

✓ M.Sc 15-16

**ETHIRAJ COLLEGE FOR WOMEN**

**DEPARTMENT OF BIOCHEMISTRY**

**SYLLABUS**

**FOR**

**M.Sc BIOCHEMISTRY**

**UNDER CHOICE BASED CREDIT SYSTEM**

**(2015-2016)**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

**MINUTES OF THE BOARD OF STUDIES MEETING**

**M.Sc BIOCHEMISTRY**

The Board of studies meeting for revision of syllabus with effect from was held in the Department of Biochemistry on 16.03.2016. The following changes and additions suggested in the PG curricula have been implemented in the new curriculum.

- Reorganisation of topics in the units was carried out in the paper Immunology.
- Quantitative analysis of urine was included in Practical III.

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

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

The board of studies meeting was held in the department of biochemistry on 16.03.2016.

The board consisted of the following members.

<b>S.NO</b>	<b>MEMBER'S NAME &amp; DESIGNATION</b>	<b>SIGNATURE</b>
1.	Dr.M. SUJATHA (CHAIRMAN BOARD OF STUDIES) HEAD DEPARTMENT OF BIOCHEMISTRY ETHIRAJ COLLEGE FOR WOMEN CHENNAI -600008	
2.	Dr. A. GEETHA (UNIVERSITY NOMINEE) HEAD DEPARTMENT OF BIOCHEMISTRY BHARATHI WOMEN'S COLLEGE CHENNAI-108	
3.	Dr. FOUZIA BANU (SUBJECT EXPERT) HEAD DEPARTMENT OF BIOCHEMISTRY JUSTICE BASHEER AHMED SAYEED COLLEGE FOR WOMEN CHENNAI -18	

4. Dr. P.T. SRINIVASAN (SUBJECT EXPERT)  
HEAD  
DEPARTMENT OF BIOCHEMISTRY  
D.G.VAISHNAV COLLEGE  
CHENNAI -106
5. Dr.A. K.HEMANTH KUMAR (INDUSTRIAL NOMINEE)  
SCIENTIST –C  
DEPARTMENT OF BIOCHEMISTRY  
NATIONAL INSTITUTE FOR RESEARCH IN TUBERCULOSIS  
CHETPET  
CHENNAI
6. Mrs. C.N. DEEPA  
ASSISTANT PROFESSOR  
DEPARTMENT OF BIOCHEMISTRY  
ETHIRAJ COLLEGE FOR WOMEN  
CHENNAI 600008
7. Dr. SAFIYA  
ASSISTANT PROFESSOR  
DEPARTMENT OF BIOCHEMISTRY  
ETHIRAJ COLLEGE FOR WOMEN  
CHENNAI 600008
8. Ms. SARANYA  
M.Sc (BATCH 2013-2015)

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600008**

**PG DEPARTMENT OF BIOCHEMISTRY**

**M.Sc -REVISED SYLLABUS EFFECTIVE FROM 2015-16**

• **PREAMBLE**

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

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

• **REGULATIONS**

**Eligibility for admission:**

Candidates for admission to the first year of the P.G Biochemistry degree course shall be required to have passed B.S c examinations conducted by the University of Madras or an examination accepted as equivalent there to by the syndicate of the of the University of Madras with any of the following subjects as major – Biochemistry, Chemistry, Botany, Zoology, Biotechnology, Microbiology & other Life sciences.

**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 2 academic years, passed the examinations of all the 4 semesters prescribed.

**Course of the study:**

- Core Subjects
- Elective Subjects
- Extra Disciplinary Elective
- Soft Skill
- Internship

**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 50 % of the marks prescribed for the examination.

**Classification of successful candidates:**

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
- Candidates who pass all the examinations prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

**Question paper pattern :**

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)**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**DEPARTMENT OF BIOCHEMISTRY (ID: SP15)**

**M.Sc BIOCHEMISTRY**

**SEMESTER – I**

S.no	Semester	Course title	Course code	Hou rs	Credits	CA marks	End semester
1	I	Chemistry Of Life	15SP15/1C/COL	4	4	40	60
2	I	Analytical Biochemistry	15SP15/1C/ABY	4	4	40	60
3	I	Advanced Physiology	15SP15/1C/APY	4	4	40	60
4	I	Elective-Genetics	15SP15/1E/GEN	4	3	40	60
5	I	Elective- Computers And Biostatistics	15SP15/1E/CBS	4	3	40	60
6	I	Soft Skill- Personality Development		2	2	-	50
7	I	Practical – I	15SP15/2C/PR1	4	-	-	-
8	I	Practical – II	15SP15/2C/PR2	4	-	-	-

