA, r-RNA, hn-RNA, Sn-RN, Secondary and tertiary structure of t-RNA 5.5 Properties of DNA Hypochromic and hyper chromic effect, melting temperature 5.6 Denaturation and Renaturation of DNA

Extended Professional Component (is a part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1 Text book of Biochemistry, U. Sathyanarayana & U. Chakrapani, 2013,5th edition, Elsevier India Pvt Ltd., Books & Allied Pvt. Ltd. 2 Fundamentals of Biochemistry, J.L. Jain, Sunjay Jain, Nitin Jain, 2013 7th edition S. Chand & Company Ltd. 3 Textbook of Medical Biochemistry, MN Chatterjee, Rana Shinde, 2002, 8thedition, Jaypee Brothers. 4 Text book of biochemistry Ambika Shanmugam, 2016, Medical Biochemistry, Wolters Kluwer India Private Ltd, 8th edition. 5 Fundamentals of Biochemistry, S Chand and Company Ltd, 8th ed

Reference Books	1 David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company. 2 Voet. D, Voet. J.G .and Pratt, C.W, 2004, Principles of Biochemistry, 4th edition John Wiley& Sons, Inc. 3 David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology,W.H.Freeman 4 Rodney F.Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques,(2nd ed),Prentice Hall 5 Zubay GL, 1999, Biochemistry,4th ed McGrew-Hill. 6 Lubert Stryer, 2010, Biochemistry, 7th ed, W. H. Freeman.
Website and e-learning source	1. https://www.britannica.com/science/biomolecule 2. https://en.wikipedia.org/wiki/Biomolecule 3. https://www.khanacademy.org/science/biology/macromolecules 4. https://rwu.pressbooks.pub/bio103/chapter/nucleotides-and-nucleic-acids/ 5. https://microbenotes.com/lipids/

Course Outcomes:

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

CO1: Classify, illustrate the structure and explain the Physical and Chemical properties of carbohydrates. (K1, K2, K3, K4)

CO2: Indicate the classification, structure, properties and biological functions of amino acids. (K1, K2, K3, K4)

CO3: Explain the classification and elucidate the different levels ofstructural organization of proteins. (K1, K2, K3, K4)

CO4: Elaborate on classification, structure, properties, functions andcharacterization of lipids (K1, K2, K3, K4)

CO5: Describe the structure, properties and functions of different types ofnucleic acids. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	H	M	L	H
CO 2	H	H	H	M	L	H
CO 3	H	H	M	M	M	H
CO 4	H	H	M	H	M	H
CO 5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">CORE PRACTICAL III: BIOMOLECULES PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Paper VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core practical III</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UCBCF24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">3</td><td colspan="3">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">The course aims at giving an overall view of the
• Identify the biomolecules carbohydrates
• Analyse the amino acid qualitatively
• Determine the quality of Lipids by titrimetric methods.
• Isolate nucleic acids from plant and animal source.
• Estiamte the amount of amino acid titremetrically</td></tr>
<tr><td>Course Outline</td><td colspan="7">I QUALITATIVE TEST FOR CARBOHYDRATES
a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g) Starch.
II QUALITATIVE TEST FOR AMINO ACIDS
a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine</td></tr>
<tr><td></td><td colspan="7">III TITRIMETRIC METHODS (15 hours) (K1, K2, K3 & K4)
1. Determination of Saponification value of an edible oil
2. Determination of Iodine number of an edible oil
3. Determination of Acid number of an edible oil
IV VOLUMETIRC ESTIMATION
1. Estimation of Glycine by Sorenson’s formal titration.
2. Estimation of Iron</td></tr>
<tr><td></td><td colspan="7">V GROUP EXPERIMENTS
1. Isolation of DNA from plant/animal source.
2. Isolation of RNA from rich source.</td></tr>
</table>

Extended Professional Component (is apart of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommend edText books	1. David T Plummer,An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-HillEdition 2. Jayaraman J, 2015, Laboratory Manual in Biochemistry, 5th edition New Age International (P) Limited 3. Sadasivam S Manickam A, 2018, Biochemical Methods, 3rd Edition New age International Pvt Ltd publisher’s.

Reference books	1. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees, 2019, A Practical book on Biochemistry 1st Edition, Everest publishing house 2. S.K. Sawhney, Randhir Singh, 2005, Introductory practical Biochemistry, 2nd Edition. 3. Anil Kumar, Sarika Garg andNeha Garg.VinodVasishtha, 2012, Biochemical Tests – Principles and Protocols. Viva Books Pvt Ltd. 4. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006. 5. Keith Wilson and John Walker, 1995, Principles and Techniques of Practical Biochemistry, 4th Edition, Cambridge University press, Britain.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html 14 3. https://www.pdfdrive.com/analytical-biochemistry-e46164604.html 4. https://www.pdfdrive.com/biochemistry-books.html 5. https://vlab.amrita.edu/?sub=3&brch=63&sim=688&cnt=2 6. https://www.atriauniversity.edu.in/isolation-and-extraction-of-dna/

Course Outcomes:

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

CO1: Qualitatively analyze the carbohydrates and report the type of carbohydrate based on specific tests. (K1, K2, K3, K4)

CO2: Qualitatively analyze amino acids and report the type of amino acids based on specific tests. (K1, K2, K3, K4)

CO3: Determine the Saponification, Iodine and acid number of edible oils. (K1, K2, K3, K4)

CO4: Isolate the nucleic acid from biological sources. (K1, K2, K3, K4)

CO5: Acquire the skill to identify biologically significant molecules qualitatively.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	H	M	H	M	H
CO3	H	H	L	M	M	M
CO4	H	M	H	M	H	H
CO5	H	H	H	M	M	L

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	H
CO3	H	L	H	H	M	M
CO4	M	H	M	M	M	H
CO5	H	H	H	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="8">SKILL ENHANCEMENT COURSE: TISSUE CULTURE</td></tr>
<tr><td>Paper No.</td><td colspan="8">Skill Enhancement Course SEC – 1V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">USBC424</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>1</td><td colspan="2"></td><td colspan="2">-</td><td colspan="3">1</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at giving an overall view of the
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 andevaluation of bioactive compounds</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (6 hours) (K1, K2, K3 & K4)
Introduction to Tissue culture, Types- seed, embryo, Types - Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques of tissue culture.</td></tr>
<tr><td></td><td colspan="8">Unit II (6 hours) (K1, K2, K3 & K4)
Media preparation, Culture Preparation – pH, Culture Preparation - temperature, Culture Preparation - solidifying agents, Role of Micro and macro nutrients, Maintenance of cultures</td></tr>
<tr><td></td><td colspan="8">UNIT-III: (6 hours) (K1, K2, K3 & K4)
Methods of gene transfer in plants, Methods of gene transfer in animals, Direct Method, Indirect Method, Gene transfer methods.</td></tr>
<tr><td></td><td colspan="8">UNIT-IV: (6 hours) (K1, K2, K3 & K4)
Cell culture technique, Explants selection, Sterilization, Inoculation</td></tr>
<tr><td></td><td colspan="8">UNIT-V: (6 hours) (K1, K2, K3 & K4)
Transgenic plants for crop improvement, Transgenic plants formolecular farming, Animal Cloning - an overview, Applications of animal cell culture.</td></tr>
<tr><td>RecommendedText books</td><td colspan="8">1. Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
2. Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
3. Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.Grierson and Covey, S.N.1988. Plant Molecular biology. Blackie.
4. Chawla, H.S., 2009, Introduction to Plant Biotechnology”, 3rd Edition, Science Publishers,</td></tr>
</table>

Reference books	1. Freshney, R. I., 2010. Culture of Animal Cells: A Manual of Basic Technique and SpecializedApplications. Wiley-Blackwell, 2010. 6th Edition. 2. Davis, J. M., 2008. Basic Cell Culture. Oxford University Press. New Delhi. 3. Davis, J. M., 2011. Animal Cell Culture. John Willy and Sons Ltd. USA 4. Butler, M. 2004. Animal Cell Culture and Technology. Taylor and Francis. Keywork USA. 5. Verma, A. S. and Singh, A. 2014. Animal Biotechnology. Academic Press, ELSEVIER, USA.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.youtube.com/watch?v=xuwV3ywCxW8&ab_channel=Scholarswing 3. https://www.youtube.com/watch?v=dFrx5J0PA&ab_channel=AnimatedbiologyWitharpan 4. https://www.youtube.com/watch?v=TORRxwbz7aY&ab_channel=NCERTOFFICIAL 5. https://www.youtube.com/watch?v=uPuxS1kxdVY&ab_channel=UtahStateUniversityExtension

Course Outcomes:

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

CO1: Introduction to plant tissue culture. (K1, K2, K3, K4)

CO2: Brief knowledge on preparation of tissue culture media. (K1, K2, K3, K4)

CO3: Understanding on different methods of gene transfer. (K1, K2, K3, K4)

CO4: Gain Knowledge on plant and animal cell culture techniques. (K1, K2, K3, K4)

CO5: Study of applications of genetically modified plants and animals (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	H	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC – V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>USBC524</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">• 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</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Photosynthesis
Photosynthesis apparatus, Pigments of photosynthesis, Photo chemical reaction
Photosynthetic electron transport chain, Path of carbon in photosynthesis-Calvin cycle, Hatch – lack pathway CAM path way, Significance of photosynthesis.</td></tr>
<tr><td></td><td colspan="7">Unit II (15 hours) (K1, K2, K3 & K4)
Secondary metabolites
Structure, Types, Sources, Biosynthesis and function of phenolics, tannin Biosynthesis and function of lignin’s, terpenes and alkaloids, Medicinal properties of secondary metabolites.</td></tr>
<tr><td></td><td colspan="7">Unit III (15 hours) (K1, K2, K3 & K4)
Plant hormones
Structure and function of plant hormone ethylene, plant hormone cytokinin’s, auxins, Abscisic acid, Florigin, Gibberellins</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (15 hours) (K1, K2, K3 & K4)
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</td></tr>
<tr><td></td><td colspan="7">UNIT-V: (15 hours) (K1, K2, K3 & K4)
Plant therapeutics
Bioactive principles in herbs, Plants with antdiabetic properties, Plants with anticancer properties, Plants with antibacterial and antiviral properties,
Plants with anti-malaria properties, Plants with anti-inflammatory properties.</td></tr>
<tr><td>Recommended Text books</td><td colspan="7">1. Singh M. Pand Panda. H, 2005. Medicinal Herbs with their formulations, Daya publishing house, Delhi.
2. Plant Physiology-Devlin N.Robert and Francis H.Witham, CBS Publications.</td></tr>
</table>

Reference books	1. Khan, I. Aand Khanum A,2004. Role of biotechnology in medicinal and aromatic plants, Vol.1 and Vol.10, Ukka 2 publications, Hyderabad. 2. Hans Walter Heldt, 2010, Plant Biochemistry and Molecular Biology, Oxford University,4th Edition, 3. Caroline Bowsher, Martin steer, Alyson Tobin, 2008,Plant biochemistry, garland science. 4. Anderson and John Brardall, 1994. Black well Scientific Publications.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.youtube.com/watch?v=pKoqUn4tAmc&list=PLWtvMsK8gLU1SYog__nz2iQ-WFNP1GAP9&ab_channel=Agriculturepedia 3. https://www.youtube.com/@krishishikshaa 4. https://www.youtube.com/watch?v=mE7EVBml0VE&ab_channel=Prof.ChadarB.R.MakeSoilHealthy 5. https://www.youtube.com/watch?v=g07VhgZuvdw&ab_channel=Agriculturepedia

Course Outcomes:

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

CO1: Gain knowledge on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis. (K1, K2, K3, K4)

CO2: Learn in detail about the structure, types, sources, biosynthesis and functions secondary metabolites. (K1, K2, K3, K4)

CO3: Understand the structure and functions of plant hormones. (K1, K2, K3, K4)

CO4: Discuss about free radicals, types and its harmful effects. Role of Enzymatic and non-enzymatic antioxidant in defense mechanism,prevention in disease (K1, K2, K3, K4)

CO5: Identify the plants with antidiabetic, anticancer, antibacterial,antiviral, anti-malaria and anti-inflammatory properties. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	H	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">BIOCHEMICAL TECHNIQUES</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course 7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>5</td><td>Course Code</td><td>UCBCG24</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">The main objectives of this course are to:
• 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 radioactiveisotopes.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Electrochemical techniques
1.1 Measurement of pH, standard Hydrogen electrode, Henderson Hesselbalch equation, pH, pOH type of Buffers, role of buffers in biological system.
1.2 Centrifugation - Basic principles, RCF, Sedimentation coefficient, Svedberg constant.
1.3 Types of rotors
1.4 Preparative centrifugation- differential and density gradient centrifugation
1.5 Rate zonal and Isopycnic techniques
1.6 construction, working and applications of analytical ultracentrifuge – Determination of molecular weight (Derivation excluded)</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
Chromatography
2.1 Chromatography - adsorption, partition.
2.2 paper chromatography - Principle, instrumentation and applications
2.3 Thin layer chromatography - Principle, instrumentation and applications
2.4 Ion-exchange chromatography Principle, instrumentation and applications
2.5 Gel permeation chromatography -Principle, instrumentation and applications
2.6 Affinity chromatography-Principle, instrumentation and applications</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
Electrophoresis
3.1 Electrophoresis –General principles, factors affecting electrophoretic mobility
3.2 Tiselius moving boundary electrophoresis
3.3 Electrophoresis with paper -Principle, instrumentation and applications
3.4 Electrophoresis with starch -Principle, instrumentation and applications
3.5 Agarose gel electrophoresis -Principle, instrumentation and applications
3.6 SDS-PAGE. Principle, instrumentation and applications</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Electromagnetic radiations** 4.7 Basics of Electromagnetic radiations- Energy, wavelength, wavenumber and frequency. **4.8** Absorption and emission spectra, Lambert – Beer Law Light absorption and transmittance **4.9** Colorimetry-Principle, instrumentation and applications **4.10** Visible spectrophotometry – Principle, instrumentation and applications – enzyme assay **4.11** UV spectrophotometry – Principle instrumentation and applications **4.12** Structural studies of proteins and nucleic acids.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **Radioactivity** 5.1 Radioactivity - Types of Radioactive decay half-life, units of radioactivity 5.2 Detection and measurement of radioactivity 5.3 Methods based upon ionization -Geiger Muller Counter 5.4 Methods based upon excitation – Solid & Liquid scintillation counters. 5.5 Autoradiography 5.6 Biological applications and safety aspects of radioisotopes.

