

**ETHIRAJ COLLEGE FOR WOMEN**

**DEPARTMENT OF BIOCHEMISTRY**

**SYLLABUS**

**FOR**

**B.Sc BIOCHEMISTRY**

**UNDER CHOICE BASED CREDIT SYSTEM**

**(2015-2016)**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

**REVISED SYLLABUS OF 2015**

**B.Sc BIOCHEMISTRY**

**PREAMBLE**

**The department of Biochemistry submits changes and additions suggested in the curricula that are in the ensuing pages.**

- **Reorganization of lab courses**
- **Modification of course content**
- **Introduction of few courses**
- **Introduction of new skill based courses**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

**MINUTES OF THE BOARD OF STUDIES MEETING**

**B.Sc BIOCHEMISTRY**

The Board of studies meeting for revision of syllabus with effect from was held in the Department of Biochemistry on the following changes and additions suggested in the UG curricula have been implemented in the new curriculum.

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

**BOARD OF STUDIES MEETING – B.Sc BIOCHEMISTRY**

The board of studies meeting was held in the department of biochemistry on

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The board consisted of the following members.

**S.NO            MEMBER'S NAME & DESIGNATION  
SIGNATURE**

1.            Dr.M. SUJATHA (CHAIRMAN BOARD OF STUDIES)  
  
                 HEAD  
  
                 DEPARTMENT OF BIOCHEMISTRY  
  
                 ETHIRAJ COLLEGE FOR WOMEN  
  
                 CHENNAI -600008
2.            Dr. A. GEETHA (UNIVERSITY NOMINEE)  
  
                 HEAD  
  
                 DEPARTMENT OF BIOCHEMISTRY  
  
                 BHARATHI WOMEN'S COLLEGE  
  
                 CHENNAI-108
3.            Dr. FOUZIA BANU (SUBJECT EXPERT)  
  
                 HEAD  
  
                 DEPARTMENT OF BIOCHEMISTRY  
  
                 JUSTICE BASHEER AHMED SAYEED COLLEGE FOR WOMEN  
  
                 CHENNAI -18
4.            Dr. P.T. SRINIVASAN (SUBJECT EXPERT)

HEAD

DEPARTMENT OF BIOCHEMISTRY

D.G.VAISHNAV COLLEGE

CHENNAI -106

5. Dr.A. K.HEMANTH KUMAR (INDUSTRIAL NOMINEE)  
SCIENTIST –C  
DEPARTMENT OF BIOCHEMISTRY  
NATIONAL INSTITUTE FOR RESEARCH IN TUBERCULOSIS  
CHETPET  
CHENNAI
6. Dr. S. VIJAYALATHA  
ASSISTANT PROFESSOR  
DEPARTMENT OF BIOCHEMISTRY  
ETHIRAJ COLLEGE FOR WOMEN  
CHENNAI 600008
7. Mrs. J. PRIYA  
ASSISTANT PROFESSOR  
DEPARTMENT OF BIOCHEMISTRY  
ETHIRAJ COLLEGE FOR WOMEN  
CHENNAI 600008
8. Ms. KALPANA (ALUMNA)  
B.Sc Batch (2012-2015)

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

**B.Sc BIOCHEMISTRY - REVISED SYLLABUS EFFECTIVE FROM 2015-16**

● **PREAMBLE**

The PG department of biochemistry is revising syllabi with effect from the academic year 2015-16 with existing CBCS and part IV and Part V components as specified by the government of Tamil Nadu.

Part IV and Part V components will seek to build the capacity of the students and provide inputs for his or her social service and social analysis capabilities.

Every academic year is divided into 2 semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

## • REGULATIONS

### 1. Eligibility for admission:

Candidates for admission to the first year of the U.G Biochemistry degree course shall be required to have passed the higher secondary examinations conducted by the Government of Tamil Nadu or an examination accepted as equivalent there to by the syndicate of the University of Madras with chemistry and biology/botany,zoology/biochemistry as one of the science subjects .

### 2. Eligibility for the award of degree:

The candidate shall be eligible for the award of the degree only if he /she have undergone the prescribed course of the study for the period of not less than 3 academic years, passed the examinations of all the 6 semesters prescribed.

### 3. Course of the study :

The main subject of the study for Bachelor Degree shall consist of the following

Part I : Tamil / other languages

Part II : English

Part III: Core subjects, Allied subjects

Part IV : Non Major Elective (1a, 1b, 1c)

Soft Skill

Environmental studies

Value Education

Part V : Extension Activity.

### 4. Passing minimum :

A candidate shall be declared to have passed in each paper /practical of the main subject of study where ever prescribed, if she secured NOT LESS THAN 40 % of the marks prescribed for the examination.

### 5. Classification of successful candidates :

Part I, II, III, IV

Successful candidates passing the examination and securing the marks

- 60 % and above , 50% and above but below 60 % in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class respectively
- All other successful candidates shall be declared to have passed the examination in the THIRD CLASS.

- Candidates who pass all the examinations (Part I, II, III, IV) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

### 6. Question paper pattern :

Unless and otherwise specified in the syllabus for each paper, the pattern of question paper shall be as follows:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

S.no	Semester	Course title	Course code	Hours	Credits	CA marks	End semester	Total
	III	Language	-	5	3	40	60	100
	III	English	-	5	3	40	60	100
	III	Major-Biophysical&Biochemical technique	BC15/3 C/BCT	7	5	40	60	100
	III	Allied Microbiology I	-	4	4	40	60	100
	III	Core Practical II	BC15/4 C/PR2	3	-	-	-	-
	III	Allied Microbiology Practical	-	2	-	-	-	-
	III	Soft skill (Exercise & health)	-	2	3	-	50	50
	III	Environmental studies	-	2	2	-	50	50



<b>S.no</b>	<b>Semester</b>	<b>Course title</b>	<b>Course code</b>	<b>Hours</b>	<b>Credits</b>	<b>CA marks</b>	<b>End semester</b>	<b>Total</b>
	IV	Language	-	5	3	40	60	100
	IV	English	-	5	3	40	60	100
	IV	Major-Enzymes	BC15/4C/ENZ	7	5	40	60	100
	IV	Allied Microbiology II		4	4	40	60	100
	IV	Major Practical II	BC15/4C/PR2	3	3	40	60	100
	IV	Allied Microbiology Practical	-	2	2	40	60	100
	IV	Soft skill Herbal Remedies		2	3	-	50	50
	IV	Value Education	-	2	2	-	50	50

<b>S.no</b>	<b>Semester</b>	<b>Course title</b>	<b>Course code</b>	<b>Hours</b>	<b>Credits</b>	<b>CA marks</b>	<b>End semester</b>	<b>Total</b>
1.	V	Intermediary Metabolism-I	BC15/5C/IN1	4	4	40	60	100
2.	V	Intermediary Metabolism-II	BC15/5C/IN2	4	4	40	60	100
3.	V	Clinical Biochemistry	BC15/5C/CLI	4	4	40	60	100
4.	V	Physiology	BC15/5C/PHS	4	4	40	60	100
5.	V	Elective – Bioinstrumentation & Biostatistics	BC15/5C/BIB	5	5	40	60	100
6.	V	Major practical- III	BC15/5C/PR3	4	-	-	-	-
7.	V	Major practical- IV	BC15/5C/PR4	5	-	-	-	-

<b>S.n o</b>	<b>Semeste r</b>	<b>Course title</b>	<b>Course code</b>	<b>Hour s</b>	<b>Credit s</b>	<b>CA mark s</b>	<b>End semeste r</b>	<b>Tota l</b>
1.	VI	Molecular Biology		4	4	40	60	100
2.	VI	Genetics		4	4	40	60	100
3.	VI	Biotechnolog y		4	4	40	60	100
4.	VI	Elective- Basics of Bioinformatic s		5	5	40	60	100
5.	VI	Elective – Immunology		5	5	40	60	100
6.	VI	Major practical- III	BC15/5C/PR 3	4	3	40	40	100
7.	VI	Major practical- IV	BC15/5C/PR 4	4	4	60	60	100

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**PG DEPARTMENT OF BIOCHEMISTRY**

**REVISED SYLLABUS EFFECTIVE FROM 2015-16**

**B.Sc. BIOCHEMISTRY**

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Part I V : Non Major Elective (1a, 1b, 1c)

Soft Skill

Environmental studies

Value Education

Part V : Extension Activity.

**9. Passing minimum :**

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**10. Classification of successful candidates :**

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**COURSE PROFILE****REVISED SYLLABUS EFFECTIVE FROM 2015-2016****SEMESTER I**

S.NO	SEM	COURSE TITLE	COURSE CODE	HRS/WK	CREDITS	CA MARKS	END SEM MARKS	TO
1	I	LANGUAGE		5	3	40	60	1
2	I	ENGLISH		5	3	40	60	1
3	I	MAJOR-CELL BIOLOGY	BC15/1C/CEL	7	5	40	60	1
4	I	ALLIED CHEMISTRY I	BC15/1A/CY1	4	4	40	60	1
5	I	MAJOR PRACTICAL I	BC15/2C/PR1	3				
6	I	ALLIED CHEMISTRY PRACTICAL	BC15/2A/CPR	2				
7	I	NME(1a/1b/1c)		2	2	-	50	
8	I	SOFT SKILL		2	3	-	50	

**SEMESTER II**

S. No	SEM	COURSE TITLE	COURSE CODE	HRS/WK	CREDITS	CA MARKS	END SEM MARKS	TOTAL
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1	II	LANGUAGE		5	3	40	60	100
2	II	ENGLISH		5	3	40	60	100
3	II	MAJOR-BIOMOLECULES	BC15/2C/BIM	7	5	40	60	100
4	II	ALLIED CHEMISTRY II	BC15/2A/CY2	4	4	40	60	100
5	II	MAJOR PRACTICAL I	BC15/2C/PR1	3	3	40	60	100
6	II	ALLIED CHEMISTRY PRACTICAL	BC15/2A/CPR	2	2	40	60	100
7	II	NME (1a/1b/1c)		2	2	-	50	50
8	II	SOFT SKILL		2	3	-	50	50

**ALLIED PAPERS OFFERED FOR I B. Sc MICROBIOLOGY**

S.No	SEM	COURSE TITLE	COURSECODE	HRS/WK	CREDITS	CA MARKS	END SEM MARKS	TOTAL
1	I	ALLIED BIOCHEMISTRY -I	BC15/1A/BC1	4	4	40	60	100
2	II	ALLIED BIOCHEMISTRY -II	BC15/2A/BC2	4	4	40	60	100

