ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI – 600 008

DEPARTMENT OF BIOCHEMISTRY

B.SC BIOCHEMISTRY SYLLABUS

CHOICE BASED CREDIT SYSTEM

OUTCOME BASED EDUCATION

(OFFERED FROM THE ACADEMIC YEAR 2018-19)

CONTENTS

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 ratification of syllabus with effect from 2018 was held in the Department of Biochemistry on 04.09.2019. The following changes and additions suggested in the UG curricula have been implemented.

- Programme Educational Objective was aimed at producing Under graduates with Subject proficiency, Professional growth, Management skills and addressing national goals.

- Generic Programme outcomes (PO) were included that the learner will be able to apply, impart, inculcate, identify and analyze the diverse fields of life science.

- Programme Specific Outcome (PSO) facilitates the students of under graduates to pursue higher education in the field of life science

- In program profile, total numbers of hours per semester, LTP components, total minimum credits for the programme including extension activity credits were included.

- The following pattern has been suggested by the Board of Studies members to be followed in Continous Assesment (CA) and End Semester Examination

  Continuous Assessment: 50 Marks
  Section A – 7 x 2 =14
  Section B – 2/3 x 8 =16
  Section C – 1/2 x 20 =20

  End Semester Examination: 100 Marks
  Section A – 10 x 2 = 20
  Section B – 5/8 x 8 = 40
  Section C – 2/4 x 20 = 40

- Rubrics for continuous assessment for the assignment, seminar, field trip, case study, problem solving and group discussion has been included.

- Evaluation pattern for the end semester examination has been included.

- Individual course profile with course objectives, course Outcomes (CO) with knowledge level components (K1 to K5), Mapping of CO with PSO and e-learning resources were added.

- Papers namely

- Clinical Endocrinology ;
- Health for Women

Were included as Self Learning papers for advanced learners in the V semester.

Self study courses are optional for the students . The paper will carry 2 credits. They will be treated as extra credits. These courses will have no instruction by the teachers .The student must learn on her own. The department will provide the syllabus and provide guidance in the form of tutorial if necessary. These courses are offered for the benefit of advanced learners. Eligibility criteria for the paper can be defined as a student who has obtained distinction in the first two years of study, without any arrears in the UG. There will be no continuous assessment for this paper

- Additional elective papers were included in V/VI semester to offer choice to students
  - Accordingly papers namely
    - Hospital Management
    - Bioethics were added as choices in the V semester

    And papers like
    - Ecology & Environmental Toxicology
    - Plant Biochemistry were added choices in the VI semester

- It was also decided that students completing NPTEL Courses will be considered for extra credits. To obtain credits from NPTEL and College, the students must pass the proctored exams conducted by NPTEL. On obtaining certificates from NPTEL the students can produce a copy of the same to the Department. These students will be given the credits specified by NPTEL in the consolidated statement of marks as MOOC-Extra credits. It will be considered along with other extra credits.
- Internship/ Review project was included in the V semester (One Extra Credit will be awarded)
- In addition to the value added Course *Herbal remedies*, the course *Advanced Biochemical Techniques* is included as an option.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI- 6000 08

PG DEPARTMENT OF BIOCHEMISTRY

BOARD OF STUDIES MEETING – B.Sc BIOCHEMISTRY

The Board of Studies meeting was held in the Department of Biochemistry on 04.09.2019.

The Board consisted of the following members:

S.NO	MEMBER'S NAME & DESIGNATION	SIGNATURE
1.	**Dr.M. SUJATHA (CHAIRMAN BOARD OF STUDIES)** ASSOCIATE PROFESSOR & HEAD DEPARTMENT OF BIOCHEMISTRY ETHIRAJ COLLEGE FOR WOMEN CHENNAI -6000 08.	
2.	**Dr.S.SUBRAMANIAN (UNIVERSITY NOMINEE** PROFESSOR DEPARTMENT OF BIOCHEMISTRY UNIVERSITY OF MADRAS, GUINDY CAMPUS CHENNAI-6000 25	
3.	**Dr.K.A. FATHIMA** HEAD & ASSOCIATE PROFESSOR DEPARTMENT OF BIOCHEMISTRY BHARATHI WOMENS COLLEGE CHENNAI- 600 108	
4.	**Dr.P.SUMATHI** ASSISTANT PROFESSOR DEPARTMENT OF BIOCHEMISTRY QUEEN MARYS COLLEGE CHENNAI -6000 04	

5. **Dr.HEMANTH KUMAR (INDUSTRIAL REPRESENTATIVE)**

SCIENTIST –D
DEPARTMENT OF BIOCHEMISTRY & CLINICAL PHARMACOLOGY
NATIONAL INSTITUTE FOR RESEARCH IN TUBERCULOSIS
CHETPET
CHENNAI.-6000 31

6. **Dr. SAFIYA**

ASSOCIATE PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

8. **Dr. J. PRIYA**

ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

9. **Ms. KALPANA KHATRI (ALUMNA)**

B.Sc Batch (2012-2015)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI- 600008
PG DEPARTMENT OF BIOCHEMISTRY
B.Sc BIOCHEMISTRY - REVISED SYLLABUS EFFECTIVE FROM 2018-19

- **PREAMBLE**

The PG Department of Biochemistry is revising syllabi with effect from the academic year 2018-19 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 analytical 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.

As the Revised Bloom's Taxonomy is being used for teaching learning and evaluation under the Outcome Based Education to improve the skills of students, all syllabi have to be framed keeping this objective in mind.

Course objectives have to be framed keeping the teaching in mind

Course outcomes have to be framed keeping the student in mind

All outcome should be observable and measurable

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 :

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 :

COMPONENT	**NATURE OF THE QUESTION**	**MAXIMUM MARKS**
SECTION A	Remembering / Recalling concepts	20
SECTION B	Recalling / Understanding concepts	40
SECTION C	Understanding / Applying concepts	40

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

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

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

UNDERGRADUATE PROGRAMME

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

On obtaining an undergraduate degree the students will be able to:

PEO1: Apply and advance the knowledge and skills acquired, to become a creative professional in their chosen field.

PEO2: Engage in self-directed continuous learning, aimed at global competency, which will promote professional and personal growth

PEO3: Develop management skills and entrepreneurial skills, by harnessing core competencies tempered by values and ethics

PEO4: Work towards achieving economic and social equity for women through application of relevant knowledge

PEO5: Contribute to promoting environmental sustainability and social inclusivity

PROGRAMME OUTCOMES (POs)

On completion of the Programme, the learner will be able:

1. To understand the central features of the extra ordinary diverse fields of life sciences
2. To impart critical thinking and problem solving ability
3. To acquire and to apply knowledge for development of diagnostic methods
4. To inculcate aptitude towards research
5. To sensitise towards gender health and environmental related issues

PROGRAMME SPECIFIC OUTCOME (PSOs)

On completion of B.Sc Biochemistry, the student will be able to:

PSO 1.Communicate the fundamental concepts of specific molecules, enzymes, cells, organ systems and metabolism of compounds

PSO 2.Apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

PSO 3.Impart practical skills and scientific knowledge in domains of molecular biology, enzymology, genetics, clinical biology and immunology

PSO 4.Develop problem solving ability by utilizing the conceptual knowledge, analytical techniques, computational and statistical approaches.

PSO 5. Facilitate to pursue post graduationin related fields in life sciences and contribute their knowledge to the betterment of the society in various research and health care sectors.

PROGRAMME PROFILE -B.Sc BIOCHEMISTRY

SEM	PART	COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	CA	SE	TOTAL
I	I	-----	Foundation Tamil – I	3	5	75	40	60	100
I	II	-----	English	3	5	75	40	60	100
I	III	BC18/1C/CBL	Core Cell Biology	5	7	105	40	60	100
I	III	BC18/1A/CH1	Allied Chemistry I	4	4	60	40	60	100
I	III	BC18/2C/CP1	Core Practical I	-	3	45	-	-	-
I	III	BC18/2A/CHP	Allied Chemistry Practical	-	2	30	-	-	-
I	IV	-----	Non Major Elective (NME) (1a/1b/1c)	2	2	30		50	50
I	IV	-----	Soft Skill	3	2	30		50	50
II	I	-----	Language	3	5	75	40	60	100
II	II	-----	English	3	5	75	40	60	100
II	III	BC18/2C/BMO	Core –Biomolecules	5	7	105	40	60	100
II	III	BC18/2A/CH2	Allied Chemistry – II	4	4	60	40	60	100
II	III	BC18/2C/CP1	Core Practical I	3	3	45	40	60	100
II	III	BC18/2A/CHP	Allied Chemistry Practical	2	2	30	40	60	100
II	IV	-----	NME (1a/1b/1c)	2	2	30	-	50	50
II	IV	-----	Soft Skill	3	2	30	-	50	50
III	I	-----	Language	3	5	75	40	60	100
III	II	-----	English	3	5	75	40	60	100
III	III	BC18/3C/BBT	Core- Biophysical & Biochemical techniques	5	7	105	40	60	100
III	III	MB18/3A/AM1	Allied Microbiology I	4	4	60	40	60	100
III	III	BC18/4C/CP2	Core Practical II	-	3	45	40	60	100
III	III	MB18/4A/PR2	Allied Microbiology Practical	-	2	30	-	-	-
III	IV	-----	Soft skill	3	2	30	-	50	50
III	IV		Environmental	2	2	30	-	50	50

			studies						
IV	I	-----	Language	3	5	75	40	60	100
IV	II	-----	English	3	5	75	40	60	100
IV	III	BC18/4C/ENZ	Core-Enzymes	5	7	105	40	60	100
IV	III	MB18/4A/AM2	Allied Microbiology II	4	4	60	40	60	100
IV	III	BC18/4C/CP2	Core Practical II	3	3	45	40	60	100
IV	III	MB18/4A/PR2	Allied Microbiology Practical	2	2	30	40	60	100
IV	IV		Soft skill	3	2	30	-	50	50
IV	IV	-	Value Education	2	2	30	-	50	50
V	III	BC18/5C/IM1	Core -Intermediary Metabolism-I	4	4	60	40	60	100
V	III	BC18/5C/IM2	Core -Intermediary Metabolism-II	4	4	60	40	60	100
V	III	BC18/5C/CBC	Core–Clinical Biochemistry	4	4	60	40	60	100
V	III	BC18/5C/PHY	Core – Physiology	4	4	60	40	60	100
V	III	BC18/5E/BBS BC18/5E1/HSM BC18/5E2/BIE	Elective	5	5	75	40	60	100
V	III		Self Learning Papers						
V	III	BC18/6C/CP3	Core practical- III	-	4	60	40	60	100
V	III	BC18/6C/CP4	Core practical- IV	-	5	75	40	60	100
VI	III	BC18/6C/MBO	Core -Molecular Biology	4	4	60	40	60	100
VI	III	BC18/6C/GNB	Core – Genetics & Nutritional Biochemistry	4	4	60	40	60	100
VI	III	BC18/6C/BTY	Core-Biotechnology	4	4	60	40	60	100
VI	III	BC18/6E/IMY	Elective – Immunology	5	5	75	40	60	100
VI	III	BC18/6E/BBI BC18/6E1/EET BC18/6E2/PBC	Elective	5	5	75	40	60	100
VI	III	BC18/6C/CP3	Core practical- III	3	4	60	40	40	100
VI	III	BC18/6C/CP4	Core practical- IV	3	4	60	60	60	100

EXTENSION ACTIVITIES – COMPULSORY & ADDITONAL

S.No	Compulsory / Additional	Activity
1	**Compulsory**	**Sports , YRC, RRC, NCC, NSS, CSS, Rotract**
	Additional	**E-Cell, Consumer Club, Enactus, Value added courses**

Total minimum credits for the programme (B.Sc Biochemistry):

139 (UG Programme) + 1(Compulsory Extension activity credits) = **140**

EVALUATION PATTERN FOR CONTINIOUS ASSESSMENT-UG

INTERNAL VALUATION BY COURSE TEACHERS (B.Sc Biochemistry)

PART I, II AND III-THEORY PAPERS

COMPONENT	TIME	MAX.MARKS	CAMARK
1. TEST I	2 HRS	50 MARKS (TO BE CONVERTED)	10
2.TEST II	2 HRS	50 MARKS (TO BE CONVERTED)	10
3.ASSIGNMENT/SEMINAR/ FIELD VISIT			10
4.PARTICIPATORY LEARNING			10
		Total	**40**

PART III- PRACTICAL PAPERS

COMPONENT	MAX.MARKS	CAMARK
1. MODEL PRACTICAL EXAM	50 MARKS (TO BE CONVERTED)	20
2. PARTICIPATORY LEARNING		20
	Total	**40**

CA QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-6X2 marks	50	12	50
K1. K 2	B-3/5x6marks	500	18	
K2, K 3	C-1/2x20 marks	1500	20	

CA QUESTION PAPER PATTERN FOR PART IV

Knowledge Level	Section	Word Limit	Marks	Total
K 1, K2	A-5X10	350	50	50

RUBRICS FOR CONTINIOUS ASSESSMENT

Assignment	**Content/originality/Presentation/Schematic Representation and Diagram/Bibliography**
Seminar	**Organisation/Subject Knowledge/Visual Aids/Confidence level/presentation-Communication and Language**
Field Visit	**Participation/Preparation/Attitude/Leadership**
Participation	**Answering Questions/Clearing Doubts/Participating in Group Discussions/Regular Attendance**
Case Study	**Finding the Problem/Analysis/Solution/Justification**
Problem Solving	**Understanding Concepts/Formula and Variable Identification/Logical Sequence/Answer**
Group Discussion	**Preparation/Situation Analysis/Relationship Management/Information Exchange/Delivery Skills**
Flipped/Blended Learning	**Preparation/Information Exchange/ Group interaction/Clearing doubts**

- FIRST FOUR RUBRICS SHOULD BE INCLUDED.
- OTHERS ARE OPTIONAL BASED ON TEACHING-LEARNING METHODOLOGY ADOPTED FOR THE PROGRAMME OF STUDY

EVALUATION PATTERN FOR END SEMESTER - UG

THEORY PAPERS

PART I/II/III (Choose what is offered by the Department-delete the rest)

SEMSTER I/II/III/IV/V/VI

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARK: 40

PART IV

SINGLE VALUATION

ORAL TEST/WRITTEN TEST

MAXIMUM MARKS: 50

PASSING MARK:20

PRACTICAL PAPERS

PART III

SEMSTER I/II/III/IV/V/VI

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100

PASSING MARKS:40

SEMESTER I COURSE PROFILE-B.Sc BIOCHEMISTRY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
-----	Foundation Tamil – I	3	5	75	--	40	60	100
-----	English	3	5	75	--	40	60	100
BC18/1C/CBL	Core Cell Biology	5	7	105	5-2-0	40	60	100
BC18/1A/CH1	Allied Chemistry I	4	4	60	3-1-0	40	60	100
BC18/2C/CP1	Core Practical I	-	3	45	0-0-3	-	-	-
BC18/2A/CHP	Allied Chemistry Practical	-	2	30	0-0-2	-	-	-
-----	Non Major Elective (NME) (1a/1b/1c)	2	2	30	2-0-0	-	50	50
-----	Soft Skill	3	2	30	--	-	50	50
	TOTAL CREDITS	20						

SEMESTER II COURSE PROFILE-B.Sc BIOCHEMISTRY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
-----	Language	3	5	75	--	40	60	100
-----	English	3	5	75	--	40	60	100
BC18/2C/BMO	Core –Biomolecules	5	7	105	5-2-0	40	60	100
BC18/2A/CH2	Allied Chemistry – II	4	4	60	3-1-0	40	60	100
BC18/2C/CP1	Core Practical I	3	3	45	0-0-3	40	60	100
BC18/2A/CHP	Allied Chemistry Practical	2	2	30	0-0-2	40	60	100
-----	NME (1a/1b/1c)	2	2	30	2-0-0	-	50	50
-----	Soft Skill	3	2	30	--	-	50	50
	TOTAL CREDITS	25						

