



**Student Representative****III UG Biochemistry**

1. K.K. Balachandra (BU190909)

**Members Absent****University Nominee****Dr. A. Gokulakrishnan**

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**Agenda**

1. To review the revised syllabus for theory papers and practicals for the first semester of B.Sc. Biochemistry students admitted during the academic year 2021-2022 and thereafter.
2. To review the revised syllabus for theory papers and practicals of first semester for Allied Biochemistry students admitted during the academic year 2021-2022 and thereafter.

**Suggestions**

1. Some minor corrections and incorporation of new keywords were suggested in the Cell Biology paper.
2. The topic derived lipids along with its classification and functions of Lipoproteins, Classes of DNA, role of Histones, Conjugated proteins and Ganglio lipids can be included in Biomolecules paper. Micro minerals like F, Mn and Mo and macro minerals like S, Cl and P can be removed from Unit-V.
3. In Allied Biochemistry-I paper topics like Anomers and Epimers can be included in Unit-I and physical and chemical properties of lipids in Unit-III and classes of DNA can be included in Unit-IV. In Unit-V, the derivation MM equation can be replaced with its significance alone.

**Resolutions**

1. The board resolved to recommend the corrections that have been suggested in the B.Sc. Biochemistry curriculum and Allied Biochemistry papers. The necessary corrections will be incorporated in the next syllabus revision.

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S. No.	NAME	MEMBER	SIGNATURE
1.	Dr. A. Gokulakrishnan	University Nominee	ABSENT
2.	Dr. G. Jayanthi	Subject Expert	<i>Dr. G. Jayanthi</i>
3.	Mr. M. Ramesh Kumar	Industrialist	<i>M. Ramesh Kumar</i>
4.	Dr. S. Selvaraj	Alumni Representative	<i>Dr. S. Selvaraj</i>
5.	Dr. A. Jayaprakash	Chair Person	<i>Dr. A. Jayaprakash</i>
6.	Dr. A.C. Gomathi	Board Member	<i>Dr. A.C. Gomathi</i>
7.	Dr. M. Fernandus Durai	Board Member	<i>M. Fernandus Durai</i>
8.	Dr. A. Poongothai	Board Member	<i>Dr. A. Poongothai</i>
9.	Dr. V. Durga Devi	Board Member	<i>Dr. V. Durga Devi</i>
10.	Dr. I. Niyas Ahamed	Board Member	<i>Dr. I. Niyas Ahamed</i>
11.	Mr. G. Sivaelango	Board Member	<i>Mr. G. Sivaelango</i>
12.	Dr. V. Gopalakrishnan	Board Member	<i>Dr. V. Gopalakrishnan</i>
13.	Dr. K. Prabu	Board Member	
14.	Mr. K.K. Balachandra	Student Representative	<i>Mr. K.K. Balachandra</i>



## **Members Absent**

### **Industrialist**

**Mr. M. Ramesh Kumar**  
Sr. Manager–Quality Control,  
Global Calcium Pvt. Ltd.,  
125,126, Sipcot Industrial Complex,  
Hosur - 635126  
Mobile No.: 7598477966  
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### **Agenda**

1. To review the revised syllabus for theory papers and practicals for the second semester of B.Sc. Biochemistry and Allied Biochemistry students admitted during the academic year 2021-2022 and thereafter.
2. To review the Programme Specific Outcomes (PSO) for B.Sc. Biochemistry.
3. To review the Course Outcomes (CO) for the subjects with different cognitive levels (K1 to K6).

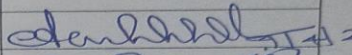
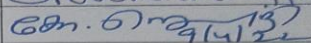
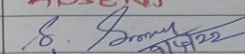
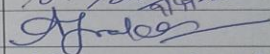
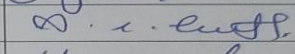
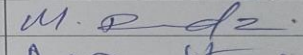
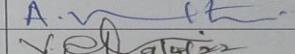
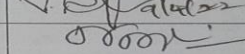
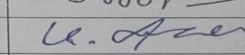
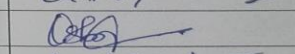
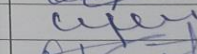
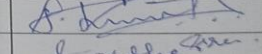
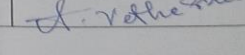
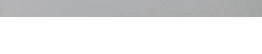
### **Suggestions**

4. In Unit-III of Human Physiology paper, it was suggested to change the keyword absorption to assimilation.
5. In Allied Biochemistry-II paper, it was suggested to include a new topic “Structure and Functions of Brain” in Unit-II.
6. The board members suggested updating the reference books in all the papers.

### **Resolutions**

1. The board resolved to recommend the corrections that have been suggested in the B.Sc. Biochemistry curriculum and Allied Biochemistry paper. The necessary corrections will be incorporated in the next syllabus revision.

**UG BOARD MEMBERS LIST**

S.No.	Name	Member	Signature
1.	Dr. A. Gokula Krishnan	University Nominee	
2.	Dr. G. Jayanthi	Subject Expert	 601. 6/12/13
3.	Mr. M. Ramesh Kumar	Industrialist	ABSENT
4.	Dr. S. Selvaraj	Alumni	
5.	Dr. A. Jayaprakash	Chairman	
6.	Dr. A.C. Gomathi	Member	
7.	Dr. M. Fernandus Durai	Member	
8.	Dr. A. Poongothai	Member	
9.	Dr. V. Durga Devi	Member	
10.	Dr. I. Niyas Ahamed	Member	
11.	Mr. G. Sivaelango	Member	
12.	Dr. V. Gopalakrishnan	Member	
13.	Dr. K. Prabu	Member	
14.	Mr. S. Revanth	Student Representative	
15.	Ms. A. Vethasree	Student Representative	

## **PROGRAMME OUTCOMES AT SHC**

### **PROGRAMME OUTCOMES AT UNDERGRADUATE LEVEL**

#### **Undergraduates will be able to:**

- PO1: Discuss their new knowledge and understanding; apply new ideas in order to acquire employability/self-employment
- PO2: Pursue higher learning programmes and become entrepreneurs
- PO3: Recognize moral and ethical values and be socially responsible citizens in the society
- PO4: Apply analytical, technical, problem solving, critical thinking skills, and decision-making skills in solving real life problems in one's life and in the society.
- PO5: Direct their own self-learning through MOOC courses, co-curricular activities, industrial exposures and field trainings
- PO6: Develop their own broad conceptual background in Biological sciences, Computing sciences, Languages and culture, Management studies, Physical sciences, etc.
- PO7: Demonstrate communication skills both oral and written in personal and academic pursuits.

**B.Sc. BIOCHEMISTRY**  
**PROGRAMME SPECIFIC OUTCOMES [PSO]**

- PS01:** Disciplinary knowledge and understanding of Biochemistry, structure and function of biological molecules and explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions.
- PS02:** Explain the biochemical processes that underlie the relationship between genotype and phenotype and demonstrate an experiential learning and critical thinking of the structure and function of both prokaryotic and eukaryotic cells (including the molecular basis and role of sub-cellular compartmentalization).
- PS03:** Demonstrate an understanding of the principles, and have practical experience of a wide range of biochemical techniques (e.g. basic molecular biology, cell biology and microbiology methods, spectrophotometry, the use of standards for quantification, enzyme kinetics; macromolecular purification, chromatography electrophoresis, etc.).
- PS03:** Analyze biochemical data (e.g. in enzyme kinetics, molecular structure analysis and biological databases and carry out laboratory-orientated numerical calculations (e.g. inter-conversion of masses, moles, and molarity, preparation of solutions and accurate dilutions), be capable in data visualization and analysis, including the application of data transformations (e.g. logarithmic, exponential).
- PS04:** Basic professional skills pertaining to biochemical analysis, carrying out clinical diagnostic tests and ability to use skills in specific areas related to Biochemistry such as industrial production, technology development, clinical, health, agriculture, community development, etc.
- PS05:** Curiosity and ability to formulate Biochemistry related problems and using appropriate concepts and methods to solve them and ability to use various e-resources in order to solve challenges related to Biochemistry.
- PS06:** Articulation of ideas, scientific writing and authentic reporting, effective presentation skills and having conversational competence including communication and effective interaction with others, listening, speaking, and observational skills.
- PS07:** Collaboration, cooperation and realizing the power of groups and community, ability to work in a group, community and ability to grasp ideas and to turn ideas into action related to biochemical mechanisms and processes related to industries, industrial production, health, agriculture, etc.



**UNDER CBCS (With effect from 2021-2022)**  
**PROGRAMME STRUCTURE**

<b>SEM</b>	<b>Sub Code</b>	<b>Title of the Subject</b>	<b>Hours</b>	<b>Credit</b>	<b>E-Hrs</b>	<b>CA</b>	<b>SE</b>	<b>Total</b>
<b>I SEMESTER</b>	LT114	Tamil-I	5	3	3	50	50	100
	LE115AT	English-I	5	2	3	50	50	100
	BC106	Cell Biology	3	3	3	50	50	100
	BC107	Biomolecules	4	4	3	50	50	100
	PBC102	Main practical- I	3	3	3	50	50	100
	ACH110	Allied Chemistry-I	4	3	3	-	-	-
	PACH209	Allied Chemistry Lab Work	2	-	-	50	50	100
	SK104	Communication Skills	2	1	-	-	-	-
	VE105A/B	Religion/Value Education-I	2	1	-	-	-	-
	CE103	Communicative English-I	-	1	-	-	-	-
<b>TOTAL</b>			<b>30</b>	<b>21</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>II SEMESTER</b>	LT214	Tamil-II	5	3	3	50	50	100
	LE215AT	English-II	5	2	3	50	50	100
	BC206	Plant Biochemistry	3	3	3	50	50	100
	BC207	Human physiology	4	4	3	50	50	100
	PBC205	Main practical-II	3	3	3	50	50	100
	ACH210	Allied Chemistry-II	4	3	3	50	50	100
	PACH209	Allied Chemistry Lab Work	2	2	3	50	50	100
	SK204	Leadership skills	2	1	-	-	-	-
	VE205A/B	Religion/Value Education-II	2	1	-	-	-	-
	CE203	Communicative English-II	-	1	-	-	-	-
<b>TOTAL</b>			<b>30</b>	<b>23</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>III SEMESTER</b>	LT312	Tamil-III	5	3	3	50	50	100
	LE309T	English-III	5	2	3	50	50	100
	BC306	Microbiology	3	3	3	50	50	100
	BC307	Biophysical chemistry	4	4	3	50	50	100
	PBC302	Main practical-III	3	3	3	50	50	100
	AM310C	Allied Biostatistics-I	6	5	3	50	50	100
	SK304	Technical Skills-I	2	1	-	-	-	-
	VE306	Human Rights	2	1	3	50	50	100
	LE309P	English Lab-III	-	1	-	-	-	-
		OUTREACH	-	-	-	-	-	-
		SHELTERS	-	-	-	-	-	-
<b>TOTAL</b>			<b>30</b>	<b>23</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>I V S</b>	LT411	Tamil-IV	5	3	3	50	50	100