3	I&II	ALLIED BIOCHEMISTRY PRACTICAL	BC15/2A/BPR	2	2	40	60	100
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**ALLIED PAPERS OFFERED FOR I B. Sc CLINICAL NUTRITION AND DIETETICS**

S.No	SEM	COURSE TITLE	COURSECODE	HRS/WK	CREDITS	CA MARKS	END SEM MARKS	TOTAL
1	I	ALLIED BASIC CHEMISTRY -I	BC15/1A/CH1	4	4	40	60	100
2	II	ALLIED BASIC CHEMISTRY -II	BC15/2A/CH2	4	4	40	60	100
3	I&II	ALLIED CHEMISTRY PRACTICAL	BC15/2A/CPR	2	2	40	60	100

**NME (1c) SUBJECT FOR OTHER DEPARTMENT STUDENTS**

S.No	SEM	COURSE TITLE	COURSECODE	HRS /WK	CREDITS	CA MARKS	END SEM MARKS	TOTAL
1	I	YOGA AND DIET	BC15/1N/YAD	2	2	-	50	50
2	II	LIFE STYLE DISEASES IN WOMEN	BC15/2N/LSD	2	2	-	50	50

**TEMPLATE FOR EVALUATION PATTERN**

SEMESTER	COURSE CODE	COURSE TITLE	CONTINUOUS ASSESSMENT				TOTAL (40)
			TEST I (10)	TEST II (10)	QUIZ/ ASSIGNMENT SEMINAR/ FIELD VISIT (10)	PARTICIPATORY LEARNING (10)	
I		LANGUAGE	10	10	10	10	40
I		ENGLISH	10	10	10	10	40



I	BC15/1C/CEL	MAJOR-CELL BIOLOGY	10	10	10	10	40
I	BC15/1A/CY1	ALLIED CHEMISTRY I	10	10	10	10	40
		LANGUAGE	10	10	10	10	40
II		ENGLISH	10	10	10	10	40
II	BC15/2C/BIM	MAJOR-BIOMOLECULES	10	10	10	10	40
II	BC15/2A/CY2	ALLIED CHEMISTRY II	10	10	10	10	40
I & II	BC15/2C/PR1	MAJOR PRACTICAL I	20	20			40
I & II	BC15/2A/CPR	ALLIED CHEMISTRY PRACTICAL	20	20			40
I	BC15/1A/BC1	ALLIED BIOCHEMISTRY –I	10	10	10	10	40
II	BC15/2A/BC2	ALLIED BIOCHEMISTRY –II	10	10	10	10	40
I & II	BC15/2A/BPR	ALLIED BIOCHEMISTRY PRACTICAL	20	20			40
I	BC15/1A/CH1	ALLIED BASIC CHEMISTRY –I	10	10	10	10	40
II	BC15/2A/CH2	ALLIED BASIC CHEMISTRY –II	10	10	10	10	40

### **PATTERN FOR CONTINUOUS ASSESSMENT**

Test I	2hrs	50 marks	10marks
TestII	2hrs	50marks	10marks
Quiz/Assignment/Semester/Field visit			10marks
Participatory Learning			<u>10marks</u>
Total			<u>40 marks</u>

### **RUBRICS FOR CONTINUOUS ASSESSMENT EVALUATION.**

- Assignment -Contents/originality/Presentation /Schematic representation and Diagram/Bibliography. (10marks)
- Seminar-Organisation/subject knowledge/Visual Aids/Confidence level/Presentation. (10marks)
- Participatory learning-Answering questions/Clearing doubts/Participation in discussion /Attendance /Communication and language. (10marks)

● **STRUCTURE OF NME (1c) SUBJECT**

Unit I	Teaching hours 10 hrs
Unit II	Teaching hours 10 hrs
Unit III	Teaching hours 10 hrs
Total	30hrs
Credits	2

**SEMESTER I**

**CELL BIOLOGY**

**Teaching hours: 105**

**Credits: 5**

**Course code : BC15/1C/CEL**

**LTP : 5 2 0**

**OBJECTIVE:** To have a basic understanding about

1. The Structure & functions of Cell and Cell organelles
2. Different cell types and Tools of cell biology.

**COURSE OUTLINE**

**UNIT I: (21hrs)**

The cell and cell organelles : Prokaryotic cell, Eukaryotic cell-Plant cell,Animal cell,cytoskeleton microtubules and microtubullar organization. Endomembrane system - Endoplasmic reticulum, Golgi complex, Membrane organelles – Mitochondria, Chloroplast, Lysosome, Peroxisomes and Glyoxisomes and Nucleus.

**UNIT II: (21hrs)**

Cell membrane transport: Chemical composition of cell membrane, model of cell membrane – sandwich model,fluid mosaic model, Membrane transport: Passive transport – Osmosis and diffusion, Active transport, Bulk transport – exocytosis, phagocytosis and endocytosis.

Cell boundries: Cell coat,cell wall –Structure, composition and function

**UNIT III:****(21hrs)**

Cell types and function: Epithelial cell – simple and compound, Muscle cell – Skeletal, cardiac, smooth muscle cells. Nerve cell, Immune cell - T&B cell, Gametes- Sperm, Ovum, Cancer cell.

Differentiation of cell surface – Invagination, Microvilli, Basement membrane, Tight junction, Desmosome, Gap junction

Extracellular matrix-Collagen,Hyaluron

**UNIT IV:****(21hrs)**

Cell division: Cell cycle, Mitosis, significance of mitosis, Meiosis – kinds of meiosis and significance of meiosis.

Cell death: Overview of programmed cell death-Apoptosis & Necrosis. Significance of apoptosis and necrosis.

Cell renewal:stem cells-Embryonic stemcell,adult stem cell.

**UNIT V:****(21hrs)**

Tools of cell biology:Microscopy,Basic principles and applications of light microscopy,phase contrast microscopy,electron microscopy.Cell slicing-role of microtome.Staining technique-Haemotoxylin and eosin staining,Cell culture technique-Animal cell ,Plant cell.

**Recommended Books:**

1. Cell biology,Genetics,Molecular Biology,Evolution and Ecology- Dr.P.S.Verma,Dr. V.K.Agarwal, V , S.Chand and Company Pvt.Ltd.
2. Cell Biology-Chanarayappa,Universities Press.
3. Cell and Molecular Biology-Praghya khanna,I.K International publishing House Pvt.Ltd.
4. Cytology- Dr.P.S.Verma,Dr. V.K.Agarwal,S.Chand and Company Pvt.Ltd.

**Reference Book:**

1. World of cell –Becker VII edition,Gr Publisher, <http://www.igbooks.com> - Free Online Library
2. The Cell –Molecular approach (III edition)-Geofery M Cooper, Sinauer Associates

**Online source:**

[www.biology.arizona.edu/cell\\_bio/cell\\_bio.html](http://www.biology.arizona.edu/cell_bio/cell_bio.html)

[www.cellbiology.yale.edu](http://www.cellbiology.yale.edu)

[www.cellbio.com](http://www.cellbio.com)

**Question paper pattern:**

The pattern of question paper shall be as follows:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
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PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit (10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**

**SEMESTER - I**  
**ALLIED CHEMISTRY - I**  
**(For I B.Sc Biochemistry)**

**TEACHING HOURS: 60**

**Credits: 4**

**CODE: BC15/1A/CY1**

**LTP : 3 1 0**

**OBJECTIVES:** To have an understanding of the fundamental aspects of theoretical and practical chemistry.

**COURSE OUTLINE**

**UNIT I: (12 HRS)**

I a. Chemical bonding- Definition- Types of bonds - Formation of different bonds with examples --Ionic bond – NaCl, KCl-Covalent bond- Single bond- H<sub>2</sub>S,HCl, Multiple bond – N<sub>2</sub> , O<sub>2</sub>--Coordinate bond –Hydronium ion, ammonium ion--Hydrogen bond – Inter and Intra molecular Hydrogen bonding e.g. O & P Nitro phenol-- Vanderwaals force.

I b. Shapes of molecules – VSEPR Theory & Hybridization CH<sub>4</sub>, H<sub>2</sub>O, NH<sub>3</sub>, BrF<sub>3</sub>,SF<sub>6</sub>, IF<sub>5</sub>, IF<sub>7</sub>.

**UNIT II: (12 HRS)**

Mechanistic basis of organic reactions – Definition of substrates – Electrophiles , Nucleophiles – Elementary treatments of Substitution reactions SN<sub>1</sub> , SN<sub>2</sub> Walden inversion - Aromatic Electrophilic substitution (Nitration, sulphonation) - Elimination Reaction- E<sub>1</sub> , E<sub>2</sub> Hoffmann and saytzeff rule- Addition Reaction – Markonikoff's rule and Kharash effect.

**UNIT III: (12 HRS)**

Electrolytes and non electrolytes examples (strong & weak electrolytes) Difference between metallic conductors and electrolytic conductors – conductance – definition , electrical conductivity – specific conductivity – equivalent conductivity – molar conductivity - relationship between equivalent and molar conductivity – effect of dilution on conductance , Ostwald's dilution law – Kohlraush's law and its application.

**UNIT IV: (12 HRS)**

Acids and bases – Arrhenius concept- Bronsted-Lowry concept- conjugate acids and bases – Lewis concept Concept of pH and pOH – Determination of pH using potentiometric method (pH meter) –Buffer examples for acidic and basic buffer – Buffer action – Biological applications of buffers.

**UNIT V (12 HRS)**

Volumetric analysis – Advantages of Volumetric analysis over other quantitative analysis – Preparation of solutions – Primary and Secondary Standards – (examples) – Definition of Mole,Molarity, Molality,Normality,Formality Dilution – Difference between end point, equivalence point - Types of volumetric analysis – Acidimetry and Alkalimetry – Examples & Indicators used Strong acid Vs Strong base , Strong acid Vs Weak base, Weak acid Vs Strong acid , Weak acid Vs Weak base – Redox Titrations – Permanganometry, Dichrometry,Iodometry,Iodimetry – Complexometry – EDTA Titrations.

## RECOMMENDED TEXTBOOKS

1. Allied Chemistry-Gopalan and Sundaram, 3<sup>rd</sup> edition
2. Text Book of Allied Chemistry-Dr.V.Veeraiyan et al,Highmount Publishing House

## REFERENCE BOOKS

1. Modern Inorganic Chemistry-R.D.Madan
2. Organic Chemistry-P.L.Soni
3. Principles of physical chemistry-Puri and Sharma

## WEBSITES

<http://www.chemistry.org>

<http://www.chemhelper.com>

### Question paper pattern:

The pattern of question paper shall be as follows:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit ( 10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**

## SEMESTER II

## BIOMOLECULES

**TEACHING HOURS: 105**

**Credits: 5**

**CODE: BC15/2C/BIM**

**LTP : 5 2 0**

### OBJECTIVE:

1. To enable the students understand the structure of biomolecules.
2. To study the biological significance of the biomolecules.