SEMESTER III COURSE PROFILE-B.Sc BIOCHEMISTRY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
-----	Language	3	5	75	----	40	60	100
-----	English	3	5	75	--	40	60	100
BC18/3C/BBT	Core- Biophysical & Biochemical techniques	5	7	105	5-2-0	40	60	100
MB18/3A/AM1	Allied Microbiology I	4	4	60	---	40	60	100
BC18/4C/CP2	Core Practical II	-	3	45	0-0-3	40	60	100
MB18/4A/PR2	Allied Microbiology Practical	-	2	30	---	40	60	100
-----	Soft skill	3	2	30	--	-	50	50
	Environmental studies	2	2	30	2-0-0	-	50	50
	TOTAL CREDITS	20						

SEMESTER IV COURSE PROFILE-B.Sc BIOCHEMISTRY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
-----	Language	3	5	75	--	40	60	100
-----	English	3	5	75	---	40	60	100
BC18/4C/ENZ	Core- Enzymes	5	7	105	5-2-0	40	60	100
MB18/4A/AM2	Allied Microbiology II	4	4	60	---	40	60	100
BC18/4C/CP2	Core Practical II	3	3	45	0-0-3	40	60	100
MB18/4A/PR2	Allied Microbiology Practical	2	2	30	---	40	60	100
	Soft skill	3	2	30	---	-	50	50
-	Value Education	2	2	30	2-0-0	-	50	50
	TOTAL CREDITS	25						

SEMESTER V COURSE PROFILE-B.Sc BIOCHEMISTRY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
BC18/5C/IM1	Core -Intermediary Metabolism-I	4	4	60	4-0-0	40	60	100
BC18/5C/IM2	Core -Intermediary Metabolism-II	4	4	60	4-0-0	40	60	100
BC18/5C/CBC	Core–Clinical Biochemistry	4	4	60	4-0-0	40	60	100
BC18/5C/PHY	Core – Physiology	4	4	60	4-0-0	40	60	100
	Elective *	5	5	75	5-0-0	40	60	100
BC18/6C/CP3	Core practical- III	-	4	60	0-0-4	-	-	-
BC18/6C/CP4	Core practical- IV	-	5	75	0-0-5	-	-	-
	TOTAL CREDITS	21						

***Elective Paper Options**

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
BC18/5E/BBS	Bioinstrumentation & Biostatistics	5	5	75	5-0-0	40	60	100
BC18/5E1/HSM	Hospital Management	5	5	75	5-0-0	40	60	100
BC18/5E2/BIE	Bioethics	5	5	75	5-0-0	40	60	100

Self Learning Papers

COURSE CODE	TITLE OF THE PAPER	CREDITS
	Clinical Endocrinology	2
	Health for Women	2

SEMESTER VI COURSE PROFILE-B.Sc BIOCHEMISTRY

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
BC18/6C/MBO	Core -Molecular Biology	4	4	60	4-0-0	40	60	100
BC18/6C/GNB	Core – Genetics & Nutritional Biochemistry	4	4	60	4-0-0	40	60	100
BC18/6C/BTY	Core-Biotechnology	4	4	60	4-0-0	40	60	100
BC18/6E/IMY	Elective – Immunology	5	5	75	5-0-0	40	60	100
	Elective*	5	5	75	5-0-0	40	60	100
BC18/6C/CP3	Core practical- III	3	4	60	0-0-4	40	60	100
BC18/6C/CP4	Core practical- IV	3	4	60	0-0-4	40	60	100
	TOTAL CREDITS	28						

***Elective Paper Options**

COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
BC18/6E/BBI	Elective- Basics of Bioinformatics	5	5	75	5-0-0	40	60	100
BC18/6E1/EET	Ecology and Environmental Toxicology	5	5	75	5-0-0	40	60	100
BC18/6E2/PBC	Plant Biochemistry	5	5	75	5-0-0	40	60	100

ALLIED PAPERS OFFERED FOR I B. Sc MICROBIOLOGY

SEM	COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
I	BC18/1A/AB1	Allied Biochemistry –I	4	4	60	4-0-0	40	60	100
II	BC18/2A/AB2	Allied Biochemistry –II	4	4	60	4-0-0	40	60	100
I & II	BC18/2A/ABR	Allied Biochemistry Practical	2	2	30	0-0-2	40	60	100
		TOTAL CREDITS	10						

ALLIED PAPERS OFFERED FOR I B. Sc CLINICAL NUTRITION AND DIETETICS

SEM	COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
I	BC18/1A/BC1	Allied Basic Chemistry -I	4	4	60	4-0-0	40	60	100
II	BC18/2A/BC2	Allied Basic Chemistry –II	4	4	60	4-0-0	40	60	100
I & II	BC18/2A/CHP	Allied Chemistry Practical	2	2	30	0-0-2	40	60	100
		TOTAL CREDITS	10						

NME (1c) SUBJECT FOR OTHER DEPARTMENTS

SEM	COURSE CODE	TITLE OF THE PAPER	CREDITS	HOURS/WK	TOTAL HOURS	L-T-P	CA	SA	TOTAL
II	BC18/1N/YOD	Yoga and Diet For Health	3	2	30	2-0-0	--	50	50
III	BC18/2N/LDW	Life Style Diseases In Women	3	2	30	2-0-0	--	50	50
		TOTAL CREDITS	6						

SEMESTER I

CELL BIOLOGY

TOTAL HOURS: 105 **COURSE CODE: BC18/1C/CBL**

CREDITS: 5 **LTP: 5-2-0**

COURSE OBJECTIVES:

1. To gain an understanding on the basic components of prokaryotic and eukaryotic cells.
2. To know about the membrane components and their structure.
3. To understand various modes of transport of substances across the membrane.
4. To know about different cell types, surfaces and junctions.
5. To provide knowledge on cellular process, function and regulation.

COURSE OUTLINE

UNIT I (21 hours)

The cell and cell organelles : Prokaryotic cell – E.Coli, Eukaryotic cell-Plant cell, Animal cell. Cytoskeleton microtubules and microtubular organization. Endomembrane system -Endoplasmic reticulum, Golgi complex, Intracellular organelles – Mitochondria, Chloroplast, Lysosome, Peroxisomes and Glyoxisomes and Nucleus.

UNIT II (21 hours)

Cell membrane – Functions of plasma membrane, Models of cell membrane – Lipid bilayer, Sandwich model and Fluid mosaic model. Composition of membrane – Membrane lipids, Carbohydrates, Proteins and their functions , Membrane asymmetry and fluidity. Cell boundries: Cell coat, Cell wall –Structure, Composition and Function.

UNIT III (21 hours)

Membrane transport: Passive transport – Osmosis, Simple and Facilitated diffusion (Ligand and Voltage Gated Channels), Active transport – Uniport, Symport, Antiport, Bulk transport – Exocytosis, Phagocytosis and Endocytosis (Pinocytosis and Receptor mediated endocytosis).

UNIT IV (21 hours)

Cell types and function: Epithelial cell – Simple and Compound, Muscle cell – Skeletal, Cardiac, Smooth muscle cells.Nervecell,Cancer cell. Differentiation of cell surface – Invagination, Microvilli, Basement membrane, Tight junction, Desmosome, Gap junction, Extracellular matrix and functions- Collagen,Hyaluronicacid,Heparin,Dermatin Sulphate and keratin Sulphate.

UNIT V (21 hours)

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. Cell renewal, Stem cells-Embryonic and adult stem cell.

RECOMMENDED BOOKS

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology - Dr P S Verma and Dr V K Agarwal. 2004 Edition, Chand (S.) & Co Ltd, India,.
2. Cell Biology- Channarayappa, 2010 Edition, Orient Black Swan / Universities Press.

REFERENCE BOOKS:

1. The World of the Cell - Wayne M. Becker, Lewis J. Kleinsmith, Jeff Hardin, Gregory Paul Bertoni, 7th Edition, Pearson Publisher, 2009.
2. The Cell: A Molecular Approach- Geoffrey M. Cooper , Robert E. Hausman, 4th Edition , ASM Press, 2007.
3. Cell and Molecular Biology - PragyaKhanna**,** 2008 Edition, IK International Publishing House Pvt. Ltd.
4. Lehninger Principles of Biochemistry- `David L. Nelson & Michael M.Cox, 4th Edition, W. H. Publication, 2004
5. Biochemistry-Donald Voet& Judith G. Voet ,3rd Edition, John Wiley and Sons Publication, 2004

JOURNALS:

1. Indian Journal of Experimental Biology
2. European journal of Cell biology – Elsevier
3. The international journal of Biochemistry & cell biology-Elsevier

E-LEARNING RESOURCES:

1. https://youtu.be/iuW3nk5EADg
2. https://youtu.be/Fp1wKo72b2A
3. https://youtu.be/6AfRX6oh9-E
4. https://www.youtube.com/watch?v=xsrH050wnIA
5. https://www.youtube.com/watch?v=XkZ8PZW9a9Q

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Distinguish between prokaryotes and eukaryotes and understand the biological actions carried out by organelles	K1, K2, K3
CO 2	Apply the knowledge to link the structure and functions of different components in the envelope system	K2, K3
CO3	Relate and apply the concept to solute transport and Immunological processes.	K3, K4

CO4	Predict the nature and mechanism of cell differentiation to various activities.	K2, K3,K4
CO5	Reason and think about how cells divide and die in daily life process.	K2, K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**3**	**3**
AVERAGE	**2.8**	**2.6**	**2.6**	**2.4**	**2.6**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER I

ALLIED CHEMISTRY - I

(For I B.Sc Biochemistry)

TOTAL HOURS: 60 **COURSE CODE: BC18/1A/CH1**

CREDITS: 4 **LTP: 3-1-0**

COURSE OBJECTIVES:

1. The introduction of how atoms bond together to form molecules and compounds are how these particles arrange themselves in all the matter around us.
2. The classification of organic reaction is introduced. To interpret and use the terminology associate with organic reactions.
3. To learn how chemical reaction can produce electricity.
4. To learn the various concepts of Acids and bases. Introducing pH,and buffers.
5. To understand various types of volumetric titrations and the chemical reaction associated with each type of volumetric titration**.**

COURSE OUTLINE:

UNIT I (12 hours)

a. Chemical bonding- Definition- Types of bonds - Formation of different bonds with examples --Ionic bond – NaCl, KCl-Covalent bond- Single bond- H2S,HCl, Multiple bond, Molecular orbital theory, Bonding, Non Bonding, Anti Bonding orbitals., Molecular orbital Configuration of Nitrogen, Oxygen and Flourine. Bond order, Diamagnetism and Paramagnetism.Co ordinate bond –Hydronium ion , Ammonium ion--Hydrogen bond – Inter and Intra molecular Hydrogen bonding e.g. O & P Nitro phenol-- Vanderwaals force.

b. Shapes of molecules – VSERR Theory & Hybridization CH_4, H_2O, NH_3, BrF_3,SF_6, IF_5, IF_7.

UNIT II (12 hours)

Mechanistic basis of organic reactions – Electronic displacement effects- Inductive, Resonance and Steric effects. Definition of substrates – Electrophiles , Nucleophiles – Elementary treatments of Substitution reactions SN1 , SN2 Walden inversion - Aromatic Electrophilic substitution (Nitration, Sulphonation) - Elimination Reaction- E1 , E2 Hoffmann and saytzeff rule- Addition Reaction – Markonikoff's rule and Kharash effect.

UNIT III (12 hours)

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 hours)

Acids and Bases – Arrehenius 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 hours)

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 – Acidimerty and Alkalimentry – 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, 3rd edition
2. Text Book of Allied Chemistry-Dr.V.Veeraiyan et al,Highmount Publishing House

REFERENCE BOOKS:

1. Modern Inorganic Chemistry-R.D.Madan,2008
2. Textbook Organic Chemistry-P.L.Soni,H.M.Chawla,29th edition ,2007.
3. Principles of Physical Chemistry-P.L.Soni,U.N.Dash,23rd revised edition,2007.
4. Chemistry for degree students – RL Madan, S.Chand Publishers, 2010.
5. Textbook Physical Chemistry-Puri & Sharma, 38th edition , 2007

JOURNALS

1. Indian Journal of Chemistry
2. Journal of Saudi Chemical Society

E-LEARNING RESOURCES:

1. http://www.chemistry.org
2. http://www.chemhelper.com
3. MATLAB
4. https://swayam.gov.in
5. https://nptel.ac.in

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Gain knowledge on the types of bonds, understand VB and MO theories. Learn the concept of intermolecular forces. Deduce the shape of different polyatomic molecules.	K1, K2
CO2	Able to describe the mechanism of electrophilic and nucleophilic substitution reactions. Learn how to apply rules in addition and elimination reactions.	K1, K2, K3
CO3	Able to classify the electrolytes To differentiate conductors and insulators.Familiarize with the laws of electricity.	K1, K2
CO4	Able to explain qualitatively the difference in behavior between strong and weak acids and bases and the pH values of their aqueous solution e to apply the uses of buffer.	K2, K3
CO5	To familiarize with term molarity, molality normality and formality and indicators. Based on law of mass action to arrive at the amount of substance in a unknown solution.	K2,K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**3**	**3**
CO2	**2**	**2**	**2**	**1**	**2**
CO3	**2**	**2**	**2**	**1**	**2**
CO4	**2**	**2**	**2**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**
AVERAGE	**2**	**2**	**2**	**2.2**	**2.4**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2.Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER II

BIOMOLECULES

TOTAL HOURS: 105 **COURSE CODE: BC18/2C/BMO**

CREDITS: 5 **LTP: 5-2-0**

COURSE OBJECTIVE

1. To inculcate the knowledge on different types of carbohydrates and their structure.
2. To instill the knowledge on the structure and types of amino acids, proteins and their organization.
3. To impart the fundamental knowledge about lipids and their types. .
4. To understand the structural and functional aspects of compound and derived lipids.
5. To provide knowledge on the structure and function of DNA and RNA.

COURSE OUTLINE

UNIT I (21 hours)

Carbohydrates – Classification, Biological functions, Optical isomerism of Sugars, Van'thoff rule, Kiliani's cyanohydrin synthesis, Epimers, Enantiomers, Mutarotation, Racemic mixture, Anomeric Forms. Introduction to Haworth structures. Monosaccharides (Glucose, Fructose), Disaccharides (Lactose, Sucrose), Polysaccharides - Homopolysaccharides (Starch, Glycogen), Hetero polysaccharides.-Muco polysaccharides (Heparin, Chondroitin sulphate).

UNIT II (21 hours)

Amino acids – Amphoteric nature, Isoelectric pH, Zwitter ion, 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. Protein Structure – Primary, Secondary, Super secondary structures, Tertiary structure and Quaternary Structure . Forces stabilizing protein structure.

UNIT III (21 hours)

Lipids- 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.

UNIT IV (21 hours)

Phospholipids-Structure and Biological functions of Lecithin, Cephalins, Phosphotidyl serine, Plasmalogens, Glycolipids (Cerebrosides, Gangliosides), Derived lipids (Cholesterol, Bile acids and Bile salts).Lipoproteins and their functions.

UNIT V (21 hours)

Structure of Purine and Pyrimidine bases, Nucleosides, Nucleotides.Cyclic nucleotides-AMP, GMP. Structure of different types of DNA-A,B and Z. Structure and role of different types of RNA- mRNA, rRNA, tRNA (Clover leaf), Heterogenous nuclear RNA. Denaturation, Melting temperature, Hyperchromicity and Annealing of DNA.

BOOKS RECOMMENDED:

1. Fundamentals of Biochemistry- J L Jain, Sunjay Jain and Nithin Jain, 2004 Edition, S.Chand Publishers.
2. Biochemistry - U Satyanarayana, 4th Edition, Elsevier India, 2013**.**

REFERENCE BOOKS

1. Lehninger Principles of Biochemistry- `David L. Nelson & Michael M.Cox, 4th Edition, W. H. Freeman Publication, 2004
2. Biochemistry-Donald Voet& Judith G. Voet ,3rd Edition, John Wiley and Sons Publication, 2004
3. Biochemistry- Jeremy M Berg, John L Tymoczko, and LubertStryer,6th Edition, Freeman Publications, 2006.
4. Textbook of Medical Biochemistry – MN Chatterjee & Rana Shindee, 7th Edition, Jaypee Publishers, 2007.
5. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, 1st Edition, Cengage Learning, 2009.