	LE409T	English-IV	5	2	3	50	50	100
	BC407	Microbial Biochemistry	3	3	3	50	50	100
	BC408	Analytical Biochemistry	4	4	3	50	50	100
	PBC405	Main practical-IV	3	3	3	50	50	100
	AM409C	Allied Biostatistics-II	6	5	3	50	50	100
	SK404	Employability Skills	2	1	-	-	-	-
	VE406	Environmental Science	2	1	3	50	50	100
	LE409P	English Lab-IV	-	1	-	-	-	-
		OUTREACH	-	2	-	-	-	-
		SHELTERS	-	2	-	-	-	-
		<b>Internship</b>		<b>1*</b>	-	-	-	-
	<b>TOTAL</b>		<b>30</b>	<b>27+1*</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>V SEMESTER</b>	BC522	Enzymology	4	4	3	50	50	100
	BC523	Intermediary metabolism	5	5	3	50	50	100
	BC524	Endocrinology	4	4	3	50	50	100
	BC525	Genetics	4	4	3	50	50	100
	PBC502	Main practical-V	5	4	6	50	50	100
	BC526A/B/C	<ul style="list-style-type: none"> <li>• Biomedical Instrumentation</li> <li>• Medical laboratory technology</li> <li>• Pharmacology</li> </ul> (one out of three)	6	4	3	50	50	100
	<b>SSP-I</b>	<b>Health Management</b>	-	<b>1*</b>	-	-	-	-
	NBC504	NME –Energy Builders	2	1	3	50	50	100
		<b>TOTAL</b>		<b>30</b>	<b>26 + 1*</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>VI SEMESTER</b>	BC620	Molecular Biology	5	5	3	50	50	100
	BC621	Immunology	4	4	3	50	50	100
	BC622	Medical Biochemistry	4	4	3	50	50	100
	PBC606	Main practical-VI	5	4	6	50	50	100
	BC623A	Subject Skill-I Biotechnology	5	5	3	50	50	100
	BC623B	Subject Skill-II Bioethics	5	5	3	50	50	100
	<b>SSP-II</b>	<b>Nutritional Biochemistry</b>	-	<b>1*</b>	-	-	-	-
	NBC604	NME – Health care and Disease management	2	1	3	50	50	100
	Certificate Courses NPTEL/MOOCs		-	<b>1*</b>	-	-	-	-
	<b>Project</b>		-	<b>2*</b>	-	-	-	-
	<b>TOTAL</b>		<b>30</b>	<b>28 + 4*</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

TOTAL HOURS  
TOTAL CREDITS

= 180 Hours  
= 148 + 2\* (SSP) + 1\* (Internship) + 1\* from other Department Certificate Courses/NPTEL/MOOCs online courses + 2\* from Project.

## **Regulation for Theory**

### **1. Evaluation Scheme for Continuous Assessment (50)**

Written tests (CA) (2)	:	30 marks
Attendance	:	05 marks
Other Components	:	15 marks

#### **Other Components**

MCQ	:	10 marks
Assignment	:	5 marks

### **2. Question Paper Pattern for CA**

The question paper shall have three sections with the maximum of 50 marks with the following break-up:

#### **Section-A**

Section A shall contain 6 short answer questions without choice drawn from two units Each question shall carry 2 marks. (6 x 2 = 12 marks)

#### **Section-B**

Section B shall contain 3 either or questions drawn from two units. Each question shall carry 6 marks. (3 x 6 = 18 marks)

#### **Section-C**

Section C shall contain 3 questions from two units. Two questions out of the three are to be answered each carrying 10 marks. (2 x 10 = 20 marks)

### **3. Question Paper Pattern for Semester Examinations**

The question paper shall have three sections with the maximum of 100 marks with the following break-up:

#### **Section - A**

Section A shall contain 10 short answer questions drawn from all the units on the basis of minimum two from units. All ten are to be answered each carrying 2 marks. (10 x 2 = 20 marks)

#### **Section - B**

Section B shall contain 5 either or questions drawn from all the five units. Each question shall carry 7 marks. (5 x 7 = 35 marks)

#### **Section - C**

Section C shall contain 5 questions drawn one each from the five units. Three questions out of the five are to be answered each carrying 15 marks. (3 x 15 = 45 marks)

## **Regulation for Practical Examinations**

### **Question paper pattern for Core Practical Examination**

Total: 100 Marks

The practical papers consist of the internal assessment (50 marks) and semester examination (50 marks)

Internal Assessment (50)

Lab Work - 25 marks

Model exam - 25 marks

Semester Examination (50)

### **Evaluation Pattern for SSP (Health Management/Nutritional Biochemistry)**

- Submission of Assignment
- One MCQ test covering the syllabus

### **Evaluation Pattern for Internship**

Submission of Internship report with certificate of attending 15 days training before IV Semester from the concerned lab – 1\* credit.

### **Evaluation Pattern for Project**

Submission of project report with Viva-2\* credits.

**Semester-I****Sub. Code: BC106****CELL BIOLOGY****3 Hours/3 Credits****Course Objectives:**

- To understand the structure of prokaryotic and eukaryotic cellular organization and to know the fluid mosaic model and membrane transport mechanism.
- To learn about the chemical composition and functions of endoplasmic reticulum, golgi apparatus and lysosomes.
- To have in-depth understanding of the Structure, Chemical composition and functions of Mitochondria and Ribosomes.
- To learn the functions of peroxisomes and glyoxysomes and composition of cytoskeleton and extracellular matrix.
- To acquire knowledge on nucleus–structure, composition and functions of chromosomes cell cycle, cell division and cell death mechanisms.

<b>S.No.</b>	<b>Description</b>	<b>Cognitive Level (K-level)</b>
<b>CO-1</b>	Develop an understanding of the structure of cell and its difference between prokaryotes and eukaryotes	<b>K6,K2</b>
<b>CO-2</b>	Define and understand the fluid mosaic model and membrane transport	<b>K1, K2</b>
<b>CO-3</b>	Categorize the chemical composition and functions of endoplasmic reticulum, golgi apparatus and lysosomes.	<b>K4</b>
<b>CO-4</b>	Broad knowledge on the structure, chemical composition and functions of mitochondria, ribosomes, peroxisomes and glyoxysomes.	<b>K3, K6</b>
<b>CO-5</b>	Demonstrate a clear understanding of the composition of cytoskeleton and extracellular matrix.	<b>K2</b>
<b>CO-6</b>	Evaluate the mechanism of cell division with reference to mitosis and meiosis	<b>K5</b>

**UNIT-I:** Cell and its Theory, Structure of Plant and Animal cell. Cells-Prokaryotes and Eukaryotes, Difference between Prokaryotes and Eukaryotes.

**UNIT-II:** Membrane structure-Fluid Mosaic model, chemical composition and physical properties. Membrane Transport-Diffusion, Active and Passive.

**UNIT-III:** Structure, Chemical composition and functions of Endoplasmic Reticulum, Golgi apparatus and Lysosomes.

**UNIT-IV:** Structure, Chemical composition and functions of Mitochondria and Ribosomes. Functions of Peroxisomes and Glyoxysomes. Cytoskeletons.

**UNIT-V:** Nucleus-Structure, composition and functions of Chromosomes. Cell cycle and Cell divisions-Mitosis and Meiosis.

**Text Books:**

1. P.S Verma and V.K.Agarwal (2016) Cytology (Cell Biology, Biomolecules and Molecular Biology), S.Chand Publishing, New Delhi.
2. Geoffrey M. Cooper and Robert E. Hausma (2015)The Cell: A Molecular Approach, Seventh Edition, Sinauer Associates, Inc.

**References:**

1. J.M. Bery, J.L. Tymoezko and L. Stryer (2008) Biochemistry, 6<sup>th</sup> Ed., W.H. Freeman and Company, New York.
2. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5<sup>th</sup> Ed., W.H. Freeman and Company, New York.
3. T.D.Pollard and W.C. Earnshaw (2002), Cell Biology, Saunders Publishing and Co, New York.
4. C.B. Powar (1994), Cell Biology, Second edition, Himalayan publishing house, Mumbai.

**Semester-I****Sub. Code: BC107****BIOMOLECULES****4 Hours/4 Credits****Course Objectives:**

- To study the structure and functions of large biological macromolecules.
- To understand the organic chemical principles in life processes.
- To introduce the knowledge of lipid and their importance.
- To provide in-depth understanding of Nucleic acids and its structure.
- To categorize the source, applications of vitamins and minerals.

**Course outcomes:**

S.No.	Description	Cognitive Level (K-level)
CO-1	Understand the knowledge of carbohydrates and their classifications in detail	K2, K3
CO-2	Acquire the basic knowledge on the classification and structure of amino acids and classify proteins based on its physical and chemical properties	K3
CO-3	Discuss the importance, classification and functions of lipids	K2
CO-4	Enumerate the structure and properties of nucleic acids and its types	K1
CO-5	Explore and recommend the source, applications of vitamins and minerals	K4, K5
CO-6	Compile the basic information on the sources, mechanism and applications of macro and micro elements	K6

**UNIT-I:** Classification of Carbohydrates. Isomers, Anomers, epimers, enantiomers and mutarotation. Ring and linear structure (Haworth projection formula). Structure, Properties and Functions of Monosaccharides, Structure and Functions of Oligo (Di-Maltose, Lactose and Sucrose) and Polysaccharide (Homo-Starch, Glycogen & Cellulose; Hetero-Proteoglycan).

**UNIT-II:** Classification and structure of Amino acids. Essential and Non-essential amino acids. Properties of amino acids–Physical and Chemical, Zwitter ion. Classifications of Proteins based on solubility, shape, composition and biological function. Structure of Proteins. Denaturation and Renaturation of Proteins.

**UNIT-III:** Classification of Lipids, Essential fatty acids, Structure, Types and Functions of Phospholipids. Structure and functions of Glycolipids and Cholesterol.

**UNIT-IV:** Structure of purine and pyrimidine nucleotides. Structure and Properties of DNA–Tm, Denaturation and Renaturation, Hypo & Hyperchromicity and Types of RNA.

**UNIT-V:** Vitamins–Fat and Water Soluble Vitamins, Chemical name, Sources, Daily requirements, Functions and Deficiency disorders. Minerals-Micro (Fe, Zn, Cu, I, F, Mn, Mo) and Macro elements (Na, Mg, Cl, Ca, P, K, S)–source, biological importance and Deficiency disorders.

**Text Books:**

1. A.C. Deb (2001), Fundamentals of Biochemistry, New Central Book Agency Pvt., Ltd., Calcutta.
2. Murray, R. K., D. K. Granner, P. A. Mayes and D. W. Rodwell. 2006. Harper's Biochemistry, 25<sup>th</sup> edition, Prentice Hall, New Jersey.
3. J.L Jain., (2005). Fundamentals of Biochemistry. S.Chand Publishing, New Delhi.
4. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5th Ed, W.H. Freeman and Company, New York.

**References:**

1. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twentyfifth edition, Prentice Hall, New Jersey.
2. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
3. G.L Zubay (1999) Biochemistry, 4th Ed, WCB, McGraw-Hill, New York.
4. Ambika Shanmugam (1998). Fundamentals of Biochemistry for Medical Students.
5. U. Satyanarayana., (2006) A textbook of Biochemistry, Books & Allied, Kolkata.



**Semester-I**

**Sub. Code: PBC102**

**MAIN PRACTICAL-I**

**3 Hours/3 Credits**

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**I. Qualitative analysis of carbohydrate**

Arabinose, Glucose, Fructose, Maltose, Lactose, Sucrose and Starch.

**II. Qualitative analysis of Amino acid**

Arginine, Cysteine, Tyrosine, Tryptophan, Histidine and Methionine.