**UNIT 1:** (21 hours)

Carbohydrates – Classification, Biological functions, Optical Isomerism and Geometric Isomerism of Sugars, Van't hof rule, Anomeric Forms. Haworth structure of Mono saccharides (Glucose, Fructose), Disaccharides (Lactose, Sucrose), mutarotation, racemic mixture, Polysaccharides - Homopolysaccharides (Starch, Glycogen), Hetero polysaccharides.- Muco polysaccharides( Heparin ,Chondroitin sulphate).

**UNIT II:** (21 hours)

Amino acids – Zwitter ion, amphoteric nature, peptide bond, Classification and Structure based on composition of side chain. Essential and non-essential amino acids. Proteins – Classification based on solubility, shape, composition and functions. Properties of proteins – Denaturation and renaturation. Protein Structure – primary, secondary. Forces stabilizing protein structure. Tertiary structure (example myoglobin), Quaternary Structure of Hemoglobin

**UNIT III:** (21 hours)

Lipids-Definition and Bloors classification, Biomedical importance of lipids, Types of Fatty acids-saturated, unsaturated, cyclic fatty acids, Essential fatty acids-its functions, triglycerides. Chemical characterization of fats- iodine value, sap value, acid number, Rm value, rancidity.

**UNIT IV:** (21 hours)

Phospholipids-structure and biological functions of lecithins, cephalins, phosphotidyl serine, plasmalogens, glycolipids, cholesterol, bile acids and bile salts.

**UNIT V:** (21 hours)

Nature of genetic material, components of nucleic acid-structure of nucleosides, nucleotides, cyclic nucleotides-AMP, GMP. Size and structure of different types of DNA-A, B and Z. Structure and role of different types of RNA- mRNA, rRNA, tRNA, Heterogenous nuclear RNA. Denaturation and annealing of DNA.

**Books Recommended:**

1. Text book of biochemistry – JL Jain.
2. Text book of biochemistry -U.Satyanarayana

**Reference Books:**

1. Biochemistry – Stryer, 4<sup>th</sup> edition
2. Principles of biochemistry – Lehninger (Second Edition)

**Web site:**

[www.phschool.com/science/biology\\_place/](http://www.phschool.com/science/biology_place/)  
[www.nios.ac.in/media/documents/313courseE/L31.pdf](http://www.nios.ac.in/media/documents/313courseE/L31.pdf)

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COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
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PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit ( 10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**



## SEMESTER – II

### ALLIED CHEMISTRY – II

(For I B.Sc Biochemistry)

**TEACHING HOURS: 60**

**Credits: 4**

**CODE: BC15/2A/CY2**

**LTP : 3 1 0**

**OBJECTIVES :** To enable students to understand the co-ordination, Industrial and drug chemistry and its application in daily life.

**UNIT I: (12 Hrs)**

Co –ordination Chemistry – Difference between Double salt and Co-ordination Compounds. Nomenclature Werner's theory, Definition and Biological importance of Chelates – Haemoglobin, Application of chelates – medicinal and analytical –Determination of hardness of water and softening of water.

**UNIT II: (12 Hrs)**

Industrial Chemistry – Fuels, Classification, Fuel Gas – natural gas, Water gas, Semi water gas, Carbureted Water gas, Producer gas, Oil gas, Gobar gas and LPG- Composition and uses. Silicones – Preparation, properties and uses. Synthetic Dyes – Classification of Dyes, Azo, Triphenylmethane, Vat and Mordant Dyes and their preparation.

**UNIT III: (12 Hrs)**

Drug Chemistry – Classification of drugs, Preparation and Properties of Sulpha drugs, Sulpha pyridine, Prontosil, Sulpha diazine and Sulpha furazole. Mode of action of Sulpha drugs.

Antibiotics – Penicillin, Chloramphenicol. Definition, example each for analgesics, antipyretics, tranquillizers, sedatives, hypnotics, local and general anaesthetics.

**UNIT IV: (12 Hrs)**

Electrochemistry – electro motive force, measurement of emf using oxygen, calomel, quinhydrone electrodes. Single electrode potential – standard hydrogen electrode, electrochemical series and its uses .Thermodynamic concept of electrode potential (Nernst equation).

**UNIT V: (12 Hrs)**

Isolation and Purification of Organic Compounds – Extraction , Differential extraction , Distillation, Fractional distillation , Steam distillation Crystallization, Sublimation, Separation Technique – Chromatography – Paper , TLC and Column.

### RECOMMENDED TEXTBOOKS

1. Allied Chemistry-Gopalan and Sundaram, 3<sup>rd</sup> edition
2. Text Book of Allied Chemistry-Dr.V.Veeraiyan et al,Highmount Publishing House

## REFERENCE BOOKS

1. Modern Inorganic Chemistry-R.D.Madan
2. Organic Chemistry-P.L.Soni
3. Principles of physical chemistry-Puri and Sharma

## WEBSITES

<http://www.chemistry.org>

<http://www.chemhelper.com>

## Question paper pattern:

The pattern of question paper shall be as follows:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit ( 10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**

**SEMESTER I & II  
MAJOR PRACTICAL I**

**TEACHING HOURS: 90**

**Credits: 2**

**CODE: BC15/2C/PR 1**

**LTP: 0 0 3**

1. Identification of prepared slides
  - a. Epithelial cell-squamous, cuboidal, columnar, ciliated
  - b. Cardiac muscle cell, skeletal muscle cell, smooth muscle cell
2. Models or pictures of cell organelle and cell junction
  - a. Mitochondria,
  - b. Nucleus,
  - c. Tight junction
  - d. Gap junction
3. Qualitative Analysis of carbohydrates:

Reactions of sugars like

Monosaccharides	:	Glucose, Fructose
Disaccharides	:	Sucrose, Maltose
Polysaccharides	:	Starch, Dextrin
5. Qualitative Analysis of amino acids:

Tyrosine, Tryptophan, Cysteine and Arginine.
6. Qualitative analysis of lipids:
7. Preparations

Preparation of starch from potato

Preparation of casein from milk

Isolation of DNA from spleen

**ALLIED CHEMISTRY PRACTICAL**  
(for I B.Sc Biochemistry & I B.Sc CND )

**TEACHING HOURS: 60**

**CREDITS: 2**

**COURSE CODE : BC15/2A/CPR**

**LTP: 0 0 2**

**VOLUMETRIC ANALYSIS**

- 1) Estimation of HCl using Standard Oxalic Acid.
- 2) Estimation of Borax – Standard Sodium Carbonate.
- 3) Estimation of Ferrous Sulphate – Standard Mohr Salt Solution.
- 4) Estimation of Oxalic Acid – Standard Ferrous Sulphate.
- 5) Estimation of Ferrous Ion – Diphenylamine Indicator.
- 6) Estimation of Zinc Using EDTA – Standard Magnesium Sulphate.

**ORGANIC SUBSTANCE ANALYSIS:**

Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests.

- 7) Reaction of Aldehyde (Aromatic).
- 8) Reaction of Carbohydrates.
- 9) Reaction of Carboxylic Acid (Mono & Di).
- 10) Reaction of Phenol.
- 11) Reaction of Amine (Aromatic, primary).
- 12) Reaction of Amide (Mono & Di).
- 13) Reaction of Ketone (not for exam)

**SEMESTER I**  
**ALLIED BIOCHEMISTRY I**  
**(For I B.Sc. Microbiology)**

**TEACHING HOURS: 60**

**Credits: 4**

**CODE: BC15/1A/BC1**

**LTP :3 1 0**

**OBJECTIVES**

To enable the students to learn

1. The chemistry of biomolecules
2. Understand metabolic cycles.

**COURSE OUTLINE**

**Unit I (12 Hrs)**

Carbohydrates – Definition, biomedical importance of carbohydrates, classification of carbohydrates (monosaccharides, disaccharides, polysaccharides), Vant Hoff's rule, stereoisomerism, optical isomerism, racemic mixture, mutarotation, epimers, aldose, ketose.

**Unit II (12 Hrs)**

Monosaccharides- Linear structure and Haworth structure of glucose and fructose, Disaccharides – lactose and sucrose, Inversion , polysaccharides – Homoglycans- structure of starch and glycogen, difference between amylose and amylopectin and glycogen.

**Unit III (12 Hrs)**

Definition of catabolism, anabolism and amphibolic cycle. Glycolysis and TCA cycle with energetics ( Structure not required)

**Unit IV (12 Hrs)**

Amino acids- Functions of amino acids, classification of amino acids based on side chain, essential, semi-essential and non-essential amino acids, zwitter ion, amphoteric nature and isoelectric point

**Unit V (12 Hrs)**

Proteins- Biomedical importance of protein classification based on shape and size (fibrous and globular ), based on function and based on physical properties.structural organization of proteins- primary, secondary, tertiary and quaternary structure, - basic concepts.

**Recommended Textbooks:**

1. Fundamentals of Biochemistry – J.L. Jain, S.Chand & Company, 6<sup>th</sup> Edition

**Reference Books:**

1. Textbook of Biochemistry – O.P. Agarwal *et al*
2. Harpers Illustrated Biochemistry- Murray et al, 26<sup>th</sup> edition

**Website**

[www.phschool.com/science/biology\\_place/](http://www.phschool.com/science/biology_place/)

[www.wtec.org/te/usws/usws](http://www.wtec.org/te/usws/usws)

**Question paper pattern :**

The pattern of question paper shall be as follows:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit (10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**

**SEMESTER II**  
**ALLIED BIOCHEMISTRY II**  
**(For I B.Sc. Microbiology)**

**TEACHING HOURS: 60**

**Credits: 4**

**CODE: BC15/2A/BC2**

**LTP :3 1 0**

**OBJECTIVES**

To enable the students to learn

1. The chemistry of biomolecules
2. Understand enzymology.

**Unit I**

**(12 Hrs)**

Enzymes- Definition of enzyme, active site, holoenzyme, apoenzyme, coenzyme, exo and endo enzymes, zymogen, turnover number. Specificity of enzymes, industrial applications of enzymes, Factors affecting enzyme activity- pH, Temp, substrate. Enzyme inhibition- competitive, non-competitive and uncompetitive inhibition.( no derivation).

