

# **DEPARTMENT OF BIOCHEMISTRY**



## HOLY CROSS COLLEGE (AUTONOMOUS)

Affiliated to Bharathidasan University  
Nationally Accredited (4<sup>th</sup> cycle) with A++ Grade (CGPA3.75/4) by NAAC  
College with potential for Excellence  
Tiruchirappalli – 620002

### SCHOOL OF LIFE SCIENCES DEPARTMENT OF BIOCHEMISTRY Programme : B.SC

<b>PO No.</b>	<b>Programme Outcomes</b> <i>Upon completion of the B.Sc. Degree Programme, the graduate will be able to</i>
PO-1	Get quality education in the areas of Biochemistry
PO-2	Acquire practical skills to gather information, assess, create and execute new ideas to develop entrepreneurial skills.
PO-3	Gain Proficiency in basic laboratory techniques and able to apply the scientific method on lab to land
PO-4	Inculcate a domestic and international perspective and be competent enough in the area of life sciences.
PO-5	Learn to recognize potential laboratory safety and conserve nature and the environment.

<b>PSO No.</b>	<b>Programme Specific Outcomes</b> <i>Upon completion of these courses the student would</i>
PSO-1	Use current biochemical and molecular techniques and carry out experiments
PSO-2	Monitoring the changes in modern life styles leads to modern diseases
PSO-3	Develop skills in cultivation of plants.
PSO-4	Prepare them to do higher studies in other biological fields like Genetic, Entomology, Biological Oceanography etc
PSO-5	Developed critical thinking skills/laboratory techniques to be capable of designing, carrying out ,interpreting scientific experiments

**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620002**

**SCHOOL OF LIFE SCIENCES**

**DEPARTMENT OF BIOCHEMISTRY**

**CHOICE BASED CREDIT SYSTEM -**

**UG COURSE PATTERN**

**B.SC**

**(For Candidates admitted from June 2020 onwards)**

Semester	Part	Course	Title Of The Course	Code	Hrs/ Wk	Credits	Marks	
I	I	Language	Tamil Paper I/ Hindi Paper I / French Paper I	U20TL1TAM01 / U20HN1HIN01 / U20FR1FRE01	3	3	100	
	II	English	English Paper I	U20EL1GEN01	3	3	100	
	III	Major Core -1	Molecules of Life	U20BC1MCT01	5	4	100	
		Major Core 2	Cell Physiology	U20BC1MCT02	4	4	100	
		Allied-1	Basics Of Bioinformatics	U20BT1ALT01	4	2	100	
		Allied-2	Plant Biochemistry	U20BO1ALT02	4	2	100	
		Major Core -3	Main Practical I	U20BC1MCP03	4	3	100	
	IV	Skill Based Elective -1	Environmental studies	U20RE1EST01	2	1	100	
		Value Education	Ethics/Bible Studies/Catechism	U20VE2LVE01/ U20VE2LVB01/ U20VE2LVC01	1			
		Extension Activities	Service Oriented Course				-	
		Extra Credit	Internship/Fie ld Work/Field Project - 30 hours Extra Credit	U20SP1ECC01	-		-	100
				<b>Total</b>	<b>30</b>	<b>22+ 2*</b>	<b>800+10 0</b>	

Semester	Part	Course	Title Of The Course	Code	Hrs/ Weak	Credits	Marks
	I	Language	Tamil Paper II/ Hindi Paper II / French Paper II	U20TL2TAM02 U20HN2HIN02 U20FR2FRE02	3	3	100
	II	English	English Paper II	U20EL2GEN02	3	3	100
		Major Core - 4	Bioinstrumentation Techniques	U20BC2MCT04	5	4	100
		Major Core -5	Nutritional <b>182</b>	U20BC2MCT05	4	4	100

II	III		Biochemistry				
		Major Elective-1	Course within the School		4	3	100
		Allied-3	Biostatistics	U20BT2ALT03	4	2	100
		Major Skill based Elective-1	Pain Relief Formulations & Cosmetics	U20BC2SBP01	2	1	100
	IV	Skill Based Course(SBC) - 1	Soft Skill Development	U20RE2SBT01	2	1	100
		Skill Based Course(SBC) - 2	Sustainable Rural Development and Student Social responsibility	U20RE2SBT02	2	1	100
		Value Education	Ethics/Bible Studies/Catechism	U20VE2LVB01/ U20VE2LVC01/ U20VE2LVE01	1	1	100
	V	Extension Activities	Service Oriented Course (Any one activity based on the Student's choice (15 activities))				
	VI	Extra Credit*	Internship/Field Work/Field Project (30 hours - Extra Credit)	U20SP2ECC02		2	100
				<b>Total</b>	<b>30</b>	<b>23+2*</b>	<b>1000+100</b>

**Major Elective Papers Offered by the Department:**

Semester	Part	Course	Title Of The Course	Code	Hrs/Week	Credits	Marks
II	III	Major Elective- I	Sports Biochemistry/ Nutrition & Therapeutic Diet	U20BC2MET01/ U20BC2MET02	4	3	100

**LIST OF Allied Papers Offered by Biochemistry: For Biotechnology & Chemistry**

<b>Semester</b>	<b>Part</b>	<b>Course</b>	<b>Title Of The Course</b>	<b>Code</b>	<b>Hrs/Weak</b>	<b>Credits</b>	<b>Marks</b>
<b>I</b>	<b>III</b>	Allied –1	Biomolecular Chemistry	U20BC1ALT01	4	2	100
		Allied –2	Allied Practical	U20BC1ALT02	4	2	100
<b>II</b>	<b>III</b>	Allied –3	Enzyme Technology	U20BC2ALT03	4	2	100

(For the candidates admitted from the academic year 2020 -21 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-2  
SCHOOL OF LIFE SCIENCES  
DEPARTMENT OF BIOCHEMISTRY  
B.Sc. -First Year - Semester – I

<b>COURSE TITLE</b>	<b>MAJOR CORE 1: MOLECULES OF LIFE</b>
<b>TOTAL HOURS</b>	<b>75</b>
<b>HOURS/WEEK</b>	<b>5</b>
<b>CODE</b>	<b>U20BC1MCT01</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>4</b>
<b>MARKS</b>	<b>100</b>

**General Objectives:**

The students will be able to understand the classification of biomolecules, structures and their importance.