JOURNALS:

1. Indian Journal of Biochemistry & Biophysics
2. Indian Journal of Experimental Biology
3. International Journal of Biological Macromolecules

E-LEARNING RESOURCES:

1. https://youtu.be/iuW3nk5EADg
2. https://youtu.be/Fp1wKo72b2A
3. https://youtu.be/6AfRX6oh9-E
4. https://youtu.be/o_-6JXLYS-k
5. https://youtu.be/0lZRAShqft0

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Relate the role of sugars in energy production and living systems	K1, K2, K3
CO 2	Apply the link between the structure and functions of proteins in biological context	K1, K2, K3
CO3	Demonstrate the role of lipids and apply the techniques to identify their purity	K2, K3, K4
CO4	Relate the structure of lipids with their reactivity in biological membrane systems and life processes.	K3, K4
CO5	Apply the structural studies to the biological processes like replication, transcription and translation	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	3	3	2	2
CO3	3	3	2	3	3
CO4	3	3	3	3	3
CO5	3	2	3	3	3
AVERAGE	2.8	2.8	2.8	2.8	2.8

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER – II

ALLIED CHEMISTRY – II

(For I B. Sc Biochemistry)

TOTAL HOURS: 60 **COURSE CODE: BC18/2A/CH2**

CREDITS: 4 **LTP: 3-1-0**

COURSE OBJECTIVES

1. To know the condition for co-ordinate bond and chelate formation.
2. To learn the definition and classification of fuel gases, synthetic inorganic polymers and dyes.
3. To understand the definition and classification of drugs.
4. To learn different electrodes and their functions.
5. To discuss more common methods of securing pure organic compound from natural source or from reaction product mixture.

COURSE OUTLINE:

UNIT I (12 hours)

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.TDS

UNIT II (12 hours)

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 hours)

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

Antibiotics – Penicillin, Chloramphenicol. Definition and example for Analgesics, Antipyretics, Tranquillizers, Sedatives, Hypnotics, Local and General Anaesthetics.Steroidal drugs,Non Steroidal inflammatory drugs.

UNIT IV (12 hours)

Electrochemistry – Thermodynamic concept of electrode potential (Nernst equation). Electro motive force, Measurement of emf using Oxygen, Calomel, Quinhydrone electrodes. Single electrode potential – Standard Hydrogen electrode, Electrochemical series and its uses .

UNIT V (12 hours)

Isolation and Purification of Organic Compounds – Extraction , Differential extraction , Distillation, Fractional distillation , Steam distillation Crystallization, Sublimation, Food chemistry – Quality of lipids- rancidity, acid number, iodine number, saponification number. 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.

RECOMMENDED TEXTBOOKS:

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

REFERENCE BOOKS:

1. Modern Inorganic Chemistry-R.D.Madan,2008
2. Textbook Organic Chemistry-P.L.Soni,H.M.Chawla,29th edition ,2007.
3. Principles of Physical Chemistry-P.L.Soni,U.N.Dash,23rd revised edition,2007.
4. Food Chemistry – Alex V.Ramani, MJP Publishers, 2009.
5. Chemistry for degree students – RL Madan, S.Chand Publishers, 2010

JOURNALS

1. Indian Journal of Chemistry
2. Journal of Saudi Chemical Society

E-LEARNING RESOURCES:

1. http://www.chemistry.org
2. http://www.chemhelper.com
3. MATLAB
4. https://swayam.gov.in
5. https://nptel.ac.in

COURSE OUTCOMES

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Able to name different co-ordinate compounds. Familiarize with the application of chelates in biological system and thereby their application in the field of medicine.	K1, K2
CO2	Apply the usage of fuel gas and dyes in daily life.	K1, K2, K3
CO3	Able to describe the mode of action of different drugs.	K1, K2
CO4	ıses and effects of Food adulteration and awareness to select Wholesome and non adulterated food.	K2, K3
CO5	Develop knowledge on the relation between the structure and properties of compounds.	K2,K3

	Various methods used to separate mixture of compounds and identify their compounds.	

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	3
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2
AVERAGE	2	2	2	2	2.2

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER I & II

CORE PRACTICAL I

TEACHING HOURS: 90 **CREDITS: 3**

CODE: BC18/2C/CP1 **LTP: 0 0 3**

COURSE OBJECTIVES

1. To understand the structure of various cell types in the body
2. To identify the major types of sugar and its structure.
3. To identify the various aminoacids from unknown samples.
4. To impact the students to train the preparations of starch and casein

COURSE OUTLINE:

1. **Identification of Slides**

   a. Epithelial cell-Squamous,Cuboidal,Columnar,Ciliated
   b. Cardiac muscle cell, Skeletal muscle cell, Smooth muscle cell
   c. Stages of mitosis
   d. Stages of meiosis

2. **Qualitative Analysis of Carbohydrates:**

Monosaccharides	:	Glucose, Fructose
Disaccharides	:	Sucrose, Maltose
Polysaccharides	:	Starch, Dextrin

3. Qualitative Analysis of Amino acids:

Tyrosine, Tryptophan, Cysteine and Arginine.

4. **Group experiments**

   1. Preparation of Starch from Potato
   2. Preparation of Casein from Milk

COURSE OUTCOMES:

1. Developing skills of microscopic examination of various types of cells.
2. Apply the analytic skills to identify the major sugars.
3. Apply the analytic skills of amino acids.
4. Acquire the knowledge of preparation of compounds from samples.

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
AVERAGE	2.5	2.5	2.5	2.5	2.5

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Hands on Training

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

TOTAL HOURS: 60 **COURSE CODE: BC18/2A/CHP**

CREDITS: 2 **LTP: 0-0-2**

COURSE OBJECTIVES:

1. To write and construct balanced equation.
2. To deduce stoichiometric relationship from calculation.

COURSE OUTLINE:

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.

1. Reaction of Aldehyde (Aromatic).
2. Reaction of Carbohydrates.
3. Reaction of Carboxylic Acid (Mono & Di).
4. Reaction of Phenol.
5. Reaction of Amine (Aromatic, primary).
6. Reaction of Amide (Mono & Di).
7. Reaction of Ketone (Not for exam)

COURSE OUTCOMES:

1. Able to arrive at a overall identification of the substance under investigation.
2. Prepare a systematic report on the analysis and submit
3. Gain hands on knowledge on the analysis of organic substances

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	2.3	2.3	2.3	2.3	2.3

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Hands on Training

SEMESTER III

BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

TOTAL HOURS: 105 **COURSE CODE :BC18/3C/BBT**

CREDITS: 5 **LT P: 5:2:0**

COURSE OBJECTIVES:

1. To Impart Knowledge about safety aspects of handling laboratory instruments.
2. To expose the students to various chromatographic techniques and fundamentals of radioactivity.
3. To appreciate electrophoretic and electrochemical principles in separation of compounds.
4. To understand the fundamentals of centrifugation techniques.
5. To study the principles and applications of spectroscopic methods.

COURSE OUTLINE:

UNIT I (21 hours)

Safety aspects of laboratory instruments - Care of instruments, Balances, types of balances.Colloids - Introduction, Classification, Properties of colloids – Tyndall effect, Brownian movement and Electrical double layer. Ultrafiltration- Biological significance.Donnan Membrane Equilibrium.Definition , Determination and Biological Significance of Viscosity, Surface tension and Osmotic pressure, Concept of Osmolarity and its significance.

UNIT II (21 hours)

Chromatographic techniques – General Principles of Chromatography, Principles,Operational procedures and Applications of Paper, Thin layer, Gel permeation, Ion exchange , Affinity and Gas liquid chromatography.

Radioisotopes, Nature of radioactive decay, 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 C^{14} ,I^{121},Baetc.Role of various radio isotopes in diagnosis.

UNIT III (21 hours)

Electrophoretic techniques - General principles, 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 Electrochemical Techniques - Measurement of pH by Glass electrode,HendersonHassalbalch equation, pH of buffer solutions, Biological buffers.

UNIT IV (21 hours)

Centrifugation techniques: Basic principles of centrifugation, Rotors, Types of centrifugation- Preparative and Analytical. Differential & Density gradient - Isopycnic, Rate zonal centrifugation technique.Analyticalultra centrifugation, Application with special reference to determination of molecular weight of Macromolecules (with derivation).

UNIT V (21 hours)

Basic principles of Electromagnetic radiation – Energy , Wavelength , Wave number and Frequency. Absorption and Emission Spectra .Beer Lambert law , Absorbance and Transmittance. Colorimetry – Principle, Instrumention and Applications.UV Spectrophotometry - Principle and Instrumentation. Spectrofluorimetry- Principle, Instrumentation and Application (Estimation of Thiamine).

RECOMMENDED TEXT BOOKS:

1. Practical Biochemistry (V Edition)- Keith Wilson & John Walker, Cambridge University pres
2. Biophysical chemistry – Debajyothi Das,10^{th} edition,2000.

REFERENCE BOOKS:

1. Introductory Practical Biochemistry – Randhir Singh and S.K.Sawhney ,10th reprint 2014
2. Instrumental methods of Chemical analysis- Chatwal Anand , Himalaya Publishing House ,2005.
3. Instrumental methods of Chemical analysis- BK Sharma, 24^{th} Edition, Goel Publishing House ,2005.
4. An Introduction to Practical Biochemistry , David T. Plummer, 3^{rd} Edition, Mc GRAW – HILL Company, 1987.
5. Introductory Practical Biochemistry, SK Sawhney & Randhir Singh, 10^{th} Edition, Narosa Publishers, 2014.

JOURNALS:

1. Biophysical journal-cell
2. Biophysical journal-Elsevier

E-LEARNING RESOURSES:

1. https://youtu.be/LhCJFxVTBks
2. https://youtu.be/PvHvx7k7UPU
3. https://youtu.be/hXJxTqGb_XU
4. https://youtu.be/MW4PwJxxyt0
5. https://youtu.be/kxNP2qv4nb8

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Acquire and follow the safe lab practices and handling various balances, knowledge of colloids from physical and chemical perspectives ,interfacial phenomenon in which central themes are surface tension ,viscosity and osmotic pressure.	K1,K2&K3
CO 2	Able to apply various chromatographic techniques and radioisotopes and gain knowledge of electromagnetic radiation and apply them practically	K3, K4
CO3	Use appropriate electrophoretic methods in separation of biomolecules and the properties of buffers and measurement of pH by glass electrode.	K3,K4
CO4	Acquire knowledge about centrifugations ,types and its applications.	K3, K4
CO5	Appreciate the principle,instrumentation and the difference between various spectroscopic methods to choose analyzing biological samples.	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2.0	3.0	2.0	2.0	2.0
CO2	3.0	3.0	3.0	3.0	3.0
CO3	3.0	3.0	3.0	3.0	3.0
CO4	3.0	3.0	3.0	3.0	3.0
CO5	3.0	3.0	3.0	3.0	3.0
AVERAGE	2.8	3.0	2.8	2.8	2.8

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER IV

ENZYMES

TOTAL HOURS: 105 **COURSE CODE: BC18/4C/ENZ**

CREDITS: 5 **LT P: 5:2:0**

COURSE OBJECTIVES:

1. To Impart Knowledge about properties of enzymes and the principles underlying their catalytic power.
2. To expose the students to various models of enzyme substrate complex and factors affecting their catalytic activity.
3. To introduce enzyme kinetics that provides much of the framework for any discussion of enzymes.
4. To appreciate the various methods involved in enzyme extraction and isolation.
5. To understand the purification techniques of enzymes and designer enzymes.

COURSE OUTLINE:

UNIT I (21 hours)

Rate of reaction, standard free energy, activation energy, transition state, chemical equilibrium in biological context, enzymes as biocatalyst, progress curve of uncatalysed and catalysed reaction.Classification of enzymes according to International Union of Biochemistry Convention. Definitions - Apoenzyme, holoenzyme, zymogens. Coenzymes - Role of NAD, TPP, PLP.Metal cofactors in enzyme catalysis.

UNIT II (21 hours)

ES complex formation, lock and key model and induced fit model. Active site (definition, characteristic features), Enzyme specificity. Factors influencing enzyme activity – pH, temperature, substrate, modulators (Activators, inhibitors), Enzyme units - IU &Katal.

UNIT III (21 hours)

Enzyme Kinetics - MichaelisMenten 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, conserted model, feedback inhibition with ATCase as an example.

UNIT IV (21 hours)

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

UNIT V (21 hours)

Purification of enzymes- dialysis, chromatography, electrophoresis - Criteria of purity of enzymes. Definition – Isoenzymes, Ribozymes, abzymes. Multienzyme complex - pyruvate dehydrogenase complex.

RECOMMENDED BOOKS:

1. Enzyme – Palmer, 18th edition ,2004.London: Portland Press
2.Enzyme Technology-AnushaBaskar and VGVidhya,Mjp Publishers,2009

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. Biochemistry-Donald Voet& Judith G. Voet ,3rd Edition, John Wiley and Sons Publication, 2004
4. Biochemistry- Jeremy M Berg, John L Tymoczko, and LubertStryer,6th Edition, Freeman Publications, 2006.
5. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, 1st Edition, Cengage Learning, 2009.

JOURNALS:

1. Enzyme Research
2. Journal of Enzyme and Microbial Technology

E-LEARNING RESOURCES:

1. https://youtu.be/j00Ep0Byu0Y
2. https://youtu.be/uAi1LJUHUOY
3. https://youtu.be/AusY2gGf0Ao
4. https://youtu.be/a-mYtHIrXR0
5. https://youtu.be/7h0XrF1BleM

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discussing concepts of activation energy and cellular reactions to occur by a biocatalyst .Ever increasing number of newly discovered enzymes ,a system for naming and classifying enzymes must be known and also the role of coenzymes in enzyme catalyzed reaction.	K1,K2,K3
CO 2	Comprehend the role of enzyme substrate complex formation and types of models and enzyme specificity.	K2, K3
CO3	Apply the kinetics of enzyme such as MM equation,LB plot and Eadie Einstein	K2,K3,K4

	mechanisms in various field of enzyme technology.	
CO4	Discuss techniques of enzyme extraction from various tissues and Isolation, intracellular localization of enzymes,marker enzymes an intensive research on the enzymes catalyzing the reactions of cell metabolism.	K3, K4,
CO5	Apply purification techniques of enzymes,properties of multienzyme complex and designer enzymes as an important practical tools in medicine, food processing,chemical industry and in agriculture.	K3, K4,

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**3**
CO2	**3**	**3**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**
AVERAGE	**2.8**	**2.8**	**2.6**	**2.6**	**2.6**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER – III & IV
CORE PRACTICAL- II

TOTAL HOURS: 90 **COURSE CODE: BC18/4C/CP2**

CREDITS: 3 **LTP: 0-0-3**

COURSE OBJECTIVES:

To impart hands-on training in redox reactions and to train them in separation of biomolecules by analytical techniques.

COURSE OUTLINE:

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

II. Preparation of buffers- Phosphate buffer, Tris buffer

III. Group Experiment

1. Estimation of Calcium in milk – Titrimetry
2. Estimation of Reducing sugars by DNSA method - Colorimetry

IV. Demo Experiments

1. Separation of Aminoacids by paper chromatography
2. Separation of Plant pigments by column chromatography
3. Separation of DNA by agarose electrophoresis

COURSE OUTCOMES:

1. Development of practical skill on redox reaction experiments
2. Prepare various buffer solutions
3. Apply the chromatographic skills to separate amino acids, DNA and plant pigments
4. Acquire the knowledge on colorimetric estimations

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
AVERAGE	2.5	2.5	2.5	2.5	2.5

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Hands on Training & Demonstration

SEMESTER V

INTERMEDIARY METABOLISM I

TOTAL HOURS: 60 **COURSE CODE: BC18/5C/IM1**

CREDITS: 4 **LT P: 4-0-0**

COURSE OBJECTIVES:

1. To introduce basic metabolic pathways and their interrelationships.
2. To understand the metabolic pathways involved in carbohydrate metabolism.
3. To expose the students to the pathways of aminoacid degradation and urea cycle.
4. To study about the biosynthesis of aminoacids.
5. To enable the students to know about the synthesis of specialized products and detoxification.

COURSE OUTLINE:

UNIT I (12 hours)

Introduction to Intermediary metabolism.Basic metabolic pathways – anabolic,catabolic and amphibolicpathways.Overview of carbohydrate, lipids and amino acid metabolism. Carbohydrate metabolism - Glycolysis , TCA Cycle and its regulation.

UNIT II (12 hours)

HMP shunt, Glycogenesis, Glycogenolysis and Gluconeogenesis. Hormonal regulation of glycogen metabolism (Glycogen synthase and glycogen phosphorylase).