**Unit II**

**(12 Hrs)**

Lipids- biomedical importance of lipids, Bloor's classification of lipids( simple, compound and derived), saturated and unsaturated fatty acids, essential fatty acids (EFA) and their functions, deficiency manifestation of EFA, properties- Saponification and rancidity, iodine number, acetyl number,. Phospholipids- functions, Biological importance of cholesterol, bile acids and bile salts.

**Unit III**

**(12 Hrs)**

Purine and pyrimidine bases with structures, nucleosides, nucleotides, nucleosides and nucleosides, biological importance.

**Unit IV**

**(12 Hrs)**

DNA- structure ( Watson and Crick model), Chargaff's rule, types of DNA- A , B and Z-DNA, properties of DNA,- effect of temperature of DNA, annealing

**Unit V**

**(12 Hrs)**

RNA- types of RNA- m-RNA, r-RNA and t-RNA, clover leaf model of t- RNA, difference between DNA and RNA, Biological importance of RNA.

**RECOMMENDED TEXTBOOKS:**

1. Fundamentals of Biochemistry – J.L. Jain, S.Chand & Company,6<sup>th</sup> Edition

**REFERENCE BOOKS:**

2. Textbook of Biochemistry – O.P. Agarwal *et al*
3. Harpers Illustrated Biochemistry- Murray et al, 26<sup>th</sup> edition

#### WEBSITE

[www.phschool.com/science/biology\\_place/](http://www.phschool.com/science/biology_place/)

[www.wtec.org/te/usws/usws](http://www.wtec.org/te/usws/usws)

#### Question paper pattern:

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(10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**



**SEMESTER I & II**  
**ALLIED BIOCHEMISTRY PRACTICAL**

**TEACHING HOURS: 60**

**CREDITS: 2**

**COURSE CODE: BC15/2A/BPR**

**LTP: 0 0 2**

**Teaching Hours**

**I Qualitative Analysis of carbohydrates –**

Glucose, fructose, maltose, sucrose

**II Qualitative Analysis of amino acids –**

Arginine, cysteine, tryptophan, tyrosine

**III Spotters –**

Centrifuge, compound microscope, pH meter, weighing balance, colorimeter, incubator

**IV Demo experiment-**

Estimation of protein by biuret method

**V Group experiment**

Preparation of starch from potato

Preparation of casein from milk

**SEMESTER -I**  
**ALLIED BASIC CHEMISTRY-I**  
**(For I B.Sc Clinical Nutrition and Dietetics)**

**TEACHING HOURS: 60**

**Credits: 4**

**OBJECTIVES:**

1. To enable students understand the fundamental aspects of inorganic, electro and analytical chemistry.
2. Students gain knowledge in the uses of chemistry in daily life

**UNIT I: (12 Hrs)**

I a. Chemical bonding- Definition- Types of bonds - Formation of different bonds with examples --Ionic bond – NaCl, KCl -Covalent bond- Single bond- H<sub>2</sub>S,HCl, Multiple bond – N<sub>2</sub> , O<sub>2</sub>--Co ordinate bond –Hydronium ion, ammonium ion--Hydrogen bond – Inter and Intra molecular Hydrogen bonding e.g. O & P Nitrophenol-- Vanderwaals force.

I b. Shapes of molecules – VSERR Theory & Hybridization CH<sub>4</sub> , H<sub>2</sub>O, NH<sub>3</sub>, BrF<sub>3</sub> , SF<sub>6</sub> ,IF<sub>5</sub> , IF<sub>7</sub>.

**UNIT II: (12 Hrs)**

Mechanistic basis of organic reactions – Definition of substrates – Electrophiles , Nucleophiles – Elementary treatments of Substitution reactions SN<sub>1</sub> , SN<sub>2</sub> Walden inversion - Aromatic Electrophilic substitution (Nitration, sulphonation) - Elimination Reaction- E<sub>1</sub> , E<sub>2</sub> Hoffmann and saytzeff rule- Addition Reaction – Markonikoff's rule and Kharash effect.

**UNIT III: (12 Hrs)**

Food chemistry – Food adulteration – Definition – Intentional addition and incidental addition – Common adulteration/contaminants in food – Food simple screening test for the detection of adulterants – Diseases or health effects caused by the adulterants – Prevention of Food Adulteration Act -1954.

**UNIT IV: (12 Hrs)**

Acids and bases – Arrhenius concept- Bronsted-Lowry concept- conjugate acids and bases – Lewis concept Concept of pH and pOH – Determination of pH using potentiometric method (pH meter) –Buffer examples for acidic and basic buffer – Buffer action – Biological applications of buffers.

**UNIT V: (12 Hrs)**

Volumetric analysis – Advantages of Volumetric analysis over other quantitative analysis – Preparation of solutions – Primary and Secondary Standards – (examples) – Definition of Mole,Molarity, Molality,Normality,Formality Dilution – Difference between end point , equivalence point - Types of volumetric analysis – Acidimetry and Alkalimetry – Examples & Indicators used Strong acid Vs Strong base , Strong acid Vs Weak base, Weak acid Vs Strong acid , Weak acidVs Weak base – Redox Titrations – Permanganometry ,Dichrometry,Iodometry , Iodimetry – Complexometry – EDTA Titrations.

**RECOMMENDED TEXTBOOKS**

1. Allied Chemistry-Gopalan and Sundaram, 3<sup>rd</sup> edition
2. Text Book of Allied Chemistry-Dr.V.Veeraiyan et al,Highmount Publishing House

## REFERENCE BOOKS

1. Modern Inorganic Chemistry-R.D.Madan
2. Organic Chemistry-P.L.Soni
3. Principles of physical chemistry-Puri and Sharma

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<http://www.chemistry.org>

<http://www.chemhelper.com>

## Question paper pattern:

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COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit (10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**

**SEMESTER – II**  
**ALLIED BASIC CHEMISTRY-II**  
**(For I B.Sc Clinical Nutrition and Dietetics)**

**TEACHING HOURS: 60**

**Credits: 4**

**CODE: BC15/2A/CH2**

**LTP :3 1 0**

**OBJECTIVES**

To enable students to

1. Understand the basics co-ordination, Industrial and drug chemistry
2. Application of chemistry in daily life.

**Unit I: (12 Hrs)**

Co –ordination Chemistry – Difference between Double salt and Co-ordination Compounds. Nomenclature Werner's theory, Definition and Biological importance of Chelates – Haemoglobin, Application of chelates – medicinal and analytical –Determination of hardness of water and softening of water.

**Unit II: (12 Hrs)**

Industrial Chemistry – Fuels, Classification, Fuel Gas – natural gas, Water gas, Semi water gas, Carbureted Water gas, Producer gas, Oil gas, Gobar gas and LPG- Composition and uses. Silicones – Preparation, properties and uses. Synthetic Dyes – Classification of Dyes, Azo, Triphenylmethane, Vat and Mordant Dyes and their preparation.

**Unit III: (12 Hrs)**

Drug Chemistry – Classification of drugs, Preparation and Properties of Sulpha drugs, Sulpha pyridine, Prontosil, Sulpha diazine and Sulpha furazole. Mode of action of Sulpha drugs.

Antibiotics – Penicillin, Chloramphenicol. Definition, example each for analgesics, antipyretics, tranquillizers, sedatives, hypnotics, local and general anaesthetics.

**Unit IV: (12 Hrs)**

Food Chemistry – Food additive – Definition – Purpose of addition – Examples – Food colours – Flavours – Sweeteners – Fat emulsifiers – Stabilizing agents – Flour improvers- Anti staling agents – antioxidants – Preservatives- Nutritional supplements – Food Fortification – Biological importance of Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Potassium (P).

**Unit V: (12 Hrs)**

Isolation and Purification of Organic Compounds – Extraction , Differential extraction , Distillation, Fractional distillation , Steam distillation Crystallization, Sublimation, Separation Technique – Chromatography – Paper , TLC and Column.

### RECOMMENDED TEXTBOOKS

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3. Principles of physical chemistry-Puri and Sharma

### WEBSITES

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<http://www.chemhelper.com>

#### Question paper pattern:

The pattern of question paper shall be as follows:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding concepts	40
PART C	Description/synthesis	40

**PART A: 10 questions, compulsory 2 questions from each unit ( 10X2=20)**

**PART B: 5 out of 8 questions, compulsory 1 question from each unit (5X8=40)**

**PART C: 2 out of 4 questions, each from different units (2X20=40)**

### SEMESTER I

### YOGA AND DIET

(For other departments)

**TEACHING HOURS: 30**

**Credits: 2**

**COURSE CODE: BC15/1N/YAD**

**LTP:2 0 0**

## **OBJECTIVE**

To create an awareness on

1. Yogasanas
2. Balanced diet for complete well being.

### **UNIT 1**

**(10 hours)**

Yoga-definition, Types of Yogas, prerequisites for yoga, Pranayama, and benefits, Work place yoga.

### **UNIT II**

**(10 hours)**

Basic asanas and their benefits – Padmasana, Vajrasana, Bhujangasana, Dhanurasana Shavasana.

### **UNIT III**

**(10 hours)**

Different classes of nutrients in food and their basic functions, Food sources of carbohydrates, proteins, lipids, vitamins, iron and calcium, food pyramid, types of vegetarian diets.

### **Recommended Books**

1. Yoga – Master the Yogic Powers – Jack Peter, First Edition, Abishek Publications\
2. Nutrition Essentials and Diet Therapy – Pecken Paugh, Saunders Elsevier

### **Web sites**

1. [www.artofliving.org/in-en/yoga](http://www.artofliving.org/in-en/yoga)
2. [www.artofliving.org](http://www.artofliving.org)
3. [www.nutritionj.com/](http://www.nutritionj.com/)

### **Question paper pattern:**

Ten out of twelve questions (5x10=50)

## **SEMESTER II**

### **LIFE STYLE DISEASES IN WOMEN**

**(For other department students)**

**TEACHING HOURS: 30 HOURS**

**CREDITS: 2**

**COURSE CODE: BC15/2N/LSD**

**LTP: 2 0 0**

#### **OBJECTIVE:**

To create awareness about

1. Lifestyle diseases and disorders in women.
2. Food habits and health

#### **UNIT-I**

**(10 Hours)**

Health problems in women-Anaemia, skin and hair problems, Cancer- Breast cancer, Cervical cancer-symptoms, diagnosis and treatment, significance of breast feeding, Obesity.

#### **UNIT-II**

**(10 Hours)**

Food habits and health- Balanced diet-diet for women-Carbohydrate, lipid, protein, vitamin and minerals-sources, requirements and deficiency symptoms.