**Semester-I****Sub. Code: ABC101****ALLIED BIOCHEMISTRY-I****4 Hours/3 Credits****Course Objectives:**

- To develop skill and acquire knowledge in fundamentals of Chemistry, Biology and will develop disciplinary theory and practical knowledge in the diversified areas of Biochemistry.
- To enable the students to understand the various perspectives of applied sciences that benefits mankind.
- To give fundamental knowledge about the course and encouraged to become unique by allowing them to perform experiments their areas of interest.
- To enable the students to equip themselves with the basic practical training in different areas of Biochemistry ranging from Metabolism, Nutrition, Plant Biochemistry, Enzymology, Clinical Biochemistry, Molecular Biology to Genetic Engineering, Biotechnology, etc.
- To help the students to take up further specialized Master level courses in these areas or to take up suitable assignments/jobs in Biotech/Biochemical industries.

**Course Outcomes:**

<b>Course Outcome (CO)</b>	<b>Description</b>	<b>Cognitive level (K level)</b>
<b>CO-1</b>	Help learners to define and understand the objectives of studying Biochemistry	<b>K1, K2</b>
<b>CO-2</b>	Analyze and understand the basic concepts of biochemical reactions that occurs in living systems	<b>K4</b>
<b>CO-3</b>	Provide students with learning experiences that help in still deep interests in learning biochemistry	<b>K3</b>
<b>CO-4</b>	Develop broad and balanced knowledge and understanding of biomolecules, key biochemical concepts, principles and theories related to biochemistry	<b>K6</b>
<b>CO-5</b>	Equip students with appropriate tools of analysis and with theoretical, technical and analytical skills to tackle issues and problems in the field of biochemistry	<b>K4</b>
<b>CO-6</b>	Recommend students to a wide range of careers that combine biology, plants and medicine.	<b>K5</b>

**UNIT-I:** Carbohydrates-Definition and Classification of carbohydrates, linear and ring forms (Haworth formula)–Glucose and Fructose. Physical properties–Mutarotation. Chemical properties-Oxidation, Reduction, Osazone formation. Disaccharide-Sucrose and Lactose, Polysaccharides-Starch and Cellulose–Sources and Functions.

**UNIT-II:** Amino acids-Definition and classification of amino acids, Physical Properties-Amphoteric nature, Isoelectric point, Isoelectric pH and Zwitter ion. Proteins–Classification, shape and size, solubility and functions. Structure of protein– Primary, Secondary, Tertiary and Quaternary.

**UNIT-III:** Lipids-Definition, classification and functions. Occurrence and biological functions-simple lipids, compound lipids (e.g. phospholipids) and derived lipids: steroids (e.g. Cholesterol). Fatty acids–Saturated and Unsaturated.

**UNIT-IV:** Nucleic acids-Nucleoside, Nucleotides, Types of Nucleic acids, DNA- Double helical model of DNA and its biological functions. RNA–Structure, Occurrence, chemistry and its biological functions of tRNA, mRNA and rRNA.

**UNIT-V:** Enzymes-Definition, classification of enzymes with one example. Mechanism of enzyme action. Lock and key mechanism, Induced fit theory. Biological functions of enzymes. Factors affecting enzyme activity–pH, temperature and substrate concentration. Michaelis-Menton equation.

**Text Books:**

1. A.C. Deb (2001), Fundamentals of Biochemistry, New Central Book Agency Pvt., Ltd., Calcutta.
2. Ambika Shanmugam. 1998. Fundamentals of Biochemistry for Medical Students.
3. Satyanarayana, U. 2006. A textbook of Biochemistry, Books & Allied, Kolkata.

**References:**

1. Chatterjee, N and Rana Shinde. 2012. Textbook of Medical Biochemistry, 8<sup>th</sup> edition, Jaypee publication, New Delhi.
2. Jain, J. L. 2005. Fundamentals of Biochemistry. S. Chand Publishing, New Delhi.
3. Murray, R.K., D.K. Granner, P.A. Mayes and D.W. Rodwell. 2006. Harper's Biochemistry, 25<sup>th</sup> edition, Prentice Hall, New Jersey.
4. Voet, D and G. Voet. 2006. Biochemistry, John Wiley and Sons, New York.

**Semester-I**

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**Sub. Code:PABC201 ALLIED BIOCHEMISTRY PRACTICAL-I 2 Hours/1 Credit**

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**I. Qualitative analysis of Carbohydrates**

Glucose, Fructose, Sucrose, Maltose and Starch.

**II. Qualitative analysis of Amino acids**

Tyrosine, Tryptophan, Cysteine, Methionine and Arginine.

**III. Volumetric estimation (Demonstration)**

Estimation of Ascorbic acid and Oxalic acid.

**Semester-II****Sub. Code: BC206****PLANT BIOCHEMISTRY****3 Hours/3 Credits****Course Objectives:**

- To provide the basic knowledge of plant cell and water absorption mechanism.
- To get familiar with photosynthetic mechanism and starch production cycle.
- To acquire knowledge about NPK cycle and its biological significance.
- To give detail idea about seed germination, primary and secondary metabolites.
- To explore the information about plant hormones and their physiological effects.

**Course Outcomes:**

<b>S.No.</b>	<b>Description</b>	<b>Cognitive Level (K-level)</b>
<b>CO-1</b>	Understand the basic knowledge of plant cell and water absorption mechanism.	<b>K2, K3</b>
<b>CO-2</b>	Acquire knowledge on photosynthetic mechanism and starch production cycle.	<b>K3</b>
<b>CO-3</b>	Discuss about NPK cycle and its biological significance.	<b>K2</b>
<b>CO-4</b>	Describe about seed germination, primary and secondary metabolites.	<b>K1</b>
<b>CO-5</b>	Explore the information about plant hormones and their physiological effects.	<b>K4</b>
<b>CO-6</b>	Assess the in-depth principle and speculate the mechanism of plant life cycle	<b>K5, K6</b>

**UNIT-I:** Plant cell-Structure and Functions, Plant cell wall, Transpiration-Types, Mechanism and Factors affecting transpiration, Mechanism of Water Absorption–Passive and Active.

**UNIT-II:** Photosynthesis–photosynthetic pigments and chloroplast. Light reaction–Photosystems, Cyclic and non-cyclic photophosphorylation, Calvin cycle, Hatch-Slack cycle.

**UNIT-III:** Cycles of Elements-N<sub>2</sub> cycle, Biochemistry of symbiotic and non-symbiotic N<sub>2</sub> fixation, Sulphur cycle and Phosphorous cycle.

**UNIT-IV:** Biochemistry of seed dormancy, seed germination, fruit ripening and Senescence, Primary and Secondary metabolites in Plants–Definition and Function.

**UNIT-V:** Plant growth regulators-Physiological effects of Auxins, Gibberellins, Cytokinins, ABA and Ethylene.

**Text Books:**

1. H.S. Srivastava (2006), Plant Physiology, Biochemistry and Biotechnology, Rastogi Publications, Merut.
2. V. Verma, Plant Physiology, (2001) 7th revised edition. Emkay publications.
3. V.K. Jain, (2000) Fundamentals of Plant Physiology, S.Chand Publishing, New Delhi.

**References:**

1. N.C. Gautam (2006), Plant Biotechnology, Shree Publishers.
2. Heldt HW (2005), 3rd Edition, Plant Biochemistry, Elsevier Academic Press Publication, USA.
3. A.J. Lack (2001).Plant Biology. Viva Books, New Delhi.
4. P.J. Lea and R.C. Leegood (1999), 2nd Edition, Plant Biochemistry and Molecular Biology, Wiley and Sons, New York.
5. Andrew Lack (2001) Plant Biology, Taylor & Francis, New York.

**Semester-II****Sub. Code: BC207****HUMAN PHYSIOLOGY****4 Hours/4 Credits****Course Objectives:**

- To understand the anatomy and physiology, various levels of organizations basic homeostatic mechanism.
- To elucidate and describe the composition, function of various body fluids like blood and lymph, their significance and related disorders
- To explain the morphology, physiology of circulatory, respiratory and digestive system and classify the structure of lungs, transport of gases between lungs and tissues. Explain the morphology, functions of kidney and nephron and their role in urine formation.
- To categorize the Structure and functions of nerve cells, conduction of nerve impulses, the role of neurotransmitters and reflex action.
- To speculate the physiology of muscle contraction in co-ordination with the joints, their articulation and skin.

**Course Outcomes:**

S.No.	Description	Cognitive Level (K-Level)
CO-1	Define and explain the anatomy and physiology, various levels of organizations basic homeostatic mechanism.	K1, K2
CO-2	Explain and determine the composition, function of various body fluids like blood and lymph, their significance and related disorders	K2, K3
CO-3	Explain and sketch the morphology, physiology of circulatory, respiratory and digestive system.	K2, K4
CO-4	Categorize the structure of lungs, transport of gases between lungs and tissues. Explain the morphology, functions of kidney and nephron and their role in urine formation.	K2, K4
CO-5	Evaluate the structure and functions of nerve cells, conduction of nerve impulses, the role of neurotransmitters and reflex action.	K5
CO-6	Speculate the physiology of muscle contraction in co-ordination with the joints, their articulation and skin.	K6

**UNIT-I:** Components of Blood, Morphology and functions of blood cells. Blood groups and Rh factor. Lymphatic system and Composition of lymph. Circulatory system - Heart anatomy, Pace maker, Cardiac cycle and ECG.

**UNIT-II:** Structure of Lungs, Transport of gases between lungs and tissues. Structure and functions of Kidney and Nephron. Mechanism of urine formation.

**UNIT-III:** Structure and functions of digestive system. Digestion and **Assimilation** of Carbohydrate, lipids, proteins and nucleic acid. Mechanism of HCl secretion in stomach. Role of hormones involved in digestion.

**UNIT-IV:** Structure and functions of nerve cells, Conduction of nerve impulse in myelinated and non-myelinated sheath. Neurotransmitters, Reflex action, Sleep and awake.

**UNIT-V:** Muscles- Types, structure and functions. Ultra structure of skeletal muscle- light band, dark band, Sarcomere, Filaments–Thick (myosin) and Thin (actin, tropomyosin and troponin). Contraction and relaxation of skeletal muscle via  $\text{Ca}^{2+}$  pump.

**Text Books:**

1. N. Arumugam (2001) Animal Physiology, Saras publication.
2. Sembulingam K and Sembulingam P (2010). Essentials of medical physiology. 5<sup>th</sup> ed. Jaypee Brothers Medical Limited. pp. 85-89.
3. R.A. Agarwal, Anil. K, Srivastava, KaushalKumar (1986), Animal physiology and Biochemistry-3rd edition. S.Chand Publishing, New Delhi.

**References:**

1. J. Brachet and A. E. Mirsky (1963), The Cell-Biochemistry, physiology and morphology, Academic Press.
2. William. F. Ganong. (2005), Review of Medical Physiology McGraw-Hill Medical; 22 edition.
3. Guyton (1996) Human Physiology and Mechanisms of Disease. Saunders Publications; 6th edition.
4. A.C. Guyton and J.E. Hall (2000), Text Book of Medical Physiology. Harcourt Asia.
5. Anne Waugh and Allison Grant (2018). Ross & Wilson anatomy and physiology in health and illness. Edinburgh: Elsevier, 2018.