Extended Professional Component (is a part of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinations SET/ NET/ GATE/ UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath 2002, Biophysical Chemistry, Principles and Techniques, 3rd Edition, Himalaya Publishing House. 2. Veerakumari L, 2009, Bioinstrumentation, 1st Edition, MJP Publishers. 3. Keith Wilson & John Walker, 2000, Practical Biochemistry-Principles and techniques, Cambridge University Press, 4th edition. 4. David Sheehan (2009), Physical Biochemistry: Principles and Applications, 2nd Edition, Wiley-Blackwell 10 5. Chatwal G.R, 2006, Analytical Chromatography, Himalaya Publishing House.
Reference Books	1. Terrance G. Cooper the tools of Biochemistry, 1977, John Wiley &Sons, Singapore. 2. Guru Mani, Research Methodology for Biological Sciences, 2011, 1st Edition, MJP Publishers. 3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1st Edition, Narosa Publishing house. 4. Robyt JF, 2015, Biochemical techniques: Theory and Practice, 1st Edition, CBS Publishers & Distributors. 5. Segel I.H, 1976, Biochemical Calculations, 2nd Edition, John Wiley and Sons

Website and e-learning source	1. https://www.britannica.com/science/chromatography 2. https://www.youtube.com/watch?v=xgxFBQZYXlE 3. https://www.youtube.com/watch?v=7onjVBsQwQ8 4. https://en.wikipedia.org/wiki/Electromagnetic_radiation 5. https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/

Course Outcomes:

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

CO1: Describe types of rotors and identify the centrifugation Technique for the separation of biomolecules. (K1, K2, K3, K4)

CO2: Demonstrate the principles, operational procedure andapplications of planar and column chromatography. (K1, K2, K3, K4)

CO3: Specify the factors and explain the separation of DNAand protein using electrophoretic technique. (K1, K2, K3, K4)

CO4: State Beer's Law and illustrate the instrumentation and uses of colorimeter and spectrophotometer. (K1, K2, K3, K4)

CO5: Enumerate various methods of measurement of radioactivity and safety aspects of radioactive isotopes. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	H	H	H	H
CO 2	H	H	H	M	H	H
CO 3	H	H	H	H	M	H
CO 4	H	H	H	H	H	H
CO 5	H	H	H	M	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	M	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Title of the Course	**CORE PRACTICAL IV: BIOCHEMICAL TECHNIQUES**						
Paper No.	**Core Paper 8**						
Category	**Core practical**	**Year**	II	**Credits**	3	Course **Code**	UCBCH24
		Semester	IV				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
Prerequisites	Higher Secondary Chemistry and Biology						
Objectives of the course	The course aims at giving an overall view of the • Acquaint the students with colorimetric estimations of biomolecules. • Equip skills on various separation techniques. • Impart knowledge about the estimation of minerals and vitamins. • Help the students to learn centrifugation, electrophoresis technique • Train the students to determine the P^H						
Course Outline	**I COLORIMETRY (15 hours) (K1, K2, K3 & K4)** 1. Estimation of amino acid by Ninhydrin method. 2. Estimation of protein by Biuret method. 3. Estimation of DNA by Diphenylamine method. 4. Estimation of RNA by Orcinol method. 5. Estimation of Phosphorus by Fiske and Subbarow method.						
	II CHROMATOGRAPHY (15 hours) (K1, K2, K3 & K4) 1. Separation and identification of sugars and amino acids by paper chromatography. 2. Separation and identification of amino acids and lipids by thin layer chromatography.						
	III DEMONSTRATION CENTRIFUGATION 1. Separation of Serum and Plasma from blood by centrifugation. **IV ELECTRO PHORESIS** 1. Separation of Serum proteins by SDS-PAGE. **V DETERMINATION OF P^H** 1. Determination of pH of urine and saliva						

Extended Professional Component (is apart of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text books	1. Jayaraman J, 2015, Laboratory Manual in Biochemistry 5th Edition, New Age International (P) Limited. 2. Sadasivam S, Manickam A Biochemical Methods 3rd Edition 2018, New age International Pvt Ltd publishers. 3. Keith Wilson and John Walker, 7th Edition 2010, Principles and techniques of Practical Biochemistry Cambridge University Press.

Reference books	1. Sawhney Singh S K, Introductory Practical Biochemistry. 2nd Edition 2005, Alpha ScienceInternational, Ltd. 2. David T. Plummer, An Introduction to Practical Biochemistry, 3rd edition, 2001, TataMcGraw- Hill publishing company limited. 3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, 6th Edition,1988, CBSPublishers and distributors, India. 4. Rageeb, Kiran Patil, Bakshi Rahman M, Sufiyan Ahmad Raees 1st Edition, 2019, A Practical book on Biochemistry Everest publishing house 5. Anil Kumar, Sarika Garg and Neha Garg.Vinod Vasishtha, 2012, Biochemical Tests – Principles and Protocols. Viva Books Pvt Ltd. 6. Harold Varley, 6th edition, 2006 Practical Clinical Biochemistry, CBS
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.pdfdrive.com/instant-notes-analytical-chemistry e912659.html 14 3. https://www.pdfdrive.com/analytical-biochemistry-e46164604.html 4. https://www.pdfdrive.com/biochemistry-books.html 5. https://www.bu.edu/picf/files/2010/10/hofferelectrobook1.pdf 6. https://www.biorad.com/webroot/web/pdf/lsr/literature/Bulletin_6040.pdf

Course Outcomes:
On completion of the course, the students should be able to

CO1: Estimate the amount of biomolecules by Colorimetric method. (K1, K2, K3, K4)
CO2: Quantify the amount of minerals by Colorimetric method (K1, K2, K3, K4)
CO3: Separate and identify sugars, lipids and amino acids by chromatography. (K1, K2, K3, K4)
CO4: Operate centrifuge for the separation of serum and plasma. (K1, K2, K3, K4)
CO5: Demonstrate the separation of proteins electrophoretically. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	M	H
CO3	H	M	H	M	M	L
CO4	H	M	M	L	H	H
CO5	H	H	H	M	M	L

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	M	M	M	M	H	H
CO3	H	M	H	H	M	L
CO4	H	H	M	L	M	H
CO5	H	H	H	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: BIOINFORMATICS</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>USBC624</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">The course aims at giving an overall view of the
• Impart knowledge on bioinformatics and applications.
• Learn about biological databases.
• Understand the local and global sequence alignment.
• Provide insights on BLAST and Microarray.
• Familiarize about structural genomics and visualization tools</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
Introduction to bioinformatics
Bioinformatics and its applications. History of bioinformatics. Scope of bioinformatics. Genome, Metabolome - Definition and its applications. Metabolome database - Human metabolome database. Transcriptome, Definition and applications.</td></tr>
<tr><td></td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
Biological Databases
Biological databases -Definition. Types of Biological databases and examples. Nucleotide sequence database (NCBI, EMBL, Gene bank, DDBJ). Protein sequence database (SwissProt, TrEMBL). Structural Database, PDB, Metabolic database KEGG.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Sequence alignment
Local alignment, Global alignment. Dot matrix analysis, PAM, BLOSUM. Dynamic Programming concept – Needleman Wunch algorithm. Smith waterman algorithm. Heuristic methods of sequence alignment.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (12 hours) (K1, K2, K3 & K4)
BLAST
BLAST – Features, Types (BLASTP, BLASTN, BLASTX). PSI BLAST, Result format. DNA Microarray – History and basic principle of microarray. DNA Microarray - Procedure and applications.</td></tr>
<tr><td></td><td colspan="7">UNIT-V: (12 hours) (K1, K2, K3 & K4)
Structural genomics
Whole genome sequencing (Shotgun approach). Comparative genomics tools for genome comparison. VISTA servers and precomputed tools. Molecular visualization tools. RASMOL, Swiss PDB viewer. Nutrigenomics - Definition and applications.</td></tr>
</table>

Recommended Text	1. Marketa J.Z. and Jeremy O. B, 2008, Understanding Bioinformatics, 1st Edition, Garland Scinces, Taylor & Francis Group, USA. 2. Claverie J. M, Notredame C, 2006, Bioinformatics for dummies, 2nd Edition, Wiley Publishing Inc., Indiana, USA. 3. Attwood T. K. and Parry Smith D. J, 1999, Introduction to Bioinformatics, Pearson Education India. 4. David Mount W, 2001, Bioinformatics, Cold Spring Harbor Lab Press.
Reference Books	**1.** Lesk A. M, 2002, Introduction to Bioinformatics, OUP, Oxford, UK. **2.** Hooman Rashidi, Lukas K, Buehler, 2005, Bioinformatics Basics: Applications in biological science and medicine, CRC Press and Taylor and Francis group. **3.** Balamurugan S, Anand T, Krishnan, Dinesh Goyal, Balakumar Chandrasekaran Computation in Bioinformatics Multidisciplinary Applications. 4. Navneet Sharma, Pharmaceutics, Pawan Raghav, K. Ramesh, Goyal, Cheminformatics and Bioinformatics in the Pharmaceutical Sciences.
Website and e-learning source	1. https://www.britannica.com/science/metabolomics 2. https://microbenotes.com/protein-databases-types-and-importance/ 3. https://www.slideshare.net/TaniaKhan10/dot-matrix 4. https://microbenotes.com/blast-bioinformatics/ 5. https://www.slideshare.net/AnsariSana1/nutrigenomics238464690

Course Outcomes:

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

CO1: Introduce the fundamentals of Bioinformatics and its applications Genome, metabolome & Transcriptome. (K1, K2, K3, K4)

CO2: Classify biological database and correlate the different file formats used by nucleic acid, protein database, structural and metabolic database. (K1, K2, K3, K4)

CO3: Develop algorithms for interpreting biological data. (K1, K2, K3, K4)

CO4: Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes. (K1, K2, K3, K4)

CO5: Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	H	M
CO2	H	M	H	M	M	H
CO3	H	H	H	M	M	M
CO4	H	H	M	M	H	M
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	M	H
CO3	H	M	H	H	M	M
CO4	H	L	H	H	M	M
CO5	H	M	H	H	M	H

Title of the Course	SKILL ENHANCEMENT COURSE: BIOCHEMICAL PHARMACOLOGY						
Paper No.	**SEC 7**						
Category	**SEC**	**Year**	III	**Credits**	1	**Course Code**	**USBC724**
		Semester	VI				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	1		-			1	
Prerequisites	Higher Secondary Chemistry and Biology						
Objectives ofthe course	The main objectives of this course are to • Introduce the basic concepts of pharmacology. • Explain the metabolism of drugs and factors responsible for metabolism. • Acquaint the adverse response and side effects of drugs. • Familiarize important drugs used for common metabolic disorders. • Provide an understanding about the action of antibiotics.						
Course Outline	**UNIT I (15 hours) (K1, K2, K3 & K4)** **Drugs – classification** 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.						
	Unit II (15 hours) (K1, K2, K3 & K4) **Drug metabolism** 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.						
	UNIT-III: (15 hours) (K1, K2, K3 & K4) **Drug allergy, Drug tolerance** Drug allergy, Drug tolerance - IC 50, LD50 of a drug, Drug intolerance, Drug addiction. Drug abuses and their biological effects, Drug resistance, Biochemical mechanism.						
	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Therapeutic Drugs** Drugs - Analgesics and Non-steroidal, Anti-inflammatory drugs, (NSAIDs) – Aspirin and Acetaminophen. Insulin, Oral ant diabetic drugs - Sulfonylureas, Biguanides, Antihypertensive drugs - ACE inhibitors, Calcium channel blockers. Anti-cancer agents – Antimetabolites.						
	UNIT-V: (15 hours) (K1, K2, K3 & K4) **Antibiotics** Antibiotics – Definition, Examples, Biochemical mode of action ofpenicillin, Streptomycin, Tetracycline, Chloramphenicol						