#### **UNIT-III**

**(10 Hours)**

Adverse effects of junk food, eating disorders-Anorexia and Bulimia nervosa. Modern lifestyle habits. Health hazards of smoking and alcoholism, tight clothing, high heels, hair coloring, face bleach, tattooing, mobile phone radiation.

#### **OUTCOME:**

Students understand the significance and importance of healthy life style.

#### **RECOMMENDED BOOKS:**

1. Understanding nutrition-Eleanor, Noss, Whitney
2. Encyclopedia of Women health-Parvesh Handa

#### **WEBSITE:**

[www.helpguide.org](http://www.helpguide.org)  
[www.healthsite.com](http://www.healthsite.com)

#### **Question paper pattern:**

Ten out of twelve questions (5X 10 = 50)

## Semester III

### BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

**Teaching hours : 105 hrs**

**Code:**

**LTP:**

**Credits : 5**

#### **Unit – I**

**(21hrs)**

Units of concentration – Normality, Molarity and Molality. Colloidal solutions- Introduction, types of Dispersion phase (DP) & Dispersion medium (DM). Tyndal effect, Ultrafiltration- biological significance. Donnan membrane equilibrium.

Viscosity, surface tension, and Osmotic pressure – definition, determination and biological significance

#### **Unit – II**

**(21hrs)**

Chromatographic techniques – general principles of Chromatography, principles, operational procedures and applications of Paper, Thin layer, Gel permeation, (Ion exchange), Affinity and Gas liquid chromatography.

Types of radioactive emission, half life, units of radioactivity. Detection and measurement of radioactivity- methods based on ionization (GM counter), excitation (Scintillation counter). Applications of radioisotopes in the elucidation of metabolic pathways and radio dating.

#### **Unit – III**

**(21hrs)**

Electrophoretic techniques, general principle, factors affecting migration rate- electric field, buffer, supporting medium. Electrophoretic mobility of samples. Paper, cellulose, acetate, agarose, gel electrophoresis, PAGE and SDS- Page.

Principles of Electrophoretic techniques, measurement of pH by Glass electrode, pH of buffer solutions, biological buffers.

#### **Unit – IV**

**(21hrs)**

Centrifugation techniques: basic principle of centrifugation, rotors, types of centrifugation- (Preparative and Analytical). Differential, Density gradient, (Isopycnic and Equilibrium centrifugation technique). Analytical ultra centrifugation, Application of Centrifugal techniques with special reference to determination of molecular weight of Macromolecules.

#### **Unit – V**

**(21hrs)**



Basic principles of Electromagnetic radiation – energy , wavelength , wave number and frequency. Absorption and Emission Spectra .Beer Lambert law , Absorbance and Transmittance. Colorimetry – Principle , Instrumentation and application. Principle , Instrumentation –UV Spectrophotometry .

Principle, Instrumentation and applications of Spectrofluimetry with reference to applications like Estimation of Thiamine.

### Recommended text books

1. Practical Biochemistry (V Edition)- Keith Wilson & John Walker, Cambridge University pres
2. Biophysical chemistry – Debajyothi Das

### Reference Books

1. Practical Biochemistry – Randhir Singh and Sawhney
2. Instrumental methods of Chemical analysis- Chatwal Anand , Himalaya Publishing House

### Website

[www.freebookcentre.net/./Biochemical- Techniques](http://www.freebookcentre.net/./Biochemical-Techniques).

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## SEMESTER – II

### PRACTICAL

Core

Course Code:BC15/4C/PR2

Teaching Hours: 45 hours

Credits: 3

L/T/P: 0/0/3

### I.Titration

1. Estimation of glycine
2. Estimation of iron
3. Estimation of copper
4. Estimation of glucose by benedicts method
5. Estimation of ascorbic acid
6. Determination of Iodine number
7. Determination of Acid number
8. Estimation of calcium in milk (Group)

## **II. Preparation of buffers- Phosphate buffer, Tris buffer**

## **III. Demo Experiments**

1. Separation of aminoacids by paper chromatography
2. Separation of lipids by thin layer chromatography
3. Separation of plant pigments by column chromatography
4. Separation of proteins by SDS – PAGE

## **SEMESTER – III**

### **ENZYMES**

**Core**

**Course Code:BC15/4C/ENZ**

**Teaching Hours: 75 hours**

**Credits: 5**

**L/T/P: 5/2/0**

### **Objective:**

1. To learn in detail about the enzymes, classification and kinetic properties.
2. To understand the mechanism of action, purification and applications of enzymes in different fields.

### **Unit I:**

**(15 hrs)**

Rate of reaction, standard free energy, activation energy, chemical equilibrium in biological context, enzymes as biocatalyst.

Definitions- Apoenzyme, holoenzyme, cofactors- Metal cofactors, coenzymes. Role of NAD, TPP, PLP. Active site – definition, characteristic features, Enzyme specificity.

**Unit II: (15 hrs)**

Classification of enzymes according to International Union of Biochemistry Convention 1964(E.C upto 2<sup>nd</sup> digit). Factors influencing enzyme activity – pH, temperature, substrate, product, modulators (Activators, inhibitors), ES complex formation, lock and key model and induced fit model, Enzyme units- IU & Katal

**Unit III: (15 hrs)**

Enzyme Kinetics- Michaelis Menten equation and its derivation, significance of Km and Vmax, Line weaver burk plot and Eadie- Hofstee plot, enzyme inhibition- competitive (with applications), Non- competitive, Uncompetitive – Derivations not included.

Allosteric inhibition, simple sequential model, concerted model, feedback inhibition with example.

**Unit IV: (15 hrs)**

Extraction of enzymes – Nature of the extraction medium, extraction of soluble enzymes, techniques for enzyme isolation, separation of cellular organelles by differential centrifugation, intracellular localization of enzymes and marker enzymes.

**Unit V: (15 hrs)**

Purification of enzymes- Dialysis, chromatography, electrophoresis- Criteria of purity of enzymes.

Designer enzymes – Ribozymes, abzymes. Multienzyme complex with pyruvate dehydrogenase complex as example. Definition – Isoenzymes, zymogens, Immobilised enzymes.

**Recommended Books:**

1. Enzyme Kinetics (1995) – Palmer, London: Portland Press
2. Enzyme Kinetics - Dixon , 1972, wiley publishers
3. Fundamental of Enzymology – Price & Steven , 1999-Bowker company
4. The Enzymes Vol. 1 & 2 – Boyer, 1983
5. Enzyme Structure & Mechanism – Alan Fersht, 1985, W.H. Freeman
6. Enzyme Biotechnology – Tripathi, G, 2009- ABD Publishers.
7. Industrial Enzyme & their Application (1998) –Uhlig, H.
8. Enzyme 3<sup>rd</sup> Ed. (1979) – Dixon M. & Webb, E.C.

**Reference Books: •**

1. Fundamentals of Enzymology - Nicholas C.Price and Lewis Stevens., Oxford University Press, New Delhi.
2. Principles of Biochemistry - 4th edition - Lehninger, Nelson and Cox, 2005, WH Freeman and Company, New York, USA.
- 3.Principles of Biochemistry with human focus - Garrett and Grisham, 2002, Harcourt College Publishers, Orlando, Florida, USA.
4. Fundamentals of Biochemistry - Donald Voet, Judith Voet and Pratt, 1995, , 2nd edition.
5. Harper's Biochemistry – Murray et al, 2000, 25<sup>th</sup> edition, Appleton and Lange Publishers.

**Journals:**

- 1.[Enzyme Research](#)
- 2.[Enzyme and Microbial Technology - Journal](#)
- 3.[Archive of "Enzyme Research"](#).

**Useful Websites and e-learning resources:**

1. [www.lsbu.ac.uk/biology/enztech/](http://www.lsbu.ac.uk/biology/enztech/)
2. [www.lsbu.ac.uk/biology/enzyme/](http://www.lsbu.ac.uk/biology/enzyme/)
3. [www.aetlted.com/tech/applications.html](http://www.aetlted.com/tech/applications.html)
4. [www.elmhurst.edu/chm/vchembooks/570enzymes.html](http://www.elmhurst.edu/chm/vchembooks/570enzymes.html)

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PART A	Definition and structures	20
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**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

**SEMESTER IV**  
**INTERMEDIARY METABOLISM I**

**CODE:BC15/5C/IN1**

**TEACHINGHOURS: 60**

**Credits: 4 LTP : 310**

**OBJECTIVE:**

To enable the student to have an understanding of carbohydrate, amino acid metabolism and its significance

**UNIT : I** **(12 hrs)**

Introduction to Intermediary metabolism. Basic metabolic pathways – anabolic, catabolic and amphibolic pathways. Carbohydrate metabolism- Glycolysis , TCA Cycle and its regulation.

**UNIT: II** **(12 hrs)**

HMP Shunt, Glycogenesis, Glycogenolysis and gluconeogenesis. Hormonal regulation of glycogen metabolism.

**UNIT : III** **(12 hrs)**

Amino acid metabolism – General catabolic reaction of amino acids- transamination, oxidative and non- oxidative deamination, decarboxylation . Urea cycle and its regulation

**UNIT: IV** **(12 hrs)**

Degradation of glucogenic and ketogenic amino acids- Phenyl alanine, Threonine, Arginine, Tryptophan, Methionine. Biosynthesis of non essential amino acids- Asparagine, Glutamin, Serine

**UNIT: V** **(12 hrs)**

Conversion of amino acids to specialized products- serotonin, GABA , dopamine, epinephrine,

nor epinephrine, creatinine and creatine.

Detoxification mechanism – Hydrolysis, oxidation, reduction, and Conjugation with examples.

**Recommended Text books :**

1. Principles of Biochemistry (III Edition)- Lehninger, Nelson and Cox
2. Biochemistry ( III Edition)- Voet &Voet

**Reference:**

1. Harpers Biochemistry- Murray et al
2. Textbook of Biochemistry (III Edition)- Zubey

**Website :**

[www.wormbook.org/...intermetabolism/](http://www.wormbook.org/...intermetabolism/)

[www.science-projects.com/MetPathways.html](http://www.science-projects.com/MetPathways.html)

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## SEMESTER IV

### INTERMEDIARY METABOLISM II

**TEACHING HOURS:60**  
**BC11/4C/IM2**

**CODE:**

**CREDITS: 4 LTP : 310**

#### **OBJECTIVE:**

To enable the student to have a thorough understanding of lipid metabolism, nucleotide metabolism and biological oxidation.