UNIT III (12 hours)

Amino acid metabolism- Transamination, Oxidative and Non - oxidative deamination, Decarboxylation. Amino acid metabolism – Urea cycle and its regulation.

UNIT IV (12 hours)

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

UNIT V (12 hours)

Conversion of amino acids to specialized products - serotonin, GABA , dopamine, epinephrine, nor epinephrine, creatinine and creatine.
Detoxification mechanism – oxidation, reduction, hydrolysis and Conjugation with examples.

RECOMMENDED TEXT BOOKS:

1. Principles of Biochemistry- Lehninger, Nelson and Cox ,4th edition,2004
2. Biochemistry -Voet&Voet,IV edition ,2013

REFERENCE BOOKS:

1. Biochemistry- Jeremy M Berg, John L Tymoczko, and LubertStryer,6th Edition, Freeman Publications, 2006.
2. Biochemistry- Geoffrey Zubay, 4th Edition,Wm.C. Brown Publishers,1998.
3. Harper's Illustrated Biochemistry- Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 26th Edition, Mcgraw-hill, 2003
4. Text book of Biochemistry with Clinical Corelation- Thomas M. Devlin, 5th Edition, John Wiley & Sons, 2001.
5. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, 1st Edition, Cengage Learning, 2009

JOURNAL:

1. Journal of Nutrition & Intermediary metabolism
2. International journal of Biochemistry Research & Review
3. International journal of Biochemistry

E-LEARNING RESOURCES:

1.https://youtu.be/GNnng0IE_kc
2.https://youtu.be/2oCxmqVwvrI
3.https://youtu.be/sKhGSozFGw4
4.https://youtu.be/c_-lwMgBsDE
5.https://youtu.be/XxNrz65dFJA

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Gain knowledge about various types of metabolism and pathways of carbohydrates by which nutrient molecules are degraded and hence energy production.	K2,K3,K4
CO 2	Explain how cells survive and proliferate by synthesis and degradation of glycogen and serve as a buffer for glucose ,HMP shunt for replenishing NADPH and ribose	K2, K3,K4
CO3	Outline the various types of aminoacid degradation and its excretory product.	K2,K3,K4
CO4	Gain insights in to the importance of aminoacid biosynthesis and degradation of specific glucogenic and ketogenicaminoacids.	K2 , K3,K4

CO5	Apply the knowledge of specialized product synthesis from aminoacid , its functions in living system and mechanism of detoxification in diagnosis of various inherited disorders.	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	2	3	3	2	2
CO3	3	3	2	2	2
CO4	3	2	3	2	2
CO5	2	3	3	2	2
AVERAGE	2.6	2.8	2.8	2	2

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER V
INTERMEDIARY METABOLISM II

TOTAL HOURS: 60 **COURSE CODE: BC18/5C/IM2**

CREDITS: 4 **LTP: 4-0-0**

COURSE OBJECTIVES:

1. To understand the chemical principles of lipid metabolism and its regulation.
2. To instill the knowledge on the metabolic reactions and regulatory pathways of derived lipids.
3. To explain the pathways of nucleotide metabolism and importance of nucleotide coenzymes.
4. To discuss about the components and the mechanism of ATP production.
5. To detail the mechanism of light harnessing and food production in plants

COURSE OUTLINE:

UNIT I (12 hours)

Biosynthesis of saturated fatty acids (Palmitic acid) and unsaturated fatty acids. Lipid metabolism- oxidation of fatty acids (saturated, odd and even numbered) - β oxidation. Ketogenesis. Biosynthesis and Degradation of triglyceride

UNIT II (12 hours)

Synthesis of phospholipids in E.coli (Phosphatidyl glycerol, Phosphatidyl serine, phosphatidyl ethanolmine and cardiolipin). Synthesis of Sphingolipid in E.coli.

Biosynthesis of Cholesterol – Regulation. Degradation of Cholesterol. Overview of lipoprotein metabolism.

UNIT III (12 hours)

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

UNIT IV (12 hours)

Biological oxidation – Electron transport chain- components and reactions 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 (12 hours)

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

RECOMMENDED TEXT BOOKS:

1. Lehninger Principles of Biochemistry- `David L. Nelson & Michael M.Cox, 4th Edition, W. H. Freeman Publication, 2004
2. Biochemistry-Donald Voet & Judith G. Voet ,3rd Edition, John Wiley and Sons Publication, 2004.

REFERENCE BOOKS:

1. Biochemistry- Jeremy M Berg, John L Tymoczko, and Lubert Stryer, 6th Edition, Freeman Publications, 2006.
2. Biochemistry- Geoffrey Zubay, 4th Edition, Wm.C. Brown Publishers,1998.
3. Harper's Illustrated Biochemistry- Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 26th Edition, Mcgraw-hill, 2003
4. Text book of Biochemistry with Clinical Corelation- Thomas M. Devlin, 5th Edition, John Wiley & Sons, 2001.
5. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, 1st Edition, Cengage Learning, 2009

JOURNALS:

1. Indian Journal of Endocrinology and Metabolism,
2. Journal of Nutrition & Intermediary metabolism- Elsvier
3. International journal of Biochemistry Research & Review

E-LEARNING RESOURCES:

1. https://youtu.be/3utYm3ouzaU
2. https://youtu.be/C8VHyezOJD4
3. https://www.youtube.com/watch?v=J7cJtwoeMuw
4. https://youtu.be/fCTbN0LaP4g
5. https://youtu.be/J30zpvbmw7s

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Appreciate the metabolic basics of diseases when lipid pathway is disturbed	K3, K4
CO 2	Gain new insights in to the important lipids and their metabolism, clinical and therapeutic aspects	K3, K4
CO3	Apply the knowledge of nucleic acid metabolic pathway for Cancer research	K3, K4
CO4	Compute the pathways and mechanism of energy generation	K3, K4
CO5	Able to link the concept of photosyntheis with agricultural production	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	2	3	3	3	3
CO3	2	3	3	3	2
CO4	3	2	2	2	3
CO5	3	3	3	3	3
AVERAGE	2.6	2.8	2.8	2.8	2.6

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom- Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER-V

CLINICAL BIOCHEMISTRY

TEACHING HOURS: 60 **COURSE CODE: BC18/5C/CBC**

CREDITS: 4 **LTP: 4-0- 0**

COURSE OBJECTIVES:

1. To enable students understand the basics of biological specimen and hematological parameters in diagnosis
2. To impart knowledge on concepts of metabolic disorders of carbohydrate and aminoacid in disease developments
3. To educate students in understanding the metabolic defects of lipid and nucleic acid and possible complications
4. To impart knowledge on diagnostic procedures for gastric and renal function.
5. To emphasize on diagnostic application of enzyme biomarkers in identification of disease

COURSE OUTLINE:

UNIT I (12 hours)

Biological specimen –Types of specimen - Blood, serum, plasma, urine, feces, CSF, amniotic fluid, solid tissues, specific cells, specimen collection and preservation-Different preservents and their role,Anticoagulants and their specific function.

Hematological parameters - PCV,MCV, ESR, Hb,MCH,MCHC. Blood disorders and diagnosis - Anaemia, polycythemia, leucopenia, leucocytosis, Thrombocytopenia.Haemophilia, Thalassemia, sickle cell Anaemia.

UNIT II (12 hours)

Disorders of carbohydrate metabolism – Hyperglycemia, Hypoglycemia, Hyperinsulinimia, Hypoinsulinimia, Diabetes Mellitus: Types-T1DM,T2DM,Gestational diabetes, diagnosis - OGTT and glycatedHb-pHysiological range; complications and treatment. Glycogen storage diseases, Galactosemia.

Hereditary disorders of Amino acid metabolism- Tyrosinemia, Phenylketonuria, Alkaptonuria, Hartnurp's disease, Cystinuria, Fanconi'ssyndrome,albinism.

UNIT III (12hours)

Disorders of lipid metabolism - Hyper and hypo Lipoproteinemia- Types, pathology and treatment. Lipidosis- Niemann Pick's disease, Tay Sach's Disease, Gaucher's disease,

Disorders of nucleic acid metabolism – LeschNyhan syndrome, Gout, Xanthinuria, OroticAciduria.

UNIT IV (12 hours)

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

Renal function test- Clearance test- urea, creatinine and inulin. PAH test, filtration fraction, proteinuria and hematuria.

UNIT V (12hours)

Liver function test- Fatty liver,Hepatitis,cirrhosis,bilirubin metabolism, jaundice and its differential diagnosis, VD Berg reaction, hippuric acid test. BSP retention test, prothrombin time

Marker enzymes and clinical significance of liver diseases, cardio vascular disease, pancreatic diseases –AST,ALT,GGTP,CK,ALP,LDH.

RECOMMENDED TEXT BOOKS:

1. Textbook of Medical Biochemistry-M.N.Chatterjee and Ranashinde ,7th edition.
2. Clinical chemistry Concepts and Applications-Shauna C.Anderson,SusanCockayne
3. Clinical Medicine –Pravinkumar & Clark, 6th edition**.**

REFERENCE BOOKS:

1. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 6th Edition
2. Essentials of Medical Biochemistry, Second Edition: With Clinical Cases Chung EunHa,N.V.Bhagavan
3. Clinical chemistry in diagnosis and treatment (VI edition)-Philip.D.Mayne
4. Davidson's principles and practice of medicine (XX edition)-John A.A. Hunter
5. Biomarkers of Disease –An evidence based approach Reprint Edition
6. by Andrew K. Trull(Editor), Lawrence M. Demers(Editor), David W. Holt(Editor), Atholl Johnston(Editor), J. Michael Tredger(Editor), Christopher P. Price(Editor)

JOURNALS:

1. Journal of Clinical and Diagnostic Research
2. Indian Journal of Clinical Biochemistry and Research

E-LEARNING RESOURCES:

1. https://www.easybiologyclass.com/topic-bioc
2. https://pdfs.semanticscholar.org
3. www.metbio.net › docs › MetBio-TrainingDoc-DARE695483-01-09-
4. https://www.ncbi.nlm.nih.gov › books › NBK507821
5. https://faculty.psau.edu.sa › filedownload › doc-12-pdf-c632369aee37f1b
6. https://www.ncbi.nlm.nih.gov › books › NBK482489

COURSE OUTCOME:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Utilize the knowledge in selecting different biological specimen, its collection and preservation in disease diagnosis; also analyze the hematological parameters in identification of blood disorders.	K1,K2
CO 2	Discuss and explain the metabolic disorders of carbohydrate ,amino acid and the inherited disorders associated with it.	K2,K3
CO3	Discuss and explain the metabolic disturbances and inherited disorders associated with lipid and nucleic acid metabolism	K1,K2,K3
CO4	Apply the knowledge of diagnostic procedures to determine the gastric and the renal function	K3,K4,K5
CO5	Explain liver disorders and apply the knowledge of diagnostic procedures to determine liver function and outline on marker enzyme of vital organ in disease diagnosis.	K3,K4, K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**3**	**3**
CO4	**2**	**2**	**3**	**3**	**2**
CO5	**2**	**3**	**2**	**2**	**3**
AVERAGE	**2.4**	**2.6**	**2.6**	**2.6**	**2.6**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY

1. Lecture (chalk and talk)
2. E content ,videos
3. Group discussion
4. Quiz-seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K2, K 3	**B-5/8x8 marks**	**500**	**40**	
K3, K 4	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER-V

PHYSIOLOGY

TEACHING HOURS: 60 **COURSE CODE: BC18/5C/PHY**

CREDITS: 4 **LTP: 4-0-0**

COURSE OBJECTIVES:

1. To Impart Knowledge about Blood composition and function and blood clotting mechanism.
2. To study about the muscular and nervous system.
3. To appreciate about the components of Urinary system and mechanism of Urine formation
4. To understand the structure and function and different components of Digestive system.
5. To introduce the organization of endocrine sytem and classification of hormones

COURSE OUTLINE:

UNIT I (12 hours)

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,Blood clotting mechanism,anticoagulants

UNIT II (12 hours)

Muscular system- types of muscle & functions. Brief outline of nervous sytem, structure of brain and spinal cord .Synapses- chemical and electrical synapse, nerve impulse, action potentional and neuro transmitters.

UNIT III (12 hours)

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

UNIT IV (12 hours)

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 (12 hours)

General organization of endocrine system- classification of hormones. Biological functions - Thyroid, Para Thyroid, Insulin, Glucagon, hormones of the adrenal glands and gonadal hormones.

RECOMMENDED TEXT BOOKS:

1. Text book of Medical BiochemistryPhysiology – MN.Chatterjee and , Rana Shinde,7^{th} edition.
2 . Animal physiology – Mariakuttikan and Arumugam

REFERENCE BOOKS :

1. Textbook of Medical Physiology – Guyton & Hall , 11^{th} edition ,2006
2. Davidson's Principles and Practice of Medicine (XX Edition)- John.A.A.Hunter
3. Human Anatomy & Physiology – Elaine N.Marieb ,3rd edition ,1995
4. Essentials of Medical Physiology –Sembulingam ,1999
5. Medical Physiology –Ganong

JOURNALS:

1. National Journal of physiology pharmacy and pharmacology
2. Journal of physiology

E-LEARNING RESOURCES:

1. physiologyonline.physiology.org
2. www.brainmac.co.uk/physoil.html
3. https://youtu .be / SPRPKLOKp8
4. https://youtu .be / ousflozhc
5. https://youtu .be / Zr4onA2K_LY

COURSE OUTCOME:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	recognize and analyze blood cells and blood groups Blood clotting mechanism	K1 K2
CO 2	Outline the muscular and nervous sytem, Mechanism of muscle contraction and structure of brain and spinal cord	K1 K2,K3
CO3	Utilise the knowledge about the structure kidney and nephron ,to understand the mechanism of Urine formation and learn the concept of Dialysis,	K1 K2,K4,K5

CO4	Acquire knowledge about the components of Digestive system,Hcl formation and Digestion process	K2, K3
CO5	Compile the classification of Hormones and its biological role	K1,K2

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	1	3	2	3
CO3	2	2	2	2	3
CO4	2	2	2	2	2
CO5	2	3	2	2	3
AVERAGE	2.0	2.0	2.2	2.0	2.6

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk; LCD)
2. Blended Classroom- Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER V

ELECTIVE - BIOINSTRUMENTATION & BIOSTATISTICS

TEACHING HOURS:75 **COURSE CODE: BC18/5E/BBS**

CREDITS: 5 **LTP : 5-0-0**

COURSE OBJECTIVES:

1. To impart knowledge about common clinical testings and assays
2. To expose the students to the various diagnostic tests and scans
3. To understand the concept the basics of various life support devices and other therapeutic procedures.
4. To introduce the basics of statistics..
5. To understand and apply the common statistical parameters .

COURSE OUTLINE:

UNIT I (15 hours)

Hematology – Coulter counter. Biochemistry – Glucose estimation using Glucose oxidase, Kinetic assay of LDH. Flame photometry for electrolyte estimation.Serological tests-Widal test, Overview of ELISA, Immuno Fluorescence and Chemiluminescent methods.

UNIT II (15 hours)

Diagnostic procedures – Histology ,Microtome ,Histopathology , X-ray , Different types of scan – Ultrasound, Computerised Axial Tomography. Methods based on electrical activity – ECG, EEG, Blood pressure measurements, Respiratory gas analyzer.

UNIT III (15 hours)

Therapeutic procedures - Blood banking, Dialysis unit- Hemodialysis and Peritoneal dialysis, Ventilator, Pacemaker, Laser applications in Medicine, Radiotherapy equipment.

UNIT IV (15 hours)

Statistics- Definitions of Biostatistics & Clinical Statistics– Primary and Secondary data, Population and sample. Collection of data (survey, experiment and observation method) Presentation of data - structure of table, line diagram, bar diagram (simple, subdivided and multiple). Pie diagrams, Pictogram.

UNIT V (15 hours)

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).

RECOMMENDED TEXT BOOKS:

1. Introduction to Biostatistics – N.Gurumani,2nd edition,2005, MJP Publishers
2. Bioinstrumentation-L.Veerakumari,2015,MJP Publishers.

REFERENCE BOOKS

1. Handbook of Biomedical instrumentation-Second edition-R.S.Khandpur,2008.
2. Biostatistics Basics and advanced-MAnjuPandey,Mv Learning,2015
3. Instrumental Methods of Analysis by Willard. CBS Publishers & Distributors, 7th Edition, 2004.
4. Statistical Methods by S. P. Gupta ,Sultan Chand & Sons, 2012.
5. Bioinstrumentation by MJ Reilly, CBS Publishers and Distributors Pvt. Ltd. 1st Edition, 2016.