**Course Objectives:**

The student will be able to

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Understand various biomolecules present in living cells - To understand the properties of carbohydrates and their structures.
CO-2	Evaluate the properties of Amino Acids, Peptides and Proteins. To study the Primary, Secondary, Tertiary and Quaternary structures of Proteins.
CO-3	To study the Components of Nucleic acids and structure of DNA and RNA and their synthesis.
CO-4	To understand the properties of lipids and its classification. Biological importance of Oils and fats
CO-5	To understand the Concept of Energy in Biosystems.

**Unit 1: Carbohydrates (15Hrs)**

Classification of carbohydrates, reducing and non-reducing sugars, General properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

*(Extra reading/key words: Soy polysaccharide fiber)*

**Unit II: Amino Acids, Peptides and Proteins (15Hrs)**

Classification of Amino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Physical and chemical properties of amino acids

*(Extra reading/key words: Phylogenetic analysis)*

### Unit 3: Nucleic Acids (15Hrs)

Components of Nucleic acids: Adenine, guanine, thymine and cytosine (structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

*(Extra reading/key words: replication, transcription, supercoil DNA)*

### Unit 4: Lipids (15Hrs)

Introduction to lipids, classification. Oils and fats: Classification of fatty acids. Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and derived lipids

*(Extra reading/key words: Prostaglandins, cardiac cycle)*

### Unit 5: Concept of Energy in Biosystems (15Hrs)

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change.

*(Extra reading/key words: ATP synthesis)*

**Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.**

CO No.	Course Outcomes:	PSOs Addressed	Cognitive Level
CO-1	Explain the significance of hydrophobic and hydrophilic forces for the structure of biomolecules with examples	PSO 1	U
CO-2	Discuss the four structure levels of proteins	PSO 2	U
CO-3	Draw and name the basic structure of carbohydrates, nucleic acids, peptides/proteins	PSO 3	R
CO-4	Distinguish between the different kinds of lipids. Identify several major functions of lipids	PSO 4	An
CO-5	List the sources and functions of the nutrients. Calorific value of food.	PSO 5	R

### TEXT BOOKS:

1. J.L. Jain, (2005): Fundamentals of Biochemistry, 6<sup>th</sup> Revised Edition, Sultan Chand and Company, New Delhi Company, New York.
2. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.

### References:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Berg, J. M., Tymoczko, J. L. & Stryer, L. Biochemistry 7th Ed., W. H. Freeman.

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**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc- First Year - Semester – I**

<b>COURSE TITLE</b>	<b>MAJOR ELECTIVE 1 – CELL PHYSIOLOGY</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC1MCT02</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>4</b>
<b>MARKS</b>	<b>100</b>

**General Objective:**

To enable the students to get themselves aware on how different tissue types are combined to form organs and how the organs function which follows from the structure and function of the constituent tissue.

**Course Objectives:**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Recall the history of cytology and draw the structure of cell organelles and locate its parts along with functions. Understand the structure of cell and its components and various events in cell cycle
CO-2	Understand the structure and functions of cell membrane and its transport
CO-3	Understand and apply the morphology and functions of Various Cell organelles
CO-4	Understand and apply structure and functions of nucleus and chromosomes.
CO-5	Understand the Oncogenes and Development of cancer and its treatment.

**UNIT – I**

**(12 Hrs)**

Overview of cells – Origin and evolution of cells. Cell theory, Classification of cells –Prokaryotic cells and Eukaryotic cells. Comparison of prokaryotic and eukaryotic cells. Molecular composition of cells: - Water, Carbohydrates, lipids nucleic acids and proteins. Cell Cycle: Phases, Meiotic and Mitotic division.

*Extrareading/Keywords: (Nucleoid, Tissue damage, Mutation )*

**UNIT – II**

**(12 Hrs)**

Cell Membrane – Fluid mosaic model of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their role. Transport across membranes –Diffusion - active and passive diffusion.

*(Extra reading/key words: cell culture)*

**UNIT – III**

**(12 Hrs)**

Endoplasmic reticulum – Types, structure and function. Golgi apparatus – Structure and function. Lysosome – Structure and functions. Morphology and functions of peroxisomes and glyoxisomes. Ribosomes – Types structure and function.

*(Extra reading/key words: inheritance of Golgi apparatus)*

**UNIT – IV**

**(12 Hrs)**

Nucleus: Structure and function. Chromosomes, chromatin structure. Mitochondria –Structure and functions. Cytoskeleton: Types of filaments and their functions. Microtubules – Chemistry and functions – Cilia and flagella.



*(Extra reading/key words: genetic inheritance)*

**UNIT – V**

**(12 Hrs)**

Oncogenesis: Development and causes of cancer, Types of cancer, Properties, early detection, Treatment. Oncogenes: Retro viral, proto, tumor suppressor gene.