Extended Professional Component (is a part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text books	1. N.Murugesh, A concise text book of Pharmacology –Sathya Publishers. **2.** Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & Company Ltd.
Reference books	1. Lippincott's illustrated Reviews- Pharmacology by Mary J.Mycek, Richard A.Harvey,Pamela C. Champe, Lippincott – Raven publishers, New Delhi. 2. David. E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt.Ltd. 3. R.S. Satoskar, S. B. Elsevier Pharmacology and pharmacotherapy. - ISBN-10:9788131248867 / ISBN-13: 978-8131248867, 2017. 4. Tripathi,K.Essentials of Medica Pharmacology.Jaypee Publishers- ISBN-10:9350259370 / ISBN-13: 978-350259375.2018. 5. S C Mehta, AshutoshKar, Pharmaceutical Pharmacology – New Age International (P)Limited, Publishers.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.youtube.com/watch?v=nirpkjciTNM&ab_channel=LevelUpRN 3. https://www.youtube.com/watch?v=gqoqexfqoBM&ab_channel=DrMatt%26DrMike 4. https://www.youtube.com/watch?v=v23FfMWbJfM&ab_channel=MedicalKnowledgeOnline

Course Outcomes:

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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	H	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ENZYMES</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 9</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">UCBCI24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">The main objective of this course are to
• Provide fundamental knowledge of 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 Km and Vmax.
• Explain the effect of inhibitors on enzyme activity.
• Understand the role of enzymes in clinical diagnosis and industries.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
Introduction to enzymes
1.1 Nomenclature and Classification based on IUB with examples.
1.2 Intracellular localization of enzymes, Isolation and purification of enzymes.
1.3 Enzyme as a catalyst - Activation energy, Enzyme specificity-absolute, Group, linkage and stereo specificities.
1.4 Non-protein enzymes – Ribozymes, abzymes.
1.5 Concept of Active site, Lock and key hypothesis and induced fit theory.
1.6 Enzyme expression Units - IU, turnover number, katal and specific activity.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3 & K4)
Enzyme Kinetics
2.1 Enzyme kinetics -Definition of kinetics
2.2 Factors affecting enzyme activity - temperature, pH, substrate and enzyme concentration.
2.3 Activators-cofactors, Derivation of Michaelis-Menton equation for uni-substrate reactions.
2.4 Lineweaver - Burk plot.
2.5 Eadie –Hofstee plot.
2.6 Significance of Km and V max and their determination using the plots</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Enzyme inhibition
3.1 Enzyme inhibition - Reversible and irreversible inhibition-types of reversible inhibitors.
3.2 Competitive, non-competitive, un-competitive inhibitors.
3.3 Graphical representation by L-B plot, (Kinetic derivations not required).
3.4 Determination of Km and Vmax in the presence and absence of inhibitors.
3.5 Allosteric enzymes.
3.6 Sigmoidal curve, positive and negative modulators.</td></tr>
</table>

	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **Mechanism of enzyme catalysis** 4.1 Acid-Base catalysis, covalent catalysis. 4.2 Electrostatic catalysis, metal ion catalysis, Proximity and orientation effect. 4.3 Coenzymes -Definition, prosthetic group, classification – vitamin and non-vitamin coenzymes. 4.4 Types, co-enzymatic forms of vitamins- NAD/NADP, FAD, FMN, Coenzyme A, TPP, PLP, lipoic acid and biotin. 4.5 Multienzyme complexes – Pyruvate dehydrogenase complex. 4.6 Isoenzymes: LDH and CK.
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **Applications of enzymes** 5.1 Industrial uses of enzymes – sources of industrial enzymes. 5.2 Clinical enzymes and their applications. 5.3 Immobilized enzymes - methods of immobilization. 5.4 Adsorption, covalent bonding, crosslinking, encapsulation, entrapment. 5.5 Applications of immobilized enzymes. Biosensors – e.g. Glucose sensors. 5.6 Industrial applications of enzymes –Food, textile and pharmaceutical industries.

Recommended Text	1. Sathyanarayana U, & Chakrapani U, 2013, Text book of Biochemistry, 4th Edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd 2. Agarwal G.R, Kiran Agarwal & Agarwal O.P, 2015, Textbook of Biochemistry (Physiological chemistry),18th Edition, Goel Publishing House. 3. Chatterjee M.N, Rana Shinde, 2007, Textbook of Medical Biochemistry - 7th Edition - Jaypee Publishers. 4. Ambika Shanmugam, 2016, Medical Biochemistry, 8th Edition, Wolters Kluwer India Private Ltd. 5. T. Devasena, 2010, Enzymology, 1st Edition, Oxford University Press.
Reference Books	1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd Edition, East West Press Pvt. Ltd. 2. David Nelson, Michael, Cox M, 2005, Principles of Biochemistry, 4th Edition W.H. Freeman and Company. 3. Voet D, Voet J.G and Pratt C.W, 2004, Principles of Biochemistry, 4th Edition John Wiley & Sons, Inc. 4. Jain J.L, Sanjay Jain, Nithin Jain, 2008, Fundamentals of Biochemistry, S Chand and Company Ltd, 8th Edition. 5. Zubay G.L *et.al*., 1995, Principles of Biochemistry, 1st Edition, WmC. Brown Publishers.
Website and e-learning source	1. www.biologydiscussion.com/notes/enzymes 2. https://www.britannica.com/science/protein/The-mechanism-of-enzymatic-action 3. https://www.youtube.com/watch?v=oVJ2LJxO6tU 4. https://www.youtube.com/watch?v=o_hevpYqXc4 5. https://www.youtube.com/watch?v=dvPnIHKqOYg

Course Outcomes:

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

CO1: Identify the major classes of enzymes, differentiate between a chemical catalyst and a biocatalyst and define the units of enzymes. (K1, K2, K3, K4)

CO2: Explain the mechanism of enzyme catalysis and the role of coenzymes in enzyme action. (K1, K2, K3, K4)

CO3: Illustrate the steady-state kinetics, interpret the MM plot and LB plot based on kinetics data, and determine Km and Vmax. (K1, K2, K3, K4)

CO4: Distinguish the types of inhibition along with its importance in biochemical reactions. (K1, K2, K3, K4)

CO5: Comprehend the various methods to produce immobilized enzymes and discuss the application of enzymes in clinical diagnosis and various industries. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	H	H
CO3	H	H	H	H	M	H
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	M	H	H	M	H
CO3	H	M	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	H	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">INTERMEDIARY METABOLISM</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 10</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">UCBCJ24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• fundamental knowledge of free energy transformation and describes biological oxidation.
• pathways of carbohydrate metabolism.
• pathways of oxidation and biosynthesis of lipids.
• catabolism of amino acids and synthesis of specialized products from amino acids.
• metabolism of nucleic acids and its regulation.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
High energy compounds and mechanism of synthesis
1.1 High energy compounds: Role of high energy compounds, Free energy hydrolysis of ATP and other oragno-phosphates, ATP ADP cycle.
1.2 Biological Oxidation: Electron transport chain its organization and function.
1.3 Inhibitors of ETC.
1.4 Oxidative phosphorylation, P/O ratio.
1.5 Peter Mitchell’s Chemiosmosis hypothesis. Mechanism of ATP synthesis.
1.6 Uncouplers of oxidative phosphorylation, substrate level phosphorylation with examples.</td></tr>
<tr><td></td><td colspan="7">Unit II (12 hours) (K1, K2, K3 & K4)
Carbohydrate metabolism
2.1 Glycolysis, TCA cycle.
2.2 Amphibolic nature and integrating role of TCA cycle, Anaplerosis.
2.3 Pentose Phosphate Pathway (HMP shunt).
2.4 Glycogenesis, Glygogenolysis and its regulation.
2.5 Gluconeogenesis and its regulation.
2.6 Glyoxylate cycle, Entner- Duodoroff pathway and Cori cycle.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Lipid Metabolism
3.1 Oxidation of fatty acids α, β and ω oxidation of saturated fatty acids.
3.2 Oxidation of fatty acids with odd number of carbon atoms and unsaturated fatty acids.
3.3 Ketogenesis, Biosynthesis of saturated fatty acids and unsaturated fatty acids.
3.4 Biosynthesis of triglycerides and phospholipid.
3.5 Degradation of triglycerides and phospholipids.
3.6 Biosynthesis and degradation of cholesterol.</td></tr>
</table>

	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **Amino acid metabolism** 4.1 Metabolic nitrogen pool. 4.2 Catabolism of amino acids: Oxidative deamination. 4.3 Non-oxidative deamination, Transamination. 4.4 Decarboxylation. 4.5 Biogenic amines. 4.6 Urea cycle and its regulation.
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **Nucleic acid metabolism** 5.1 Biosynthesis of purines – De-novo synthesis. 5.2 Biosynthesis of pyrimidines – De-novo synthesis. 5.3 Biosynthesis of purines and pyrimidines – Salvage pathways. 5.4 Degradation of purines. 5.5 Degradation of pyrimidines. 5.6 Conversion of ribonucleotide to deoxyribonucleotide.

Extended Professional Component (is a part of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Sathyanarayana U & Chakrapani U, 2015, Biochemistry, 4th edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd. 2. Chatterjee M.N, and Rana Shinde, 2012, Textbook of Medical Biochemistry, 8th edition, Jaypee Brothers Medical Publishers Pvt. Ltd.
Reference Books	1. David L. Nelson, Michael M. Cox, 2008, Lehninger Principles of Biochemistry, 5th edition, W.H. Freeman and Company. 2. Robert K. Murray, Daryl K. Granner, Victor W. Rodwell, 2006, Harper's Illustrated Biochemistry, 27th edition, McGraw Hill publishers. 3. Voet. D, Voet. J. G. and Pratt, C.W, 2010, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc. 4. Zubay G.L, William Parson, Dennis E. Vance,1995, Principles of Biochemistry, 2nd edition, WmC. Brown Publishers. 5. Peter J. Kennelly, Kathleen M Botham, Owen P Mc Guinness, Victor W. Rodwell, 2023, Harper's Illustrated Biochemistry, 32nd edition, McGraw Hill Education
Website and e-learning source	1) https://nptel.ac.in/courses/104/105/104105102/ 2) http://www.nptelvideos.in/2012/11/biochemistry-i.html 3) https://www.youtube.com/watch?v=jdCfGHsQOYQ&pp=ygUqbnB0ZWwgYmlvY2hlbWlzdHJ5IGNhcmJvaHlkcmF0ZSBtZXRhYm9saXNt 4) https://www.youtube.com/watch?v=-fy8-owt6sk&list=PLRpz4J5dUMCf0Jk8oojz__5TuaXtPNLmX 5) https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf

Course Outcomes:

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

CO1: State the concept of bioenergetics and illustrate the mechanism of flow of electrons and the production of ATP. (K1, K2, K3, K4)

CO2: Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism. (K1, K2, K3, K4)

CO3: Sketch the oxidation and biosynthesis of fatty acids, phospholipids, triglycerides and cholesterol with suitable examples. (K1, K2, K3, K4)

CO4: Explain catabolism of amino acids, synthesis of nonessential amino acids and specialized products from amino acids. (K1, K2, K3, K4)