JOURNALS:

1. International journal of Instrumentation Technology
2. The international journal of Biostatistics-De Gruyter
3. The Indian journal of Statistics

E-LEARNING RESOURCES:

1. www.stat.isu.edu
2. www.inderscience.com
3. www.degruyter.com
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/
5. https://www.eecs.umich.edu/courses/bme458/download/bme458_notes1.pdf

COURSE OUTCOME:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Analyze the common clinical testings& assays	K1
CO 2	Discuss about various diagnostic procedures	K1
CO3	Explain the use of life support devices and understand the therapeutic procedures.	K2,K3
CO4	Explain the Basics of Statistics, Present Datas	K3,K4,K5
CO5	Solve problems involving common statistical parameters	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	2	3	3	2	2
CO3	3	3	3	2	3
CO4	3	3	3	3	3
CO5	2	2	3	3	3
AVERAGE	2.4	2.8	3	2.6	2.8

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

1. Lecture (chalk and talk)
2. E content ,videos
3. Group discussion
4. Quiz-seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions
K 1	A-10X2 marks	50	20	100	Section B/C-must be have 2 theory and 3problems
K1, K 2	B-5/8x8 marks	500	40		
K2, K 3	C-2/4x20 marks	1500	40		

SEMESTER V

ELECTIVE: HOSPITAL MANAGEMENT

TOTAL HOURS: 75 **COURSE CODE: BC18/5E1/HSM**

CREDITS: 5 **LT P: 5-0-0**

COURSE OBJECTIVES:

1. To understand the role of administration in patient care ,planning and management
2. To understand the importance of information system in hospitals
3. To understand the policy and procedures in clinical services
4. To understand the legal and safety aspects in health care services
5. To understand the aspects of counselling and its importance in hospital management

COURSE OUTLINE

UNIT I **(15 Hours)**

General features of a hospital, various departments –Outpatient department, Casualty and Emergency services, General surgery department ,ICU, Obstetrics department, Clinical laboratory .

Supportive services- Admission department, Medical records department, Pharmacy, Food services Housekeeping department, Volunteer department.

UNIT II **(15 Hours)**

Information system in hospital: Communication, Delegation, Decision making, Monitoring, Evaluation, Meetings and Negotiations;Quality assurance

UNIT III **(15 Hours)**

Biomedical research: Ethics; consent, nature of consent. Ethics pertaining to blood transfusion,transplanatation-Donor categories ,confirmation of brain death,live donation, bio medical waste management.

UNIT IV **(15 Hours)**

Hospital Administration, Hospital ethics, Challenges in hospital administration, Legal aspects, Working conditions, Environmental Safety, Health services ,National Health Policy

UNIT V **(15 Hours)**

Counselling- Types, Techniques, Function, Development of counselling services, Duties of a counsellor

Recommended text books

1. Hospitals-Facilities Planning and Management,K.J.Kunders, Tata Mc graw Hill, New Delhi,2008
2. Hospital Administration and Human Resource Management,R.C.Goyal,4th Edition,Prentice Hall of India Pvt Ltd., 2005

Reference text books

1. Hospital Administration and Management: Theory and Practice: R. Kumar S.L. Goel,

2. Hospital Administration and Management: A Comprehensive Guide,Joydeep Das Gupta, Jaypee Brothers,Medical Publishers Pvt. Limited, 2009

3. Principles of Hospital Administration and Planning,BM Sakharkar,Jaypee brothers,Medical Publishers Pvt. Limited,2008

4. Hospital Management,K. V. Ramani , 2011,Pearson Education India

5. Hospital Administration And Human Resource Management, D. K. Sharma, R. C. Goyal,6th edition,PHI learning Pvt., Ltd.2013

E LEARNING RESOURCES

1. https://shodhganga.inflibnet.ac.in/bitstream/10603/43767/10/10_chapter%201.pdf
2. https://www.asianhhm.com/facilities-operations/environmental-safety-hospitals
3. http://ncert.nic.in/vocational/pdf/keda101.pdf
4. https://www.scribd.com/document/332414371/BM-Sakharkar-Principles-of-Hospital-Administration-and-Planning-2nd-Edition-pdf
5. https://www.pdfdrive.com/hospital-administration-books.html

COURSE OUTCOMES:

CO/ PSO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Analyze the importance and role of various departments , support services in hospitals	K2,K3
CO 2	Discuss about information system in hospitals and Quality assurance	K3, K4
CO3	Communicate about Ethics governing various clinical aspects like blood transfusion, transplantation	K3,K4
CO4	Aware of various legal and safety aspects in hospital administration	K3, K4
CO5	Discuss about counselling and analyze the role of counsellors in Hospital management	K4, K5

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**200**	**40**	
K2, K 3	**C-2/3x20 marks**	**500**	**40**	

SEMESTER V

ELECTIVE: BIOETHICS

TOTAL HOURS: 75 **COURSE CODE: BC18/5E2/BIE**

CREDITS: 5 **LT P: 5-0-0**

COURSE OBJECTIVES:

1. To instil ethical values in students
2. To create awareness on our rights and To respect others rights
3. To impart standard and safe practices in Biomedical field
4. To sensitise the students to ethical issues in research.
5. To inculcate knowledge on intellectual property rights

COURSE OUTLINE:

UNIT I (15 hours)

Ethics - Introduction; Types - Meta ethics, Applied ethics,Moral ethics, Descriptive ethics, Normative ethics;Principles – Beneficience, Non-Malificence, Respect to Autonomy, Justice; Theories – Deontology, Utilitarianism, Rights, Causist, Virtue; Case-studies; Bioethics

UNIT II (15 hours)

Ethical issues in Biotechnology and Biomedical Research: ICMR guidelines for Biomedical Research; Consent – Types, consent from minors;Cloning; stem cells,Gene Therapy, GMO.

UNIT III (15 hours)

Biosafety – Definition, Containment facilities, levels of Biosafety; Biomedical waste Management – segregation, collection, transportation, disposal; International guidelines-GLP, GCP.

UNIT IV (15 hours)

Ethical issues concerning birth, life and death: Reproductive technologies - Gamete donation, In Vitro Fertilisation, Embryo transfer, surrogacy, prenatal diagnosis, sex-selection; Genetic Screening, organ transplantation, withholding and withdrawing medical treatment; abortion, euthanasia.

UNIT V (15 hours)

Intellectual property rights- Basic concepts and need for Intellectual Property rights - Patents, Copyrights,Geographical Indications, Trademarks, designs;Plagiarism, Basis of patentability; Non patentable inventions, Methods for patent application;WTO, TRIPS.

RECOMMENDED BOOKS:

1. Bioethics,Shaleesha. A.Stanley, Wisdom Educational Service, 2008
2. Bioethics, S. Ignacimuthu, Alpha Science International Ltd, 2009
3. Principles of Biomedical Ethics, Tom L. Beauchamp, Seventh Edition, OUP USA
4. Bioethics: The Basics, Alastair V. Campbell, RoutledgePublishings, 1st edition
5. Intellectual property rights and copyrights – S V Satakar, ESS publication, New Delhi, 2002

REFERENCE BOOKS:

1. Bioethics: Introduction to History, Methods, and Practice, Nancy S. Jecker, **S**econd edition , Jones & Bartlett Publishers (2007)
2. Biotechnology and Intellectual Property Rights - Kshitij Kumar Singh, 2015 edition, Springer Nature

JOURNALS:

1. Bioethics
2. Journal of Intellectual Property Rights

E-LEARNING RESOURCES:

1. https://www.onlineethics.org
2. https://www.ethics.org
3. http:ethics.iit.edu
4. http://research-ethics.org
5. http://www.ipindia.nic.in

COURSE OUTCOMES:

CO	**CO STATEMENT**	**KNOWLEDGE LEVEL**
CO1	Apply ethics, realise rights and responsibilities in society	K3,K4
CO2	Be ethical in biomedical research	K3, K4
CO3	Follow standard guidelines in laboratory and clinical trials	K3,K4
CO4	Follow ethical practices in biomedicine	K3, K4
CO5	Identify intellectual property in research and apply for patents	K4, K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**3**
CO2	**2**	**3**	**3**	**3**	**3**
CO3	**2**	**3**	**3**	**2**	**3**
CO4	**2**	**3**	**3**	**2**	**3**
CO5	**2**	**3**	**3**	**3**	**3**
AVERAGE	**2**	**2.8**	**2.8**	**2.4**	**3**

KEY: STRONGLY CORELATED -3, MODERATELY CORELATED -2, WEAKLY CORELATED -1, NO CORELATION-0

TEACHING METHODOLOGY:

5. Lecture (chalk and talk)
6. E content ,videos
7. Group discussion
8. Quiz-seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**200**	**40**	
K2, K 3	**C-2/3x20 marks**	**500**	**40**	

SEMESTER V

SELF LEARNING - CLINICAL ENDOCRINOLOGY

COURSE OBJECTIVES:

6. To impart knowledge about various hormones and their mechanism of action
7. To understand the functions and abnormalities of thyroid and parathyroid gland
8. To inculcate the knowledge on adrenal gland
9. To understand the role of pancreatic and gastro intestinal tract hormones
10. To study the disorders associated with reproductive glands.

COURSE OUTLINE:

UNIT I

Hormones, hormone secreted by various glands, tropic hormones of hypothalamus and Pituitary (functions only), Classification of hormones (Steroid, Amino acid derivatives, Peptide / Protein hormones), Hormone receptor interaction (Over view), Mechanism of action of hormones (membrane receptor, c-AMP, IP_3-DAG, nuclear chromatin).

UNIT II

Thyroid gland, functions of thyroid hormones, hypothyroidism – Goitre, Myxedema, hyperthyroidism- Exophthalmos, Natural goitrogens.

Parathroid gland, functions of parathyroid hormones, Rickets, Osteomalacia, Osteoporosis.

UNIT III

Adrenal gland, functions of adrenal cortex hormones - corisol, aldosterone, hypo adrenalism – Addison's disease, hyper adrenalism – Cushing's disease, functions of adrenal medullary hormones – epinephrine, Nor-epinephrine.

UNIT IV

Pancreas, functions of pancreatic hormones- Insulin, Glucagon, Somatostatin, Diabetes mellitus (Type I & II), Insulinoma.

Functions of Gastro intestinal hormones – Gastrin, Cholecystokinin, Secretin, Ghrelin, Leptin, Motilin, P- substance.

UNIT V

Gonadal glands (Ovary, Testis), functions of gonadal hormones –Testosterone, Estrogen, Progestrone, Functions of Relaxin, Hypogonadism in males, Poly Cystic Ovarian Syndrome (PCOS).

RECOMMENDED BOOKS:

1. Text book of Medical physiology - Guyton & Hall, 11th Edition, Churchill Livingstone, 2004
2. Text book of Biochemistry with clinical correlations - Thomas M.Devlin, 6th Edition, John Wiley & Sons Inc. Publications, 2004.
3. Text book of Medical Biochemistry – MN Chatterje & Rana Shinde, 8th Edition, Jaypee Publishers, 2013.
4. Human Anatomy & Physiology – Elaine N.Marieb, RN, 3rd Edition, The Benjamin/ Cummings Publishing Company, 1991.
5. Clinical Chemistry Concepts & Applications – Shauna C.Anderson, Susan Cockayne, 1993, W.B.Saunders Publishers, Tokya,

REFERENCE BOOKS:

1. William's Text book of Endocrinology- Larsen, Kronenberg, Melmed & Polonsky, 10th Edition, Saunders Publishers, 2003.
2. Mark's Basic Medical Biochemistry- A Clinical Approach, Colleen Smith, Allan D.Marks, Michael Lieberman, 2nd Edition, Lippincott Williams & Willkins, 2005.

JOURNALS:

6. *Indian Journal of Endocrinology and Metabolism*
7. *Hormones and Behavior*

E-LEARNING RESOURCES:

6. https://youtu.be/-SPRPkLoKp8
7. https://youtu.be/rQsfhSbK53s
8. https://youtu.be/JlI5N2N4d-k
9. https://youtu.be/Ck2tOAQiXBA
10. https://youtu.be/Nhl9EQiftZ0

COURSE OUTCOMES:

CO/ PSO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply the knowledge in integration of body system by endocrines	K2,K3,K4
CO 2	Analyse the integration of thyroid hormones with metabolism and parathyroid hormones with calcium metabolism.	K3, K4
CO3	Link the relationship between adrenal hormones with, neurotransmission, mineral and energy metabolism	K3,K4
CO4	Discuss the link between pancreatic and gastro intestinal hormones with diseases	K3, K4
CO5	Create awareness on gonadal systems and measures to prevent the reproductive disorders	K4, K5

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	200	40	
K2, K 3	C-2/3x20 marks	500	40	

SEMESTER V

SELF LEARNING - HEALTH FOR WOMEN

COURSE OBJECTIVES:

1. To provide basic understanding about the physiology of female reproductive system and associated ailments.
2. To inculcate knowledge about fetal development, vaccines and diagnostic tests during pregnancy
3. To educate on possible complications of pregnancy and STD
4. To create awareness about health issues of women associated with lifestyle
5. To emphasize on healthy living with balanced diet and physical fitness.

COURSE OUTLINE:

UNIT I

Study of the female reproductive system and hormones, Menarche, Menstrual cycle, Menopause. Problems associated – Premenstrual syndrome, Amenorrhoea, Dysmenorrhoea, Polycystic ovary and fallopian tube obstruction.

UNIT II

Pregnancy-Vaccines and diagnostic tests during pregnancy. Development of foetus in different trimesters. Parturition – different types, Significance of breast feeding, Vaccination for infants

UNIT III

Complications associated with pregnancy – Gestational diabetes, Ectopic pregnancy, Eclampsia, Miscarriage and still birth, Contraception methods and Sexually transmitted diseases-AIDS, Syphilis, Gonorrhoea-Symptoms, Diagnosis and Treatment.

UNIT IV

Health problems in women – Anemia, Varicose veins, Cancers – Breast cancer, Cervical cancer and Ovarian cancer - Symptoms, Diagnosis and Treatment.

Health and lifestyle disorders-sleeping disorder, eating disorder, liposuction, breast implant-symptoms, diagnosis and treatment

UNIT V

Balanced diet for Women – Nutrition during aldolesence, pregnancy,lactation ,infants and older women .Fitness and Health-yoga and meditation

RECOMMENDED BOOKS :

1. Human Anatomy and Physiology-Elaine .N marieb Pearson publisher 3rd edn, 1995.
2. Understanding nutrition- Eleanor,noss,Whitrney. Wadsworth Publishing; 10 edition
3. Encyclopedia of Women health-Parvesh Handa Atlantic Publishers and Distributors Pvt Ltd

REFERENCE BOOKS:

1. Nutrition- Dr.M.Swaminathan ,Kalyani Publishers

JOURNALS:

1. *Women's Health* Issues
2. Journal of Womens health care
3. International Journal of Womens health
4. Health care for Women International

WEBSITE:

1. www.healthywomen.org/
2. www.womenshealthmag.com/

COURSE OUTCOMES:

CO/ PSO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply the knowledge to understand the physiology of female reproductive system	K2,K3,K4
CO 2	Acquire the knowledge on pregnancy and create awareness on child care	K3, K4
CO3	Create Awareness on pregnancy complications and sexually transmitted diseases	K3,K4
CO4	Create Awareness on health and life style related disorders	K3, K4
CO5	Create awareness on importance of diet in different stages of women	K4, K5

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**200**	**40**	
K2, K 3	**C-2/3x20 marks**	**500**	**40**	

SEMESTER VI

MOLECULAR BIOLOGY

TOTAL HOURS: 60 HRS **COURSE CODE: BC18/6C/MBO**

CREDITS: 4 **LT P: 4-0-0**

COURSE OBJECTIVES:

1. To introduce the type of DNA sequences and chromosome structure.
2. To instill the knowledge of the molecular basis of DNA synthesis.
3. To understand the moleculae basis of RNA synthesis and modified into different types of RNA.
4. To discuss about the genetic code, molecular basis of protein synthesis & modification.
5. To detail the mechanism of DNA mutation and Repair system.