*(Extra reading/key words: CCI therapies)*

**Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.**

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. Compare and contrast the events of cell cycle and its regulation	PSO 1	An
CO-2	Design the model of a cell.	PSO 2	HM
CO-3	Describe the Structure and Functions of Various cell organelles such as Endoplasmic reticulum, golgi complex, Ribosomes, & Lysosomes.	PSO 2	R
CO-4	Explain the organization of Genes and chromosomes, chromosome morphology and its aberrations.	PSO 3	U
CO-5	Distinguish the types and mechanism of Cancer. Describe the Oncogenes.	PSO 4	An

**TEXT BOOK**

1. Powar. C.B. Cell Biology, Himalaya publishing House, Delhi, 1996.

**BOOKS FOR REFERENCE:**

1. Verma P.S and V.K Agarwal – Cell Biology, S.Chand and company Ltd., New Delhi, 1998.
2. De Robertis E.D.P, and De Robertis E.M., Cell and Molecular Biology, 8<sup>th</sup>Edn. B.I.Waverly pvt. Ltd., New Delhi, 1995.
3. Freifelder.D., Molecular Biology, N.K.Mehra for Narosa publishing House New Delhi, 1990.
4. Kleinsmith, L.J and Kish V.M., Principles of Cell Biology Harper and Row publishers, New York, 1998.
5. Alberts et al., Molecular Biology of the Cell, 6<sup>th</sup>edn,
6. Alberts et al., 2008, Molecular biology of the cell, Garland science, USA, 5<sup>th</sup>edn

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**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. - First Year - Semester – I**

<b>COURSE TITLE</b>	<b>Major Practical – I</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC1MCP03</b>
<b>COURSE TYPE</b>	<b>PRACTICAL</b>
<b>CREDITS</b>	<b>3</b>
<b>MARKS</b>	<b>100</b>

**General Objective:**

This course will provide students with an understanding of Qualitative and quantitative Principles of Biomolecules.

**Course Objectives**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Understand the biological functions of biomolecules
CO-2	Identify and analyse the chemical and biochemical properties of biomolecules
CO-3	Understand principles, theory and calculations of each experiment
CO-4	Perform quantitative and qualitative analysis of known standards as well as unknown samples develop problem-solving skills and to nurture professional attitudes.
CO-5	Understand the applicability of the biochemical methods to realistic situations.

**I QUALITATIVE ANALYSIS:**

1. Reactions of simple sugars - glucose, fructose, galactose, xylose, lactose, maltose, sucrose, starch and dextrin.
2. Reactions of proteins – solubility, Biuret, Millon's and Xanthoproteic tests, denaturation by heat, pH change, precipitation by heavy metals and by acidic reagents, color reactions of amino acids like Try, Tyr, Arg, Pro, His.
3. Reactions of lipids – Solubility, saponification, acrolein test for unsaturation, Liebermann–Burchard test for cholesterol.

**II QUANTITATIVE ANALYSIS**

1. Estimation of reducing sugar by Benedict's titrimetric method.
2. Estimation of amino acids by formal titration.
3. Determination of acid number of an edible oil.
4. Estimation of Iodine value
5. Estimation of saponification value of fat
6. Estimation of DNA by diphenylamine method
7. Estimation of RNA by orcinol method.

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Gain technical experience and handle adjustable micro pipettes in a reproducible manner	PSO 1	U
CO-2	Demonstrate the use of standard curves.	PSO 2	An
CO-3	Plan experiments, write protocols	PSO 2	U
CO-4	Perform logical reasoning and criticizing data	PSO 3	R
CO-5	Name the functional groups in carbohydrates, nucleic acids, peptides/proteins and lipids.	PSO 4	An

**TEXT BOOK:**

1. J. Jayaraman (2011). Laboratory Manual in Biochemistry, New Age International Pvt Limited.

**BOOK FOR REFERENCE:**

1. ShivarajaShankara YM, Ganesh MK, Shivashankara AR (2012). Laboratory Manual for Practical Biochemistry, JaypeeBrothers,Medical Publishers Pvt. Limited.

(For the candidates admitted from the academic year 2020 -21 onwards)  
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**SCHOOL OF LIFE SCIENCES**  
**PG DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. - First Year - Semester – I**

<b>COURSE TITLE</b>	<b>ALLIED 1: BIOMOLECULAR CHEMISTRY</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC1ALT01</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>2</b>
<b>MARKS</b>	<b>100</b>

**General Objectives:**

To enable the students to learn the basic functions, structures and biological importance of lifeless chemical compounds

**Course Objectives:**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Exposure with the nature of various biomolecules present in living cells - To understand the properties of carbohydrates and their structures.
CO-2	To understand the properties of lipids and its classification. Biological importance of Oils and fats.
CO-3	Evaluate the properties of Amino Acids, Peptides and Proteins. To study the Primary, Secondary, Tertiary and Quaternary structures of Proteins.
CO-4	To study the Components of Nucleic acids and structure of DNA and RNA and their synthesis
CO-5	To understand Classification of enzymes and their industrial applications.

**UNIT-I**

(12 Hrs)

Carbohydrates: Monosaccharides-Definition, classification, structure and properties. Disaccharides-Definition, types, structure and biological importance. Polysaccharides-types and properties.

*(Extra reading/key words: Soy polysaccharide fiber)*

**UNIT-II**

(12 Hrs)

Lipids:-Definition, Classification and properties of lipids. Types of fatty acids -saturated, unsaturated and essential fatty acids. Classification and significance of lipoproteins and phospholipids. Importance of steroids, structure and biological significance of cholesterol.

*(Extra reading/key words: Prostaglandins, cardiac cycle)*

**UNIT-III**

(12 Hrs)

Amino acids: Classification of amino acids, essential amino acids, reactions of amino and carboxyl groups of amino acids. Proteins: Definition, classification and function of Proteins, structural levels of organization (Preliminary treatment). Denaturation and isoelectric point of Proteins.

*(Extra reading/key words: Phylogenetic analysis)*

**UNIT-IV****(12 Hrs)**

Nucleic acids: Components of DNA and RNA. Double helical structure of DNA. Structure and types of RNA. Denaturation and renaturation of DNA. Genetic code. Protein synthesis (an outline)

*(Extra reading/key words: replication, transcription, supercoil DNA)*

**UNIT-V****(12 Hrs)**

Enzymes: as a catalyst. Classification of enzymes with examples, nomenclature of enzymes. Units of Enzyme Activity. Coenzymes and cofactors (structures not needed). Characteristics of Enzymes, Factors affecting enzyme activity. Applications of Enzymes in Biology.