**Semester-II**

**Sub. Code: PBC205**

**MAIN PRACTICAL-II**

**3 Hours/3 Credits**

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**I. Titrimetric methods**

1. Estimation of Ascorbic Acid
2. Estimation of Glucose by Benedict's Method
3. Estimation of Glycine by Sorensen's Formal Titration method
4. Estimation of Calcium from Milk

**II. Preparations**

1. Preparation of Starch from potato
2. Preparation of Casein from Milk
3. Preparation of Albumin from Egg
4. Mitosis and Meiosis of Onion root tip.

**Semester-II****Sub. Code: ABC201****ALLIED BIOCHEMISTRY-II****4 Hours/3 Credits****Course Objectives:**

- To develop the skill to understand and acquire knowledge in the functioning of principal organs in human body.
- To emphasis on the major organs and the process they govern like circulation, heart function, muscle function, respiratory, Nervous, digestive and excretory system.
- To develop an ability to relate various interrelated physiological and metabolic events in systems physiology, building knowledge on basic physiological principles established in the Physiology of Organisms.
- To expand the practical biological skills in the Physiology of Organisms.
- To create the ability to think laterally and in an integrating manner and develop interdisciplinary approach. Overall knowledge of the avenues for research and higher academic achievements in the field of biochemistry and allied subjects.

**Course Outcomes:**

<b>Course Outcome (CO)</b>	<b>Description</b>	<b>Cognitive level (K level)</b>
CO-1	Observe and describe the structure of major human organs and explain their role in the maintenance of healthy individuals	<b>K1, K2</b>
CO-2	Explain the interplay between different organ systems and how organs and cells interact to maintain biological equilibrium in changing environment	<b>K2</b>
CO-3	Understand and gain insights into the functions of important physiological systems including the cardio-respiratory, nervous, digestive and excretory systems	<b>K2</b>
CO-4	Analyze how these separate systems interact to yield integrated physiological responses such as exercise, fasting and ascent to high altitude	<b>K4</b>
CO-5	Evaluate and report on experiments and observations in the physiology of the system clinically	<b>K5</b>
CO-6	Validate the experimental design to understand the responses of different organ system	<b>K6</b>

**UNIT-I:** Circulatory system: Components of Blood, Morphology and functions of blood cells. Lymphatic system and Composition of lymph. Circulatory system-Heart anatomy, Cardiac cycle and ECG.

**UNIT-II:** Nervous system: **Structure and functions of Brain**, Structure and functions of nerve cells, Conduction of nerve impulse in myelinated and non-myelinated sheath. Neurotransmitters, Reflex action.

**UNIT-III:** Respiratory system: Structure and functions of Lungs, Mechanism of breathing, Ventilation, Artificial ventilation, Regulation of respiration, Transport of gases, Anoxia, Hypoxia, Non-respiratory functions of the lungs.

**UNIT-IV:** Digestive system: Structure and functions. Digestion and absorption of Carbohydrate, lipids, proteins and nucleic acid. Mechanism of HCl secretion in stomach. Role of hormones involved in digestion.

**UNIT-V:** Excretory system: Structure and functions of Kidney and Nephron, Mechanism of urine formation–Filtration, Reabsorption and Secretion, Composition of urine, Dialysis.

**Text Books:**

- 1.N. Arumugam (2001) Animal Physiology, Saras publication.
- 2.A.C. Guyton and J.E. Hall (2000), Text Book of Medical Physiology. Harcourt Asia.
- 3.Anne Waugh and Allison Grant (2018). Ross & Wilson anatomy and physiology in health and illness. Edinburgh: Elsevier, 2018.
- 4.Sembulingam K and Sembulingam P (2010). Essentials of medical physiology. 5<sup>th</sup> ed. Jaypee Brothers Medical Limited. pp. 85-89.

**References:**

- 1.J. Brachet and A. E. Mirsky (1963), The Cell - Biochemistry, physiology and morphology, Academic Press.
- 2.William. F. Ganong. (2005), Review of Medical Physiology McGraw-Hill Medical; 22 edition.
- 3.Guyton (1996) Human Physiology and Mechanisms of Disease. Saunders Publications; 6<sup>th</sup> edition.
- 4.R.A. Agarwal, Anil. K, Srivastava, KaushalKumar (1986), Animal physiology and Biochemistry-3<sup>rd</sup> edition. S.Chand Publishing, New Delhi.

**Semester-II**

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**Sub. Code: PABC202 ALLIED BIOCHEMISTRY PRACTICAL-II 2 Hours/1 Credit**

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**I. Urine Analysis**

Qualitative analysis of Normal and pathological (abnormal) urine.

**II. Haematology**

1. Estimation of Haemoglobin content by Sahli's method.
2. Determination of ESR.

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**Semester-III****Sub. Code: BC306****MICROBIOLOGY****3 Hours/3 Credits**

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**Objective:**

To understand the basic structure of Microbes and Microbiological techniques.

**Course outcomes:**

By learning this subject, students can obtain knowledge of microbial cell structure and metabolism, evolutionary forces and their consequences. Gain wide knowledge as how microorganisms interact with their environment and interaction between humans.

**UNIT-I:** Microbiology–History, Branches and Scope. Spontaneous generation–Abiogenesis and Biogenesis; Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, and Alexander Fleming.

**UNIT-II:** Microscopy–Principles and applications of Bright field; Dark field; Phase contrast microscope and Fluorescence microscope; Principles and Applications of Electron Microscopy–SEM and TEM.

**UNIT-III:** Bacteria–Ultra structure; Classification (Gram positive and Gram negative); Shape and arrangement; Cell wall polysaccharides; Growth curve and Factors affecting microbial growth. Fungi (Mold and Yeast), Algae and Protozoa - Ultra structure, Characteristics and Economic importance.

**UNIT-IV:** Virus - General properties, Structure and Classification; Plant (TMV & CMV) and Animal viruses (Dengue & Corona); Viroids and Prions; Bacteriophage–Structure, Lytic and Lysogenic cycle.

**UNIT-V:** Sterilization–Dry heat, Moist heat, Filtration and Radiation; Disinfection and Disinfectants; Culture medium, Staining techniques–Gram staining and Acid fast staining; Antibiotic sensitivity test.

**Text Books:**

1. M.J. Pelczar Jr, E.C.S. Chan and N.R. Kreig (2006). “Microbiology” - 5<sup>th</sup> Edition Mc Graw Hill Inc. New York.
2. Park William Halock (2001) Pathogenic Microorganisms, Leafebiger, Philadelphia.

**References:**

1. R. Ananthanarayan and C.K. Jayaram Paniker (2000). Text book of Microbiology. 6th Edition, Orient Longman Limited, Chennai.
2. P. Chakraborty (2003). A Text book of Microbiology. 2nd Edition, Published by New Central Book Agency (P) Ltd., Kolkata.
3. R.C. Dubey and D.K. Maheswari, (2010). A Text book of Microbiology. 3<sup>rd</sup> Edition, S. Chand Publishing, New Delhi.
4. H.Frobisher, R.D.Hinsdil, K.T.Crabtree and D.R.Goodhert (2005). Fundamentals of Microbiology, Saunder and Compa
5. C.B. Powar and H.F. Daginawala, (2008). General Microbiology. Volume: II. Himalaya Publishing House.

### **Semester-III**

**Sub. Code: BC307**

**BIOPHYSICAL CHEMISTRY**

**3 Hours/3 Credits**

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#### **Objective:**

To understand about basic biophysical units and its chemistry.

#### **Course outcomes:**

On completion of this subject, students will be able to understand the range of physical methods used to characterize the organization, properties and function of biological molecules, along with the necessitating sophisticated methods to study them at the molecular level. This course will also provide the basic knowledge on the principle, instrumentation and application of various basic and sophisticated analytical instruments.

**UNIT-I:** Units of measurement of solutes in solution, normality, molality, molarity, and milliosmol, Percentage solution examples for this concept. Ionic strength, Isotonic, hypertonic and hypotonic solution. Diffusion, Osmosis and its applications.

**UNIT-II:** Acid and bases, Arrhenius, Lowry & Bronsted concept, Lewis concept–conjugated pairs. pH, pOH, buffer, buffering capacity, common ion effect. Henderson–Hasselbalch equation. Buffer systems–Bicarbonate, Phosphate, Protein & Haemoglobin buffers.

**UNIT-III:** Principles of electrochemical techniques, Reference electrodes – Silver and Calomel electrode. Determination of pH using pH indicator, Universal indicators, pH paper & pH meter- Instrumentation and applications, Hydrogen electrode and glass electrodes.

**UNIT-IV:** First law of thermodynamics, Work, heat, free energy, enthalpy and entropy, exothermic and endothermic reactions, Reversible & irreversible process, isothermal and adiabatic process, Hess's law and its applications, Kirchoff's equation, relations between Cp & Cv.

**UNIT-V:** Definition and determination of viscosity coefficient. Poiseuille's equation, Stoke's law and terminal velocity. Surface tension: Definition, determination of surface tension, temperature effect. Equilibrium constant, Le-Chatelier's principle and applications.

#### **Text Books:**

1. B.R. Puri, L.R. Sharma, M.S. Pathania (2016), Principles of Physical Chemistry. 47<sup>th</sup> Ed., Vishal Publishing Co.

2. K.Wilson and J. Walker (2006), Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, sixth Edition, Cambridge University Press, New York, USA.

**References:**

1. Upadhyay, K. Upadhyay and N. Nath (2007), Biophysical chemistry, Third revised edition, Himalaya publishing House, Mumbai.
2. Vasantha Pattabhi and Gautham, (2002), Biophysics, second reprint 2005. Narosa Publishing House PVT Ltd, New Delhi.
3. R. Gurdeep, Chatwal and Sham K. Aanand. (2006). Instrumental Methods of Chemical Analysis, Himalaya publishing House, New Delhi.
4. David Freifelder (1976)., Physical biochemistry, applications to biochemistry and molecular biology, second edition. W.H.Freeman & Co Ltd.
5. M.L Srivastava (2008)., Bioanalytical Techniques., Narosa, Chennai.



**Semester-III**

**Sub. Code: PBC302**

**MAIN PRACTICAL-III**

**3 Hours/3 Credits**

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**I. Preparation**

a).Preparation of Buffer

1. Phosphate buffer
2. Tris buffer
3. Citrate buffer.

b).Solution preparation

1. Normality and Molarity solution
2. Saturated solution, Percentage solution, Sucrose gradient solution and dilute solution.

**II. Techniques**

a).Colorimetry

1. Estimation of Amino acids by Ninhydrin method.
2. Estimation of Protein by Biuret method.
3. Estimation of Protein by Lowry's method.
4. Estimation of Phosphorus by Fiske and Subbarow method.

## Semester-IV

Sub. Code: BC407

MICROBIAL BIOCHEMISTRY

3 Hours/3 Credits

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### Objective:

To understand about the mode of microbial infections, fermentation and use of microbes in waste management.

### Course outcomes:

By learning this subject, students can demonstrate knowledge of microbial cell structure and metabolism, evolutionary forces and their consequences. They gain knowledge on the conditions and optimization protocol needed for various microbial products and gain knowledge on the use of microorganisms in waste management.

**UNIT-I:** Food preservation-Principles and Preservatives; Dairy products–Cheese and Yoghurt; Baker’s yeast (Bread making) and Alcoholic beverages (Beer & Wine production). SCP-Cultivation and Applications.