**SEMESTER – II**

S.no	Semester	Course title	Course code	Hou rs	Credits	CA marks	End semester
1	II	Enzyme Biochemistry	15SP15/2C/EZB	4	4	40	60
2	II	Metabolism And Regulation	15SP15/2C/MAR	4	4	40	60
3	II	Hormones And Signal Transduction	15SP15/2C/HOR	4	4	40	60
4	II	Elective- Research Methodology	15SP15/2E/RES	4	3	40	60
5	II	Extra Disciplinary Elective		4	3	40	60
6	II	Soft Skill- Foreign Language		2	2	-	50
7	II	Practical – I	15SP15/2C/PR1	4	4	40	60
8	II	Practical – II	15SP15/2C/PR2	4	4	40	60
9	II	Internship			2		



**SEMESTER – III**

S.no	Semester	Course title	Course code	Hou rs	Credits	CA marks	End semester	
1	III	Molecular Biology	15SP15/3C/MOB	4	4	40	60	1
2	III	Clinical Biochemistry & Biomedical instrumentation	15SP15/3C/CMI	4	4	40	60	1
3	III	Elective - Pharmacology	15SP15/3E/PHC	4	3	40	60	1
4	III	Extra disciplinary elective		4	3	40	60	1
5	III	Soft skill Computing Skills in Biochemistry	15SP15/3S/CSB	2	2	-	50	50
6	III	Practical- III	15SP15/4C/PR3	4	-	-	-	-
7	III	Practical- IV	15SP15/4C/PR4	4	-	-	-	-
8	III	Project	15SP15/4C/PRJ	4	-	-	-	-

### SEMESTER- IV

S.no	Semester	Course title	Course code	Hou rs	Credits	CA marks	End semester
1	IV	Immunology	15SP15/4C/IMU	5	4	40	60
2	IV	Biotechnology	15SP15/4C/BTC	5	4	40	60
3	IV	Elective Bioinformatics	15SP15/4E/BIM	4	3	40	60
4	IV	Soft skill- Essentials of Presentation skills	15SP15/4S/EPS	2	2	-	50
5	IV	Practical- III	15SP15/4C/PR3	5	4	40	60
6	IV	Practical- IV	15SP15/4C/PR4	5	4	40	60
7	IV	Project	15SP15/4C/PRJ	4	4	40	60

The above courses of the PG program enrich the skills in employability / skill development Entrepreneurship which caters the needs of the students

**ELECTIVE SUBJECTS FOR OTHER DEPARTMENTS**

<b>S.no</b>	<b>Semester</b>	<b>Course title</b>	<b>Course code</b>	<b>Hours</b>	<b>Credits</b>	<b>CA marks</b>	<b>End semester</b>	<b>Total</b>
1.	II	Women and Health	15SP15/2E/WOM	4	3	40	60	100
2	III	Lifestyle Associated Diseases	15SP15/3E/LID	4	3	40	60	100

## EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

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

- **RUBRICS FOR CONTINUOUS ASSESSMENT EVALUATION.**

Assignment -Contents/originality/Presentation /Schematic representation and Diagram/Bibliography. (10marks)

Seminar- Organisation/subject knowledge/Visual Aids/Confidence level/Presentation. (10marks)

Participatory learning- Answering questions/Clearing doubts/Participation in discussion /Attendance /Communication and language. (10marks)

## SEMESTER I

### CHEMISTRY OF LIFE

**TEACHING HOURS: 60 Hours**

**Credits: 4**

**COURSE CODE: 15SP15/1C/COL**

**LTP: 3 1 0**

#### Objective:

Studying in detail about biomolecules which support life.

#### COURSE OUTLINE:

##### UNIT-I: (12hrs)

**Carbohydrates**- Classification, Structure and biological importance of Mono saccharide ,Disaccharides ,Homopolysaccharides , Mucopolysaccharides . Proteoglycans, glycoproteins, bacterial cell wall carbohydrates- peptidoglycan, teichoic acids, blood group oligosaccharides

**Lipids**-classification, structure and functions of fatty acids, triglycerides, phospholipids, glycolipids, prostaglandins, thromboxanes and leukotrienes. structure and functions of sterols and steroids.

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

**Types of DNA** , forces stabilizing deoxyribo nucleic acids, , topology of DNA-writhe, twist and linking number , types of RNA- rRNA, tRNA, mRNA and other types –structure and functions.

Classification and Structure of amino acids. **Protein**-Classification based on structure and function, forces involved in the stabilization of protein structure, Ramachandran plot. Detailed account of primary , secondary, super secondary , tertiary and quaternary structure,. Folding of proteins-Molecular chaperons, Prions

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

**Cellular Foundations**-Origin of cells – Prokaryotes, Eukaryotes, Multicellularity in higher organisms, Cellular architecture ,Extracellular matrix- Collagen, Hyaluronic acid, Cell- Cell Interactions-Cell adhesion proteins, Junctions, Cytoskeleton-Microtubules, Micro filaments, Intermediate filaments.