*(Extra reading/key words: plasma enzymes, antioxidant enzymes)*

**Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars**

<b>CO No.</b>	<b>Course Outcomes:</b>	<b>PSOs Addressed</b>	<b>Cognitive Level</b>
CO-1	Explain the significance of hydrophobic and hydrophilic forces for the structure of biomolecules with examples	PSO 1	U
CO-2	Discuss the four structure levels of proteins	PSO 2	U
CO-3	Draw and name the basic structure of carbohydrates, nucleic acids, peptides/proteins	PSO 3	R
CO-4	Distinguish between the different kinds of lipids. Identify several major functions of lipids	PSO 4	An
CO-5	Industrial applications of enzymes.	PSO 5	U

**Text Books:**

1. J.L. Jain, (2005): Fundamentals of Biochemistry, 6th Revised Edition, Sultan Chand and Company, New Delhi Company, New York.

**Reference Books:**

- Biochemistry –Lehninger, Nelson, Cox-CBS Publishers
- Harper’s Biochemistry: R.K. Murray, D.K Granner, P.A. Mayes and U.W.Rodwell –Lange Medical publications, 23<sup>rd</sup>edition.
- Textbook of Medical Biochemistry –RanaShindae and Chatterjee.
- Fundamentals of biochemistry –A.C. Deb New Central Book Agency, Calcutta 6<sup>th</sup>Edition.

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**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. - First Year - Semester – I**

<b>COURSE TITLE</b>	<b>Allied 2- AlliedPractical</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC1ALT02</b>
<b>COURSE TYPE</b>	<b>PRACTICAL</b>
<b>CREDITS</b>	<b>2</b>
<b>MARKS</b>	<b>100</b>

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Understand the biological functions of biomolecules
CO-2	Identify and analyse the chemical and biochemical properties of biomolecules
CO-3	Understand principles, theory and calculations of each experiment
CO-4	Perform qualitative analysis of known standards as well as unknown samples develop problem-solving skills and to nurture professional attitudes.
CO-5	Understand the applicability of the biochemical methods to realistic situations.

## **QUALITATIVE ANALYSIS**

### **1. ANALYSIS OF SUGARS**

- a) Monosaccharides-Glucose, Fructose, Galactose, Mannose, Pentose.
- b) Disaccharides-Sucrose, Maltose and Lactose.
- c) Polysaccharides-Starch and Dextrin.

### **2. ANALYSIS OF AMINO ACIDS**

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

### **3. LIPID ANALYSIS [GROUP EXPERIMENTS]**

- a) Determination of Saponification number.
- b) Determination of Acid number.
- c) Determination of Iodine number.
- d) Determination of RM number.

### **4. DEMONSTRATION EXPERIMENTS**

- a) Preparation of buffer and its pH measurements using pH meter.
- b) Separation of amino acids by TLC.
- c) Separation of Carotenoids by Adsorption chromatography.

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Gain technical experience and handle adjustable micro pipettes in a reproducible manner	PSO 1	U
CO-2	Demonstrate the use of standard curves.	PSO 2	An
CO-3	Plan experiments, write protocols	PSO 2	U
CO-4	Perform logical reasoning and criticizing data	PSO 3	R
CO-5	Name the functional groups in carbohydrates, nucleic acids, peptides/proteins and lipids.	PSO 4	An

**Text Book:**

1. David T. Plummer, An introduction to practical bio-chemistry.

**REFERENCES**

1. Pattabiraman, Laboratory manual in bio-chemistry.
2. J.Jayaraman, Practical bio-chemistry.

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**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. First Year - Semester – II**

<b>COURSE TITLE</b>	<b>MAJOR CORE 4: BIOINSTRUMENTATION TECHNIQUES</b>
<b>TOTAL HOURS</b>	<b>75</b>
<b>HOURS/WEEK</b>	<b>5</b>
<b>CODE</b>	<b>U20BC2MCT04</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>4</b>
<b>MARKS</b>	<b>100</b>

**General Objective:**

The student will be able to get a comprehensive technical knowledge in Life sciences

**Course Objectives**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Understand the working principles, tools and techniques of various analytical methods
CO-2	Understand and analyze the principles and applications of chromatography in research and related experiments.
CO-3	Apply the knowledge for the separation of proteins/peptides by selecting appropriate separation techniques.
CO-4	Apply the principle of electrophoresis to understand certain functionalities of Biomolecules.
CO-5	Apply the principle of radioisotopes to understand certain functionalities of isotopes

**UNIT: I**

**(15 Hrs)**

**SPECTROMETRIC METHODS**

Properties of electromagnetic radiations and their interaction with matter; UV and visible light spectroscopy; Beer-Lambert law; spectrofluorimetry; Mass spectrometry; components of mass spectrometer; methods of ionization and mass analysis including MALDI-TOF; IR spectroscopy;; NMR spectroscopy.

*(Extra reading/key words: Picosecond spectroscopy)*

**UNIT: II**

**(15 Hrs)**

**CHROMATOGRAPHY**

Chromatography: Principles of chromatography; distribution coefficient; retention time; capacity factor; plate height and resolution; peak broadening; TLC and column chromatography; matrix materials; HPLC; normal phase and reversed phase chromatography; ion exchange chromatography; gel exclusion chromatography; affinity chromatography; Gas chromatography.

*(Extra reading/key words: nanoliquid chromatography)*

**UNIT: III**

**(15 Hrs)**

**CENTRIFUGATION METHODS**

Centrifugation: Basic principles of sedimentation; centrifugal field and relative centrifugal force; types of centrifuges; types of rotors; differential centrifugation; density gradient centrifugation; preparative and analytical centrifugation. Safety aspects of centrifuges.