**UNIT-II:** Bacterial diseases – Typhoid, Anthrax, Tuberculosis and Leprosy; Fungal diseases-Candidiasis, Aspergillosis and Dermatophytes; Viral diseases-AIDS, Covid-19, Dengue, Rabies and Hepatitis.

**UNIT-III:** Microbial fermentation and Fermentor; Industrial fermentation–Penicillin, Streptomycin, Ethanol, Vitamin B<sub>12</sub>, Glutamic acid, Protease, Amylase and Lipase.

**UNIT-IV:** Solid and Liquid Wastes, Solid waste management–Saccharification, Gasification and Composting; Liquid waste management–Aerobic and Anaerobic methods; Bioremediation and *Biodeterioration* of wastes.

**UNIT-V:** Biofertilizers-Characteristic features of bacterial biofertilizers, types and uses. Biopesticides–Scope, Classification and Importance. Composting and Vermicomposting and Organic farming.

### Text Books:

1. M.J. Pelczar Jr, E.C.S. Chan and N.R. Kreig (2006). “Microbiology”- 5<sup>th</sup> Edition Mc Graw Hill Inc. New York.
2. M.J. Waites (2007). Industrial Microbiology. Blackwell Publishing Company. UK.

### References:

1. R. Ananthanarayan and C.K. Jayaram Paniker (2000). Text book of Microbiology. 6th Edition, Orient Longman Limited, Chennai.

2. R.M. Atlas and R. Bartha (1992). Microbial ecology. Fundamentals and applications. 3rd Edition. Red Wood City. C.A. Benjamin
3. W.C. Frazies and D.C. Westhoff (1988). Food microbiology. 4th Edition. McGraw Hill NY.
4. U. Satyanarayana (2005). Biotechnology. 1st Edition, Books and Allied (P) Ltd., Kolkata.
5. N.S. SubbaRao (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.

#### **Semester-IV**

**Sub. Code: BC408**

**ANALYTICAL BIOCHEMISTRY**

**4 Hours/4 Credits**

#### **Objective:**

To understand about the principle, instrumentation and applications of analytical instruments.

#### **Course outcomes:**

After the completion of this course, students gain knowledge in analyzing biochemical components using broad range of techniques for separation, identification, quantification and functional characterization of biological molecules.

**UNIT-I:** Basic principles-Sedimentation rate, Svedberg unit, different types of rotors. Types of centrifuges, Different types of centrifugation –Analytical and preparative, Differential, density gradient, isopycnic and equilibrium centrifugation and its applications.

**UNIT-II:** General principles (partition and adsorption), instrumentation and Applications of chromatography–Paper Chromatography, Thin layer chromatography, Affinity Chromatography, Ion Exchange Chromatography, Gel filtration chromatography, Gas Liquid chromatography and HPLC.

**UNIT-III:** General principles, factors affecting the migration rate-sample, electric field, buffer and supporting medium. Paper electrophoresis, Tiselius moving boundary electrophoresis, Agarose gel electrophoresis, SDS-PAGE and Immunoelectrophoresis.

**UNIT-IV:** Basic principles of electromagnetic radiation. Energy, wavelength, wave number and frequency. Absorption and emission spectra. Beer–Lambert’s law, light absorption and its transmittance. Principles, instrumentation and applications–Colorimeter, UV-visible, Flame Emission and Atomic Absorption Spectrophotometer.

**UNIT-V:** Atomic structure, radiation, types of radioactive decay, half-life, and units of radioactivity (Roentgen, Rad, Rem, Let). Detection and measurement of radioactivity–methods based upon ionization (GM counter), methods based upon excitation (Liquid and solid scintillation counter), Autoradiography, Applications of radioisotopes, Radiation hazards and safety measures.

#### **Text Books:**

1. P. Asokan (2001), Analytical Biochemistry. Chinnaa Publications.

2. M K. Wilson and J. Walker (2006), Practical Biochemistry–Principles and techniques of Biochemistry and Molecular Biology, sixth Edition, Cambridge University Press, New York, USA.

**References:**

1. A. Upadhyay, K. Upadhyay and N. Nath (2007), Biophysical chemistry, Third revised edition, Himalaya publishing House, Mumbai.
2. Vasantha Pattabhi and Gautham, (2002), Biophysics, second reprint 2005. Narosa Publishing House PVT Ltd, New Delhi.
3. R. Gurdeep, Chatwal and Sham K. Aanand. (2006). Instrumental Methods of Chemical Analysis, Himalaya publishing House, New Delhi.
4. David Freifelder., (1976), Physical biochemistry, applications to biochemistry and molecular biology, second edition. W.H.Freeman & Co Ltd.

**Semester-IV**

**Sub. Code: PBC405**

**MAIN PRACTICAL-IV**

**3 Hours/3 Credits**

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**I. Electrophoresis**

1. Separation of serum protein by SDS-PAGE
2. Separation of DNA by Agarose gel electrophoresis.

**II. Chromatography**

1. Paper chromatographic separation and detection of amino acids
2. Separation of carbohydrates and amino acids by TLC

**III. Microbiology**

1. Preparation of liquid and solid media.
2. Isolation of bacteria from Air, soil and water.
3. Isolation and maintenance of organisms by plating and streaking methods.  
Slants and swab culture.
4. Gram's staining method.
5. Antibiotic sensitivity test

**Semester-V****Sub. Code: BC522****ENZYMOLGY****4 Hours/4 Credits**

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**Objective:**

To understand the role of enzymes in biochemical reactions and its applications

**Course outcome:**

Student will have a strong foundation in distinguishing the fundamentals of enzyme properties, nomenclatures, characteristics and its mechanisms. They will be able to apply biochemical calculation for enzyme kinetics, Compare methods for production, purification, characterization and immobilization of enzymes, can discuss various application of enzymes.

**UNIT-I:** Enzymes-Definition, Nomenclature and IUBMB classification, and enzyme units (IU, Katal, turnover number and specific activity). Metalloenzymes and metal activated enzymes. Multi-enzyme systems–PDH and FAS. Non-protein enzymes, Cofactor, Coenzymes, prosthetic group, apoenzyme and holoenzyme.

**UNIT-II:** Active site–General characteristics; Mechanism of action of enzyme – Lock and Key theory and induced fit theory. Structure and functions of coenzyme reaction involving nucleotides-NAD/NADP, FMN/FAD and Coenzyme-A, Biotin, Folate, Lipoate. Isoenzymes (LDH and CK).

**UNIT-III:** Enzyme Kinetics–Reaction rate, energy of activation, enzyme catalysis and factors affecting enzymatic reactions. Michaelis-Menton equation, Line-Weaver Burk plot, Eadie–Hofstee plot and Hanes-Woolf plot.

**UNIT-IV:** Enzyme inhibition–Reversible: Competitive, Non-competitive and uncompetitive and irreversible inhibitions (kinetics and derivations not required). Feedback inhibition, Allosteric enzymes and its regulation.

**UNIT-V:** Isolation and purification of enzymes: Salting in and out, Dialysis, Chromatography and electrophoretic techniques. Criteria of purity of enzymes. Enzyme immobilization- Methods and applications.

**Text Books:**

1. Trevor Palmer (2004). Enzymes-Biochemistry, Biotechnology, Clinical Chemistry. First Edition, East West Press, New Delhi.
2. J.M. Bery, J.L. Tymoezko and L. Stryer (2008) Biochemistry, 6<sup>th</sup> Ed, W.H. Freeman and Company, New York.

**References:**

1. U. Sathyanarayanan (2002), Essentials of Biochemistry Books and allied (p) Ltd.

2. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5<sup>th</sup> Ed, W.H. Freeman and Company, New York
3. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
4. G.L Zubay (1999) Biochemistry, 4<sup>th</sup> Ed, WCB, McGraw-Hill, New York.
5. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.
6. T.M. Devlin (2002), Textbook of Biochemistry with Clinical correlations, 5th edition, John Wiley & Sons Inc, Publications.
7. A.C. Deb (2001), Fundamentals of Biochemistry, New Central Book Agency Pvt., Ltd., Calcutta.
8. S.M. Bhatt (2011), Enzymology and Enzyme Technology. (2011), S. Chand Publishing, New Delhi.

## Semester-V

Sub. Code: BC523 INTERMEDIATORY METABOLISM

5 Hours/5 Credits

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### Objective:

To promote and understand biochemical reactions, central metabolic pathways, kinetics of energy and homeostasis of metabolism.

### Course outcome:

At the end of this course, the student is able to explain the general design of metabolic pathways based on bioenergetics principle, can understand the structures and functions of biological molecules. Students can describe how carbohydrates (glucose and glycogen), lipids (fatty acids and triglycerides) and nitrogenous compounds (amino acids and nucleotides) are synthesized and degraded, and more importantly, how metabolic pathways are regulated and recognize the biochemical basis of diseases arise due to defects in metabolism.

**UNIT-I:** The basic metabolic pathways-anabolic, catabolic and amphibolic pathways. Aerobic and Anaerobic glycolysis and its energetics. Citric acid cycle-Pyruvate Dehydrogenase Complex and its energetics. Gluconeogenesis. Glycogenesis, Glycogenolysis and Pentose phosphate pathway.

**UNIT-II:** Electron Transport Chain-Components of ETC. Role of ETC-Oxidative Phosphorylation-Chemiosmotic Hypothesis, Uncouplers and High Energy Compounds (ATP and GTP).

**UNIT-III:** Biosynthesis and  $\beta$ -Oxidation of Fatty Acids, Biosynthesis of Triacyl Glycerol and Phospholipids and Cholesterol.

**UNIT-IV:** Catabolism of Amino acids-Transamination, Oxidative Deamination and Non-Oxidative Deamination, and Urea Cycle. Formation of Creatine Phosphate and Creatinine, Methylation and Decarboxylation.

**UNIT-V:** Nucleic Acid Metabolism-Biosynthesis and Degradation of Purine and Pyrimidine Nucleotides-Denovo Synthesis and Salvage Pathway.

### Text Books:

1. Fundamentals of Biochemistry. (2005)., J.L Jain S. Chand Publishing, New Delhi.
2. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2012), Harper's Biochemistry, twenty eighth edition, Prentice Hall, New Jersey.

### References:



1. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5<sup>th</sup> Ed, W.H. Freeman and Company, New York
2. J.M. Bery, J.L. Tymoezko and L. Stryer (2008), Biochemistry, 6<sup>th</sup> Ed, W.H. Freeman and Company, New York.
3. Trevor Palmer (2004). Enzymes-Biochemistry, Biotechnology, Clinical Chemistry. First Edition, East West Press, New Delhi.
4. A.C. Deb (2001), Fundamentals of Biochemistry, New Central Book Agency Pvt., Ltd., Calcutta.
5. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
6. U. Sathya Narayanan and U. Chakrapani. (2007), Text book of Biochemistry, 3<sup>rd</sup>edition, Pvt Ltd.
7. Fundamentals of Biochemistry for Medical Students,(1998) Ambika Shanmugam.

**Semester-V****Sub. Code: BC524****ENDOCRINOLOGY****4 Hours/4 Credits**

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**Objective:**

To understand the role of hormones in biochemical reactions and its applications.

**Course outcome:**

Students will develop the ability to independently evaluate and monitor common endocrine disorders. They will be able to describe major actions of each hormone on target cells, synthesis pathways and inactivation of certain hormones like steroid and thyroid. Student will also gain complete knowledge on hormones and the control of its synthesis and secretion site for each hormone, including feedback relationships.