#### **UNIT I:**

Lipid metabolism- oxidation of fatty acids (saturated , odd and even numbered)-  $\alpha$ , $\beta$ , and  $\omega$  oxidation. Biosynthesis of saturated fatty acids (Palmitic acid) and unsaturated fatty acids. Ketogenesis.

#### **UNIT II :**

Biosynthesis and Degradation of triglyceride, Phospholipid and Sphingolipid. Biosynthesis of Cholesterol – Regulation. Degradation of Cholesterol

#### **UNIT III :**

Nucleotide metabolism – Biosynthesis of Purine and pyrimidine bases, salvage pathway. Degradation of purine and pyrimidine bases in the Uricotelic and Ureotelic systems. Coenzyme nucleotides- NAD, FAD, TPP,PLP

#### **UNIT IV:**

Biological oxidation – Electron transport chain- components and reaction of ETC.

Theories of Oxidative phosphorylation- Redox loop and proton pump mechanism. Inhibitors of ETC and oxidative phosphorylation. High energy compounds and linkages.

#### **UNIT V:**

Photosynthesis – Chloroplast , Thylakoid membrane, light and dark reaction, photo respiration and photo phosphorylation. Synthesis of Sucrose and Starch in plants.

**Recommended Text books :**

3. Principles of Biochemistry (III Edition)- Lehninger, Nelson and Cox
4. Biochemistry ( III Edition)- Voet &Voet

**Reference:**

3. Harpers Biochemistry- Murray et al
4. Textbook of Biochemistry (III Edition)- Zubey

Website:

[www.wormbook.org/...intermetabolism/](http://www.wormbook.org/...intermetabolism/)

[www.science-projects.com/](http://www.science-projects.com/)

[biochemistryden.blogspot.com/](http://biochemistryden.blogspot.com/)

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

**SEMESTER-V**

**CLINICAL BIOCHEMISTRY**

**TEACHING HOURS:60**

**COURSE**

**CODE:**

**CREDITS: 4**

**LTP:**

**3/1/0**



**OBJECTIVE:**

To enable the student to have a fundamental understanding of etiology, pathophysiology, symptoms and treatment of various diseases.

**UNIT-I :**  
**(12 hours)**

Blood Cells- function – Clinical significance. Haematology- normal values, blood disorders- Anaemia, polycythemia, leucopenia, leucocytosis, Thrombocytopenia. Haemophilia, Thalassemia, sickle cell Anaemia, Porphyria. PCV, ESR.

**UNIT-II:**  
**(12 hours)**

Disorders of carbohydrate metabolism- Diabetes- Types, diagnosis, complications and treatment. Glycogen storage diseases, galactosemia.

Hereditary disorders of Amino acid metabolism- Tyrosinemia, Phenylketonuria, alkaptonuria, Hartnup's disease, Cystinuria, Fanconi's syndrome. Prenatal diagnosis- Amniocentesis and chorionic villus sampling.

**UNIT-III :** **(12 hours)**

Disorders of lipid metabolism- Hyper and hypo Lipoproteinemia- Types, pathology and treatment. Lipidosis- Niemann Pick's disease, Tay-Sachs' Disease, Gaucher's disease, Atherosclerosis, fatty liver, coronary heart disease- causes & symptoms

Disorders of nucleic acid metabolism – Lesch Nyhan syndrome, gout, xanthinuria, orotic aciduria.

**UNIT-IV:** **(12 hours)**

Gastric function test- examination of resting content, fractional gastric analysis using test meal, stimulation test- alcohol, histamine and insulin. Tubeless gastric analysis.

Renal function test- Classification, clearance test- urea, creatinine and inulin. PAH test, filtration fraction. Concentration and dilution tests.

**UNIT-V:** **(12 hours)**

Liver function test- bilirubin metabolism, jaundice and its differential diagnosis, VD Berg reaction, hippuric acid test,

BSP retention test, prothrombin time, serum enzymes in liver diseases.

clinical enzymology- marker enzymes for cardiovascular disease, pancreatic and bone disease.

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## **SEMESTER-V**

### **PHYSIOLOGY**

**TEACHING HOURS:60**  
**CODE:**

**COURSE**

**CREDITS: 3**

**LTP: 3/1/0**

#### **OBJECTIVE:**

To study about the structure and function of vital organ systems and hormones.

#### **UNIT-I:**

**(12hours)**

Blood- composition & function. Types of blood cells, morphology & function- RBC, WBC, platelets erythropoiesis. Blood groups- A B O & Rhesus system; coomb's test, Bombay blood group, function of plasma proteins. Composition & functions of lymph & lymphoid system,

Circulatory system- structure and function of heart, arteries, veins and capillaries.

**UNIT-II:**

**(12hours)**

Muscular system- types of muscle & functions. Anatomy of skeletal muscles, mechanism of contraction of skeletal muscle. brief outline of nervous system, structure of brain, spinal cord, nerve fibres. Synapses- chemical and electrical synapse, nerve impulse, action potential and neurotransmitters.

**UNIT-III:**

**(12hours)**

Urinary system- overall design of urinary system. Kidney structure and organization. Structure, function and classification of nephrons. Mechanism of urine formation- functions of glomerular filtration rate and selective reabsorption, tubular secretion.

**UNIT-IV:**

**(12hours)**

Physiological anatomy of respiratory system- respiratory units and function. Exchange of gases.

Digestive system- structure and function of different components of digestive system, mechanism of secretion of HCL, Role of hormones and enzymes in digestive process. Digestion of carbohydrates, lipids and proteins

**UNIT-V:**

**(12hours)**

general organization of endocrine system- classification of hormones. Biological functions- thyroid, parathyroid, insulin, glucagon, hormones of the adrenal glands and gonadal hormones.

**Recommended text books :**

1. Human Anatomy & Physiology – Elaine N. Marieb, 4<sup>th</sup> edition
2. Animal physiology – Mariakuttikan and Arumugam

Reference books :

1. Textbook of Medical Physiology – Guyton & Hall, 6<sup>th</sup> edition
2. Human Physiology – Dr. C.C. Chatterjee
3. Davidson's Principles and Practice of Medicine (XX Edition) - John. A. A. Hunter

**website :**

**[physiologyonline.physiology.org](http://physiologyonline.physiology.org)**

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## SEMESTER V

### Bioinstrumentation & Biostatistics

**TEACHING HOURS:75**  
**BC15/5E/BIB**

**CODE:**

**CREDITS: 5 LTP : 310**

#### Unit – I

**15 hrs**

Hematology – parameters, routine methods, Hematology analyzer. Biochemistry – Colorimetry based estimation of metabolites using enzyme kits (Glucose estimation using Glucose oxidase) kits for kinetic assay of enzymes (LDH). Flame photometry for electrolyte instrumentation. Overview of ELISA, ImmunoFluorescence and Chemiluminescent methods for hormone assays (competitive and sandwich approaches)

Other samples used in laboratory – urine (uristir), CSF, faeces, Amniotic fluid (Aminocentesis)

#### Unit – II

**15 hrs**

Detection of Pathogens- Serology (Widal), Microscopic methods (Malarial parasite), culture methods & Antibiotic sensitivity. Diagnostic procedures – Histopathology , X-ray (Angiogram). Different types of scan – ultrasound, Computerised Axial Tomography. Methods based on electrical activity – ECG, EEG, Blood pressure measurements, Respiratory gas analyzer, Spirometer .

**Unit – III****15 hrs**

Therapeutic procedures- Blood banking, Dialysis unit- Hemodialysis and Peritoneal dialysis, Ventilator, Pacemaker, Defibrillator, Artificial valves, Laser applications in Medicine. Shortwave and Microwave diathermy. Radiotherapy equipment.

**Unit – IV****15 hrs**

Biostatistics – Outline of Statistical Investigations. Population and sample. Collection of data, primary and secondary data. Presentation of data in the form of tables and graphs- Line diagram, bar diagram, (different types). Pidiagrams , Pictograms, cartograms , Use of Excel to prepare graph.

**Unit – V****15 hrs**

Measures of central tendencies- Mean , Median, Mode (individual data, discrete series, continuous series). Measures of dispersion- Range, quartile , deviation , standard deviation ( Individual data, discrete series, continuous series, Use of excel to calculate central tendencies and dispersion measures

## **SEMESTER –V**

### **PRACTICAL –III**

#### **I. COLORIMETRY – Serum Analysis**

- a) Estimation of Creatinine (Jaffe's method)
- b) Estimation of Urea
- c) Estimation of Cholesterol
- d) Estimation of Glucose (Orthotoluidine method)
- e) Estimation of Uric acid (kit based)

#### **II. HEMATOLOGY (Group Experiments)**

- a) Total count of RBC, WBC and Platelets
- b) Differential count of WBC
- c) Hematocrit and ESR
- d) Estimation of Hemoglobin (Drabkin's reagent )

#### **III. FLAME PHOTOMETRY**

Estimation Of Serum Sodium And Potassium

**SEMESTER –V**  
**PRACTICAL –IV**

**I.Serum analysis**

- a) Estimation of Vitamin C
- b) Estimation of Iron by Dipyrical method

**II. Enzymology**

- a) Activity of
  - i) Amylase
  - ii) SGOT
  - iii) ALP
  - iv) LDH

Effect of Temperature, pH , & Substrate concentration of Salivary amylase.

**III.Urine Analysis**

**SEMESTER VI**  
**MOLECULAR BIOLOGY**

**CORE :**

**Teaching hours : 60**

**Course code : BC15/ 5C/MBY**  
**Credits : 4**  
**L T P : 4 1 0**

## **Objective**

- **Introducing the molecular concepts of life processes**
- **Understanding the molecular basis of cellular activities**

### **Unit I : Gene Organization ( 12 HRS)**

Genes, DNA sequences – Unique and repetitive sequences, coding , non coding DNA ,Satellite DNAs , Cot Curves , Chromosomes – Types, properties, Prokaryotic gene organization , Eukaryotic gene organization.

### **Unit II : DNA Replication ( 12 HRS)**

Chemistry of DNA synthesis, Modes of DNA replication , Semiconservative Replication – Meselson and Stahl experiment, Enzymes of DNA replication – DNA polymerases, Helicases, Primase, Ligase s, Topoisomerases, Prokaryotic replication. Brief outline of eukaryotic replication.