*(Extra reading/key words: commercial application)*



**UNIT: IV****(15 Hrs)****ELECTROPHORETIC TECHNIQUES**

Electrophoresis: General principle of electrophoresis; support media (agarose and polyacrylamide gels); electrophoresis by SDS-PAGE; native PAGE. Gradient gels; isoelectric focusing; two dimensional PAGE; Pulse Field Gel Electrophoresis (PFGE); capillary electrophoresis.

*(Extra reading/key words: microchip electrophoresis)*

**UNIT: V****(15 Hrs)****RADIOISOTOPE TECHNIQUES**

Radioisotope Techniques: Nature detection and measurements of radioactivity. GM counter; scintillation counter; pulse height analyser; isotope dilution analysis; autoradiography.

CT, MRI, PET

*(Extra reading/key words: radionuclide generator)*

**Note: Extra Reading/ Key Words are only for internal testing (Seminar / Assignments)**

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Understand the basic concepts and principles of biochemical techniques (spectrophotometry, )	PSO 1	R, U
CO-2	Understand how various chromatography detection	PSO 2	R
CO-3	Explain the theoretical principles of selected instrumental methods within centrifugation methods, and main components in such analytical instruments.	PSO 2	U
CO-4	Integrate different analytical techniques to solve analytical and bioanalytical problems in electrophoresis,	PSO 3	R
CO-5	Understand the physical principles of a range of isotopes in biology	PSO 4	An

**TEXT BOOK:**

1. Keith Wilson and John Walker (2004): Principles and Techniques of Practical Biochemistry, 5<sup>th</sup> edition, United Kingdom, Cambridge University Press

**BOOKS FOR REFERENCE:**

1. G.R. Chatwal and S. Anand (1999): Instrumental Methods of Chemical Analysis, Himalaya Publishing, Mumbai
2. Srivastava V.K. and K.K. Srivastava (1981): Introduction to Chromatography-Theory and Practicals, 2<sup>nd</sup> edition, S. Chand and Company, New Delhi.
3. Chatwal. G. and S. Anand (1995): Spectroscopy (atomic and molecular), Himalaya Publishing House, Mumbai.
4. Sharma B.K. (1993): Chromatography, 1<sup>st</sup> edition Goel publishing House.
5. A. Upadhyay, K. Upadhyay and N. Nath (2003): Biophysical Chemistry, 3<sup>rd</sup> edition, Himalaya

(For the candidates admitted from the academic year 2020 -21 onwards)  
**HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-2**  
**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF BIOCHEMISTRY**  
**B.ScFirst Year - Semester – II**

<b>COURSE TITLE</b>	<b>MAJOR CORE 1: NUTRITIONAL BIOCHEMISTRY</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC2MCT05</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>4</b>
<b>MARKS</b>	<b>100</b>

**General Objectives:**

The students will be able to understand the role of nutrients in health

**Course Objectives:**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Exposure with the nature of food groups and status for good health.
CO-2	Evaluate the roles and nutritive significance of carbohydrates, lipids and proteins.
CO-3	To study the role of vitamins for good health
CO-4	Understand the differential functions of nutritional food constituents and deficiency states.
CO-5	Understand the categorization and assessment of nutritional foods status and national nutrition institutions roles.

**UNIT-I**

**(12 Hours)**

**FOOD AND NUTRITION**

Concepts of food and nutrition. Basic food groups- energy yielding, body building and functional foods. Units of energy. Calorific and nutritive value of foods. Measurement of calories by bomb calorimeter. Basal metabolic rate (BMR) - definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA- definition and determination. Interrelationship between Nutrients and Health - visible symptoms of good health.

*(Extra reading/key words: Application of Photoelectric Colorimeter)*

**UNIT-II**

**(12 Hours)**

**FOOD CONSTITUENTS**

Physiological role and nutritional significance of carbohydrates, lipids and proteins. Evaluation of proteins by nitrogen balance method - Biological value of proteins - Digestibility Coefficient, Biological Value, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition- Kwashiorkor and Marasmus. Clinical manifestations and management. Obesity (elementary details).

*(Extra reading/key words: Applications of nanostructured materials in food science )*

**UNIT-III  
VITAMINS****(12 Hours)**

Balanced diet, example of a low and high cost balanced diet – for infants, children, adolescents, adults and elderly people. Role of dietary fiber. Vitamins- definition and types of vitamins. Sources, requirement, biological functions, deficiency symptoms of thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, folic acid, biotin, cyanocobalamin, vitamins C, A, D, E and K. Hypervitaminosis.

*(Extra reading/key words: clinical applications of vitamins )*

**UNIT-IV  
MINERALS****(12 Hours)**

Minerals- sources, requirement, physiological functions, deficiency and toxicity of calcium, sodium, potassium, iron, magnesium, chromium, cobalt, copper, manganese, molybdenum, selenium, iodine and zinc.

*(Extra reading/key words: Health hazards of drinking demineralized water)*

**UNIT-V  
COMMUNITY NUTRITION****(12 Hours)**

Assessment of Nutritional Status – Anthropometry, Malnutrition – Definition, causes of Malnutrition. International organizations, National agencies in community nutrition - FAO,

WHO, UNICEF and CARE, ICDS, Midday meal programme, Role of National Institutions- ICMR, CSIR, NIN, CFTRI. *(Extra reading/key words: Malnutrition in Indian Children)*

**Note: Extra Reading/ Key Words are only for internal testing (Seminar / Assignments)**

CO No.	Course Outcomes:	PSOs Addressed	Cognitive Level
CO-1	Demonstrate the knowledge and understanding of the fundamental concepts in food and nutrition.	PSO 1	U
CO-2	assess the nutritional status of individuals in various life-cycle stages	PSO 2	R
CO-3	Utilize the knowledge from the physical and biological sciences as a basis for understanding the role of food and nutrients in health and disease processes.	PSO 3	R
CO-4	Determine nutrition-related conditions and diseases by applying knowledge of metabolism and nutrient functions, food sources, and physiologic systems.	PSO 4	An
CO-5	Demonstrate nutritional foods status and national nutrition institutions roles..	PSO 5	U