COURSE OUTLINE:

UNIT I (12 hours)

Gene Organization - Genes, DNA sequences – Unique and repetitive sequences, coding, non codingDNA ,Satellite DNAs , Cot Curves , Chromosomes – Types, properties, Gene organization in Prokaryotes and Eukaryotes.

UNIT II (12 hours)

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

UNIT III (12 hours)

Transcription - Chemistry of Transcription, RNA polymerases, Role of sigma factor, Closed and open promoter complexes, Prokaryotic Transcription, Post transcriptional modifications of mRNA – capping, tailing, splicing.

UNIT IV (12 hours)

Translation - Basic features and deciphering of the Genetic code, Genetic code dictionary, wobble hypothesis, Ribosomes, Protein synthesis in prokaryotes - Activation of aminoacids, aminoacyltRNAsynthetases, tRNA as adaptor molecule, Prokarotic translation, post translational modifications.

UNIT V (12 hours)

Mutation and DNA Repair - 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 BOOKS :

1. Biochemistry - Voet Donald and Voet Judith : 2004. Wiley International Edition , 3rd Edition : John Wiley & Sons.
2. Lehninger Principles of Biochemistry – Nelson David and Cox Michael : 2004 . W.H.Freeman& Co : New York

REFERENCE BOOKS:

1. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky, Lawrence, Matsudaira, Paul, Baltimore : 2006, 4th Edition, W.H Freeman & Co .
2. Lewin's Genes X– Krebs Jocelyn, Lewis Benjamin, Goldstein, Eliottt, Kilpatrick, Stephen : 2009 . Jones and Bartlett.
3. The world of cell – Becker, Wayne ,Kleinsmith, Lewis, Hardin, Jeff ,Bertoni ,Gregory paul : 2009, 7th Edition, Pearson Education Inc.
4. Essentials of Molecular biology- V.Malathi, 2013 , First Edition, Pearson Publishers.
5. The Cell – molecular approach , Geoffrey M. Cooper & Robert E. Hausman, 3rd Edition, 2002.

JOURNAL

1. Journal of Molecular Biology
2. Journal of Molecular Biology Research

E-LEARNING RESOURSES:

1. https://youtu.be/3wTAEfjo20c
2. https://youtu.be/sGyZ2s3FOWg
3. https://youtu.be/k4AI4UipziI
4. https://youtu.be/gvYJaPxkSZg
5. https://youtu.be/o4yJF90OR9M

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Gain knowledge about the organization of genes to chromosomes in prokaryotes and eukaryotes ,types of DNA sequences,complexity of DNA sequences determined by renaturation kinetics.	K1, K2,K3
CO 2	Apply the concept gained in mechanism of	K2, K3,K4

	replication in the field of molecular biology.	
CO3	Gain knowledge about different types of RNA and its synthesis leads to understanding protein synthesis and development.	K3, K4
CO4	Apply the knowledgeofprotein synthesis to create polypeptide for drug development against genetic disorders**.**	K3, K4
CO5	Familiar and able to link the concept with mutation and repair system.	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	2	3	2	3
CO2	3	3	2	2	2
CO3	3	2	3	2	3
CO4	3	3	3	2	3
CO5	3	3	3	3	2
AVERAGE	2.8	2.6	2.8	2.2	2.6

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN:

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER VI

GENETICS & NUTRITIONAL BIOCHEMISTRY

TEACHING HOURS: 60 **COURSE CODE: BC18/ 6C/GNB**

CREDITS : 4 **LTP : 4-0-0**

COURSE OBJECTIVE

1. To inculcate the knowledge about Mendel's contribution to Genetics
2. To learn about the genetic disorders, their etiology and diagnosis
3. To compile various Nutrition and balanced diet,various dietary requirements of nutrients. To acquire knowledge about protein calorie malnutrition
4. To revise the facts about Fat and Water soluble vitamins and their importance.
5. To extract facts about Obesity and various lifestyle associated diseases

COURSE OUTLINE:

UNIT I (12 hours)

MendelianGenetics : Contributions of Mendel , Genotype, Phenotype .Monohybrid cross, Dihybrid cross, , Back Cross, Test cross, Mendel's laws of Inheritance- Law of Dominance, Law of Segregation, Law of Independent assortment , Reciprocal crosses. Incomplete Dominance, Co dominance, Gene Interactions – Complementary , Supplementary genes

UNIT II (12 hours)

Chromosomal genetics - Linkage and crossing over, Chromosomal mapping, Autosomes Brief outline of Autosomal linked diseases, Structure of sex chromosomes , Sex linked inheritance- Haemophilia, Genetic Diseases- Overview of Chromosomal anomalies- Ploidy ,Chromosomal Aberrations. Down's Syndrome, Klinefelter's syndrome, Turner's syndrome

UNIT III (12 hours)

Nutrition - Balanced diet, Food pyramid, Dietary requirement and functions of Carbohydrates, Lipids and Proteins. Calorific values of food components., Biological value of proteins, NPU. Basal metabolism- Basal metabolic rate, Factors affecting BMR, Respirometer.RQ, SDA. Protein Calorie Malnutrition-Kwashiorkar& Marasmus

UNIT IV (12 hours)

Vitamins – Fat soluble vitamins (A,D,E,K) and Water soluble vitamins (B complex and C) (Sources, biological functions and RDA)

Minerals- iron, calcium, iodine, selenium (Sources, biological functions and RDA). Nutritional requirements in infancy, childhood, pregnancy and lactation and old age.

UNIT V (12 hours)

Obesity – Causes, Anthropometric measurements and Diet management. Dietary management in – Infection, Fever, Constipation, Diabetes mellitus, Peptic Ulcer, PCOS, Hypertension, Cardiovascular diseases, Pancreatitis, Cirrhosis and Cancer.

RECOMMENDED TEXT BOOKS:

1. Essentials of Molecular Biology - David Friefelder,2nd edition,1999
2. Fundamentals of Biochemistry – Donald Voet and Judith Voet,4th edition,2013.

REFERENCE BOOKS:

1. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin, Goldstein, Eliottt, Kilpatrick, Stephen : 2009 . Jones and Bartlett
2. Cell biology,Genetics,MolecularBiology,Evolution and Ecology– Verma&Agarwal ,2013.
3. Nutrition and Diet Therapy-Sangeetha Karnik,1st edition,2006.
4. Nutrition Essentials and diet Therapy-Peckenpaugh,10th edition,2007.
5. Essentials of Molecular Biology by DrVMalathi

JOURNALS:

1. Journal of Genetics-Indian Academy of Science
2. Open journal of Genetics- an academic Publisher
3. Journal of Genetics & Genomics-Elsevier

E-LEARNING RESOURCES:

1. https://youtu.be/NWqgZUnJdAY
2. https://youtu.be/Tw9PV1GqdAE
3. https://youtu.be/fwxFmUnoNZw
4. https://youtu.be/P8VU3CWt2e4
5. https://youtu.be/afYCN3Upy_w

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Knowing about the Mendel's experiments in Genetics and understanding its concept	K1, K2
CO 2	Exploring facts about the Genetic disorders and to relate it.	K1, K2, K3
CO3	Analyse the role of various nutrients, their dietary allowances and relate in day to day life.	K1, K2
CO4	Revise the Knowledge about the water and fat soluble vitamins and its significance and its functions	K3, K4
CO5	Outline the Knowledge about Obesity and obtaining better results.	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	3	3
CO3	2	2	2	3	2
CO4	2	3	3	2	2
CO5	2	3	3	2	2
AVERAGE	2.2	2.4	2.4	2.4	2.2

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER VI

BIOTECHNOLOGY

TEACHING HOURS: 60 **COURSE CODE: BC18/6C/BTY**

CREDITS: 4 **LTP : 4-0-0**

COURSE OBJECTIVES:

1. To introduce the tools of genetic engineering
2. To instill the knowledge about the strategies of gene cloning method.
3. To enable students understand plant Biotechnology in crop improvement and disease resistance
4. To impart knowledge on types of cell cultures and their application in medical field.
5. To utilize the knowledge in understanding the application of biotechnology in various industries

COURSE OUTLINE:

UNIT I (12 hours)

Introduction to Biotechnology- Scope and Importance, Tools of R-DNA technology; Enzymes, Linkers, Adaptors, Vectors - Plasmid, Phages, Cosmid, Viral, Shuttle and Expression vectors. Automated Gene Machine, Gene amplification-PCR and Application, DNA sequencing-Sanger's method.

UNIT II (12 hours)

Strategies of r-DNA Technology; Isolation and Identification of Gene of interest-Gene Library. Gene transfer methods – Electroporation, Liposome mediated transfer, 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. Blotting- Southern, Northern, Western.

UNIT III (12 hours)

Plant Biotechnology: Plant tissue culture-Requirements for plant tissue culture, Types of culture, Applications of plant tissue culture.Applications of Transgenic plants- Herbicide resistant crops and Insect resistant crops.

UNIT IV (12 hours)

Animal Biotechnology: Requirement for animal tissue culture, Mammalian cell culture, Stem cell culture, Cell lines and its maintenance. Applications of animal cell culture.Transgenic animals and its applications.

Medical Biotechnology: Production of Insulin, Interferon, tPA ,Principles of Gene therapy.

UNIT V (12 hours)

Industrial Biotechnology : Fermentation, Fermentor and Fermentation process-types. 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 ,8th reprint 2013
2. Textbook of Biotechnology- R.C.Dubey
3. Textbook Of Biotechnology-DR.Prakash S Lohar,MJP publisher ,2012
4. Biotechnology – Kumaresan

REFERENCE BOOKS:

1. Molecular Biotechnology Principles and Applications of Recombinant DNA-BernardR Glick and Jack J Pasternak,3rd edition,2003.
2. Essentials of Biotechnology-Michael Crichton.
3. Biotechnology-Ellyn Daugherty
4. Textbook of Biotechnologyby Lydell Norris
5. Molecular Biotechnology: Principles and Practices by Channarayappa

JOURNALS:

1. Indian Journal of Biotechnology & Biotechemistry
2. International Journal of Biotechnology

E-LEARNING RESOURCES:

1. www.niscair.res.in
2. www.gate2biotech.com/instantnotes-
3. https://nptel.ac.in
4. www.routeetvies.fr › 1-plant-biotechprinciples-techniques-and-applications
5. https://ncerthelp.com

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Outline the fundamental steps in genetic engineering procedures and discuss the various tools of recombinant DNA technology	K1,K2
CO 2	Discuss the technique used to isolate specific gene of interest, explain various gene transfer method and selection procedure for identifying transformants	K2,K3
CO3	Identify various natural and artificial ways to propagate plants to increase genetic variety and genetic composition	K3,K4
CO4	Outline the fundamentals of various types of animal cell cultures. Discuss the role of biotechnology in the health care sector	K3,K4.K5
CO5	Explain and discuss the various steps	K3,K4,K5

	involved in large scale production and harvesting of genetically engineered protein. Discuss the role of biotechnology in various industrial sectors	

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	2	3	2	2	2
CO3	2	2	3	2	3
CO4	3	3	2	3	3
CO5	3	3	3	3	3
AVERAGE	2.4	2.8	2.6	2.6	2.8

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (chalk and talk)
2. E content ,videos
3. Group discussion
4. Quiz-seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K2, K 3	B-5/8x8 marks	500	40	
K3, K 4	C-2/4x20 marks	1500	40	

SEMESTER VI

ELECTIVE- BASICS OF BIOINFORMATICS

TEACHING HOURS: 75 **COURSE CODE: BC18/6E/BBI**

CREDITS : 5 **L T P : 5-0-0**

COURSE OBJECTIVES:

1. To impart knowledge about the basics of Internet communication.
2. To expose the students to the principles and applications of Bioinformatics & data bases
3. To understand the concept of Sequence alignment & gene prediction.
4. To enable students understand protein structural organization, prediction and visualization.
5. To understand the basics of Phylogenetics analysis and Drug designing.

COURSE OUTLINE:

UNIT I (15 hours)

Introduction to Internet – IP address, URL;networks - LAN, WAN; Communication protocols – TCP, IP, FTP, HTTP; www, web browsers, Search Engines. Types of Databases - Flat files, Relational, Object oriented databases.

UNIT II (15 hours)

Bioinformatics- Definition and Comparison between Computers and Biology; Principles, Applications of Bioinformatics and Challenges , NCBI, Biological databases. INSDC, GenBank, Protein sequence databases: Uniprot, PDB; Literature database – PubMed; Data retrieval systems – Entrez.

UNIT III (15 hours)

Introduction to Sequence, Alignments, Type of Alignments and their Significance, Dot plot, Pairwise alignment –BLAST and Multiple Sequence Alignment -Clustal W algorithm.

Gene prediction, Human Genome Project and its significance, OMIM.

UNIT IV (15 hours)

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.

UNIT V (15 hours)

Basics of Phylogenetic analysis - Definitions of Homologs, Orthologs, Paralogs and Xenologs; Definitions for Genomics, Metagenomics, Transcriptomics, Proteomics, Lipidomics, Interactomics, Pharmacogenomics ,Metabolomics,Chemoinformatics.
Basic Steps in drug development- Stages, Clinical Trials, Structure based drug designing.

RECOMMENDED BOOKS:

1. Essential Bioinformatics by Jin Xiong
2. Text book of Bioinformatics-Sharma, Munjal and Shankar,2008.

REFERENCE BOOKS:

1. 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 Ouellellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999
4. Bioinformatics Concepts, Skills and Applications , by S. C. Rastogi, CBS; 2 edition (1 December 2009),ISBN-10: 8123914822,ISBN-13: 978-8123914824
5. Bioinformatics, 3ed ,by Andreas D. Baxevanis , B.F. Francis Ouellette , Wiley; Third edition (2009),ISBN-10: 9788126521920,ISBN-13: 978-8126521920

JOURNALS:

1. Bioinformatics-Oxford journal
2. BMC Bioinformatics
3. Bioinformatics.oxfordjournals.org
4. Indian Journal Of Bioinformatics And Biotechnology

E-LEARNING RESOURCES:

1. www.ncbi.nlm.nih.gov
2. www.ebi.ac.uk
3. https://www.ks.uiuc.edu/Training/Tutorials/science/bioinformatics-tutorial/bioinformatics.pdf
4. https://zhanglab.ccmb.med.umich.edu/papers/2009_8.pdf
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5421137/

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the basics of Internet communication	K1
CO 2	Discuss about the use of Bioinformatics and Database	K1,K2
CO3		K3,K4

	Align sequences,Utilize sequence aligning tools, predict genes.	
CO4	Discuss about protein structural organization, predict protein Structure and utilize structure prediction & visualization tools	K4,K5
CO5	Explain about Phylogenetics analysis and discuss about Drug designing.	K4,K5

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**
CO3	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**2**	**3**	**3**	**2**	**3**
AVERAGE	**2.4**	**3**	**2.8**	**2.8**	**3**

TEACHING METHODOLOGY

1. Lecture (chalk and talk)
2. E content ,videos
3. Group discussion
4. Quiz-seminar

.

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER VI

ELECTIVE - IMMUNOLOGY

TEACHING HOURS: 75 **COURSE CODE: BC18/6E/IMY**

CREDITS: 5 **LT P: 5-0-0**

COURSE OBJECTIVES:

11. To Impart Knowledge about the types and the various determinants of immunity.
12. To expose the students to different types of lymphoid organs and to the cellular basis of immunity.
13. To appreciate clonal selection theory, mechanism of cell mediated and humoral mediated immune responses
14. To understand the diagnostic methods of immunology.
15. To study the disorders associated with immunological processes.

COURSE OUTLINE:

UNIT I (15 hours)

Infection – Types of infection, Immunity – Innate Immunity, Active, Passive, Natural and Artificial immunity, Factors affecting Innate immunity – Physical, Mechanical, Biochemical, Cellular and Genetic factors. Inflammation, Mechanism of Phagocytosis.

Unit II (15 hours)

Cells involved in Immune response – T,B and Null cells, Structure and functions of lymphoid organs- Thymus, Bone Marrow, Spleen, Lymph nodes, Mucous Associated Lymphoid Tissue, Gut Associated Lymphoid Tissue.

UNIT III (15 hours)

Antigen, Factors affecting Antigenicity, Epitope , Haptens , Adjuvants. Clonal Selection Theory, Antibody – Classes, Structure and Biological function. Humoral and Cell Mediated Immunity.