### **Unit III: Transcription (12 HRS)**

Chemistry of Transcription, RNA polymerases, Role of sigma factor, Closed and open promoter complexes, Prokaryotic Transcription , Brief outline of Eukaryotic Transcription, Post transcriptional modifications of m RNA – capping, tailing, splicing

### **Unit IV : Translation ( 12 HRS)**

Basic features and deciphering of the Genetic code, Genetic code dictionary, wobble hypothesis, Ribosomes, Protein synthesis in prokaryotes - Activation of aminoacids, aminoacyl t RNA synthetases, t RNA as adaptor molecule, Prokaryotic translation, post translational modifications .

### **Unit V : Mutation and DNA Repair (12 HRS)**

Mutation – Types , Physical and chemical mutagens ,DNA damages and mutations ,DNA repair – Direct repair systems , Excision repair – Base and nucleotide excision repair , Mismatch repair .

## **Recommended Text Books**

1. Biochemistry - Voet Donald and Voet Judith : 2004. Wiley International Edition , 3<sup>rd</sup> Edition : John Wiley & Sons.
2. Lehninger Principles of Biochemistry – Nelson David and Cox Michael : 2004 . W.H.Freeman & Co : New York
3. Essentials of molecular biology- V.Malathi, 2013 , First Edition, Pearson Publishers.

## **Reference Books**



1. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky , Lawrence, Matsudaira, Paul, Baltimore : 2006 , 4<sup>th</sup> Edition , W.H Freeman & Co .
2. Lewin’s Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliott , Kilpatrick ,Stephen : 2009 . Jones and Bartlett.
3. The world of cell – Becker, Wayne , Kleinsmith , Lewis ,Hardin, Jeff ,Bertoni ,Gregory paul : 2009 , 7<sup>th</sup> Edition ,Pearson Education Inc .

### Journals

4. Roeder, R . 1996 . The role of general initiation factors in Transcription by RNA polymerase II ,Trends in Biochemical Sciences , 21 (9) : 325-335.
5. Catez, Frederic , Brown ,David, Misteli , Tom , Bustin , Michael : 2002. Competition between Histone H1 and HMGN proteins for chromatin binding sites , EMBO reports 3 (8) : 760-766
6. Saha, Anjanabha,Wittmeyer ,Jacqualine ,Cairns : 2006 . Chromatin remodelling : The industrial revolution of DNA around Histones . Nature Reviews Molecular cell biology ,7: 437-447.

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## SEMESTER VI GENETICS

**Teaching hours : 60  
5C/GEN**

**Course code: BC15/**

**Credits : 4  
L T P : 4 1 0**

### Objective

- Understanding Genes and their role in life processes
- Understanding the basis of genetic inheritance

**Unit I**  
Mendelian Genetics

**(12 HRS)**

Contributions of Mendel, Mendel's Hybridization experiments, Alleles, Monohybrid cross, Dihybrid cross, Genotype, Phenotype, Back Cross, Test cross, Dominant, Recessive relationships. Reciprocal crosses.

**Unit II (12 HRS)**

Mendelian Laws

Mendel's Law of Dominance, Law of segregation, law of Independent assortment, Incomplete Dominance, Co dominance, Gene Interactions – Complementary, Supplementary genes.

**Unit III (12 HRS)**

Bacterial Genetics

Bacterial genome, Gene exchange mechanism in Bacteria- transformation – Griffith's Experiment, Transforming principle, Mechanism of Transformation, Transduction – types, Conjugation- F factor, F plasmid, Mechanism of conjugation, high frequency recombination (Hfr) strain.

**Unit IV (12 HRS)**

Genetic Inheritance

Sex determination, X-Linked Inheritance, Y-linked inheritance, Autosomal Inheritance - Dominant and recessive Inheritance, Linkage, crossing over, Gene mapping,

**Unit V (12 HRS)**

Genetic Diseases

Human karyotype, Chromosome Banding, Chromosomal aberrations, Chromosomal abnormalities – Down's Syndrome, Klinefelter's syndrome, Turner's syndrome (Basic Concepts)

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

**SEMESTER VI**  
**BIOTECHNOLOGY**

**Teaching hours : 60**

**Course code:**  
**Credits : 4**

**UNIT –I :** **(12 hrs)**

Introduction to Biotechnology- scope and importance, tools of R-DNA technology ; enzymes, linkers, adaptors, vector- plasmid, phages, cosmid, viral, shuttle and expression vectors.

**UNIT-II:** **(12 hrs)**

Strategies of R-DNA Technology; Isolation and identification of gene of interest- Gene library, PCR, Blotting- southern, northern, western, automated gene machine. Gene transfer methods – Electroporation, transformation, liposome mediated transfer, transduction, gene gun method, selection of recombinants, - marker gene and reporter genes for animal and plant cells, colony hybridization methods. Blue white selection method, Insertional inactivation method and immunological method.

**UNIT-III:** **(12 hrs)**

Plant Biotechnology: plant tissue culture- requirements for plant tissue culture, types of culture, application of plant tissue culture. Micropropagation, somoclonal variation, protoplast culture, embryo rescue, germplasm & cryopreservation. Application of Transgenic plants- herbicide resistant crops and Insect resistant crops

**UNIT-IV:**

**(12 hrs)**

Animal Biotechnology: Requirement for animal tissue culture, mammalian cell culture stem cell culture, cell lines and its maintenance. Application of animal cell culture. Transgenic animals and its application.

Medical Biotechnology: production of insulin, interferon, t-PA .Gene therapy- Basics of principle.

**UNIT-V:**

**(12 hrs)**

Industrial Biotechnology : fermentation, bioreactors- types, types of fermentation process. Downstream processing- production of Vinegar, Single Cell Protein-ALGAE.

Enzyme Biotechnology: Immobilization of enzymes, methods of immobilization. Industrial application of enzymes- food industry, textile industry, pharmaceutical industry, paper and pulp industry.

**Recommended Books:**

1. Biotechnology – U.Sathyanarayana
2. Textbook of Biotechnology- R.C.Dubey
3. Biotechnology – Principles and Application – S.C.Rastogi
4. Elements of Biotechnology – P.K.Gupta
5. Biotechnology – Kumaresan

**Reference books :**

1. Molecular Biotechnology- Glick and Pasternick
2. Molecular Biotechnology- Primrose

**Website :**

www.gate2biotech.com/instantnotes-

[www.springer.com](http://www.springer.com)

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

**Semester VI**  
**Basics of Bioinformatics**

**TEACHING HOURS:75**

**CODE:**

**Credits:5**

**Unit I**

**15 hrs**

**Basics of internet** – IP address, domain names, URL; networks - LAN, WAN; communication protocols – TCP, IP, FTP, HTTP; www, web browsers, search engines. Flat files, relational, object oriented databases

**Unit II**

**15 hrs**

**Bioinformatics** - Relationship between computers and biology; Principles, challenges and applications of bioinformatics. Biological databases. NCBI, Nucleic acid sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot, PIR; Structure Database: PDB; literature database – PubMed; Data retrieval systems - Entrez

**Unit III**

**15 hrs**

Introduction to Sequences, alignments, type of alignments and their significance; Local alignment and Global alignment algorithms, Pairwise alignment (BLAST) and multiple sequence alignment (Clustal W algorithm).

**Unit IV**

**15 hrs**

Protein Structure: Primary, Secondary, Super Secondary, Tertiary, Quaternary, Peptide bond, phi, psi and chi torsion angles; significance of Ramachandran plot; Motif and Domain. 3D Protein structure prediction (homology modelling) and structure visualization. Gene prediction, human genome project and its significance, OMIM

**Unit V**

**15 hrs**

Basics of Phylogenetic analysis - definitions of homologs, orthologs, paralogs and xenologs; Definitions for proteomics, genomics, Metagenomics, Transcriptomics, Metabolomics, Lipidomics, Interactomics. Chemoinformatics, pharmacogenomics; Drug designing- Steps in drug development. Structure based drug designing.

Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004

2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellette, B.F., Wiley India Pvt Ltd. 2009

3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999

Essential Bioinformatics by Jin Xiong

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
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PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## **SEMESTER VI**

### **B.Sc Immunology**

**TEACHING HOURS:75**

**CODE:**

**Credits:5**

**Unit – I****(15 hrs)**

Infection – pathogenicity, virulence, Immunity – Innate Immunity, types, Non specific body defence- Anatomical, physiological, phagocytic, Inflammationary Barriers. Acquired Immunity – Natural, Artificial , Active , Passive. Antibody – classes, structure and biological function. Humoral and cell mediated immunity .

**Unit – II****(15 hrs)**

Cells involved in Immune response – T,B, Null cells, Structure and functions of lymphoid organs- Thymus, bone marrow, spleen, lymph nodes, MucousAssociated Lymphoid Tissue,Gut AssociatedLymphoid Tissue.

**Unit – III****(15 hrs)**

Antigen , factors affecting antigenicity, epitope , haptens , adjuvants. Clonal selection theory , Co-operation of T cells & B cells. Overview of Major Histocompatibility Complex and HLA Antigens.

**Unit – IV****(15 hrs)**

Principles of Ag-Ab interactios – Precipitation, agglutination, opsonisation , flocculation , and application. Principle – ELISA, RIA,Immuno electrophoresis and Immunofluorescence . Monoclonal Ab- Hybridoma technology and applications.

**Unit – V****(15 hrs)**

Hypersensitivity – types – I, II, III, & IV. Autoimmune diseases – Hashimotos thyroiditis and Rheumatic arthritis. Transplantation Immunology (an overview) – types of grafts, graft rejection

**Recommended Text books:**

1. Immunology (VI Edition)- Kuby
2. Essential Immunology (III Edition) –Roitt

**Reference Books**

1. Immunology an Introduction (V edition)- L.R.Tizard
2. Immunology a short course – Eli Benjamin

**Website :**

[www.whfreemen.com/kuby](http://www.whfreemen.com/kuby)

[www.immunologylink.com](http://www.immunologylink.com)

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

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**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## SEMESTER VI MOLECULAR BIOLOGY

**CORE :**

**Teaching hours : 60**

**Course code : BC15/ 5C/MBY**

**Credits : 4**

**L T P : 4 1 0**

**Objective**

- **Introducing the molecular concepts of life processes**
- **Understanding the molecular basis of cellular activities**

**Unit I : Gene Organization**

( 12 HRS)

Genes, DNA sequences – Unique and repetitive sequences, coding , non coding DNA ,Satellite DNAs , Cot Curves , Chromosomes – Types, properties, Prokaryotic gene organization , Eukaryotic gene organization.

**Unit II : DNA Replication**

( 12 HRS)

Chemistry of DNA synthesis, Modes of DNA replication , Semiconservative Replication – Meselson and Stahl experiment, Enzymes of DNA replication – DNA polymerases, Helicases, Primase, Ligase s, Topoisomerases, Prokaryotic replication. Brief outline of eukaryotic replication.