**Text Book:**

1.M.Swaminathan ( 1995 ) Principles of Nutrition and Dietetics. Bappco

**References:**

1. Garrow, JS , James WPT and Ralph A (2000) . Human nutrition and dietetics (10th ed) Churchill Livingstone
2. Andreas M. Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1st ed) CRC Press
3. Margaret Mc Williams (2012) . Food Fundamentals ( 10th ed) Prentice Hall
4. Tom Brody (1998). Nutritional Biochemistry (2nd ed) , Academic Press, USA
5. Aravind Kumar (1999). Human rights and social movements, Anmol publishers.

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**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. -First Year - Semester – II**

<b>COURSE TITLE</b>	<b>SBE 3: PAIN RELIEF FORMULATION AND COSMETICS</b>
<b>TOTAL HOURS</b>	<b>30</b>
<b>HOURS/WEEK</b>	<b>2</b>
<b>CODE</b>	<b>U20BC2SBP01</b>
<b>COURSE TYPE</b>	<b>PRACTICAL</b>
<b>CREDITS</b>	<b>1</b>
<b>MARKS</b>	<b>100</b>

**General Objective:**

This course is one of the most advanced introductions in Pain relief and cosmetic production.

**Course Objectives:**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Understand the working principles, tools and techniques of preparative methods
CO-2	Understand and analyze the principles and applications of formulations in research and related experiments.
CO-3	apply the knowledge for the preparation of lotions and creams
CO-4	Apply the principle and understand certain functionalities of preparations.
CO-5	Analyze data for assessment and evaluate data to use in recommendation understand and evaluate the strengths, limitations and creative use of techniques for problem-solving.

**PREPARATION OF**

1. Turpentine liniment
2. Soap liniment
3. Pain balm preparation.
4. Simple ointment & Sulphur ointment
5. Calamine lotion
6. Calamine Benzoate Lotion
7. Cold cream
8. Vanishing cream
9. Hair cream
10. Liquid tincture of liquor ice
11. Compound Tincture of Benzoin
12. Tincture of Orange
13. Shampoo
14. Nail bleach
15. Cuticle remover
16. Compound syrup of ferrous phosphate
17. Commercial cough syrup
18. Talcum powder
19. Baby powder
20. Tooth powder.

<b>CO No.</b>	<b>Course Outcomes</b>	<b>PSOs Addressed</b>	<b>Cognitive Level</b>
CO-1	Apply the knowledge of preparing conventional dosage formulations	PSO 1	An
CO-2	Develop their interview skills	PSO 2	R
CO-3	Explain the relationship between disease and formulations	PSO 2	U,R
CO-4	Discuss the preparations and their applications	PSO 3	R,An
CO-5	Define solubility, percent concentration, molarity, mole fraction, and molality.	PSO 4	An

**BOOKS FOR REFERENCE:**

1. Arthur J. Winfield, R. Michael and E. Richard, Pharmaceutical Practice (2000), 3rd edition, Elsevier Publication.
- .....

(For the candidates admitted from the academic year 2020 -21 onwards)  
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**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. First Year - Semester – II**

<b>COURSE TITLE</b>	<b>ELECTIVE - SPORTS BIOCHEMISTRY</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC2MET01</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>3</b>
<b>MARKS</b>	<b>100</b>

**General objective:** The student learns about the various Exercises, Physical fitness and nutrition for sports.

**Course Objectives:**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	Apply the knowledge of exercise in sports, yogasana and swimming
CO-2	Evaluate the strength, power and endurance of muscles after exercise
CO-3	Analyze the blood flow and oxygen flow before and after exercise
CO-4	Analyse the Physical fitness and BMI during the period.
CO-5	Evaluate the role of various nutrition during exercise

**UNIT – I**

**(12 Hours)**

**Sports, Exercise and Games: -**

Introduction, calisthenics, Gymnastics, combative and swimming;  
 Yogasana and its importance – Padmasana, Vajrasana, Dhunurasana, and Suryanamaskar; -  
 Track and field events – Running and Jumping Team events – Kabaddi.

*Extra reading/Key Words: Yogasana ,vajrasana and other asanas.*

**UNIT – II**

**(12 Hours)**

**Skeletal muscle system and Cardio respiratory system:**

Skeletal muscle types; - relation with different types of activities; strength, power and endurance of muscles; -  
 Muscle blood flow and cardiac output during exercise;  
 Oxygen consumption and pulmonary ventilation in exercise; Hypoxia and hypercapnia.

*Extra reading/Key Words: Pulmonary ventilation, Hypoxia and Hypercapnia*

**UNIT – III**

**(12 Hours)**

**Nervous system and the effect of Exercise on the system:**

Types of nervous system-central nervous system (CNS) and Peripheral nervous system(PNS).Structure of neuron-  
 Effect of exercise on nervous system.

*Extra reading/Key Words: Peripheral and central nervous system*

**UNIT – IV**

**(12 Hours)**

**Physical fitness assessment and metabolic system in exercise:**

Body composition; body fat percentage by skin fold method; BMI; Ideal weight and assessment of muscle mass.Muscle  
 metabolic systems in exercise; Recovery of muscle metabolic systems after exercise.

*Extra reading/Key Words: Muscle metabolic system, BMI*

**UNIT – V**

**(12 Hours)**

**Nutrition for sports and Exercise:**

Nutritional considerations for sports person:-

Carbohydrate: Energy source for sports and exercise; carbohydrates composition for pre-exercise, during and recovery period.