UNIT IV (15 hours)

Principles of Ag-Ab interactios – Affinity, Avidity, Precipitation – Precipitation curve, Agglutination, Principle – ELISA, RIA, Immuno electrophoresis and Immunofluorescence . Monoclonal Ab production- Hybridoma technology.

UNIT V (15 hours)

Hypersensitivity – Gel- Coomb's classification, Immediate Type – I (Allergic Asthma), II (Erythroblastosis Foetalis), III & Delayed Type – IV (Contact Dermatitis). Autoimmune Diseases – Hashimotos Thyroiditis and Rheumatic Arthritis.

RECOMMENDED BOOKS:

6. Immunology- Peter ,Alex and Micheal,2nd edition,2004
7. Fundamentals of Medical Immunology-Venugopal Jayapal,2007
8. Text book of Microbiology-Ananthanarayanan and Panickar,9th edition,2013.

REFERENCE BOOKS:

3. Immunology - Kuby ,5th edition,2003.
4. Essential Immunology –Roitt,3rd edition

JOURNALS:

8. Journal of Immunology Research
9. Open journal of Immunology-scientific Research Publishing

E-LEARNING RESOURCES:

11. www.whfreemen.com/kuby
12. www.immunologylink.com
13. www.hindawi.com
14. https://youtube/ESQYCHS41BY
15. https://youtube/8iyrbvlsauy

COURSE OUTCOMES:

CO/ PSO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply and practice the methods to improve immunity	K1,K2
CO 2	Appreciate and analyse the integration of immune cells and organs	K2, K3
CO3	Apply the knowledge on the production of vaccines and immune kits.	K2,K3
CO4	Analyse and diagnose the various immune disorders.	K3, K4
CO5	Preventive measures for allergy and other hypersensitivity reactions	K3, K4

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	2	3
CO2	2	2	3	2	3
CO3	2	3	2	3	2
CO4	2	3	2	3	2
CO5	3	3	2	3	2
AVERAGE	2.4	2.6	2.4	2.6	2.4

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER VI

ELECTIVE: ECOLOGY AND ENVIRONMENTAL TOXICOLOGY

TOTAL HOURS: 75 **COURSE CODE: BC18/6E1/EET**

CREDITS: 5 **LT P: 5-0-0**

COURSE OBJECTIVE

1. To enable student to understand ecosystem structures and functions
2. To provide deep understanding of incredible diversity of life, interactions between different ecosystem services and impacts of natural disturbances on ecosystem
3. To impart knowledge on harmful effects and disposal of radioactive wastes
4. To enable student to understand inorganic and organic pollutants, their entry into the environment and transformation within the environment
5. To impart knowledge on various bioremediation methods

COURSE OUTLINE

Unit I **(15 hours)**

Introduction to Ecology_Definition,Branches and relation of ecology with other disciplines-Significance of ecology for man.Structure of Ecosystem-Abiotic and biotic components.Examples of ecosystem,Productivity of ecosystem,food chain in ecosystem,ecological pyramids

Adaptations-aquatic adaptation,volant adaptation and desert adaptation

Unit II **(15 hours)**

Ecosystem-fresh water communities- physiochemical nature, Lentic-biotic communities, distribution of oxygen and dissolved nutrients. Loti –charecteristics of lotic and its inhabitants

Estuaries -Types of estuaries, physiochemical aspects of estuaries. Biotic communities

Marine - physiochemical stratification, currents, marine communities (biotic) coral reef as a specialized oceanic ecosystem

Terrestrial Ecosystems-Classification, biomes, tundra, alphine, forest, grassland, desert, wetland biomes and tropical savanna biomes

Unit III **(15 hours)**

Radioactive pollution- Radioactivity and kinds of radiation. Sources of radioactive pollution.Effect of radioactive pollution, protection and control from radiation, disposal of radioactive waste

Unit IV **(15 hours)**

Chemical toxicology-Toxic metals-toxic effects of Pb,Cd,Hg,Ar,Cr and Ni. Estimation of toxic metals.

Toxicity of pesticides-toxic effects of organochlorines, halogenated hydrocarbons, carbonamates, heterocyclic compound, organophosphates, chlorinated phenoxy substances and amides in urea

Unit V **(15 hours)**

Bioremediation - Insitu engineered bioremediation, intrinsic bioremediation and natural attenuation and bio barriers

Ex situ-Bioremediation, phytoremediation, microbial degradation of xenobiotics

RECOMMENDED BOOKS

1.Ecology-Verma and Agarwal

2.Environmental chemistry-B.K.Sharma

REFERENCE BOOKS

1.Walker, C.H. et al. 1996. *Principles of Ecotoxicology*. Taylor & Francis. Inc. 321 pp. ISBN 0748402217.

2.Shaw, I. and J. Chadwick. 1998. *Principles of Environmental Toxicology*. Taylor & Francis. Inc. 216 pp. ISBN 0748403557.

3.Ecology: From Individuals to Ecosystems by Michael Begon, Colin R. Townsend ,John L. Harper

4.Ecology and Environment by Pd Sharma

5.Principles and Methods of Toxicology edited by A. Wallace Hayes

JOURNALS

1. *https://www.frontiersin.org › journals › environmental-science › sections › environme*
2. *https://www.springer.com › ... › Environmental Sciences › Environmental Toxicology*

E- LEARNING RESOURCES

1. https://youtu.be/MWPj2IkeklI
2. https://youtu.be/I8Uj4yD0g6M
3. *https://www.conserve-energy-future.com › radioactive-pollution-causes-effects-solutionhttps://www.conserve-energy-future.com › radioactive-pollution-causes-effects-solution*

4. https://youtu.be/6ny9qGUJjLE
5. https://youtu.be/fkVyBBl6aQo

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)

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Utilize the knowledge in understanding the ecosystem	K1,K2
CO 2	Discuss and explain the interaction between various ecosystem and impact of natural disturbances on ecosystem	K2,K3
CO3	Discuss and explain the harmful effects of radioactive pollutants and their waste	K1,K2
CO4	Apply the knowledge in executing preventive measures on understanding toxic metals , oraganic and inorganic pollutants into environment	K3,K4
CO5	Apply the knowledge in the disposal of waste by various bioremidiation methods	K2,K3

MAPPING OF CO WITH PSO

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	2
CO2	3	3	2	2	2
CO3	3	3	3	2	3
CO4	2	3	3	2	2
CO5	2	2	2	3	3
AVERAGE	2.4	2.6	2.6	2.4	2.4

Mapping Levels : 1- Slight (Low) 2 – Moderate (Medium) 3- Substantial (High)

SEMESTER VI

ELECTIVE- PLANT BIOCHEMISTRY

TOTAL HOURS: 75 **COURSE CODE: BC18/6E2/PBC**

CREDITS: 5 **LT P: 5-0-0**

COURSE OBJECTIVES:

16. To impart knowledge about carbohydrate metabolism in plants.
17. To understand lipid metabolism in plants.
18. To impart knowledge about the plant products & role of enzymes in nitrogen fixation .
19. To understand seed germination.
20. To understand Mendelian genetics.

COURSE OUTLINE

UNIT I **(15 Hours)**

Carbohydrates metabolism in plants-storage carbohydrates-sucrose-transport and mobilization, sucrose as regulator ,sucrose derivatives, trehalose-synthesis ,catabolism ,trehalose in plants symbiotic association ,fructans synthesis,metabolism, structural carbohydrates-Plant cell wall architecture, structural components-cellulose, hemi Cellulose, pectin-synthesis.

UNIT II **(15 Hours)**

Lipid metabolism in plants-plant membrane lipids , plant fatty acids- biosynthesis , triacyl glycerol biosynthesis ,lipid catabolism, plant lipids as second messenger's , cutins , suberins, waxes.

UNIT III **(15 Hours)**

Role of enzymes involved in nitrogen fixation:nitrogenase , nitrate reductase and nitrite reductase,nitrateassimilation. Ammonia assimilation, asparagine assimilation. Sulphur metabolism: sulphate activation, reduction and sulphite reduction. Basic knowledge of plant products- alkaloids, flavanoids, tannins, quinine,terpenoids,lignins and non protein amino acids.

UNIT IV **(15 Hours)**

Seed germination physiology of seed germination. Factors affecting seed germination- water stress, salinity stress, temperature and light .Biochemical changes during germination. natural growth hormones. Auxins, gibberellins ,cytokines , ethylene and abscissic acid. Synthetic growth hormones. Effect of growth regulators on seed germination.

UNIT V **(15 Hours)**

Mendelian genetics – phenotype , genotype, alleles , mendels law of inheritance, monohybrid cross, dihybrid cross,test cross, back cross , incomplete dominance , co dominance , linkage and crossing over complementary genes ,epitasis, non mendelian inheritance.

RECOMMENDED BOOKS:

1. A textboob of plant physiology biochemistry and biotechnology-Dr.S.K.Verma& Mohit Verma
2. Plant physiology-salisbury & Ross
3. Key notes on Plant Biotechnology-Venkatam R .prakash reddy
4. Plant biochemistry – Ayush aggarwal
5. Plant biochemistry- Dr.V.Arun kumar & Dr. Senthil Kumar

REFERENCE BOOKS:

1. Plant Biochemistry- Devlin
2. Plant Biochemistry- Goodwin& Mereer
3. Seed germination – Bewely & Black ,Vol I & II
4. Plant Biochemistry- P.M.Dey & J.B. Harborne
5. Plant Biochemistry- Hans- Walter Heldt

JOURNALS:

1. Journal of Plant Biochemistry and Biotechnology-Springer link
2. Journal of Plant Biochemistry and Biotechnology-Scimago

E-LEARNING RESOURCES:

1. www.biology.ufl.edu
2. www.edu.au
3. www.acsedu.com
4. www.hortcourses.com
5. www.acseduonline.com.

COURSE OUTCOMES:

CO/ PSO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	To Impart knowledge on how energy sources are utilised in carbohydrate metabolism by plants.	K2,K3,
CO 2	To gain knowledge on lipid metabolism in plants	K2, K3
CO3	To Impart knowledge on various plant products and the role of enzymes in nitrogen fixation.	K2,K3
CO4	Consider the role of various factors affecting seed germination and hormones involved in seed germination.	K3, K4
CO5	To Impart knowledge on mendelian genetics	K3, K4

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**200**	**40**	
K2, K 3	**C-2/3x20 marks**	**500**	**40**	

SEMESTER –V & VI

CORE PRACTICAL –III

TEACHING HOURS: 120 **COURSE CODE: BC18/6C/CP3**

CREDITS: 3 **LTP : 0-0-4**

COURSE OBJECTIVES:

1. To enable students to take up jobs in Diagnostic laboratories.
2. To pursue carrier /research in Clinical Biochemistry
3. To train students in isolation of Biomolecules from biological samples.

COURSE OUTLINE:

I. COLORIMETRY

a) Estimation of Creatinine (Jaffe's method)
b) Estimation of Urea
c) Estimation of Cholesterol
d) Estimation of Glucose (Orthotoluidine method)
e) Estimation of Protein(Lowry method)
f) Estimation of Vitamin C
g) Estimation of Iron (Dipyridyl method)

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. DEMONSTRATION EXPERIMENTS

a) Isolation of DNA from Spleen
b) Isolation of Albumin from Egg
c) Isolation of Lecithin form Egg yolk

COURSE OUTCOMES:

1. Estimating the biomolecules,trace elements and vitamins using coloriemetry
2. Demonstrating students to know about the counting of blood cells and Hamoglobin estimation which rises in pathological condition
3. Impact the students to learn and train the isolation techniques of compounds from various samples.

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	3	3	3	3	3

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

SEMESTER –V & VI

CORE PRACTICAL –IV

TEACHING HOURS: 135 **COURSE CODE: BC18/6C/CP4**

CREDITS: 3 **LTP : 0-0-5**

COURSE OBJECTIVES:

1. To develop practical and analytical skills in handling biological samples
2. To enable students analyze the experimental data
3. To determine the abnormal and normal constituents of urine

COURSE OUTLINE:

I.QUANTITATIVE ANALYSIS

1. Estimation of DNA (Diphenyl amine method)

2. Estimation of RNA (Orcinol method)

3. Estimation of xylose (Orcinol method)

4. Estimation of aminoacid (Ninhydrin method)

II. Enzymology

Activity of

i) SGOT
ii) SGPT
iii) Specific activity of ALP
iv) Effect of Temperature, pH , & Substrate concentration of Salivary amylase.

III. URINE ANALYSIS

b) Analysis of normal and abnormal constituents

COURSE OUTCOMES:

1. Estimate the nucleic acid and biomolecules using colorimetry
2. Determine the specific activity of marker enzymes and salivary enzyme
3. Analyse and report the normal and abnormal compounds of urine

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
AVERAGE	3	3	3	3	3

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

SEMESTER I

ALLIED BIOCHEMISTRY I

(For I B.Sc. Microbiology)

TEACHING HOURS: 60 **COURSE CODE: BC18/1A/AB1**

CREDITS: 4 **LTP :3-1-0**

COURSE OBJECTIVEs:

1. To demonstrate the importance and the properties of Carbohydrates
2. To learn the types of Carbohydrates in detail and understanding their properties
3. To explain the concept of metabolic activities
4. To Learn the amino acids and its classification based on various criteria
5. To discuss the importance and its classification and functions of Proteins.

COURSE OUTLINE:

UNIT I (12 hours)

Carbohydrates – Definition, Biomedical importance of carbohydrates, Classification of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides), Vant Hoff's rule, Stereoisomerism, Optical isomerism, Mutarotation, Epimers, Aldose, Ketose.

UNIT II (12 hours)

Monosaccharides- Linear structure and Haworth structure of Glucose and Fructose, Disaccharides – Lactose and Sucrose, Inversion of Sucrose , Polysaccharides – Homoglycans- Structure of Starch and Glycogen, Heteropolysaccharides – Chondroitin sulphate .

UNIT III (12 hours)

Definition of Catabolism, Anabolism and Amphibolic cycle. Glycolysis and TCA cycle with energetics, Glycogenesis and Glycogenolysis (Structure not required)

UNIT IV (12 hours)

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 hours)

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 Quarternary structure, - Basic concepts.

RECOMMENDED BOOKS:

1. Fundamentals of Biochemistry by J L Jain, Sunjay Jain and NithinJain . Publisher S.chand, 2004 Edition.
2. Biochemistry by U Satyanarayana. Publisher Elsevier India, 4th Edition 2013.

REFERENCE BOOKS:

1. Principles of Biochemistry by Lehninger, A.L, Publisher: W.H.Freeman, New York. . 2005, 4 th Edition
2. Biochemistry by Lubertstryer, Publisher: W.H .Freeman & company, 2001, 5 th Edition.
3. Biochemistry by Voet, D.andVoet .J.G. Publisher: , John Wiley and Sons, Inc. 2004 . 3 rd Edition
4. Textbook of Biochemistry – Zubey, IV edition,1998
5. Textbook of Medical Biochemistry-M.N.Chatterjee and Ranashinde ,^{7th} edition.

JOURNALS:

1. Journal of Biomolecules-Open access
2. International journal of Biological macromolecules-Elsvier
3. Journal of Biomolecules- Wiley
4. Journal of Biomolecular Techniques

E-LEARNING RESOURCES:

1. www.phschool.com/science/biology_place/
2. www.wtec.org/te/usws/usws
3. https://youtu.be/8quij1m7XUhk
4. https://youtu.be/RnL71VNCMCY
5. https://youtu.be/1R6KB12Wtyw

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	To utilise the importance of Carbohydrates in life	K1,K2
CO 2	To assess the types of Carbohydrates in detail. Exploring the application of Sucrose day to day life	K3
CO3	Applying the knowledge about various metabolic activities occurring in our body.	K1,K2,K3
CO4	Compile the various aminoacids and applying the knowledge about the essential and semi essential amino acids	K1,K2
CO5	Identifying the Primary,Secondary and Tertiary types of Proteins.	K1,K2

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	3	3	3	2	2
AVERAGE	2.0	2.2	2.2	2.0	2.0

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN :

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	500	40	
K2, K 3	C-2/4x20 marks	1500	40	

SEMESTER II

ALLIED BIOCHEMISTRY II

(For I B.Sc. Microbiology)

TEACHING HOURS: 60 **COURSE CODE: BC18/2A/AB2**

CREDITS: 4 **LTP :3-1-0**

COURSE OBJECTIVES:

1. To learn the characteristics of enzymes and its activity
2. To acquire knowledge about Lipids in detail and its properties
3. To understand the concept of DNA Double helical structure and DNA types
4. To Know the physical and chemical properties of DNA and the types of RNA
5. To learn the types of various classes of Hormones

COURSE OUTLINE:

UNIT I (12 hours)

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 hours)

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 hours)

Purine and Pyrimidine bases with structures, Nucleosides, Nucleotides, DNA- Structure (Watson and Crick model), Chargaff's rule, Types of DNA- A , B and Z- DNA.