CO5: Describe the metabolism of nucleic acids with necessary illustrations and its regulation. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">CLINICAL BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Paper 11</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>UCBCK24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td></td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4 & K5)
Disorders of carbohydrate metabolism:
1.1 Maintenance of blood glucose by hormone with special reference to insulin
1.2 Role and functions of glucagon.
1.3 Abnormalities in glucose metabolism: Diabetes mellitus; types, causes, biochemical manifestations, diagnosis and treatment, glycated hemoglobin.
1.4 Inborn errors of carbohydrate metabolism - glycosuria.
1.5 Fructosuria, Pentosuria and Galactosemia
1.6 Glycogen storage diseases.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4 & K5)
Disorders of Lipid Metabolism:
2.1 Lipoproteins – Types and functions
2.2 Atherosclerosis and Ischemic heart disease
2.3 Fatty liver and hyperlipidemia
2.4 Hypercholesterolemia, Lipidosis and Xanthomatosis
2.5 Tay-Sach`s disease, Niemann-Pick disease,
2.6 Lipotropic agents</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3, K4 & K5)
Liver & Kidney Function Tests:
Liver Function Tests:
3.1 Bilirubin metabolism and jaundice, Estimation of conjugated and total bilirubin in serum (Diazo method).
3.2 Detection of bilirubin and bile salts in urine (Fouchet’stest and Hay’s Sulphur test, Thymol turbidity test, Prothrombin time
3.3 Serum enzymes in liver disease serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH).
Kidney Function Tests:
3.4 Measurement of urine pH, Volume specific gravity, osmolality, sediments in urine
3.5 Inulin, urea, and creatinine clearance tests.
3.6 Concentration and dilution tests, Phenol red test, Levels of plasma protein and its significance related to kidney function.</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3, K4 & K5) **Gastric Function test:** 4.1 Composition of gastric juice 4.2 Collection of gastric contents and examination of gastric residuals 4.3 Fractional test meal (FTM) 4.4 Alcohol stimulation test 4.5 Histamine stimulation test 4.6 Tubeless gastric analysis
	UNIT-V: (18 hours) (K1, K2, K3, K4 & K5) **Clinical enzymology:** 5.1 Enzymes and its functions 5.2 Enzymes and its diagnostic importance - Lactate Dehydrogenase (LDH), Creatine kinase 5.3 Enzymes and its diagnostic importance – Aspartate transaminase, Alanine transaminase 5.4 Enzymes and its diagnostic importance – Amylase, Alkaline phosphatase, Acid phosphatase 5.5 Enzymes and its diagnostic importance – Gamma glutamyl transferase, Aldolase 5.6 Streptokinase and its functions
Recommended Text	1. Chatterjee MN and Rana Shinde, 2012, Textbook of Medical Biochemistry, 8th Edition, Jaypee Brothers Medical Publishers (P) LTD, New Delhi. 2. Ambika Shanmugam's, Biochemistry for medical students,8th Edition, published by Wolters Kluwer India Pvt. Ltd. 3. Kalpana L A, Perce A J ,2009, Clinical Chemistry, 5th Edition. 4. Nandha Maheswari ,2017, Clinical Biochemistry, Jaypee Medical Publish ,2nd Edition.
Reference Books	6. Philip D. Mayne, 1994, Clinical chemistry in diagnosis and treatment 6th Edition, ELBSP Publications. 7. Thomas M. Devlin ,2014, Textbook of Biochemistry with clinical correlations, 7th Edition. 8. Saunder,2014, Tietz Fundamentals of Clinical chemistry and molecular Diagnostics, 7th Edition. 9. Carl A Burtis, 2017, Fundamental of Clinical chemistry, 8th Edition, Harcourt Private Limited. 10. Gowen lock A H, 2009, Varley's Practical Clinical Biochemistry, 5th Edition.
Website and e-learning source	1. https://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate- metabolism 2. https://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests 3. https://onlinecourses.nptel.ac.in/noc20_ge13/preview 4. https://pdfroom.com/books/clinical-biochemistry-an-illustrated-text 5e/v0K2lGPZgap 5. https://pdfroom.com/books/practical-clinical-biochemistry/QEBgj9yadoN

Course Outcomes:

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

CO1: Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis, and treatment.

CO2: Analyze the lipid profile and different deficiency state

CO3: Describe the liver and kidney functions and specific diagnostic. methods used for biological sample.

CO4: Detail about the composition of gastric juice and special test for diagnosis.

CO5: Elaborate the enzyme markers used for diagnostic studies.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">CORE PRACTICAL – V CLINICAL BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Practical 12</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core Practical</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>UCBCL24</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• 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 quantitative analysis of urine sample for diagnostic purpose.
• Train students on various hematological tests and its significance.</td></tr>
<tr><td>Course Outline</td><td colspan="7">CLINICAL ANALYSIS
1. Estimation of creatinine by Jaffe’s method (serum & urine)
2. Estimation of urea by diacetyl monoxime method (serum &urine)
3. Estimation of uric acid (serum &urine)
4. Estimation of cholesterol by Zak’s method
5. Estimation of Glucose by Ortho Toluidine method
6. Estimation of Protein by Lowry’s method
7. Estimation of Haemoglobin by Shali’s/Drabkins method
8. Assay of SGPT and SGOT</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. Manickam, S.S,2018, Biochemical Methods 3rd Edition, New age International Pvt Ltd publishers.
2. Plummer,D.T, An Introduction to Practical Biochemistry, Tata Mc Graw Hill-ISBN: 97800708416
3. Alan H Gowenlock. 1998, Varley’s Practical Clinical Biochemistry, 6th Edition, CBS Publishers, India.
4. B. Godkar, 2020, Textbook of Medical Laboratory Technology, Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.
5. Kanai L Mukerjee, 1996, Medical Lab Technology, Vol I& II, 1st edition, Tata Mc graw Hill, Pennsylvania.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Singh, S.K, 2005, Introductory Practical Biochemistry(2nded.).Alpha Science International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026
2. Ashwood, B. A, 2001, Tietz Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346</td></tr>
</table>

Website and e-learning source	1. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors 2. https://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf 3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf 4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdfpdf

Course Outcomes:

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

CO1: Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose.

CO2: Assay the activity of various clinically important enzymes and relate their clinical importance.

CO3: Estimate the important biomolecules in biological samples and relate their clinical significance.

CO4: Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results.

CO5: Perform the routine hematological tests.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	M	L	M
CO2	H	H	H	M	M	M
CO3	H	H	H	M	H	H
CO4	H	H	H	M	H	M
CO5	H	H	H	M	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	M
CO2	H	H	H	M	M	M
CO3	H	H	H	M	M	H
CO4	H	H	H	M	M	M
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: MEDICAL LAB TECHNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective I A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UEBCA24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objective of the course is to,
• Outline the organization of a laboratory for its efficient functioning
• Discuss the various methods of blood collection and its preservation
• Evaluate the significance of urine analysis and its correlation with disease
• Demonstrate about the blood transfusion method
• Apply histopathological techniques in detecting abnormal cells</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
1. 1 Introduction: Code of conduct for laboratory personnel
1.2 Medical care, organization of the clinical laboratory
1.3 Functional components of a laboratory
1.4 Basic needs and role of medical laboratory technician
1.5 Safety aspects in the laboratories
1.6 First aid in the laboratories</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
2.1 Specimen collection: Blood collection by vein puncture and capillary puncture
2.2 Equipment and storage of blood collection - transport and waste disposal
2.3 Anticoagulants
2.4 Collection and preservation of urine, sputum, throat swab
2.5 Collection and preservation of stool
2.6 Collection and preservation of CSF specimens</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
3.1 Collection and processing of blood for transfusion
3.2 Preparation for blood collection and Blood bank
3.3 Screening, Rejection, Registration of Donors
3.4 Blood Collection procedure, Transportation
3.5 Clinical significance of Blood Transfusion
3.6 Coomb’s test</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (15 hours) (K1, K2, K3 & K4)
4.1 Urine - Normal and Abnormal constituents of urine
4.2 Routine examination of urine- Physical examination -Colour, Appearance, Odour andSpecific gravity
4.3 Microscopic exam Fixation `of urine sediment - organized and unorganized elements –Culture test (24 and 48 Hrs) – Crystal appearance in urine
4.4 Pregnancy test (hCG test) –Typhoid test (Widal test)
4.5 Malaria test (QBC test)</td></tr>
</table>

	4.6 Tuberculosis test (Mantoux tuberculin skin test)
	UNIT-V: (18 hours) (K1, K2, K3 & K4) 5.1 Introduction to histopathology and cytology 5.2 Laboratory equipment for cytology and histology 5.3 Reagents, microscope, microtome, paraffin oven, tissue floating bath, automated tissueprocessor and slide warmer 5.4 Preparation of tissues for histology 5.5Collection of specimens for cytological evaluation 5.6Clinical significance of cytological technique

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations NET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Ramakrishnan S, Sulochana KN, 2012, Manual of Medical Laboratory Techniques, 1st Edition, Jaypee Brothers Medical Publishers Pvt.Ltd. 2. Sood Ramnik, 2014, Concise Book of Medical Laboratory Technology: Methods &Interpretation, 2nd Edition, Jaypee Brothers Medical Publishers. 3. Shivaraja Shankara YM, 2013, Laboratory manual for Practical Biochemistry, 2nd Edition, Jaypee publications. 4. Talib VH, 2004, A Handbook of Medical laboratory technology - CBS publishers,
ReferenceBooks	1. Kanai L Mukherjee- Medical laboratory technology. Tata MC Graw-hill publishingcompany limited, Volume-I, 2nd Edition, 2010 2. Kanai L Mukherjee- Medical laboratory technology. Tata MC Graw-hill publishingcompany limited, Volume-II, 2nde Edition, 2010 3. Kanai L Mukherjee- Medical laboratory technology. Tata MC Graw-hill Publishing Company Limited. Volume-III - 2nd Edition, 2010
Website and e-learning source	1. https://youtu.be/OauxaRXQ2IM 2. https://youtu.be/a_m76KUab9s 3. https://youtu.be/58Gp8Tiui1E 4. https://youtu.be/22MHdz5sEuc 5. https://youtu.be/qAoa94WBaIc

Course Outcomes:

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

CO1: Understand the concept and scope and work efficiently in medical laboratories

CO2: Work under different specialties of Laboratory Medicine and gather the knowledge about preservation techniques

CO3: phlebotomy procedures and be able to draw specimen collections

CO4: Understand the abnormal constituents

CO5: Nurture the procedures of histopathology and stating techniques

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	H	H	H	H
CO 2	H	H	H	H	H	H
CO 3	H	H	H	H	H	H
CO 4	H	H	H	M	H	H
CO 5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: RESEARCH METHODOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective I B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td>UEBCB24</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td></td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">The main objectives of this course are to:
• Introduce the components of research.
• Acquaint on the experimental design and literature survey
• Analyse the data and find out the significance statistically
• Highlight the importance of computation in research.
• Provide mechanics of writing a research report hands-on experience in designing and working on small projects.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Characteristics and types of Research:
1.1 Characteristics and types of Research
1.2 Research Methods versus Methodology
1.3 Research designs in Biochemistry
1.4 Experimental - in vitro, in vivo, in situ
1.5 Clinical trials. Identification and criteria of selecting a research problem (Hypothesis)
1.6 Formulation of objectives; Research plan and its components.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
Experimental design
2.1 Experimental design – Objective Design of work
2.2 Guidelines for design of experiments
2.3 Literature Search - Databases for literature search,
2.4 Material and methods
2.5 Designing biological experiments.
2.6 Compilation and documentation of data</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
Statistical Analysis
3.1 Statistical Analysis: Measures of variation - standard deviation
3.2 Non-linear regression
3.3 Standard error. Analysis of variance for one-way and two-way classified data and multiple comparison procedures.
3.4 Significance - students “t” test
3.5 Chi-square test.
3.6 Dunnet’s test</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Computer and its role in research:** 4.1 Computer and its role in research: Basics of MS word 4.2 MS Excel: tabulation calculation and data analysis preparation of graphs 4.3 Histograms and charts 4.4 Use of statistical software SPSS. 4.5 Power Point: preparation of presentations 4.6 Scientific poster designing
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **Scientific writing for journals** 5.1 Scientific writing for journals - Preparation of Abstract Impact factor, h-indexi-10 index citation index. 5.2 Dissertation/Thesis writing: format, content and chapterization Writing style. 5.3 Drafting titles & sub-titles, Captions and legends. 5.4 Writing results, Discussion and conclusions. Bibliography and references- referencing style - Harvard and Vancouver systems. 5.5 Appendices and acknowledgement. 5.6 Ethical issues in research; Intellectual property right and plagiarism.

Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinations SEM/TEM /GATE/UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. A H Gowen lock, 2009, Varley's Practical Clinical Biochemistry, 5th edition. 2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers. 3. Gurumani.N, Research Methodology for biological Sciences, 2014, MJP Publishers. 4. Kothari, C.R., Research Methodology: Methods and Techniques. 2004, New Age International. 5. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
Reference Books	1. Prabhat Pandey, Meenu Mishra Pandey, 2015Research Methodology: Tools and Techniques. 2. Coley, S.M. and Sheinberg, C. A., 1990, "Proposal Writing", Sage Publications. 3. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press. 4. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications 5. Scientific Thesis Writing and Paper Presentation. MJP Publishers.2010

Website and e-learning source	1. https://explorable.com/research-methodology 2. http://www.scribbr.com 3. http://www.open.edu 4. http://www.macmillanihe.com

Course Outcomes:

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

CO1: Explain the types of research and formulate and plan the research.

CO2: Design experimental setup, review the literature, compile and document the data.

CO3: Analyze and validate the experimental data using statistical tools

CO4: Interpret the data using computational tools.