##### UNIT IV: (12hrs)

**Biological Membranes**- Structure, composition- Membrane lipids, lipid bilayer, Membrane carbohydrates, Membrane proteins and assembly of biological membranes, Functions of biomembranes, ,Membrane asymmetry, Flip flop movement-flippases, Membrane model-Fluid Mosaic model. RBC membrane and Liposome as model.

Transport process-active transport-  $\text{Na}^+$ ,  $\text{K}^+$ ATPase,  $\text{Ca}^{2+}$ ATPase, Proton pump;Passive diffusion;facilitated diffusion-glucose transport in erythrocytes,anion transport system.Transport process driven by ion gradients-Uniport,Symport,Antiport.Specialised membrane pores-Porins,Ionopores-Valinomycin-mobile carrier ionophore, Gramicidin-channel forming ionophores

**RECOMMENDED BOOKS:**

1. Principles of Biochemistry- Lehninger,Nelson&Cox ,2<sup>nd</sup> Edition, W. H. Freeman Publication
2. Biochemistry-Voet & Voet ,3<sup>rd</sup> Edition,Jhon Wiley and sons Publication
3. Biochemistry- Stryer 4<sup>th</sup> Edition,Freeman Publication

**REFERENCE BOOKS:**

1. Harper's Biochemistry- Murray, 26<sup>th</sup> Edition
2. Biochemistry- Zubay , 4<sup>th</sup> Edition

**Journals :**

International Journal of Chemical and Life sciences

International journal of biochemistry and biomolecules

The BioChemistry : An Indian Journal

Indian journal of biochemistry

**Web site:**

[www.journals.elsevier.com/bioorganic-and-medicinal-chemistry/](http://www.journals.elsevier.com/bioorganic-and-medicinal-chemistry/)

[www.chemistryguide.org/biochemistry.html](http://www.chemistryguide.org/biochemistry.html)

**Question paper pattern :**

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PART A	Definition and structures	20
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**SEMESTER I**

**ANALYTICAL BIOCHEMISTRY**

**TEACHING HOURS: 60 Hours**

**CREDITS: 4**

**COURSE CODE: 15SP15/1C/ABY**

**LTP: 3 1 0**

**Objective:**

To enable the students to gain fundamental knowledge of analytical techniques

**COURSE OUTLINE:**

**UNIT I (12hrs)**

**Safe Laboratory practices** - Prevention of accidents , Protection from Physical , Chemical and Biological hazards, Hazardous waste disposal, Containment facility, Levels of Biosafety

**Centrifugation Techniques** - Basic principles of Sedimentation , Differential and density gradient centrifugation , Analysis of sub cellular fractions , Analytical ultra centrifugation

**UNIT II (12hrs)**

**Chromatography** - General principle and operational procedure of column chromatography, Gel permeation, Ion exchange, Affinity, Gas liquid and high performance liquid chromatography , capillary electrochromatography

**Electrochemical Techniques in Research** - Potentiometry , Amperometry, Ion selective Electrodes , Gas sensors , Biosensors, Polarography

**UNIT III (12hrs)**

**Electrophoresis**- General principle, Factors affecting Electrophoretic separation, Isoelectric focussing , SDS PAGE, 2D PAGE , 3 D gel eletrophoresis , Estimation and recovery of proteins in gels Electrophoresis of nucleic acids, DNA sequencing gels, Pulse field gel electrophoresis Immunoelectrophoresis , Blotting techniques.

**UNIT IV (12hrs)**

**Radioactivity** - Detection and quantification of Radioactivity , GM counter , Scintillaation counter , Autoradiography, Use of radioisotopes in Research.

**Microscopy** – Principles and applications of phase contrast, fluorescence, scanning and transmission electron microscopy. Preparation of sample for histopathology- Fixing, processing, embedding and sectioning.

## UNIT V

(12hrs)

**Spectroscopy** - General principles, UV spectrophotometry, Fluorimetry, Atomic absorption spectroscopy, Flame emission spectroscopy, Nephelometry, Luminometry  
Immunological techniques - RIA, Immunofluorescence, ELISA, Immunohistochemistry

### Recommended Textbooks:

1. Principles and techniques of practical biochemistry – Keith Wilson and John Walker , 7<sup>th</sup> Edition, Cambridge University Press.
2. BioPhysical Chemistry Principles and Techniques - Upadhyay& Upadhyay Nath, Himalaya Publishing House.

### Reference Books:

1. Spectroscopy – B.K. Sharma, Goel Publishing House.
2. Analytical biochemistry – Holme and Peck, Prentice Hall

### Journals :

Analytical Biochemistry

Biochemistry & Analytical Biochemistry

International Journal of Analytical Biochemistry Research

Analytical and Bioanalytical Chemistry

### Web site:

[www.springer.com](http://www.springer.com) › Home › Chemistry › Analytical Chemistry

<http://www.nature.com/subjects/analytical-biochemistry>

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**SEMESTER I  
ADVANCED PHYSIOLOGY**

**TEACHING HOURS: 60 Hours**

**CREDITS: 4**

**COURSECODE: 15SP15/1C/APY**

**LTP : 3 1 0**

**Objective**

Study of organs systems in detail enable student to understand the metabolic and clinical aspects of diseases vividly.