**UNIT-I:** Hormones–Definition, Chemical nature and classification. Mechanism of action of Group I and Group II hormones, Signal transduction and introduction to Hormonal receptors (Tyrosine receptors). Positive and negative feedback regulation of endocrine system.

**UNIT-II:** Hypothalamus and hypothalamic releasing factor. Pituitary hormones- Chemistry, Secretion, Functions and Regulation. Anterior Pituitary hormones–GH, Pituitary tropic hormones (LH, FSH, TSH, ACTH and Prolactin) and Posterior Pituitary hormones (Vasopressin and Oxytocin).

**UNIT-III:** Thyroid and Parathyroid Hormones–Chemistry, Synthesis, Secretion, Functions and Regulations. Pancreatic Hormones–Chemistry, Secretion, Functions and Regulations (Insulin and Glucagon).

**UNIT-IV:** Adrenal gland hormones–Chemistry, Secretion, Functions and Regulations of Adrenal Cortex hormones (glucocorticoids and mineralocorticoids) and Adrenal Medullary hormones (Epinephrine and Nor-Epinephrine). Renin-angiotensin system.

**UNIT-V:** Chemistry, Secretion, Functions and Regulations of Gonadal hormones– Testosterone, Estrogen and Progesterone. Ovarian cycle and its regulation.

**Text Books:**

1. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.
2. Guyton (1996) Human Physiology and Mechanisms of Disease. Saunders Publications; 6th edition.

**References:**

1. Williams Textbook of Endocrinology. (2011)., ShilomoMelmed., Elsevier, New Delhi.
2. K.V. Krishnadas (1996), Textbook of Medicine, Jaypee publication, New Delhi.
3. N.Chatterjee and Rana Shinde (2012) Textbook of Medical Biochemistry - eighth edition, Jaypee publication, New Delhi.

4. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5<sup>th</sup> Ed, W.H. Freeman and Company, New York
5. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
6. G.L Zubay (1999) Biochemistry, 4<sup>th</sup> Ed, WCB, McGraw-Hill, New York.

**Semester-V**

<b>Sub. Code: BC525</b>	<b>GENETICS</b>	<b>4 Hours/4 Credits</b>
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**Objective:**

To understand the basic aspects of genetics and associated laws.

**Course outcome:**

On satisfying the requirements of this course, students will have the knowledge and skills to explain the key concepts in population, evolutionary and quantitative genetics including the basis of genetic variation, heritability and mutation.

**UNIT-I:** Genetics-Introduction; Premendelian concepts of heredity– Fluid theory, Reproductive blood theory, Preformation, Epigenesis, Inheritance of acquired characters, Theory of Pangenesis and Germplasm theory; Rediscovery of Mendel’s original work, Genotype and Phenotype; Heredity; Gene, Genome, Trait, Genetic material and Genetic maps.

**UNIT-II:** Mendelian Inheritance and laws; Laws of Probability–Rule of addition and rule of multiplication; chi-square analysis, Pedigree analysis; Incomplete and Co-dominance; Multiple alleles; Lethal alleles; Epistasis; Pleiotropy; Sex linked inheritance.

**UNIT-III:** Linkage and Crossing over; Morgan’s Law; complete and incomplete linkage; Back and Test cross; Types of linkage; gene mapping–cross over, gene mapping for two point and three point crosses; Interference and Coefficient of Coincidence.

**UNIT-IV:** Chromosomal Mutations–Deletion, Duplication, Inversion and Translocation; Ploidy–Euploidy, Aneuploidy and Polyploidy. Down Syndrome, Turner syndrome and Klinefelter syndrome.

**UNIT-V:** Population Genetics, Hardy Weinberg Law–Gene Frequency, Factors affecting gene frequency, Eugenics, Euphenics and Euthenics.

**Text Books:**

1. A.V.S.S Sambamurty, (2007), Molecular Genetics, Narosa, Chennai.
2. P.J. Russell (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.

**References:**

1. E.J. Gardner, M.J.Simmons and D.P. Snustad (2008). VIII ed. Principles of Genetics. Wiley India.
2. D.P. Snustad M.J. Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. W.S. Klug, M.R. Cummings, C.A, Spencer, C.A. (2009). Concepts of Genetics. XI Edition. Benjamin Cummings.

4. B.R. Glick, J.J Pasternak (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
5. Gurbachan S Miglani (2006), Developmental Genetics, IK. International, New Delhi.

### **Semester-V**

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**Sub. Code: PBC502**

**MAIN PRACTICAL-V**

**5 Hours/5 Credits**

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#### **I. Colorimetric Estimation**

1. Estimation of Creatinine by Jaffe's Method.
2. Estimation of Urea by Diacetyl Monoxime Method.
3. Estimation of DNA by Di Phenyl Amine method.
4. Estimation of RNA by Orcinol method.
5. Estimation of glucose by O-Toluidine method.
6. Estimation of Cholesterol by Zak's method.

#### **II. Urine Analysis**

Qualitative analysis of Normal and pathological (abnormal) urine.

**Semester-V**

**MAJOR ELECTIVE-I**

**Sub. Code: BC526A BIOMEDICAL INSTRUMENTATION**

**6 Hours/4 Credits**

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**Objective:**

To focus on biomedical instrumentation and their applications in Life sciences.

**Course outcome:**

The main objective of this course is to introduce student to basic biomedical equipment. As a result, student can understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body.

**UNIT-I:** Classification of Biomedical Equipment–Diagnostic, therapeutic and clinical laboratory equipment. Applications of endoscope, laparoscope and cardioscope. Transducers for biomedical application.

**UNIT-II:** Bioelectric signals, recording and their characteristics, Bioelectrodes–types, electrodes for ECG, EMG, EOG and ERG, electrodes tissue interface, contact impedance and effects of high contact impedance.

**UNIT-III:** Biosensor-mechanism and types. Autoanalyzer-Types and application. Automatic tissue processing and application of microtome. Pulse oximetry. Magnetic resonance imaging system, NMR components and its biological applications.

**UNIT-IV:** Measurement of Heart rate, pulse rate, respiration rate and blood pressure. X- Ray Machine–Basic components, types, dental image intensifier system, trouble shooting and maintenance.

**UNIT-V:** Therapeutic instruments–Introduction, types, classification, power source and electrodes of cardiac pacemaker. Computer application in medicine-computerized catheterization laboratory, computerized patient monitoring system.

**Text Books:**

1. Arumugam, (2002) Biomedical Instrumentation, Anuratha Agencies Publishers, 2<sup>nd</sup> edition.
2. Mandeep singh, (2014) Introduction to biomedical instrumentation, Paperback publishers.

**References:**

1. Edward J. Bukstein, (2001) Introduction to Biomedical electronics, Sane and Co. Inc. USA.
2. Goddes and Baker, (2002) Principles of applied biomedical instrumentation, John Wiley.
3. R.S. Khandpur, (2003) Hand book of Medical instruments, TMH, New Delhi, 644pp.
4. Cromwell, (2007) Biomedical instrumentation, Prentice Hall of India, New Delhi.
5. John G. Webster (2007) Medical instrumentation, John Wiley.
6. Carr and Brown (2009) Biomedical instrumentation and measurement, Pearson.

7. R.S Khandpur (2014) Handbooks biomedical instrumentation, 3<sup>rd</sup> edition McGraw Hill Education (India) Private Limited.

**Semester-V**

**MAJOR ELECTIVE-II**

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**Sub. Code: BC526B MEDICAL LABORATORY TECHNOLOGY 6 Hours/4 Credits**

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**Objective:**

To provide knowledge about laboratory practices, collection of biological specimens and their analysis.

**Course outcome:**

The student will be able to perform routine clinical laboratory procedures within acceptable quality control parameters in Hematology, Chemistry, Immunohematology, and Microbiology.

**UNIT-I:** Specimens–Collection and preservation of Blood, Urine, Feces, Sputum, Semen, Throat swab, Amniotic fluid and CSF. Smears–types, preparation and maintenance. Good laboratory practices.

**UNIT-II:** Blood–Blood pressure, Clotting time, Bleeding time, Hemoglobin Estimation, RBC count and WBC count, Differential count, Erythrocyte Sedimentation Rate, Packed cell volume and platelet counting.

**UNIT-III:** Urine–Composition, Preservation, Microscopic and Macroscopic Examination (Physical and Chemical examination). Feces–Composition, Macroscopic and Microscopic Examination, Chemical examination–Occult blood and Steatorrhea.

**UNIT-IV:** Histopathology–Tissue cutting, fixation, embedding, tissue slicing by microtome, slide mounting and staining.

**UNIT-V:** Culturing of organism from various specimens (Pus, Urine, Blood, Sputum and Throat Swab). Gram's staining and Acid-fast staining. Antibiotic sensitivity test.

**Text Books:**

1. D.Sahu (1997), Critical approach to clinical medicine, Vikas Publishing, Noida.
2. Devlin, T.M. (2002), Textbook of Biochemistry with Clinical correlations, 5th edition, John Wiley & Sons Inc, Publications.
3. Ramnik Sood (2009), Medical Laboratory Technology: Methods and Interpretation. JPB; Sixth edition.
4. Kanai L. Mukherjee and Anuradha Chakravarthy (2017), Medical Laboratory Technology, Procedure Manual for Routine Diagnostic Tests - Vol. 1. McGraw Hill Education; Third edition.

**References:**

1. P.D. Mayne (1994), Clinical chemistry in diagnosis and treatment. A Hodder Arnold Publication; 6<sup>th</sup> Revised edition.

2. W.J. Marshall and S.K. Bangeit, (1995), Clinical biochemistry - Metabolic concepts and clinical aspects, Churchill Livingstone.
3. K.V. Krishna Das, Text Book of Medicine, (1996), Jaypee publication, New Delhi.
4. A.C. Guyton and J.E. Hall, (2000), Text Book of Medical Physiology Harcourt Asia.
5. Guyton (1996) Human Physiology and Mechanisms of Disease. Saunders Publications; 6<sup>th</sup> edition.
6. N.Chatterjee and Rana Shinde (2012) Textbook of Medical Biochemistry - eighth edition, Jaypee publication, New Delhi.
7. K. Sampath (1999), Hospital and Clinical Pharmacy, Vikas Publishing. Noida.

**Semester-V**

**MAJOR ELECTIVE-III**

**Sub. Code: BC526C**

**PHARMACOLOGY**

**6 Hours/4 Credits**

**Objective:**

To give focus on drug chemistry and its mechanism of actions.

**Course outcome:**

This course will provide the basic information on drug, drug metabolism, adverse drug reactions, general awareness of different types of drugs and its effects. This course will also give focus on drug chemistry and its relationship in life sciences.

**UNIT-I:** Drugs-Sources, routes of drug administration, dosage and dosage forms. Classification, Absorption, Distribution, Metabolism and Elimination of drug.

**UNIT-II:** Drug-Receptor interactions involvements of binding forces in drug receptor interaction, Receptor mediated and non-mediated interactions.

**UNIT-III:** Drug metabolism-Phase I and II enzyme reactions and biochemical importance of xenobiotic metabolism.

**UNIT-IV:** Cancer-Definition and types, Chemotherapy-anticancer drugs, antimetabolites, antibiotics and alkylating agents. Radiation therapy.

**UNIT-V:** Vaccination against infection. Adverse drug reactions, biological effects of drug abuse and drug dependence, drug tolerance and intolerance. Assay of drug potency-Bioassay and Immunoassay.