CO5: Compile and draft a research report, present results findings and publish ethically.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	L	H	H	H
CO 2	H	H	M	H	H	H
CO 3	H	H	H	H	H	H
CO 4	H	H	M	M	H	H
CO 5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE PRACTICAL - MEDICAL LAB TECHNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective practical</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UEBCC24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">HEMATOLOGY EXPERIMENTS (10 hours) (K1, K2, K3 & K4)
1. Collection and preservation of blood and urine samples.
a. Blood grouping
b. Blood clotting time
c. Bleeding time
d. RBC Counting
e. Total and differential count of white blood cells
f. Packed cell volume
g. Erythrocyte sedimentation rate
h. HCG kit test</td></tr>
<tr><td></td><td colspan="7">2. Qualitative analysis of normal constituents of urine
Urea, Creatinine, Phosphorus, Calcium
Abnormal constituents
a) Calcium b) Sugar (Glucose, fructose, pentose) c) Protein d) Amino acids (Tyrosine, Histidine, Tryptophan) e) Ketone bodies f) Bile pigments with clinical significance.</td></tr>
<tr><td>Recommended Text books</td><td colspan="7">1. Manickam SS, 2018, Biochemical Methods, 3rd Edition, New age International Pvt. Ltd. P ublishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408.
2. Plummer DT, 2017, An Introduction to Practical Biochemistry, 3rd Edition, Tata Mc Graw Hill-ISBN: 97800708416.
3. Ranjna Chawla, 2014, Practical Clinical Biochemistry Methods and interpretations, 4th Edition, Jaypee Brothers Medical Publishers, New York.</td></tr>
</table>

Reference books	1. Singh SK, 2005, Introductory Practical Biochemistry, 2nd Edition, Alpha Science International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026. 2. Ashwood B, 2001, Tietz Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346 / ISBN 13: 978072168634. 3. Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th Edition, CBS Publishers, India. 4. Godkar B, 2020. Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd Edition, Bhalani Publishers
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors 3. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf 4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y 5. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y *

Course Outcomes:

On completion of the course, the students should be able to:

CO1: Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose. (K1, K2, K3, K4)

CO2: Obtain the skill to conduct biochemical analysis using standard protocols. (K1, K2, K3, K4)

CO3: Estimate the important biomolecules in biological samples and relate their clinical significance. (K K2, K3, K4)

CO4: Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results. (K1, K2, K3, K4)

CO5: Perform the routine haematological tests. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	M	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	H	H	H	M	M
CO4	H	H	M	M	H	H
CO5	H	H	H	M	H	L

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE PRACTICAL - LAB COURSE IN MOLECULAR BIOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective II B</td></tr>
<tr><td>Category</td><td>Elective practical</td><td>Year
Semester</td><td>III
V</td><td>Credits</td><td>3</td><td>Course Code</td><td>UEBCD24</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims to enable the students:
• To isolate the chromosomal and extrachromosomal DNA.
• To detect the isolated DNA using electrophoresis.
• To prepare the cells to accept the foreign DNA and to detect the insertion.
• To identify the expression of DNA qualitatively and quantitatively.
• To isolate RNA and to amplify the molecule.
• To learn and employ the knowledge of softwares and databases in analysing the sequences under investigation.</td></tr>
<tr><td>Course Outline</td><td colspan="7">5. Isolation of plasmid DNA and Genomic DNA, Restriction enzyme cleavage of chromosomal DNA and plasmid DNA.
6. Agarose gel electrophoresis of DNA
7. Preparation of competent E. coli cells, Transformation of plasmid DNA.
8. SDS-PAGE, Western blotting, Southern blotting, ELISA.
9. PCR, RT-PCR
10. Basic BLAST search, Sequence analysis using computer software</td></tr>
<tr><td>Recommended text books</td><td colspan="7">1. Molecular Biology Techniques, A classroom laboratory manual: 4th Edition, Carson S, Miller H, Srougi M, Witherow DS; Elsevier.
2. Jayaraman J, 2015, Laboratory Manual in Biochemistry, 5th edition New Age International (P) Limited
3. Sadasivam S Manickam A, 2018, Biochemical Methods, 3rd Edition New age International Pvt Ltd publisher's.</td></tr>
<tr><td>Reference books</td><td colspan="7">6. Anil Kumar, Sarika Garg andNeha Garg.VinodVasishtha, 2012, Biochemical Tests – Principles and Protocols. Viva Books Pvt Ltd.
7. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
8. Keith Wilson and John Walker, 1995, Principles and Techniques of Practical Biochemistry, 4th Edition, Cambridge University press, Britain.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">1. https://www.ncbi.nlm.nih.gov/probe/docs/techpcr/
2. http://universe84a.com/collection/gel-electrophoresis/
3. https://www.ncbi.nlm.nih.gov/</td></tr>
</table>

Course Outcomes:

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

CO1: Qualitatively analyze the carbohydrates and report the type of carbohydrate based on specific tests. (K1, K2, K3, K4)

CO2: Qualitatively analyze amino acids and report the type of amino acids based on specific tests. (K1, K2, K3, K4)

CO3: Determine the Saponification, Iodine and acid number of edible oils. (K1, K2, K3, K4)

CO4: Isolate the nucleic acid from biological sources. (K1, K2, K3, K4)

CO5: Acquire the skill to identify biologically significant molecules qualitatively.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	L	M	H	M	M
CO3	M	H	M	L	M	M
CO4	H	M	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	L	M	M	L	H	L
CO3	H	M	H	H	M	M
CO4	M	H	H	M	H	H
CO5	H	H	H	M	H	M

<table>
<tr><td>Title of the Course</td><td colspan="7">MOLECULAR BIOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 13</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UCBCM24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">The course aims at giving an overall view of the
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Replication
1.1 Central Dogma of molecular Biology, DNA as the unit of inheritance.
1.2 Experimental evidences by Griffith’s transforming principle, Avery, McLeod and McCarthy’s experiment and Hershey and Chase Experiment.
1.3 Replication in prokaryotes & Eukaryotes: Modes of replication, Messelson and Stahl’s experimental proof for semiconservative replication.
1.4 Mechanism of Replication – Initiation, events at Ori C, Elongation – replication fork, semi discontinuous replication, Okazaki fragments, and termination.
1.5 Bidirectional replication, Inhibitors of replication.
1.6 Models of replication-theta, rolling circle and D loop model.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
Transcription
2.1 Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination.
2.2 Post-transcriptional modifications.
2.3 Inhibitors of transcription.
2.4 RNA splicing and processing of mRNA.
2.5 Processing of tRNA and rRNA.
2.6 Reverse transcription.</td></tr>
</table>

	UNIT-III: (15 hours) (K1, K2, K3 & K4) **Translation** 3.1 Genetic Code and its characteristics. 3.2 Wobble hypothesis. 3.3 Translation: Adaptor role of tRNA, Activation of amino acids. 3.4 Initiation, elongation and termination of protein synthesis. 3.5 Post-translational modifications. 3.6 Inhibitors of protein synthesis.
	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Regulation of Gene Expression** 4.1 Regulation of Gene Expression in Prokaryotes – Principles of gene regulation, negative and positive regulation. 4.2 Concept of operons. 4.3 Regulatory proteins. 4.4 Activators, repressors. 4.5 Regulation of lac operon. 4.6 Regulation of trp operon.
	UNIT-V: (15 hours) (K1, K2, K3 & K4) **Mutation** 5.1 Mutation: Types - Nutritional, Lethal, Conditional mutants. 5.2 Missense mutation and other point mutations. 5.3 Spontaneous mutations; chemical and radiation – induced mutations. 5.4 DNA repair: Direct repair, Photo reactivation. 5.5 Excision repair, Mismatch repair. 5.6 Recombination repair and SOS repair.

Extended Professional Component (is a part of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsNET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text books	1. Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st Edition, Ane books, India. 2. David Friefelder, 1987, Molecular Biology, 2nd Edition, Narosa Publishing House.
Reference books	1. Karp G, 2010, Cell and Molecular Biology: Concepts and Experiments, 6th Edition, John Wiley & Sons. Inc. 2. De Robertis EDP, De Robertis, EMF, 2010, Cell and Molecular Biology, 8th Edition, Lippincott Williams and Wilkins, Philadelphia. 3. Verma PS and Agarwal VK, 2013, Cell biology, Genetics, Molecular Biology, Evolution and Ecology, 1st Edition, Chand & Company Pvt. Ltd. 4. James D Watson, 2013, Molecular Biology of the Gene, 7th Edition, Benjamin Cummings. 5. George M Malacinski, 1992, Freifelder's Essentials of Molecular Biology, 4th Edition, Narosa publishing House.

Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. www.mednotes.net/notes/biology 3. https://microbenotes.com/dna-transcription-rna-synthesis/ 4. https://www.onlinebiologynotes.com/repair-mechanism-of mutation/ 5. https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/ 6. https://rwu.pressbooks.pub/bio103/chapter/regulation-of-gene-expression/

Course Outcomes:

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

CO1: Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and modes of replication. (K1, K2, K3, K4)

CO2: Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA. (K1, K2, K3, K4)

CO3: Decipher the genetic code and summarize the process of translation. (K1, K2, K3, K4)

CO4: Comprehend the principles of gene expression and explain the concept of operon in prokaryotes. (K1, K2, K3, K4)

CO5: Distinguish the types of mutations and explain the various mechanisms of DNA repair. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	H	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSIOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core paper 14</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UCBCN24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objectives of this course are to
• Aid in understanding the physiology of respiratory and circulatory systems
• Explain the structure and physiology of the nervous and muscular system
• Explicate the functions of digestive and excretory system of the body.
• Impart knowledge about the process of reproduction.
• Emphasize the importance of various endocrine factors that regulate metabolism,growth, homeostasis and reproduction.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
1.1 Overview of respiratory system, Types of respiration, Transport of respiratory gases.
1.2 Exchange of respiratory gases in lungs and tissues.
1.3 Chloride Shift & Bohr’s effect, Lung surfactant.
1.4 Circulatory System-Structure and functions of the Heart
1.5 Arterial and venous system, Cardiac cycle, Pace maker
1.6 Blood pressure and Factors affecting blood pressure</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3 & K4)
2.1 Structure of neuron, synaptic transmission,
2.2 Reflex action, neurotransmission
2.3 Resting membrane
2.4 Action potential
2.5 Neuro transmitters- acetyl choline, Noradrenaline, Dopamine,
2.6 Serotonin, Histamine, GABA, Substance.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (12 hours) (K1, K2, K3 & K4)
3.1 Structure and types of muscles
3.2 Skeletal and smooth muscles
3.3 Cardiac muscles
3.4 Muscle proteins
3.5 Types and functions
3.6 Mechanism of muscle contraction</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (12 hours) (K1, K2, K3 & K4)
4.1 Oogenesis,
4.2 Spermatogenesis,
4.3 Capacitation and transport of sperm
4.4 Blood test is barrier.
4.5 Fertilization, early development, Implantation,
4.6 Placentation and Parturition</td></tr>
</table>

	UNIT-V: (12 hours) (K1, K2, K3 & K4) 5.1 Classification of hormones, 5.2 Endocrine glands and their secretions, 5.3 Structure and functions of Insulin, thyroxin. 5.4 Steroid hormones- Corticosteroids, 5.5 Sex hormones – testosterone and estrogen, 5.6 Menstrual cycle.
Recommended Text books	1. Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7thedition, Jaypee Brothers Medical Publishers (P) Ltd. 2. Chatterjee C.C., 1988, Human Physiology -VolI &II, 1st edition, Medical Allied Agency. 3.Mariakuttikan and Arumugam, 2017, Animal Physiology, Sara's publication
Reference books	1. Chatterjee MN and Rana Shinde, 2007, Text book of medical biochemistry physiology- 7thedition, Jaypee brothers- medical publishers, 2. Meyer, Meyer& Meij, 2002, Human Physiology, 3rd edition, A.I.T.B.S Publishers. 3. Guyton and Hall, 2011, Textbook of Medical Physiology, 12th edition,W. B. Saunders Company. 4. Guyton &Hall, 2010, Textbook of Medical Physiology, 12th edition, SaundersPublishers. 5. Elaine N. Marieb, 1995, Human anatomy and physiology, 3rdedition, Benjamin/Cummings (aPearson education company)
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.youtube.com/watch?v=6qnSsV2syUE 3. https://www.youtube.com/watch?v=9_h0ZXx1lFw 4. https://slideplayer.com/slide/9431799/

Course Outcomes:

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

CO1: Explain the exchange of gases, design of blood vessels and cardiac cycle. (K1, K2, K3, K4)

CO2: Summarize the events in transmission of nerve impulsesmechanism of muscle contraction. (K1, K2, K3, K4)

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. (K1, K2, K3, K4)

CO4: Describe the process of Oogenesis, Spermatogenesis, Fertilization and Parturition. (K1, K2, K3, K4)