Fat: Role as an energy source: effect of fasting and fat ingestion

Protein: Protein requirement during exercise, recovery process and protein supplement.

Vitamins: Role of B-complex vitamins. Minerals: Role of Potassium and sodium.

*Extra reading/Key Words:Importance of fats,proteins and vitaminsfor a sports person.*

**Note: Extra Reading/ Key Words are only for internal testing (Seminar / Assignments)**

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Demonstrate the knowledge and understanding of the fundamental concepts in various exercises.	PSO 1	U
CO-2	Assess the strength and power of muscle before and after the regular exercise and functioning of cardiac system.	PSO 2	R
CO-3	Understand the functioning of the nervous system and the effect of exercise on the system.	PSO 2	An
CO-4	Assess the fitness with BMI. muscle mass and ideal weight	PSO 3	R
CO-5	Assess the nutritional need and status of individualduring sports period	PSO 4	An

**Text Book:**

1. Health and Physical Education by B.N. Dash, Neelkamal Publications Pvt Ltd.

**References:**

- 1 . Human physiology and mechanism of disease by Guyton, 5th Edition, W. B. Saunders Publication.
2. Essentials of food and Nutrition by M. SwaminathanVol I – II.
3. Food, Nutrition and Diet therapy by Kraure and Mohan, 6th Edition, W. B. Sounders company, London.

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**HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-2**  
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**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc. First Year - Semester – II**

<b>COURSE TITLE</b>	<b>NUTRITION AND THERAPEUTIC DIETS</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC2MET02</b>
<b>COURSE TYPE</b>	<b>THEORY</b>
<b>CREDITS</b>	<b>3</b>
<b>MARKS</b>	<b>100</b>

**General objective:**

The student able to understand, analyze and apply the basis for recommending the dietary allowances for different groups.

**Course Objectives:**

<b>CO No</b>	<b>Course Objectives</b>
CO-1	Understand and apply the concept of nutritional foods and status for good health
CO-2	Analyze the interventions to affect change and enhance wellness in diverse individuals and groups
CO-3	Understand the nutritional care process to identify nutrition-related problems, and determine and evaluate nutrition interventions
CO-4	Apply food safety principles related to food, management. Apply the guidelines of planning a healthy diet to various groups of people in the practice scenario
CO-5	Understand data for assessment and evaluate data to use in planning the dietary recommendation

**UNIT: I**

**NUTRITIONAL STATUS (12 Hours)**

Introduction to nutrition – Food as a source of nutrient, functions of food, definition of nutrition, classification of nutrients. Interrelationship between Nutrients and Health - visible symptoms of good health. Loss of nutrient value – light, heat, leaching of nutrients.

**COMMUNITY NUTRITION**

Assessment of Nutritional Status – Anthropometry, Malnutrition – Definition, causes of Malnutrition.

**NUTRITION IN HEALTH**

Basis for recommending the dietary allowances, factors to be considered in formulating diets for different income groups. Food faddism & the faulty food habits. Nutritive value of common Indian recipes.

*(Extra reading/key words: Malnutrition in Indian Children)*

**UNIT: II  
GROUP**

**(12 Hours) NUTRITION FOR SPECIAL**

Nutrition in pregnancy – Physiological stages in pregnancy, nutritional requirements, foods selection. Nutrition during lactation: Physiology of lactation, Nutritional requirements. Nutrition during infancy – Growth and development, Nutritional requirements, Breast feeding, problems in weaning – proportion of carbohydrates and proteins in weaning food. Infant formula, introduction of supplementary foods



*(Extra reading/key words: Smartphone Applications for Promoting Healthy Diet and Nutrition)*

**UNIT: III**

**(12 Hours)**

**NUTRITION FOR CHILDREN**

Nutrition during early childhood - Growth and nutrient needs, nutrition related problems, feeding pattern. Nutrition of school children: Nutritional requirements, importance of snacks, school lunch. Nutrition during adolescence – growth and Nutrient needs, Food choices, Eating habits, Factors influencing. Nutrition of adults: Sedentary, moderate and heavy activity needs. Geriatric Nutrition: factors affecting food intake and nutrient use, nutrient needs, Nutrition related problems.

*(Extra reading/key words: Child Nutrition Programs)*

**UNIT: IV**

**(12 Hours)**

**DIETETIC MANAGEMENT OF DISEASES**

Diet in obesity and underweight. Diet in febrile conditions: Typhoid, Tuberculosis, Malaria, Pneumonia and influenza. Gastro intestinal tract diseases: peptic ulcer (Gastric and duodenal), gastritis, Diarrhoea, dysentery and constipation. Diseases of the liver – Hepatitis and Cirrhosis. Diabetes Mellitus, anemia.

*(Extra reading/key words: Survey on ulcer patients in a selected locality)*

**UNIT: V**

**(12 Hours)**

Diet in disease of cardiovascular system – atherosclerosis, hypertension, hyperlipidemia, different sodium restricted diets. Diet in Hypo and hyperthyroidism. Diet in allergy – Definition, classification, manifestations, common food allergies, tests for allergy, dietetic treatment. Nutrition in cancer, Nutrition in Immune system dysfunction and AIDS.

*(Extra reading/key words: Nutrition support in metabolic disorders)*

**Note: Extra Reading/ Key Words are only for internal testing (Seminar / Assignments)**

<b>CO No</b>	<b>Course Outcomes</b>	<b>PSOs Addressed</b>	<b>Cognitive Level</b>
CO-1	Demonstrate coherent and advanced knowledge of the principles and concepts associated with nutrition and dietetics.	PSO 1	R
CO-2	Demonstrate understanding of the etiology, pathophysiology and clinical features of diseases and conditions that require dietary modification.	PSO 2	R
CO-3	Apply knowledge of food, nutrition, dietetics and health to the nutritional care of children, adolescents, adults and old age people and their families.	PSO 2	An
CO-4	Translate current scientific knowledge of diseases and conditions into practical nutritional advice for patients.	PSO 3	U
CO-5	Demonstrate a professional approach to dietetic practice.	PSO 4	An

**TEXT BOOK:**

1. Swaminathan, M. (1985) Advanced Text Book on Food and Nutrition. 2<sup>nd</sup>Edn. The Bangalore printing and publishing Co., Ltd.
2. Srilakshmi, B., (1997). Dietetics, New Age International (P) limited publishers, New Delhi.