**Text Books:**

1. Chatwal G R (1996) Pharmaceutical Chemistry-Inorganic., Himalaya, Bombay
2. Bentley (1969) Bentley and Driver's Text Book of Pharmaceutical Chemistry Oxford and IBH, New Delhi.

**References:**

1. Burger, D. J. Abraham (2003) Oxford textbook, of Clinical pharmacology and drug therapy. D.G. Burger's medicinal Chemistry & Drug Discovery.
2. K. D .Tripathi (2004) Essentials of Medical Pharmacology. 5<sup>th</sup> edition, Jaypee, New Delhi.
3. Richard A. Harvey, Pamela C. Champe, Richard Finkel, Luigi Cubeddu, Michelle A. Clarke (2008) Pharmacology (Lippincott Illustrated Reviews Series), 4<sup>th</sup> edition, Wolters kluwer.
4. William, O. and Foge, B.I. (2008) Principles of medicinal chemistry, Waverks Pvt Ltd., New Delhi.
5. Bhandarkar (2010) Pharmacology and Pharmacotherapeutics, 10<sup>th</sup> edition Elsevier.
6. Satoskar (2015) Pharmacology and Pharmacotherapeutics, 24<sup>th</sup> edition, Elsevier.
7. R.S.Satoskar. S.D. Bhandhakar and S.S. Anilapure (2015) Pharmacology and Pharmacotherapeutics, Elsevier.



**Objective:**

To gain knowledge about first aid, basic health issues and handling emergencies.

**Course outcome:**

This course will provide the basic information about safe guards to health, first aid for accidents, handling emergencies of general and specific disease. This course will also give awareness about symptoms and giving first aid during common health issues before meeting the physician.

**UNIT-I:** Safe guards to health–Physical fitness and Normal weight, Diet–Normal diet, BMI, Classification of foods, Merits and Demerits of taking foods.

**UNIT-II:** First Aid for Accidents–Wounds, Burns, Snake Bites, Hiccup, Shock, Poisoning, Vomiting and Drowning.

**Unit-III:** Handling Emergencies–Heart attack, Allergy–Food and Insect bite, Diabetic conditions, Unconsciousness, Asthma and Sprain.

**UNIT-IV:** General Diseases–Causes, symptoms and preventions of Constipation, Diarrhea, Itching, Dental caries and Obesity.

**UNIT-V:** Specific Disease -Cataract, Cancer, AIDS, Ulcer and Appendicitis.

**Text Books:**

1. DevendraVora. (1995), Health in Your Hands. Navneet Pub., Mumbai.
2. Harrison's principles of internal medicine–Vol-I & II, (2015), McGraw Hill Education; 19<sup>th</sup> edition.

**References**

1. H.K Bakhru (1990), Herbs that Heal: Natural Remedies for Good Health, Orient, Delhi.
2. K.V. Krishna Das, (2008), Text book of medicine, 5<sup>th</sup> edition.
3. S.S. Purohit, H.N. Kakrani and A.K. Saluja (2003) Pharmaceutical Biotechnology, Student edition publications, Jodhapur.
4. M.J. Mycek, A.R.Harve and P.C.Champe (1997), Lipincott's Illustrated Reviews: Pharmacology, 2<sup>nd</sup> edition, Lipincotts Williams and Wilkins publishers.
5. R.S. Satoskar, S.D.Bhandarkar and S.S. Annapure (1999), Pharmacology and Pharmocotherapeutics., Popular Prakashan, Mumbai.
6. ShashiGoyal (2012), Food,Nutrition and Health. S. Chand Publishing, New Delhi.

## **Semester-V**

**Sub. Code:NBC504 NON-MAJOR ELECTIVE: ENERGY BUILDERS 2 Hours/1 Credit**

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### **Objective:**

To understand about various biological macromolecules, its functions and disease conditions.

### **Course outcome**

A student draws complete knowledge of health management at the end of this course. Based on an individual's requirement a complete diet schedule can be framed by the student.

**UNIT-I:** Carbohydrates–Introduction, source, classification and biological importance. Disease conditions-Diabetes Mellitus and Hypoglycemia.

**UNIT-II:** Proteins–Introduction, source, classification and biological importance. Disease conditions-Kwashiorkor and Marasmus.

**UNIT-III:** Fats–Introduction, source, classification and biological importance. Disease conditions-Obesity and Atherosclerosis.

**UNIT-IV:** Vitamins–Fat and Water Soluble Vitamins, Sources, Daily requirements, Functions and Deficiency disorders.

**UNIT-V:** Minerals-Micro (Fe, Zn, Cu, I, F, Mn, Mo) and Macro elements (Na, Mg, Cl, Ca, P, K, S)–Source, biological importance and Deficiency disorders.

### **Text Books:**

- 1.J.L.Jain., Nitin Jain and Sunjay Jain (1979) Elementary Biochemistry, S. Chand Publishing. New Delhi.
- 2.Nitin Jain., Sunjay Jain and J.L.Jain, (2007) Fundamentals of Biochemistry, S. Chand Publishing. New Delhi.

### **References:**

- 1.R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.
- 2.D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5th Ed, W.H. Freeman and Company, New York.
- 3.Sathyanarayanan.U (2002), Essentials of Biochemistry Books and allied (p) Ltd.
- 4.D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
- 5.G.L Zubay (1999) Biochemistry, 4th Ed, WCB, McGraw-Hill, New York.
- 6.Ambika Shanmugam (1998), Fundamentals of Biochemistry for Medical Students.

## **Semester-VI**

**Sub. Code: BC620**

**MOLECULAR BIOLOGY**

**5 Hours/5 Credits**

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### **Objective:**

To give basic aspects of molecular theories and central dogma.

### **Course outcome:**

Students will be able to exhibit a knowledge base in genetics, cell and molecular biology, anatomy and physiology. Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology.

**UNIT-I:** Organization of Genes, Chromosome Structure, Types and Functions. DNA as Genetic Material - Evidence and Central Dogma, Satellite DNA.

**UNIT-II:** Replication-Types, Evidence for Semi-Conservative Replication. Replication in Prokaryotes and Eukaryotes. Inhibitors of Replication.

**UNIT-III:** Transcription: RNA Polymerases in Prokaryotes, Role of Sigma Factor, Steps-Initiation, Elongation and Termination (Rho-dependant and independent). Inhibitors. Post-Transcriptional Modifications and Reverse Transcription.

**UNIT-IV:** Translation: Genetic code-Codon Dictionary and Salient Features of Genetic Code. Composition of Prokaryotic and Eukaryotic Ribosomes, Structure of RNA, Role of signal peptide. Steps-Activation of Amino Acids, Initiation, Elongation and Termination of protein synthesis in prokaryotes. Post-Translational Modifications. Inhibitors of Protein Synthesis.

**UNIT-V:** Gene Mutation: Types-Point Mutation (transition and transversion), Frame Shift Mutation- Insertion and Deletion, Suppressor Mutation-Nonsense and Missense suppression. Mutagens-Physical and Chemical Mutagens. DNA Repair Mechanism-Base Excision, UV repair, Recombination repair and SOS. Gene Regulation-operon concept (Lac operon).

### **Text Books:**

1. P.S Verma and V.K.Agarval (2016) Cytology (Cell Biology, Biomolecules and Molecular Biology), S. Chand Publishing. New Delhi.
2. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5<sup>th</sup> Ed, W.H. Freeman and Company, New York.

### **References:**

1. Rastogi, S.C. (2003), Cell and Molecular Biology, 2<sup>nd</sup> edition, New Age International Publishers.
2. Benjamin Lewin (2004) Genes VII, Pearson Education Limited, New York.
3. G.Karp.John (2002), Cell and Molecular biology – 3<sup>rd</sup> edition Wiley and Sons N.Y.
4. David Freifelder (1976), Physical biochemistry, applications to biochemistry and molecular biology, second edition. W.H. Freeman & Co Ltd.

5. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.

## **Semester-VI**

**Sub. Code: BC621**

**IMMUNOLOGY**

**4 Hours/4 Credits**

### **Objective:**

To know about the mechanism of action of Antigen-Antibody interactions.

### **Course outcome:**

The study of immunology will enable the student to gain a broad foundation base and build upon that base for understanding the defense mechanisms of the human body. Such foundation will be germane to advanced courses for the student entering medical school or graduate school or for any student actively involved in the medical healing arts.

**UNIT-I:** History of Immunology-Edward Jenner and Louis Pasteur with their experiments. Immunity-Innate and Acquired immunity. Immune Response-Antibody and Cell Mediated response. Cells of the immune system, Organs of the immune system–primary and secondary lymphoid organs.

**UNIT-II:** Antigen-Properties, Cross reactivity, Antigenicity, Immunogenicity, antigen determinants, Haptens, Adjuvants, Self-antigen (MHC) an outline only. Antibodies - Properties and Structure of classes and subclasses of Immunoglobulins.

**UNIT-III:** Antigen–Antibody interaction–Precipitation and Agglutination, Complements and their activation pathway, Cytokines and their functions.

**UNIT-IV:** Hypersensitivity–type I, II, III and IV and their clinical manifestations. Transplantation-types, Mechanism of Allograft rejection, Immuno suppressor agents, Tissue and organ transplantation. Basic concepts of plastic surgery.

**UNIT-V:** Immunization-Passive and Active, Vaccines-Recombinant vaccines, DNA vaccines, Benefits and adverse effects of vaccination. Principle and applications of RIA, ELISA, Immunofluorescence and Complement fixation test. Monoclonal Antibody production and its applications.

### **Text Books:**

1. Annadurai. B (2008), A textbook of Immunology and Immunotechnology, 1<sup>st</sup> Edition, S.Chand & Co, Ltd, New York.
2. J. Kuby, R.A.Goldsby, T.J. Kindt and B.A. Osborne, B.A. (2007), Immunology, 4<sup>th</sup> edition, W.H.Freeman and Company, New York, USA.

### **References:**

1. J. Kuby (2002), Immunology, 5th edition, W.H.Freeman and Company, New York.
2. Ian R. Tizard (2000), Immunology: An Introduction., 4th edition, W.B. Saunders Co., Philadelphia.

3. Murphy Kenneth (2008), Janeway's Immunobiology, Garland Science Publishers, New York.
4. Peter J. Delves, Ivan Maurice Roitt,, Seamu J. Martin and Deninis Burton (2006), Roitt's Essential Immunology, 11th edition, Blackwell Scientific Publications, London.
5. Rajasekaran Pandian (2007), Immunology and Immunotechnology, Panima Publishers, Chennai.
6. I. Roitt, J. Brostoff and DMale (2002), Essential Immunology, 8th edition, English Language Book Society, London.

## Semester-VI

Sub. Code: BC622

MEDICAL BIOCHEMISTRY

5 Hours/4 Credits

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### Objective:

To give input on clinical diseases, symptoms and treatments.

### Course outcome:

This course will provide the basic knowledge on principles and practices of Clinical laboratory and understand the clinical disorders and treatments. It also imparts knowledge about exact clinical condition, causative agents, signs and symptoms, diagnosis, and treatment measures of diseases affecting principal organs.

**UNIT-I:** Blood sugar level–Definition, Types and Normal Values, Renal threshold of Glucose, Regulation of blood glucose- Hormonal action. Hypo and Hyperglycemia–Causes, Diagnosis and Treatment. Diabetes mellitus, Glycosuria, Fructosuria, Galactosemia, HbA<sub>1C</sub>, ketoacidosis, Glycogen Storage Disease, GTT.