CO5: Understand the role of different hormones that regulate metabolism, growth, glucose homeostasis and reproductive function. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	M	H	M	H	L	H
CO3	H	H	H	M	M	L
CO4	H	H	H	M	L	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	M	M	H	L
CO3	H	L	H	L	M	M
CO4	H	L	M	M	H	H
CO5	H	H	H	M	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">BIOTECHNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core 15</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">UCBCO24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• fundamental knowledge on gene manipulation and gene transfer technologies.
• procedures involved in plant tissue culture.
• animal cell culture and stem cell technology.
• employability skills of students by providing knowledge in recent techniques such as PCR, blotting, ELISA etc.
• application of fermentation technology.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Basics of recombinant DNA technology
1.1 Recombinant DNA technology, principles of gene cloning.
1.2 Restriction endonucleases.
1.3 Enzymes used in DNA manipulation.
1.4 DNA ligase, Ligation of DNA molecule.
1.5 Linkers and adapters, homopolymer tailing, End labelling.
1.6 Construction maps of PBR322, λ bacteriophage.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
Introduction to Plant tissue culture and gene transfer in plants
2.7 Plant tissue culture – basic requirements for culture.
2.8 Media requirements – MS Medium.
2.9 Callus culture, protoplast culture.
2.10 Vectors – Ti plasmid (cointegration vector and binary vector)
2.11 Viral vectors – TMV, CaMV and their applications.
2.12 Transgenic plants – pest resistant, herbicide resistant and stress tolerant plants.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
Introduction to animal tissue culture and gene transfer in animals
3.1 Animal tissue culture – basic requirements.
3.2 Animal cell lines and organ culture
3.3 Culture methods – primary cell culture, types of cell cultures -monolayer, suspension, clone, mass and stem cell culture.
3.4 Transgenic animals: transgenic mice- production and its applications.
3.5 Stem cell technology – definition, types and applications.
3.6 Cell fusion methods – virus, chemical and liposome, Hybridoma cells e.g. – monoclonal antibody production.</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **Molecular methods in gene manipulation** 4.1 DNA isolation methods – principles. 4.2 PCR – principle, types. 4.3 Application of PCR in clinical diagnosis and forensic science. 4.4 Southern blotting- principle, technique and their applications. 4.5 Northern blotting- principle, technique and their applications. 4.6 DNA finger printing- principle, technique and their applications.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **Basic concepts in Fermentation** 5.1 Fermentation technology – basics and applications. 5.2 Fermenter design, types and process. 5.3 Media and media optimization methods 5.4 Downstream processing 5.5 Production and applications of ethanol, Streptomycin and Proteases 5.6 Production of edible vaccines.

Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. James D. Watson, Amy A. Caudy, Richard M. Myers, Jan Witkowski, 2006, Recombinant DNA: Genes and Genomes - a Short Course, 3rd edition, W.H. Freeman & Co 2. Sathyanarayana U, 2008, Biotechnology, 3rd edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd. 3. Cassida L.E, 2007, Industrial Microbiology, New Age International
Reference Books	**1.** Reed G, 2004, Prescott and Dunn's Industrial Microbiology, CBS Publishers & Distributors **2.** David P. Clark, Pazdernik N. J, 2009, Biotechnology: applying the genetic revolution- Elsevier. **3.** Click B.R. and Pasternark J.J, 2010, Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th edition, American Society for Microbiology **4.** Chaitanya K.V, 2019, Genome and Genomics, 1st edition, Springer Nature. 5. Stanbury P.F, Whitaker A and Hall S.J, 2006, Principles of fermentation technology. 2nd edition, Elsevier Science Ltd.
Website and e-learning source	1) https://nptel.ac.in/courses/102/103/102103041/ 2) https://www.sciencedirect.com/topics/neuroscience/genetic-engineering 3) http://www.biologydiscussion.cm/biotechnology/techniques-biotechnology/importanttechniques-of-biotechnology-3-techniques/15683 4) https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1 5) https://www.slideshare.net/zeal_eagle/fermentation-technology

Course Outcomes:

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

CO1: Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonuclease. (K1, K2, K3, K4)

CO2: Get acquainted with the use of cloning and vectors in plant tissue culture. (K1, K2, K3, K4)

CO3: Understand the methods for production of proteins using recombinant DNA technology and their applications, basics of tissue culture, trans genesis, stem cell technology. (K1, K2, K3, K4)

CO4: Gain knowledge about the importance of gene and gene manipulation technologies. (K1, K2, K3, K4)

CO5: Gain knowledge about the importance of gene and gene manipulation technologies. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: MEDICAL CODING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline specific Elective III A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UEBCE24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">The course aims at giving an overall view of the
• basic concept in Medical coding.
• medical terminology.
• classification of diseases based on WHO/AHA.
• CPT code used for diseases as per American Medical Association (AMA).</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
Medical coding concepts
1.1 Introduction to Medical coding.
1.2 Health care in India and US
1.3 Importance and significance of coding in today’s world
1.4 Health care common procedure coding system
1.5 First Aid.
1.6 CPR</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
Medical Terminology and coding
2.1 Introduction to Medical Terminology.
2.2 Specialization I & II.
2.3 Diagnostic coding.
2.4 HCPCS and types.
2.5 HCPCS significance and usage
2.6 Modifiers Level II HCPCS</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
Documentation and codes
3.1 Documenting medical records.
3.2 Importance of Documentation.
3.3 Types of dictation formats.
3.4 Significance of parent codes.
3.5 Symbols.
3.6 Alpha numeric codes.</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **ICD10CM coding system** 4.1 Introduction to Human Anatomy and Coding. 4.2 Pathophysiology 4.3 ICD10CM Overview 4.4 ICD10CM Classification system 4.5 General coding 4.6 Chapter specific guidelines
	UNIT-V: (15 hours) (K1, K2, K3 & K4) **CPT coding system** 5.1 Introduction to CPT coding. 5.2 Types of CPT coding 5.3 Category I to III 5.4 Six sections of CPT 5.5 CPT Modifiers 5.6 Medical Law and Ethics

Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. L. Sandra, Johnson, Robin Linker, Understanding Medical Coding, A comprehensive guide 2. Buck's Step – by – step Medical Coding Elsevier reference
Reference Books	**1.** Terry Tropin M Shai, 2017, ICD-10-CM coding guidelines made easy, Create space Independent pub. **2.** Besty J Shiland, 2017, Medical terminology and anatomy for ICD-10 Coding, 3rd edition, Elsevier Mosby **3.** Marsha S. Diamond, 2006, Mastering Medical Coding, 3rd edition, Elsevier. **4.** Beth A. Rich, 2012, Medical coding: A journey, Illustrated edition, Pearson. **5.** Elizabeth Roberts, 2018, Medical Coding in the Real World, 3rd edition, American health information management association.
Website and e-learning source	1) https://www.slideshare.net/rajesh3102/introduction-to-coding 2) https://www.slideshare.net/SealingOnlyYours/intoduction-to-cpt 3) https://www.slideshare.net/CureMDHealthcare/icd0-conventions-and-guidelines 4) https://www.youtube.com/watch?v=FkbTNUn6qkE 5) https://www.youtube.com/watch?v=Xj67rhzr8oY

Course Outcomes:

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

CO1: Explaining the basic concept of coding and its application. Possess the knowledge about the First aid and CPR (K1, K2, K3, K4)

CO2: Possess the knowledge about medical terminology used in Medical coding industry (K1, K2, K3, K4)

CO3: Possess the knowledge about the ICD-10 CM international classification of diseases based on WHO. (K1, K2, K3, K4)

CO4: Possess the knowledge about the CPT codes used for diseases as per American Medical Association (AMA). (K1, K2, K3, K4)

CO5: Understand CPT coding and its types (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: BIOENTREPRENEURSHIP</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective IV</td></tr>
<tr><td>Category</td><td>Elective IC</td><td>Year
Semester</td><td>III
VI</td><td>Credits</td><td>3</td><td>Course Code</td><td>UEBCF24</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>5</td><td></td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">The main objectives of this course are to:
• Impart knowledge on bio entrepreneurship and the types of industries
• Learn about business plan, proposal and funding agencies
• Understand the market strategy and the role of information technology in expansion of business
• Provide insights on legal requirement and accounting to establish as Bio entrepreneurship
• Familiarize about business bio incubators centers</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
1.1 Biopharma
1.2 Bio agriculture
1.3 CRO – Clinical Research Organizations
1.4 Introduction to Trademarks
1.5 Copyrights
1.6 Patents</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
2.1 Business Plan, Budgeting and Funding Idea or opportunity
2.2 Business proposal preparation.
2.3 Funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start-up and make in India Initiative;
2.3 Dispute resolution skills; external environment changes;
2.4 Avoiding/managing crisis
2.5 Decision making ability.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
3.1 Market Strategy
3.2 Basics of market forecast for the industry
3.3 Distribution channels – franchising, policies
3.4 Promotion and advertising
3.5 Branding and marketing
3.6 Introduction to information technology for business administration and Expansion</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3 & K4) 4.1 Legal Requirements, Finance and Accounting. 4.2 Registration of company in India; Ministry of Corporate Affairs (MCA) 4.3 Basics in accounting: Introduction to concepts of balance sheet, 4.4 Profit and loss statement, double entry, bookkeeping 4.5 Finance and break-even analysis 4.6 Difficulties of entrepreneurship in India
	UNIT-V: (18 hours) (K1, K2, K3 & K4) 5.1 Role of knowledge centres such as universities, innovation centres, 5.2 Research institutions (public & private) 5.3 Business incubators in Entrepreneurship development 5.4 Quality control and quality assurance 5.5 Definition, role and importance of CDSCO, NBA 5.6 Definition, role and importance of GLP, GCP, GMP.

Extended Professional Component (isa part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinations SEM/TEM/GATE/UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Adams, D. J. ,2008, Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham. 2. Shimasaki, C, 2014, Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press 3. Onetti, A, 2015, Business modeling for life science and biotech companies, Creating value and competitive advantage with the milestone bridge. 4. Kapeleris, D. H, 2006, Innovation and entrepreneurship in biotechnology: Concepts, theories & cases
Reference Books	1. Desai, V, 2009, The Dynamics of Entrepreneurial Development and Management, New Himalaya. New Himalaya House Delhi 2. Ono, R. D,1991, The Business of Biotechnology, From the Bench of the Street. Butterworth- Heinemann - ISBN 10: 1138616907 / ISBN 13: 9781138616905 3. Jordan, J. F, 2014, Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press - ISBN-10: 812243049X ,ISBN-13 : 978-812243049

Website and e-learning source	**1.** http://www.simplynotes.in/enotes/mbabba/entreprneurship-development/ **2.** https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introductionto-entrepreneurship/ 3. https://link.springer.com/book/10.1007/978-0-387-48345-0 4. https://books.google.co.in/books/about/Handbook_of_Bioentrepreneurship.html?id=0UoM48fo6_IC&redir_esc=y

Course Outcomes:

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

CO1: Understand the concept and scope for entrepreneurship

CO2: Identify various operations involved in a venture creation

CO3: Gather funding and launching a winning business

CO4: Nurture the organization and harvest the rewards

CO5: Illustrate about the Business incubator centers and Bioentrepreneurship

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	H	H	M	H
CO 2	H	H	H	H	L	H
CO 3	H	H	H	H	L	H
CO 4	H	H	H	M	H	H
CO 5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: IMMUNOLOGY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective IV A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Discipline Specific Elective</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UEBCG24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• 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.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Structure and function of lymphoid organs
1.1 Structure and function of primary lymphoid organ – Thymus
1.2 Structure and function of primary lymphoid organs - Bone marrow
1.3 Secondary lymphoid organ – Spleen
1.4 Secondary lymphoid organ - lymph node
1.5 Cells involved in immune system
1.6 Functions - Phagocytosis – Inflammation</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
Antigens & Antibody structure and function
2.1 Antigens - Nature, Immunogens, and haptens, cross reactions
2.2 Immunoglobulin- types- structure and function.
2.3 Cells involved in antibody formation, Clonal selection theory, Co-operation of T-cell with B-cell.
2.4 Differentiation of T and B lymphocyte
2.5 Humoral and cell mediated immunity.
2.6 Monoclonal antibody – Production and application in biology.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3, K4)
Immunity and its types
3.1 Immunity and its types-Innate, Acquired
3.2 Active and passive Immunity
3.3 Natural and Artificial Immunity
3.4 Commonly used toxoid vaccines, killed vaccines, live attenuated vaccines.
3.5 rDNA Vaccines
3.6 DNA and subunit vaccines</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3, K4) **Hypersensitivity** 4.1 Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), 4.2 Auto- immune diseases with examples. 4.3 Organ specific and systemic autoimmunity. 4.4 SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC 4.5 Graft Vs host reaction 4.6 Immunosuppressive Agents.
	UNIT-V: (18 hours) (K1, K2, K3, K4) **Antigen-antibody reactions** 5.1 Antigen-antibody reactions, General features of Antigen Antibody reactions. 5.2 Precipitation and Immuno diffusion 5.3 SID and DID - Oudin Procedure, Oakley Fulthrope Procedure, Radio immune diffusion, Ouchterlony double diffusion, CIE. 5.4 Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test 5.5 Wasserman's reaction 5.6 RIA & ELISA.
Recommended Text	1. Kuby. J, 2018. Immunology, 5th Edition. W.H. 2. Rao, C. V,2017, Immunology, 3rd Edition, Alpha Science Int. Ltd 3. Tizard ,1995, An Introduction to Immunology. Harcourt Brace College Publications 4. Kuby J, 2017, Textbook of Immunology, 9th Edition, W H Freeman company, New York. 5. Dulsy Fathima and Arumugam, 2004, Immunology, Saras Publications ,13th Edition.
Reference Books	1. Kenneth M. Murphy, Paul Travers, Mark Waldport ,2007, Jane way's Immune biology, 7th Edition, Garland Science. 2. Abul K. Abbas, Andrew H. Lichtman, Jordan S. Pober ,1994, Cellular and molecular immunology, 2nd Edition, B. Saunders Company. 3. Abul Abbas, Andrew Lichtman, Shiv Pillai, 2019, Basic Immunology Functions and Disorders of the Immune System, 6th Edition - ISBN: 9780323549431eBook 4. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt,2006, Roitt's Essential Immunology, 11th edition, Wiley-Blackwell 5. Tizard L R, 2017, Immunology, 13th edition.
Website and e-learning source	1) https://nptel.ac.in/courses/102/103/102103041/ 2) https://www.sciencedirect.com/topics/neuroscience/genetic-engineering 3) http://www.biologydiscussion.cm/biotechnology/techniques-biotechnology/importanttechniques-of-biotechnology-3-techniques/15683 4) https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1 5) https://www.slideshare.net/zeal_eagle/fermentation-technology

Course Outcomes:

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

CO1: Associate structure and function of the organs involved in our body's natural Defense

CO2: Classify antigens and antibodies and the role of lymphocytes in defending the host.