**BOOKS FOR REFERENCE:**

1. Davidson. S.Passmore, R.Brook JF and Truswell (1985) Human Nutrition and Dietetics. The English Language Book society, Living Stone. (Latest Edition)
2. David, S. Robinson, Food Biochemistry and Nutritional Value. Longman Scientific and Technical, John Wiley and sons, Inc., New York.
3. Raheena Begum, M. (1989) A Text Book of Foods, Nutrition and Dietetics Sterling Publishers Pvt., Ltd., New Delhi.
4. Shynbhangini, A. Joshi, (1992) Nutrition and Dietetics, Tata McGraw- Hill Publishing Co., Ltd., New Delhi.
5. Sue Rodwell Williams, (1985), "Nutrition and Diet Therapy" The C.V Mosby Saint Louis

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**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF BIOCHEMISTRY**  
**B.Sc - First Year - Semester – II**

<b>COURSE TITLE</b>	<b>Allied-3 -ENZYME TECHNOLOGY</b>
<b>TOTAL HOURS</b>	<b>60</b>
<b>HOURS/WEEK</b>	<b>4</b>
<b>CODE</b>	<b>U20BC2ALT03</b>
<b>COURSE TYPE</b>	<b>THEORY CUM LAB</b>
<b>CREDITS</b>	<b>2</b>
<b>MARKS</b>	<b>100</b>

- Objectives
1. To understand the basic concepts of enzymes.
  2. To study the enzyme kinetics and applications.
  3. This course also emphasizes on the growth of attitude and capability of the students to work in a group and gain knowledge on the related field for lifelong learning.

**Course Objectives:**

<b>CO No.</b>	<b>Course Objectives</b>
CO-1	To understand the fundamentals of enzyme classification, Nomenclatures, isolation and purification procedure
CO-2	This course serves to provide an awareness of the current and possible future applications of enzyme technologies.
CO-3	Provides the theory and knowledge relevant to the enzymology principles including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics.
CO-4	To Discuss various application of enzymes that can benefit human life. Techniques employed in enzymes purification and characterization are also emphasized in this course.
CO-5	Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.

**Unit I Introduction to Enzymes: (12 Hours)**

Enzyme - Definition, Enzyme classification & Nomenclature of enzymes (IUB). Sources of Enzyme. Extraction, isolation and purification of enzyme by various methods.

*Extra reading/key words: plasma enzymes, antioxidant enzymes)*

**UNIT-II Mechanism of enzyme action : (12 Hours)**

Concept of active site and energetic of enzyme substrate complex formation - specificity of enzyme action; - turnover number –Enzyme Kinetics: Determination of Michaelis- Menten's equation – LB equation single substrate and multi-substrate reactions– allosteric regulation of enzymes.

*(Extra reading/key words: ribonuclease, carboxy peptidase)*

**UNIT-III: Enzyme inhibitions and significance of Enzyme Technology:(12 Hours)**

Enzyme inhibitions: Competitive, non-competitive & uncompetitive inhibitions; nucleophilic & electrophilic attack; Role of metal ions in enzyme catalysis. Immobilized enzymes – Techniques and applications of immobilization - Commercial production of important enzymes;

*(Extra reading/key words: salivary amylase)*

*Note: Extra Reading/ Key Words are only for internal testing (Seminar / Assignments)*

**Unit -IV. Enzyme practical: (12 Hours)**

Isolation of extra and intra cellular enzymes. Isolation of membrane bound enzymes, Purification of enzymes. Assay of enzyme activity (Salivary amylase), Effect of PH, temperature on enzyme activity and Determination of Km and Vmax of the enzymes.

**Unit V: (12 Hours)**

Purification of enzymes, Ammonium sulphate precipitation of enzymes, Partial purification of enzymes by dialysis, Colorimetric assay for enzyme activity.

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Remember and understand the major classes of enzyme and isolation & purification of Enzymes.	PSO 1	R, U
CO-2	Differentiate between equilibrium and steady state kinetics and analyzed simple kinetic data and estimate important parameter (Km. Vmax, Kcat etc.)	PSO 2	U
CO-3	Understand the Inhibition kinetics and elaborate the use of enzymes in industries.	PSO 2	U,An
CO-4	Learn how to calculate and present the resultant data in tabular and graphical format.	PSO 2	U,An
CO-5	Have insight in the physico-chemical properties of proteins that underlie purification methods.	PSO 3	R

**TEXT BOOK:**

1. Keith Wilson and John Walker (2004): Principles and Techniques of Practical Biochemistry, 5<sup>th</sup> edition, United Kingdom, Cambridge University Press.

**Books for Reference:**

1. Introduction to Biomolecules Enzymes, RenukaHarikrishnan, Indrajai Pub,1995.
2. Understanding Enzymes-Fourth Edition, Trevor Palmer, New Delhi: Prentice Hall of India Foster, Nature of Enzymology, Croom Helm, 1979.
3. Fundamentals of Enzymology, Nicholas C Price, Oxford University Press1989.
4. Enzymes, Samuel Devlin Sarup& Sons, 2005.
5. Biochemistry – 4th Edition, Stryer 1995.
6. Fundamentals of Biochemistry. (6th ed.) J.L. Jain, Sanjay Jain and Nitin Jain. New Delhi: S. Chand& company Ltd. 1997.
7. Biochemistry (German Edition) Jeremy M. Berg and LubertStryer, 2013