**UNIT-II:** Diseases related to amino acid-Clinical manifestation of Phenylketonuria, Cystinuria, Albinism, Fanconi syndrome, Tyrosinemia and Alkaptonuria. Lipoproteins- Hyperlipoproteinemia, Hypolipoproteinemia, Atherosclerosis, Myocardial infarction, Ischemic Heart Disease and Obesity.

**UNIT-III:** Liver–Functions, Liver function test, Metabolism of Bilirubin, Jaundice–classification, causes and differential diagnosis. Liver disorders–Causes, Symptoms, Diagnosis and Treatment for Acute and Chronic Hepatitis, Cirrhosis, Fatty Liver, Gall Stones.

**UNIT-IV:** Kidney–Functions, Renal function test, Clearance test–Urea, Creatinine, Inulin, PAH test, Concentration and Dilution test. Renal disorders: Causes, symptoms, Diagnosis and Treatment–Glomerulonephritis, Diabetes Insipidus, Nephrotic syndrome, Renal failure and UTI.

**UNIT-V:** Gastric function test- Collection of gastric content, Examination of gastric residuum, FTM, Alcohol Stimulation test, Tubeless gastric analysis. GI tract disorders-Peptic ulcer, Gastric carcinoma, Zollinger-Ellison syndrome. Pancreatic function test- Composition of pancreatic juice. Disorders-Acute and Chronic pancreatitis and Steatorrhoea. Intestinal function test.

### Text Books:

- 1.N.Chatterjee and Rana Shinde (2012) Textbook of Medical Biochemistry- eighth edition, Jaypee publication, New Delhi.
- 2.T.M. Devlin (2002), Textbook of Biochemistry with Clinical correlations, 5th edition, John Wiley & Sons Inc, Publications.

### References:

1. Carl A. Burtis, Edward.R. Ashwood, David E Bruns, Tietz Text book of clinical chemistry and molecular diagnostics, (5th edition). Elsevier, St. Louis, USA, [2012].

2. Harrison, T.R. Fauci, Branunwalad and Isselbaeher, Principles of Internal Medicine [1998] McGraw Hills.[Vol-I & II]
3. Joan F. ZilvaA, PR Pannall, Clinical Chemistry in Diagnosis and Treatment, Liyods–Luke [Medical Books] Ltd., London [1975].
4. K.V. Krishnadas, Textbooks of Medicine [1996], Jaypee Brothers.
5. W.J. Marshall and S.K. Bangert, Clinical Chemistry [1995]

**Semester-VI**

**Sub. Code: PBC606**

**MAIN PRACTICAL-VI**

**5 Hours/4 Credits**

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**I. Experiments on Enzymes by Colorimetry**

1. Effect of pH, temperature and substrate concentration on salivary amylase
2. Effect of pH, temperature and substrate concentration for urease
3. Assay of Serum Transaminases (SGOT) & (SGPT)

**II. Haematology**

1. Collection of Blood and Blood grouping
2. Measurement of BP
3. Enumeration of Total RBC count
4. Enumeration of Total WBC Count
5. Estimation of Haemoglobin content by Sahli's method
6. Determination of ESR
7. Differential Counting
8. Bleeding and Clotting time
9. PCR (demonstration)



## **Semester-VI**

**Sub. Code: BC623A**

**SS1: BIOTECHNOLOGY**

**5 Hours/5 Credits**

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### **Objective:**

To give knowledge on applied field of life sciences like DNA technology, tissue culture techniques and Fermentation technology.

### **Course outcome:**

Students will acquire an in-depth knowledge on Recombinant DNA technology, methods of gene transformation, molecular techniques, plant and animal tissue culture.

**UNIT-I:** Recombinant DNA technology and its tools-Isolation of gene, Cloning vectors: plasmid, cosmid, phage, YAC, BAC, HAC, binary vector, shuttle vector and expression vectors, rDNA formation. Ligation, Use of linkers and adapters.

**UNIT-II:** Methods of gene transformation. Recombinant selection and screening methods-Insertional inactivation, Hybridization and Immunological methods.

**UNIT-III:** Molecular techniques-Southern, Northern and Western blotting and its applications. PCR – Types and its applications, DNA sequencing methods-Maxam-Gilbert.

**UNIT-IV:** Plant tissue culture-Media composition, nutrients, growth regulators, initiation and differentiation. Callus and suspension culture, Micro propagation, Somatic embryogenesis and Somoclonal variation. Applications of Transgenic plants.

**UNIT-V:** Animal tissue culture-substrate, culture media and culture procedures, Primary culture and cell lines, tissue culture- slide, flask and test tube culture. Applications of transgenic animals.

### **Text Books:**

1. R.C. Dubey (1993) A textbook of Biotechnology, S. Chand Publishing, New Delhi.
2. A.K. Srivastava, R.K. Singh and M.P. Yadav (2005), Animal Biotechnology, Oxford and IBH.

### **References:**

1. N Channarayappa, (2006), Molecular biotechnology University Press, Hyderabad
2. R.C.Dubey (2014) Advanced Biotechnology, S. Chand Publishing, New Delhi.
3. H.D. Kumar (1997), Molecular Biology & Biotechnology Vivas publishing house Pvt. Ltd.
4. Bernard, R. Glick Jack.J. Pasternak, (2003) Molecular biotechnology-Principle and application of recombinant DNA, 3<sup>rd</sup>edition Library of Congress.
5. S. B. Primrose (1994), Molecular Biotechnology, 2nd Ed. Blackwell Scientific publishers, Oxford.
6. V. Kumaresan and N. Arumugam (2016) Fundamentals of Biotechnology-Saras Publications.

## Semester-VI

Sub. Code: BC623B

SS2: BIOETHICS

5 Hours/5 Credits

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### Objective:

To understand the ethical aspects in Biology and Biocontainment.

### Course outcome:

After successful completion of this course, students will acquire knowledge about bioethics, ethical concerns of Biotechnology research and innovation, laboratory animal handling and methods of application of patents.

**UNIT-I:** Bioethics-Definition, Ethics in scientific research. Biomedical waste-Source, handling and disposal. Animal Incineration methods. General Laboratory Practices.

**UNIT-II:** Ethical concerns of Biotechnology research and innovation, Biosafety levels-Genetically modified organisms and its release-Genetically modified foods, Biosafety guidelines in India.

**UNIT-III:** Genetics and Genomics Research-Defining risks and benefits-principles governing research in human genetics–informed consent in genetic research, ethical issues in genetic testing and stem cell research.

**UNIT-IV:** Composition of institutional Ethical Committee (IEC). Ethics in animal experimentation. CPCSEA guidelines for Animal care in research.

**UNIT-V:** Biotechnological inventions. Patentable subjects and protection in biotechnology. Principles and general requirements for patenting. Methods of application of patents. Intellectual property rights (IPR).

### Text Books:

- 1.The Cambridge Textbook of Bioethics by Singer, Peter, A. and Viens A.M. Cambridge University Press, 2008.
- 2.Biotechnology by U. Sathyanarayana. Books and Allied (p) Ltd., 2009.
- 3.Biotechnology by Singh, B.D. kalyani publishers, 2009.

### References:

1. Shaleesha A. Stanley, Bioethics, Wisdom educational service, 2008, Wisdom Educational Service.
2. Indian Council of Medical Research. Ethical guidelines for bio-medical research on human participants; Chapter VII. New Delhi (2006).
3. Designing Clinical Research: Stephen Hulley 4<sup>th</sup> Edition (2013).

**Objective:**

To know about importance of Nutrition and associated health risks.

**Course outcome:**

This self-study paper makes the student to acquire sound knowledge about different types of nutrients and its composition. Students will also acquire knowledge on balanced diet, vitamins and therapeutic diets.

**UNIT-I:** Introduction and Definition of Food, Nutrition, and Diet. Classification of Food by Origin and Chemical Composition, Classes of Nutrients-Micro & Macro, Types of Nutrition. Food groups based on their functions-Energy yielding, Body building and Protective foods.

**UNIT-II:** Units of energy measurement-Calorie, Joule & BTU, measurement of food stuffs by Bomb Calorimeter, Calorific value of Proteins, Carbohydrates and Lipids. RQ of foods and BMR.

**UNIT-III:** Composition of balanced diet and RDA (for Indian)-for infant, children, adolescent and adult (male and female), pregnant & lactating women and old age. Protein Energy Malnutrition-Kwashiorkar and Marasmus.

**UNIT-IV:** Fat and Water Soluble Vitamins (Vitamin B complex & C)-Chemical name, Sources, Daily requirements and Deficiency disorders.

**UNIT-V:** Diet in peptic ulcer, High Blood Pressure, Renal calculi, Diabetes Mellitus, Constipation, Diarrhea, jaundice and Anemia.

**Text Books:**

1. B. Srilakshmi (2012), Nutrition Science, New Age, New Delhi, 2012.
2. M. Swaminathan (1986) Hand book of food and nutrition, Bangalore Printing & Publishers.

**References:**

1. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.
2. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5<sup>th</sup> Ed, W.H. Freeman and Company, New York.
3. U. Sathyanarayanan (2002)., Essentials of Biochemistry Books and allied (p) Ltd.
4. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
5. G.L Zubay (1999) Biochemistry, 4<sup>th</sup> Ed, WCB, McGraw-Hill, New York.

**Semester-VI****NON-MAJOR ELECTIVE**

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**Sub. Code: NBC604 HEALTH CARE AND DISEASE MANAGEMENT 2 Hours/1 Credit**

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**Objective:**

To give awareness about first aid, basic health issues, handling emergencies.

**Course outcome:**

A student draws complete knowledge of health management at the end of this course. Based on an individual's requirement a complete diet schedule can be framed by the student. It also provides knowledge on first aid treatments and handling emergencies.

**UNIT-I:** Safeguards to Health: Physical fitness, BMI, balanced diet, sleep quota and sleep disorders. Hygienic practices.

**UNIT-II:** First aid: Treatment for accidents, Wounds, Burns, dog bite, insect bite and stings, Poisoning, Fainting and Drowning.

**UNIT-III:** Handling Emergencies: Heart attack, blood pressure, hypoglycemia, epilepsy, foreign objects in the ear and nose, sprains.

**UNIT-IV:** General Diseases: Causes, symptoms and treatment for headache, fever, common cold and cough, constipation, diarrhea, itching, allergies and stomach aches.

**UNIT-V:** Specific Diseases: Cataract, Cancer, AIDS, Covid-19, Dengue, Jaundice, Ulcer and Kidney stone.

**Text Books:**

1. Shashi Goyal. (2012) Food, Nutrition and Health, S.Chand Publishing, New Delhi.
2. Devendra Vora. (1995) Health in Your Hands., Navneet Pub., Mumbai.

**References:**

1. H.K Bakhru, (1990). Herbs that Heal Natural Remedies for Good Health, Orient, Delhi.
2. Harrison's principles of internal medicine–Vol-I & II, (2015), McGraw Hill Education; 19<sup>th</sup> edition.
3. K.V. Krishna Das, (2008), Text book of medicine, 5th edition, K.V. Krishna Das, Text book of medicine, 5<sup>th</sup> edition.
4. Harold Shryock and Hubert O. Swartout, M.D., Dr. P.H (1970) You and Your health –(Vol-I, II & III), Pacific Press Publishing, California.