CO3: Describe the types of immunity and the uses of vaccines.

CO4: Understand the immune related diseases and mechanism of transplantation.

CO5: Examine the immunological tests and relate it to the immune status of an Individual.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	M	H
CO2	H	H	M	H	M	H
CO3	H	H	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	H	H
CO2	H	H	M	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: BASICS OF FORENSIC SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective IVB</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Discipline Specific Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UEBCH24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td></td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objectives of this course are to
Gain knowledge on the basic practices of forensic analysis.
Perform investigation using fresh blood.
Carry out the analysis using body fluids
Investigate the presence of forms of drugs and poisons in body fluids.
Execute the identification test on multiple samples.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3 & K4)
1.1 Forensic Science: Definition & History
1.2 Development of forensic science.
1.3 Crime scene management
1.4 Crime investigation;
1.5 Collection, Preservation. Packing and forwarding of specimens
1.6 Physical and trace evidences for analysis.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3 & K4)
2.1 Blood – grouping and typing of fresh blood samples.
2.2 Blood typing including enzymes.
2.3 Cases of disputed paternity
2.4 Cases of disputed maternity problems.
2.5 DNA profiling.
2.6 Techniques involves in DNA profiling</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (15 hours) (K1, K2, K3 & K4)
3.1 Analysis of body fluids
3.2 Analysis of illicit liquor including methyl and ethyl alcohol in body fluids.
3.3 Analysis of illicit liquor including methyl and ethyl alcohol in breath.
3.4 Chemical examination
3.5 Physiology and pharmacology of Insecticides
3.6 Physiology and pharmacology pesticides.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: (15 hours) (K1, K2, K3 & K4)
4.1 Psychotropic drugs –Sedatives.
4.2 Psychotropic drugs - Stimulants, opiates
4.3 Drugs of abuse.
4.4 Identification of poisons from viscera,
4.5 Identification of poisons from tissues
4.6 Identification of poisons from body fluids.</td></tr>
</table>

	UNIT-V: (18 hours) (K1, K2, K3 & K4) 5.1 Identification tests- Identification of hair, 5.2 Determination of species origin 5.3 Determination of Sex, site and individual identification from hair. 5.4Classification and identification of fibers. 5 . 5 Examination and identification of saliva, milk, 5.6 Examination and identification of urine and fecal matter

Extended Professional Component (is a part of internal component only, not to be included in theexternal examination question paper)	Questions related to the above topics, from various competitive examinations S E T / N E T / G A T E, UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Antony J Britino, Forensic Science: Fundamentals & Investigations, Wraparound Teacher's Edition 2. Roy Saferstein , 2022, Forensic Science, An Introduction, 4th edition 3. Richard Safarstein, Criminalistics – An Introduction to Forensic Science, 10th Edition 4. P.C. Dikshit, Chittaranjan Behera, 2022, Textbook of Forensic Medicine and Toxicology ,3rd Edition, jeepee Publishers and Distributors (P) Ltd 5. Jim Fraser (Editor), Robin Williams , 2008, Handbook of Forensic Science, Willian Publications
Reference Books	1. An Introduction to Forensic DNA Analysis by Norah Rudin& Keith Inman USA, Second edition. 2. Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E. 3. Forensics by Embar-Seddon, Ayn and Pass. Allan D. 4. Forensic Medicine by Adelman, Howard C &Kobilinsky, Lawrence
Website and e-learning source	1. https://bookauthority.org/books/best-forensic-science-books 2. https://www.taylorfrancis.com/books/mono/10.4324/9781315170336/forensic-science-suzanne-bell 3. https://fivebooks.com/best-books/forensic-science-jim-fraser/ 4. https://www.taylorfrancis.com/books/edit/10.4324/9780429318757/forensic-science-kathy-mirakovits-jay-siegel

Course Outcomes:

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

CO1: Gain knowledge on basics of forensic science and method for collection and preservation of samples

CO2: Assess the paternity, maternity problems and DNA profiling

CO3: Identify the presence of alcohol, i n s e c t i c i d e s and pesticides in body fluids

CO4: Detail on the test performed to identify the presence of drugs and poisons in body fluids

CO5: Identify species and sex from the available body fluids

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	M	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL AWARENESS FOR COMPTETITIVE EXAMINATIONS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Professional Competency SEC - 8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td>Credits</td><td>2</td><td>Course Code</td><td>UPBC24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn verbal aptitude in English grammar.
• To solve problems related to mathematical reasoning.
• To understand quantitative aptitude calculations.
• To be able to write comprehensions in English.
• To familiarize with ecosystem and its principle.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (6 hours) (K1, K2, K3 & K4)
Verbal Aptitude:
1.1 Basic English grammar: tenses, articles.
1.2 Adjectives, prepositions.
1.3 Conjunctions.
1.4 Verb-noun agreement, and other parts of speech.
1.5 Basic vocabulary: words, idioms, and phrases in context Reading.
1.6 Comprehension Narrative sequencing</td></tr>
<tr><td></td><td colspan="7">UNIT II (6 hours) (K1, K2, K3 & K4)
Mathematical Reasoning:
2.1 Types of reasoning - Number series, Letter series,
2.2 Codes and Relationships.
2.3 Mathematical Aptitude: - Fraction, Time & Distance.
2.4 Ratio, Proportion and Percentage,
2.5 Profit and Loss, Interest.
2.6 Discounting, Averages etc.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (6 hours) (K1, K2, K3 & K4)
Quantitative Aptitude:
3.1 Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data).
3.2 2- and 3-dimensional plots, maps, and tables.
3.3 Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms.
3.4 permutations and combinations, and series.
3.5 Mensuration and geometry.
3.6 Elementary statistics and probability.</td></tr>
</table>

	UNIT-IV: (15 hours) (K1, K2, K3 & K4) **English Comprehension:** 4.1 A passage of text be given. Questions be asked from the passage to be answered. 4.2 Information and Communication Technology (ICT) ICT: General abbreviations and terminology. 4.3 Basics of Internet, Intranet. 4.4 E-mail, Audio and Video-conferencing. 4.5 Digital initiatives in higher education. 4.6 ICT and Governance.
	UNIT-V: (18 hours) (K1, K2, K3 & K4) **Human and environment interaction:** 5.1 Anthropogenic activities and their impacts on environment. 5.2 Environmental issues: pollution- Air, Water, Soil, Noise. 5.3 Waste (solid, liquid, biomedical, hazardous, electronic). 5.4 Climate change and its Socio-Economic and Political dimensions. 5.5 Natural and energy resources: Solar, Wind, Soil, Hydro, Geothermal, Biomass, Nuclear and Forests. 5.6 Natural hazards and disasters.

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations NET/SET /GATE and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Raymond Murphy, 2024, Essential English Grammar with Answers, 2nd Edition, Paperback. 2. Aggarwal RS, 2022, A Modern Approach To Verbal & Non-Verbal Reasoning All Government and Entrance Exams, Paperback.
ReferenceBooks	1. Norman Lewis, 2009, Word Power made easy, Goyal Publishers & Distributors Pvt. Ltd. 2. Lyn D English, 1997, Mathematics & Reasoning. 3. Hildebrad FB, 2003, Introduction to numerical analysis, 2nd Edition.
Website and e-learning source	1. https://www.youtube.com/@biochemistryauxiliumcollege 2. https://www.cuemath.com/learn/mathematical-reasoning/ 3. https://www.examfriend.in/questions-and-answers/estimation/numerical-estimation 4. https://englishforeveryone.org/Topics/Reading-Comprehension.html 5. https://unacademy.com/content/nta-ugc/study-material/ecology-environment/people-environment-interaction/

Course Outcomes:

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

CO1: To use proper vocabularies in comprehension and paragraph writing.

CO2: To solve problems related to reasoning, number series, percentage etc.

CO3: Able to interpretate data in computational formats.

CO4: Able to use ICT for better learning.

CO5: Describe the importance of ecosystem and human interaction with nature.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	H	H	M	H	H	H
CO 2	H	H	H	M	H	H
CO 3	M	L	M	M	M	M
CO 4	H	H	H	H	M	L
CO 5	H	M	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	M	H	M	H
CO3	H	M	L	M	H	H
CO4	M	H	M	H	H	M
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ALLIED: BIOCHEMISTRY I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Generic Elective 1/ Allied</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">UABCA24</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="5"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="8">The main objectives of this course are to:
• Introduce the structure and classification of carbohydrates
• Comprehend the metabolism of carbohydrates
• Study the classification and properties of amino acids
• Elucidate the various levels of organization of Proteins
• Study functions and deficiency diseases of vitamins</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3 & K4)
Definition and classification of carbohydrates
1.1 Definition and classification of carbohydrates.
1.2 Physical properties of Carbohydrate –Mutarotation, isomerism.
1.3 Chemical Properties – Reactions of Glucose – Oxidation, Reduction and Osazone formation.
1.4 Linear and cyclic forms (Haworth projection) for glucose, fructose, mannose and disaccharides (Maltose, Lactose sucrose).
1.5 Occurrence, structure and General properties of monosaccharides and disaccharides.
1.6 Occurrence and significance of polysaccharides.</td></tr>
<tr><td></td><td colspan="8">UNIT II (12 hours) (K1, K2, K3 & K4)
Metabolism- Catabolism and Anabolism
2.1 Carbohydrate metabolism- Glycolysis
2.2 Pentose phosphate pathway
2.3 TCA cycle
2.4 Electron transport chain
2.5 HMP shunt
2.6 Glycogen metabolism and energetics.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Amino acids
3.1 Amino Acids: Occurrence, biological importance of amino acids and structure of peptide bond
3.2 Amino acids - Classification based on structure and polarity side chain
3.3 Physical properties -Amphoteric nature and Isoelectric pH
3.4 Chemical properties - reactions of carboxyl, amino and both groups.
3.5 Amino acid metabolism -transamination, Deamination
3.6 Decarboxylation.</td></tr>
</table>

	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **Proteins** 4.1 Proteins- classification 4.2 Biological functions physical properties- ampholytes, isoelectric point, salting in and salting out 4.3 Denaturation, nature of peptide bond. 4.4 Secondary structure - α-helix and β-pleated sheet 4.5 Tertiary structure 4.6 Quaternary structure
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **Vitamins** 5.1 Vitamins: Fat soluble vitamins A and D - Sources, RDA, Biochemical functions and Deficiency diseases 5.2 Vitamins: Fat soluble vitamins E - Sources, RDA, Biochemical functions and Deficiency diseases 5.3 Fat soluble vitamin K - Sources, RDA, Biochemical functions and Deficiency diseases 5.4 Water soluble vitamins B1, B2 and B5- Sources, RDA, Biochemical functions and Deficiency diseases 5.5 Water soluble vitamins B6 and B12 - Sources, RDA, Biochemical functions and Deficiency diseases 5.6 Water soluble vitamin C - Sources, RDA, Biochemical functions and Deficiency diseases

Extended Professional Component (isa part of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. Sathyanarayana U, & Chakrapani U, 2013, Text book of Biochemistry, 4th Edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd,. 2. Agarwal G.R, Kiran Agarwal & Agarwal O.P, 2015, Textbook of Biochemistry (Physiological chemistry),18th Edition, Goel Publishing House. 3. Chatterjee M.N, Rana Shinde, 2007, Textbook of Medical Biochemistry - 7th Edition - Jaypee Publishers. 4. Ambika Shanmugam, 2016, Medical Biochemistry, 8th Edition, Wolters Kluwer India Private Ltd. 5. T. Devasena, 2010, Enzymology, 1st Edition, Oxford University Press.