UNIT IV (12 hours)

Physical properties of DNA – Shape, Size, Effect of Temperature, Denaturation and Renaturation of DNA, Chemical properties of DNA – Hydrolysis by acids, alkali, enzymes and pH.

RNA- types of RNA- m-RNA, r-RNA and t-RNA, Clover leaf model of t- RNA. Biological importance of RNA.

UNIT V (12 hours)

Hormones – Classification, Pituitary hormones, Thyroid, Parathyroid hormones, Insulin, Glucagon, Adrenocortical hormones, Testosterone and Etrogen (Biological Significance only).

RECOMMENDED BOOKS:

1. Fundamentals of Biochemistry by J L Jain, Sunjay Jain and NithinJain . Publisher S.chand, 2004 Edition.
2. Biochemistry by U Satyanarayana. Publisher Elsevier India, 4th Edition 2013.

REFERENCE BOOKS:

1. Biochemistry by Lubertstryer, Publisher: W.H .Freeman & company, 2001, 5 th Edition.
2. Biochemistry by Voet, D.andVoet .J.G. Publisher: , John Wiley and Sons, Inc. 2004 . 3 rd Edition
3. Textbook of Biochemistry – Zubey, IV edition,1998
4. Textbook of Medical Biochemistry-M.N.Chatterjee and Ranashinde ,^{7th} edition.
5. Principles of Biochemistry by Lehninger, A.L, Publisher: W.H.Freeman, New York. . 2005, 4 th Edition.

JOURNALS:

1. Journal of Biomolecules
2. International Journal of Biological macromolecules
3. Journal of Biomolecules
4. Journal of Biomolecular Techniques

E-LEARNING RESOURCES:

1. https://youtu.be/Dj2KGwJXJc
2. https://youtu.beVmQV3Qs9Qzk
3. https://youtu.be/_-vZ_G7K6P0
4. https://youtu.be/Y4p6Faru4
5. https://youtu.be/WMVEGAVdEoc

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Compute the various types of enzymes and the factors affecting its activity and apply them practically	K1,K2
CO 2	Utilize knowledge about the importance of Lipids and its classification. Knowing the various properties of lipids	K3
CO3	Demonstrate the composition of Nucleic acid and Watson and crick model of DNA	K1,K2

CO4	Learning the various properties of DNA and the various types of RNA and its compostion	K1.K2
CO5	Outline the types of Hormones ,its classification and effects of hormones in our body.	K1,K2

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**
AVERAGE	**2.0**	**2.2**	**2.2**	**2.0**	**2.0**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

Question paper pattern:

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER I & II

ALLIED BIOCHEMISTRY PRACTICAL

TEACHING HOURS: 60 **COURSE CODE: BC18/2A/ABR**

CREDITS: 2 **LTP: 0-0-2**

COURSE OBJECTIVES:

1. To understand the properties of Carbohydrates and amino acids
2. To explore the facts about Various Biochemical Instrumentation

COURSE OBJECTIVES:

I Qualitative Analysis of carbohydrates –

Monosaccharides - Glucose, fructose

Disaccharides - Maltose, Sucrose

Polysaccharides - Starch

II Qualitative Analysis of Amino acids –

Arginine, Cysteine, Tryptophan, Tyrosine

III Spotters –

Centrifuge, Compound microscope, pH meter, Weighing balance, Colorimeter, Incubator

IV Group experiment

Preparation of starch from potato

Preparaion of casein from milk

COURSE OUTCOMES:

1. Able to identify the Carbohydrates and aminoacids
2. Applying the facts of biochemical instrumentation in practically

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2
AVERAGE	2	2	2	2	2

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Hands on Training

SEMESTER -I

ALLIED BASIC CHEMISTRY-I

(For IB.Sc Clinical Nutrition and Dietetics)

TOTAL HOURS: 60 **COURSE CODE: BC18/1A/BC1**

CREDITS: 4 **LTP: 3-1-0**

COURSE OBJECTIVE

1. The introduction of how atoms bond together to form molecules and compounds are how these particles arrange themselves in all the matter around us.
2. The classification of organic reaction is introduced. To interpret and use the terminology associate with organic reactions.
3. To learn the various concepts of Acids and bases. Introducing pH,and buffers.
4. Identifying the buying practice of food items and the extent of awareness related to selected food products.
5. To understand various types of volumetric titrations and the chemical reaction associated with each type of volumetric titration.

COURSE OUTLINE:

UNIT I (12 hours)

a. Chemical bonding- Definition- Types of bonds - Formation of different bonds with examples --Ionic bond – NaCl, KCl -Covalent bond- Single bond- H2S,HCl, Multiple bond , Molecular orbital theory, Bonding, Non Bonding, Anti Bonding orbitals., Molecular orbital Configuration of Nitrogen, Oxygen and Flourine. Bond order, Diamagnetism and Paramagnetism.Co ordinate bond –Hydronium ion, ammonium ion--Hydrogen bond – Inter and Intra molecular Hydrogen bonding e.g. O & P Nitrophenol-- Vanderwaals force.

b. Shapes of molecules – VSERR Theory & Hybridization CH4 , H2O, NH3, BrF3 , SF6 ,IF5 , IF7.

UNIT II (12 hours)

Mechanistic basis of organic reactions – Electronic displacement results- Inductive, Resonance and Steric effects. Definition of substrates – Electrophiles , Nucleophiles – Elementary treatments of Substitution reactions SN1 , SN2 Walder inversion - Aromatic Electrophilic substitution (Nitration, sulphonation) - Elimination Reaction- E1 , E2 Hoffmann and saytzeff rule- Addition Reaction – Markonikoff's rule and Kharash effect.

UNIT III (12 hours)

Food chemistry- Quality of lipids- rancidity, acid number, iodine number, saponification number. 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 hours)

Acids and bases – Arrehenius 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 hours)

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 – Acidimerty and Alkalimentry – Examples & Indicators used Strong acid Vs Strong base , Strong acid Vs Weak base, Weak acid Vs Strong acid , Weak aicdVs Weak base – Redox Titrations – Permanganometry ,Dictromatery,IodometryIodimetry – Complexometry – EDTA Titrations.

RECOMMENDED BOOKS:

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

REFERENCE BOOKS:

1. Modern Inorganic Chemistry-R.D.Madan,2008
2. Textbook Organic Chemistry-P.L.Soni,H.M.Chawla,29th edition ,2007.
3. Principles of Physical Chemistry-P.L.Soni,U.N.Dash,23rd revised edition,2007.
4. Food Chemistry – Alex V.Ramani, MJP Publishers, 2009.
5. Chemistry for degree students – RL Madan, S.Chand Publishers, 2010

JOURNALS

1. Indian Journal of Chemistry
2. Journal of Saudi Chemical Society

E-LEARNING RESOURCES:

1. http://www.chemistry.org
2. http://www.chemhelper.com
3. MATLAB
4. https://swayam.gov.in
5. https://nptel.ac.in

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Gain knowledge on the types of bonds, understand VB and MO theories Understand the concept of intermolecular forces. Deduce the shape of different polyatomic molecules.	K1, K2

CO 2	Able to describe the mechanism of electrophilic and nucleophilic substitution reactions. Learn how to apply rules in addition and elimination reactions.	K1, K2, K3
CO3	ıses and effects of Food adulteration and awareness to select ıdnon adulterated food.	K1, K2
CO4	Able to explain qualitatively the difference in behavior between strong and weak acids and bases and the pH values of their aqueous solution e to apply the uses of buffer.	K2, K3
CO5	To familiarize with term molarity, molality normality and formality and indicators. Based on law of mass action to arrive at the amount of substance in a unknown solution.	K2,K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**3**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**2**	**2**
CO5	**2**	**2**	**2**	**2**	**2**
AVERAGE	**2**	**2**	**2**	**2**	**2.2**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER – II

ALLIED BASIC CHEMISTRY-II

(For I B.Sc Clinical Nutrition and Dietetics)

TOTAL HOURS: 60 **COURSE CODE: BC18/2A/BC2**

CREDITS: 4 **LTP: 3-1-0**

COURSE OBJECTIVES:

1. To know the condition for co-ordinate bond and chelate formation.
2. To learn the definition and classification of fuel gases, synthetic inorganic polymers and dyes.
3. To understand the definition and classification of drugs.
4. To understand the definition and classification of food additives.
5. To discuss more common methods of securing pure organic compound from natural source or from reaction product mixture.

COURSE OUTLINE:

UNIT I (12 hours)

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 hours)

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 hours)

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.Steroidal drugs and Non Steroidal inflammatory drugs.

UNIT IV (12 hours)

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 suppliments – Food

Fortification – Biological importance of Sodium (Na), Potassium (K),Calcium (Ca),Magnesium (Mg),Potassium(P).

UNIT V (12 hours)

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

RECOMMENDED BOOKS:

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

REFERENCE BOOKS:

1. Modern Inorganic Chemistry-R.D.Madan,2008
2. Textbook Organic Chemistry-P.L.Soni,H.M.Chawla,29th edition ,2007.
3. Principles of Physical Chemistry-P.L.Soni,U.N.Dash,23rd revised edition,2007.
4. Food Chemistry – Alex V.Ramani, MJP Publishers, 2009.
5. Chemistry for degree students – RL Madan, S.Chand Publishers, 2010

JOURNALS:

1. Indian Journal of Chemistry
2. Journal of Saudi Chemical Society

E-LEARNING RESOURCES:

1. http://www.chemistry.org
2. http://www.chemhelper.com
3. MATLAB
4. https://swayam.gov.in
5. https://nptel.ac.in

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Able to name different co-ordinate compounds. Familiarize with the application of chelates in biological system and thereby their application in the field of medicine.	K1, K2
CO2	apply the usage of fuel gas and dyes in daily life.	K1, K2, K3
CO3	ble to describe the mode of action of different drugs.	K1, K2
CO4	e to analyse purpose of additives and to know their limits	K2, K3

CO5	Develop extraction knowledge on the relation between the structure and properties of compounds. Various methods used to separate mixture of compounds and identify their compounds.	K2,K3

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**3**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**2**	**2**
CO5	**2**	**2**	**2**	**2**	**2**
AVERAGE	**2**	**2**	**2**	**2**	**2.2**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Videos
3. Quiz, Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1, K 2	**B-5/8x8 marks**	**500**	**40**	
K2, K 3	**C-2/4x20 marks**	**1500**	**40**	

SEMESTER I

YOGA AND DIET

(For Other Department Students)

TEACHING HOURS: 30 **COURSE CODE: BC18/1N/YOD**

CREDITS: 3 **LTP:2-0-0**

COURSE OBJECTIVES:

1. To learn the types and importance of Yoga and to understand the concept of Work place yoga
2. To understand the various asanas and their benefits
3. To understand the different classes of Nutrients present in food and the vegetarian diets

COURSE OUTLINE:

UNIT I (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, DhanurasanaShavasana.

UNIT III (10 hours)

Different classes of Nutrients in food and their Basic functions, Food sources of Carbohygrates, Proteins, Lipids, Vitamins, Minerals- 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

REFERENCE BOOKS:

1. Science of Yoga by Annswanson, DK Publishing.
2. The Complete Illustrated Book of Yoga by Swami Vishnu Devananda
3. Yoga – a gem for women by Geetha S Iyengar

E-LEARNING RESOURCES:

1. https://youtu.be/tAUf7aajBWE
2. https://youtu.be/YGjVOTfQRX4
3. https://youtu.be/TNzugtjP8Z4

COURSE OUTCOMES:

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Acquiring knowledge about the various types of Yoga and how carrying out yoga in day to day life to attain self control and peace	K1,K2
CO 2	Exploring the various asanas and acquiring their benefits	K2
CO3	Learning the classes of Nutrients and applying it to have a balanced diet ,there by having benefitted	K1,K2

MAPPING OF CO WITH PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**
AVERAGE	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1, K 2,K3	**A= 5 X10**	**350**	**50**	**50**

SEMESTER III

LIFE STYLE DISEASES IN WOMEN

(For Other Department Students)

TEACHING HOURS: 30 **COURSE CODE: BC18/2N/LDW**

CREDITS: 3 **LTP: 2-0-0**

COURSE OBJECTIVES:

1. To acquire knowledge about the different health problems in Women
2. To understand the various various biomolecules and the balanced diet
3. To know the various eating disorders and its adverse effects.

COURSE OUTLINE:

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 for Women-Carbohydrates, Lipids, Proteins, 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.

.

RECOMMENDED BOOKS:

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

REFERENCE BOOKS:

1. Clinical Biochemistry and metabolic medicine-Martin Andrew Crook
2. Davidson's Principles and Practice of Medicine-Boon, Colledge & Walker, Elsevier 20th Edition 2006
3. Textbook of Medical Biochemistry Paperback – 15 Apr 2007by Shinde Rana Chatterjee

E-LEARNING RESOURCES:

1. https://youtu.be/jDdL2bMQXfE
2. https://youtu.be/7WnpSB14nDM
3. https://youtu.be/ollz9MqtW-U

COURSE OUTCOME

CO .NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Getting to know the health problems faced by women and the methods of diagnosis and treatment	K1,K2
CO 2	Exploring the healthy food habits by knowing the balanced diet and acquiring benefits by applying it	K1,K2
CO3	Learning the various eating disorders and exploring the knowledge about smoking and alcoholism and its adverse effects.	K1,K2

MAPPING- COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**3**
AVERAGE	**2.3**	**2.3**	**2.3**	**2.0**	**2.3**

KEY: STRONGLY CORRELATED – 3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED – 1, NO CORRELATION – 0

TEACHING METHODOLOGY:

1. Lecture (Chalk and Talk-LCD)
2. Blended Classroom-E Content, Videos
3. Quiz, Seminar
4. Peer Learning

QUESTION PAPER PATTERN:

Knowledge Level	Section	Word Limit	Marks	Total
K1, K2,K3	**A= 5 X10**	**350**	**50**	**50**

CERTIFICATE COURSE

HERBAL REMEDIES

Course Duration : 45 hours

1. Herbal remedies for facial problems (1+3 hrs)
2. Herbal remedies for hair problems (1+3hrs)
3. Herbal remedies for management of Diabetes Mellitus(1+2hrs)
4. Herbs for Skin care(1+2hrs)
5. Herbal remedies for management of joint pain(1+3hrs)
6. Herbal remedies for management of respiratory illness(1+2hrs)
7. Herbal remedies for management of menstrual problems and nutritional anaemia(1+3hrs)
8. Herbal remedies for management of GI tract disorders(1+3hrs)
9. Herbal remedies for management of obesity(1+3hrs)
10. Herbs used during pregnancy and lactation(1+3hrs)
11. Herbal medicines for healthy liver and kidney(1+3hrs)
12. Herbs as Immunostimulants(1+3hrs)

CERTIFICATE COURSE

ADVANCED BIOCHEMICAL TECHNIQUES

Course Duration : 60 hrs

1. Introduction to Biosafety, Bioethics and Intellectual Property Rights (3 hrs)
2. Infra Red Spectroscopy (1+2 hrs)
3. Gas Liquid Chromatography (1+2 hrs)
4. Immunological Techniques (1+4 hrs)
5. High Performance Liquid Chromatography (1+3 hrs)
6. Conductometric Titration (1+3 hrs)
7. Agarose Gel Electrophoresis (1+3 hrs)
8. Isolation and Estimation of DNA from Animal Tissue (1+3 + 3 hrs)
9. Melting temperature of DNA (1+3 hrs)
10. Gravimetry- Estimation of Calcium from milk (1+3 hrs)
11. Different methods of extraction of compounds from plants (1+5 hrs)
12. ELISA (Enzyme Linked Immunosorbant Assay) (1+5 hrs)
13. Plant Tissue Culture – Callus culture (1+6 hrs)