**Unit III: Transcription**

(12 HRS)

Chemistry of Transcription, RNA polymerases, Role of sigma factor, Closed and open promoter complexes, Prokaryotic Transcription , Brief outline of Eukaryotic Transcription, Post transcriptional modifications of m RNA – capping, tailing, splicing

**Unit IV : Translation**

( 12 HRS)



Basic features and deciphering of the Genetic code, Genetic code dictionary, wobble hypothesis, Ribosomes, Protein synthesis in prokaryotes - Activation of amino acids, aminoacyl t RNA synthetases, t RNA as adaptor molecule, Prokaryotic translation, post translational modifications .

**Unit V : Mutation and DNA Repair** (12 HRS)

Mutation – Types , Physical and chemical mutagens ,DNA damages and mutations ,DNA repair – Direct repair systems , Excision repair – Base and nucleotide excision repair , Mismatch repair .

**Recommended Text Books**

7. Biochemistry - Voet Donald and Voet Judith : 2004. Wiley International Edition , 3<sup>rd</sup> Edition : John Wiley & Sons.
8. Lehninger Principles of Biochemistry – Nelson David and Cox Michael : 2004 . W.H.Freeman & Co : New York
9. Essentials of molecular biology- V.Malathi, 2013 , First Edition, Pearson Publishers.

**Reference Books**

4. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky , Lawrence, Matsudaira, Paul, Baltimore : 2006 , 4<sup>th</sup> Edition , W.H Freeman & Co .
5. Lewin’s Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliott , Kilpatrick ,Stephen : 2009 . Jones and Bartlett.
6. The world of cell – Becker, Wayne , Kleinsmith , Lewis ,Hardin, Jeff ,Bertoni ,Gregory paul : 2009 , 7<sup>th</sup> Edition ,Pearson Education Inc .

**Journals**

10. Roeder, R . 1996 . The role of general initiation factors in Transcription by RNA polymerase II ,Trends in Biochemical Sciences , 21 (9) : 325-335.
11. Catez, Frederic , Brown ,David, Misteli , Tom , Bustin , Michael : 2002. Competition between Histone H1 and HMGN proteins for chromatin binding sites , EMBO reports 3 (8) : 760-766
12. Saha, Anjanabha,Wittmeyer ,Jacqualine ,Cairns : 2006 . Chromatin remodelling : The industrial revolution of DNA around Histones . Nature Reviews Molecular cell biology ,7: 437-447.

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
PART A	Definition and structures	20
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PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## **SEMESTER VI GENETICS**

**Teaching hours : 60  
5C/GEN**

**Course code: BC15/**

**Credits : 4  
L T P : 4 1 0**

### **Objective**

- Understanding Genes and their role in life processes
- Understanding the basis of genetic inheritance

### **Unit I (12 HRS)**

Mendelian Genetics

Contributions of Mendel, Mendel's Hybridization experiments, Alleles, Monohybrid cross, Dihybrid cross, Genotype, Phenotype, Back Cross, Test cross, Dominant, Recessive relationships. Reciprocal crosses.

### **Unit II (12 HRS)**

Mendelian Laws

Mendel's Law of Dominance, Law of segregation, law of Independent assortment, Incomplete Dominance, Co dominance, Gene Interactions – Complementary, Supplementary genes.

### **Unit III (12 HRS)**

Bacterial Genetics

Bacterial genome, Gene exchange mechanism in Bacteria- transformation – Griffith's Experiment, Transforming principle, Mechanism of Transformation, Transduction – types, Conjugation- F factor, F plasmid, Mechanism of conjugation, high frequency recombination (Hfr) strain.

### **Unit IV (12 HRS)**

Genetic Inheritance

Sex determination, X-Linked Inheritance, Y-linked inheritance, Autosomal Inheritance - Dominant and recessive Inheritance, Linkage, crossing over, Gene mapping,

### **Unit V (12 HRS)**

Genetic Diseases

Human karyotype, Chromosome Banding, Chromosomal aberrations, Chromosomal abnormalities – Down's Syndrome, Klinefelter's syndrome, Turner's syndrome (Basic Concepts)

<b>COMPONENT</b>	<b>NATURE OF THE QUESTION</b>	<b>MAXIMUM MARKS</b>
PART A	Definition and structures	20
PART B	Understanding the concepts	30
PART C	Description / synthesis	50

**Part A: 10 out of 12 questions, compulsory 2 questions from each unit (10x2=20)**

**Part B: 5 out of 7 questions, compulsory 1 question from each unit (5x6=30)**

**Part C: 5 out of 7 questions, compulsory 1 question from each unit (5x10=50)**

## **SEMESTER VI**

### **BIOTECHNOLOGY**

**Teaching hours : 60**

**Course code:  
Credits : 4**

**UNIT –I :**

**(12 hrs)**

Introduction to Biotechnology- scope and importance, tools of R-DNA technology ; enzymes, linkers, adaptors, vector- plasmid, phages, cosmid, viral, shuttle and expression vectors.

**UNIT-II: (12 hrs)**

Strategies of R-DNA Technology; Isolation and identification of gene of interest- Gene library, PCR, Blotting- southern, northern, western, automated gene machine. Gene transfer methods – Electroporation, transformation, liposome mediated transfer, transduction, gene gun method, selection of recombinants, - marker gene and reporter genes for animal and plant cells, colony hybridization methods. Blue white selection method, Insertional inactivation method and immunological method.

**UNIT-III: (12 hrs)**

Plant Biotechnology: plant tissue culture- requirements for plant tissue culture, types of culture, application of plant tissue culture. Micropropagation, somoclonal variation, protoplast culture, embryo rescue, germplasm & cryopreservation. Application of Transgenic plants- herbicide resistant crops and Insect resistant crops

**UNIT-IV: (12 hrs)**

Animal Biotechnology: Requirement for animal tissue culture, mammalian cell culture stem cell culture, cell lines and its maintenance. Application of animal cell culture. Transgenic animals and its application.

Medical Biotechnology: production of insulin, interferon, t-PA .Gene therapy- Basics of principle.

**UNIT-V: (12 hrs)**

Industrial Biotechnology : fermentation, bioreactors- types, types of fermentation process. Downstream processing- production of Vinegar, Single Cell Protein-ALGAE.

Enzyme Biotechnology: Immobilization of enzymes, methods of immobilization. Industrial application of enzymes- food industry, textile industry, pharmaceutical industry, paper and pulp industry.

**Recommended Books:**

6. Biotechnology – U.Sathyanarayana
7. Textbook of Biotechnology- R.C.Dubey
8. Biotechnology – Principles and Application – S.C.Rastogi
9. Elements of Biotechnology – P.K.Gupta
10. Biotechnology – Kumaresan

**Reference books :**

3. Molecular Biotechnology- Glick and Pasternick
4. Molecular Biotechnology- Primrose

**Website :**

www.gate2biotech.com/instantnotes-

[www.springer.com](http://www.springer.com)

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**Semester VI**  
**Basics of Bioinformatics**

**TEACHING HOURS:75**

**CODE:**

**Credits:5**

**Unit I**

**15 hrs**

**Basics of internet** – IP address, domain names, URL; networks - LAN, WAN; communication protocols – TCP, IP, FTP, HTTP; www, web browsers, search engines. Flat files, relational, object oriented databases

**Unit II**

**15 hrs**

**Bioinformatics** - Relationship between computers and biology; Principles, challenges and applications of bioinformatics. Biological databases. NCBI, Nucleic acid sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot, PIR; Structure Database: PDB; literature database – PubMed; Data retrieval systems - Entrez

**Unit III**

**15 hrs**

Introduction to Sequences, alignments, type of alignments and their significance; Local alignment and Global alignment algorithms, Pairwise alignment (BLAST) and multiple sequence alignment (Clustal W algorithm).

**Unit IV****15 hrs**

Protein Structure: Primary, Secondary, Super Secondary, Tertiary, Quaternary, Peptide bond, phi, psi and chi torsion angles, significance of Ramachandran plot; Motif and Domain. 3D Protein structure prediction (homology modelling) and structure visualization.  
Gene prediction, human genome project and its significance, OMIM

**Unit V****15 hrs**

Basics of Phylogenetic analysis - definitions of homologs, orthologs, paralogs and xenologs; Definitions for proteomics, genomics, Metagenomics, Transcriptomics, Metabolomics, Lipidomics, Interactomics. Chemoinformatics, pharmacogenomics;  
Drug designing- Steps in drug development. Structure based drug designing.

Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004

2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellette, B.F., Wiley India Pvt Ltd. 2009

3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999

Essential Bioinformatics by Jin Xiong

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## **SEMESTER VI**

### **B.Sc Immunology**

**TEACHING HOURS:75**

**CODE:**

**Credits:5**

**Unit – I****(15 hrs)**

Infection – pathogenicity, virulence, Immunity – Innate Immunity, types, Non specific body defence- Anatomical, physiological, phagocytic, Inflammationary Barriers. Acquired Immunity – Natural, Artificial , Active , Passive. Antibody – classes, structure and biological function. Humoral and cell mediated immunity .

**Unit – II****(15 hrs)**

Cells involved in Immune response – T,B, Null cells, Structure and functions of lymphoid organs- Thymus, bone marrow, spleen, lymph nodes, MucousAssociated Lymphoid Tissue,Gut AssociatedLymphoid Tissue.

**Unit – III****(15 hrs)**

Antigen , factors affecting antigenicity, epitope , haptens , adjuvants. Clonal selection theory , Co-operation of T cells & B cells. Overview of Major Histocompatibility Complex and HLA Antigens.

**Unit – IV****(15 hrs)**

Principles of Ag-Ab interactios – Precipitation, agglutination, opsonisation , flocculation , and application. Principle – ELISA, RIA,Immuno electrophoresis and Immunofluorescence . Monoclonal Ab- Hybridoma technology and applications.

**Unit – V****(15 hrs)**

Hypersensitivity – types – I, II, III, & IV. Autoimmune diseases – Hashimotos thyroiditis and Rheumatic arthritis. Transplantation Immunology (an overview) – types of grafts, graft rejection

**Recommended Text books:**

3. Immunology (VI Edition)- Kuby
4. Essential Immunology (III Edition) –Roitt

**Reference Books**

3. Immunology an Introduction (V edition)- L.R.Tizard
4. Immunology a short course – Eli Benjamin

**Website :**



[www.whfreemen.com/kuby](http://www.whfreemen.com/kuby)

[www.immunologylink.com](http://www.immunologylink.com)

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