Reference Books	1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd Edition, East West Press Pvt. Ltd. 2. David Nelson, Michael, Cox M, 2005, Principles of Biochemistry, 4th Edition W.H. Freeman and Company. 3. Voet D, Voet J.G and Pratt C.W, 2004, Principles of Biochemistry, 4th Edition John Wiley & Sons, Inc. 4. Jain J.L, Sanjay Jain, Nithin Jain, 2008, Fundamentals of Biochemistry, S Chand and Company Ltd, 8th Edition. 5. Zubay G.L *et.al*., 1995, Principles of Biochemistry, 1st Edition, WmC. Brown Publishers.
Website and e-learning source	1. https://www.geeksforgeeks.org/classification-of-carbohydrates/ 2. onlinecourses.swayam2.ac.in/cec20_bt12 3. onlinecourses.swayam2.ac.in/cec20_bt19 4. https://www.khanacademy.org/science/biology/macromolecules/proteins-and-amino-acids/a/orders-of-protein-structure 5. https://www.britannica.com/science/vitamin

Course Outcomes:

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

CO1: Classify the structure of carbohydrates and its properties. (K1, K2, K3, K4)

CO2: Explain the metabolism of carbohydrates and its significance (K1, K2, K3, K4)

CO3: Classify amino acids and its properties. (K1, K2, K3, K4)

CO4: Explain the classification and elucidate the different levels of structural organization of proteins. (K1, K2, K3, K4)

CO5: Identify the disease caused by the deficiency of vitamins. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	L	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	L	H
CO3	H	M	H	H	L	H
CO4	H	M	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED: BIOCHEMISTRY PRACTICAL I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective 1 / Allied</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">UABCB24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">2</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the:
To comprehend the safety measures in the laboratory
Identify carbohydrates by qualitative test
Estimate biomolecules volumetrically
Estimate protein quantitatively
To confer about the principle and application of chromatography, electrophoresis and colorimeter.</td></tr>
<tr><td>Course Outline</td><td colspan="7">I Safety Measures in the Laboratory</td></tr>
<tr><td></td><td colspan="7">II Qualitative analysis of carbohydrates
a) Monosaccharides-Glucose, Fructose
b) Disaccharides- Lactose, Maltose, Sucrose
c) Polysaccharides-Starch</td></tr>
<tr><td></td><td colspan="7">III Volumetric analysis
a) Estimation of ascorbic acid using 2,6 dichlorophenol indophenol as link solution
b) Estimation of Glucose by Benedict’s method
c)Estimation of Glycine by Sorenson Formal titration</td></tr>
<tr><td></td><td colspan="7">IV Quantitative analysis
a) Colorimetric estimation of protein by Biuret method</td></tr>
<tr><td></td><td colspan="7">V Instrumentation: (Demonstration)
a) Chromatography: Column, Paper, Thin layer
b) Electrophoresis: Vertical and Horizontal
c) Colorimeter</td></tr>
</table>

Recommended Text	1. Jayaraman J, 2001, Manuals in Biochemistry - New Age International Publishers. 2. Varley H, Alan Gowen lock 2002, Practical Biochemistry - 6th Edition, CBS Publishers.
Reference Books	1. David Plummer T, 2005, Practical Biochemistry - 3rd Edition, McGraw Hill Publishers. 2. Sawhney S.K. and Randhir Singh, 2001, Introductory Practical Biochemistry, 2nd Edition - Narosa Publishers. 3. Kanai Mukherjee L, 2010, Medical Laboratory Technology - Volume I - Tata Graw Hill Publication Company Limited.
Website and e-learning source	1. https://www.youtube.com/watch?v=ojhdTFmkY 2. https://www.youtube.com/watch?v=1kTbPx0WFiA 3. https://www.youtube.com/watch?v=Jr_ylwvxcQg 4. https://www.youtube.com/results?search_query=qualitative+analysis+of+starch 5. https://www.youtube.com/watch?v=_i_JjW_rNHM

Course Outcomes:

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

CO1: To understand the safety measures in the laboratory. (K1, K2, K3, K4)

CO2: Understand the various identification tests for carbohydrates (K1, K2, K3, K4)

CO3: Estimate biomolecules volumetrically. (K1, K2, K3, K4)

CO4: Estimate protein quantitatively (K1, K2, K3, K4)

CO5: Discuss the principle and application of chromatography, electrophoresis and colorimeter. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	L	H
CO3	H	M	H	H	L	H
CO4	H	M	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED BIOCHEMISTRY II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective 2 / Allied</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td rowspan="2">UABCC24</td></tr>
<tr><td>Semester</td><td>II</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td></td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The main objectives of this course are to:
• Impart knowledge on the classification, properties and characterization of lipids.
• Comprehend the metabolism of Lipids
• Acquaint with the structure, properties and functions of nucleic acids
• Learn about the enzyme kinetics and inhibition
• Study the importance of Hormones</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3 & K4)
Lipids–Bloor’s classification of lipids
1.1 Biological importance of lipids and types of Fatty acid–Saturated, Unsaturated, Compound lipids and derived lipids
1.2 Physical Properties and Chemical Properties–Reactions involving Double bond, Carboxyl and Hydroxyl groups
1.3 Classification of Lipids - Simple Lipids (Fats, Oils and Waxes)
1.4 Compound lipids - Phospholipids: Phosphoglycerides (Lecithin, Cephalin and Plasmalogen), Phosphoinositides (Phosphotidyl inositol) and phosphosphingosides (Sphingomyelin), Glycolipids: Cerebrosides, Gangliosides.
1.5 Derived lipids -Sterols (Cholesterol – structure and functions)
1.6 Iodine number, Acid number, Saponification number, Reichert – meissl number of oils.</td></tr>
<tr><td></td><td colspan="7">Unit II (12 hours) (K1, K2, K3 & K4)
Lipid metabolism
2.1 Oxidation of fatty acids (Palmitic acid) – Beta oxidation
2.2 Role of carnitine, energetics
2.3 Ketogenesis
2.4 Alpha oxidation and Omega oxidation
2.5. Biosynthesis of Cholesterol
2.6 Biosynthesis of saturated fatty acids.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: (12 hours) (K1, K2, K3 & K4)
Nucleic acids
3.1 Purine and pyrimidine bases, Nucleosides, nucleotides and Polynucleotides
3.2 DNA structure, various types
3.3 Properties, absorbance, effect of temperature
3.4 Structural Components and Biological importance of RNA
3.5 Different types of RNA, structure and function
3.6 Difference between DNA and RNA, Genetic code</td></tr>
</table>

	UNIT-IV: (12 hours) (K1, K2, K3 & K4) **Enzymes Classification** 4.1Nomenclature, IUB system of enzyme classification, active site, specificity 4.2 Isoenzymes, units of enzyme activity 4.3 Factors affecting enzyme activity, substrate concentration, pH, and temperature. 4.4 Michaelis and Menten equation 4.5 Line weaver Burk plot. 4.6 Enzyme inhibition, competitive, uncompetitive and non-competitive inhibition
	UNIT-V: (12 hours) (K1, K2, K3 & K4) **Hormones** 5.1 Hormones, Receptors, Effectors, Targets–Definition 5.2 Classification of hormones 5.3 Biological functions and disorders of Insulin 5.4 Biological functions and disorders of Thyroid hormones 5.5 Growth hormone- Biological functions and disorders 5.6 Oxytocin and Vasopressin -Biological function and disorders

Extended Professional Component (isa part of internal component only, not to beincluded in the external examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

RecommendedText	1. Sathyanarayana U, & Chakrapani U, 2013, Text book of Biochemistry, 4th Edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd. 2. Agarwal G.R, Kiran Agarwal & Agarwal O.P, 2015, Textbook of Biochemistry (Physiological chemistry),18th Edition, Goel Publishing House. 3. Chatterjee M.N, Rana Shinde, 2007, Textbook of Medical Biochemistry - 7th Edition - Jaypee Publishers. 4. Ambika Shanmugam, 2016, Medical Biochemistry, 8th Edition, Wolters Kluwer India Private Ltd. 5. T. Devasena, 2010, Enzymology, 1st Edition, Oxford University Press.
Reference Books	1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd Edition, East West Press Pvt. Ltd. 2. David Nelson, Michael, Cox M, 2005, Principles of Biochemistry, 4th Edition W.H. Freeman and Company. 3. Voet D, Voet J.G and Pratt C.W, 2004, Principles of Biochemistry, 4th Edition John Wiley & Sons, Inc. 4. Jain J.L, Sanjay Jain, Nithin Jain, 2008, Fundamentals of Biochemistry, 8th Edition, S Chand and Company Ltd. 5. Zubay G.L *et.al*., 1995, Principles of Biochemistry, 1st Edition, WmC. Brown Publishers.

Website and e-learning source	1. https://www.abcam.com/pathways/fatty-acid-oxidation 2. onlinecourses.swayam2.ac.in/cec20_bt19 3. https://www.britannica.com/science/DNA 4. https://iubmb.qmul.ac.uk/enzyme/rules.html 5. https://www.slideshare.net/AnupBajracharya1/hormones-and-its-classification

Course Outcomes:

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

CO1: Elaborate on the classification, structure, properties, functions and characterization of lipids (K1, K2, K3, K4)

CO2: Discuss the metabolism of lipids and its importance (K1, K2, K3, K4)

CO3: Explain about structure, properties and functions of nucleic acids (K1, K2, K3, K4)

CO4: Derive Michaelis Menten's equation and concepts of enzyme inhibition. (K1, K2, K3, K4)

CO5: Classify the Hormones and its biological functions (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	L	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	L	H
CO3	H	M	H	H	L	H
CO4	H	M	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED BIOCHEMISTRY PRACTICAL II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective 2/ Allied</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">UABCD24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry and Biology</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the:
• Identify amino acids by qualitative test
• Prepare biomolecules from its sources
• Estimate biomolecules volumetrically
• Determination of Iodine/ saponification number of an edible oil
• To confer about the principle and application of UV Spectrophotometer and Centrifuge.</td></tr>
<tr><td>Course Outline</td><td colspan="7">I. Qualitative analysis of amino acids
a) Arginine
b) Cysteine
c) Tryptophan
d) Tyrosine</td></tr>
<tr><td></td><td colspan="7">II. Biochemical preparations
a) Preparation of casein from milk.
b) Preparation of starch from potato.
c) Preparation of albumin from egg.</td></tr>
<tr><td></td><td colspan="7">III Volumetric Analysis:
a) Estimation of Iron using potassium permanganate
b) Estimation of Nitrite using sodium hydroxide</td></tr>
<tr><td></td><td colspan="7">IV Group Experiment
Determination of Iodine/ Saponification number of an edible oil (Demonstration)</td></tr>
<tr><td></td><td colspan="7">V Instrumentation: (Demonstration)
a) UV Spectrophotometer
b) Centrifuge</td></tr>
</table>

Recommended Text	1. Jayaraman J, 2001, Manuals in Biochemistry - New Age International Publishers. 2. Varley H, Alan Gowen lock 2002, Practical Biochemistry - 6th Edition, CBS Publishers.
Reference Books	1. David Plummer T, 2005, Practical Biochemistry - 3rd Edition, McGraw Hill Publishers. 2. Sawhney S.K. and Randhir Singh, 2001, Introductory Practical Biochemistry, 2nd Edition - Narosa Publishers. 3. Kanai Mukherjee L, 2010, Medical Laboratory Technology - Volume I - Tata Graw Hill Publication Company Limited.
Website and e-learning source	1. https://www.youtube.com/watch?v=eSxclkj_H5s 2. https://www.youtube.com/watch?v=94A0dr4R9mI 3. https://www.youtube.com/results?search_query=preparation+of+casein++from+milk 4. https://www.youtube.com/results?search_query=qualitative+analysis+of+starch 5. https://www.youtube.com/watch?v=xzy3IPGG8T8

Course Outcomes:

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

CO1: Understand the various identification tests for amino acids (K1, K2, K3, K4)

CO2: To Prepare biomolecules from its sources (K1, K2, K3, K4)

CO3: Estimate biomolecules volumetrically (K1, K2, K3, K4)

CO4: To determine the saponification number of an edible oil (K1, K2, K3, K4)

CO5: Discuss the principle and application of UV spectrophotometer and centrifuge (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	L	H

CO/PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	L	H
CO3	H	M	H	H	L	H
CO4	H	M	H	H	M	H
CO5	H	L	H	H	M	H