**COURSE OUTLINE:**

**Unit – I:** (12 Hrs)

**Digestive system** – Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. Dietary requirement and functions of carbohydrates, lipids and proteins. Biological value of proteins. Basal metabolism- basal metabolic rate, factors affecting BMR, RQ, Calorific values of food components.

**Unit – II:** (12 Hrs)

**Types of neuronal cells** -Nerves: regeneration of nerve fibers, generation of nerve impulse, all or none principle. Mechanism of synaptic transmission, transmission of nerve impulse. Types of neurotransmitters and their receptor. Division of vertebrate nervous system: CNS, PNS, ANS, regions of the brain.

**Unit – III:** (12 Hrs)

**Functional anatomy of kidney**, renal blood flow, its determination, regulation and peculiarities GFR – definition, measurement, filtration membrane, forces involved, control of GFR Tubular function – reabsorption, secretion and concentration mechanism Nerve supply to urinary bladder, micturition, Non excretory functions of kidney .

**Unit – IV** (12 Hrs)

**Structure of heart**, cardiac cycle, heart sounds, E.C.G (elementary knowledge) vasomotor circulation, coronary circulation, blood pressure. Structure of muscle cells and muscle contraction.

**Unit – V** (12 Hrs)

**Anatomy of female reproductive system** and Causes of female infertility (acquired and genetic), treatments, Gametogenesis, Puberty, fertilization (natural and assisted (*in vitro*), Pregnancy (first, second & third trimester), Placenta as source of stem cells, cord banking, reproductive aging

(menopause and andropause). Anatomy of Male reproductive system and causes of male infertility (environmental and genetic), treatments

### RECOMMENDED BOOKS

1. Chaudhuri (Sujith K), 5th Edition Concise Medical Physiology New Central Books, Calcutta.
2. Tortora (Gerald J), Principles of anatomy and physiology 11th Edition John Waley & Sons, Ref. college publication.
3. A.K. Jain – Textbook of Medical Physiology, 4th Edition 2008. 7. BIJLANI (RL), Understanding medical physiology; text book for medical students, Jaypee Brothers, New Delhi .

### REFERENCE BOOKS

1. Human Physiology by Guyton and Hall Press Pub Saunders
2. Biochemistry, 4th Edition - Donald Voet, Judith G. Voet – Publisher John Wiley & Sons.
3. Human reproductive Biology by Jones and Lopez Pub
4. Principles of Biochemistry: Mammalian Biochemistry: Smith EL, Hill RL, White A, McGraw Hill

#### Journals :

International Journal of Advanced Physiology and Allied Sciences

American Journal of Physiology

Indian Journal of Physiology and Pharmacology

National Journal of Physiology, Pharmacy and Pharmacology

#### Website :

[www.getbodysmart.com/ap/site/resourcelinks/links.html](http://www.getbodysmart.com/ap/site/resourcelinks/links.html)

[advan.physiology.org/](http://advan.physiology.org/)

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**SEMESTER I**

**ELECTIVE-GENETICS**

**TEACHING HOUR: 60 Hours**

**CREDITS: 3**

**COURSE CODE: 15SP15/1E/GEN**

**LTP: 3 1 0**

**OBJECTIVE**

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

**COURSE OUTLINE:**

**Unit I** (12 hrs)

**Definition of gene**, Organization of genes, Chromosome –Composition ,structure and function, Human Karyotype ,Types of chromosomal anomalies-Ploidy,Chromosomal Aberrations – Duplication, Inversion, Deletion and Translocation, Gene Mutations

**Unit II** (12 hrs)

**Contribution of Mendel**,Mendels laws of Inheritance- Law of Dominance, Law of Seggregation, Law of Independent assortment,Incomplete Dominance, Co dominance ,Test Cross, Back cross, Complementary and Supplementary Genes , Epistasis.

**Unit III** (12 hrs)

**Chromosomal genetics - Linkage and crossing over**, chromosomal mapping, Autosomes, Autosomal linked diseases, Autosomal Dominant – Huntington Disease, Autosomal recessive- Cystic Fibrosis, Structure of sex chromosomes , Sex determination and Sex linked inheritance- Haemophilia, Epigenetics , Prenatal Dignosis and Genetic Counselling.

**Unit IV** (12 hrs)

Genetic basics of Diseases- Diabetes, Cancer- Oncogenes, Tumor suppressor genes , Genetics of Apoptosis ,Heart Diseases-Genes of Coronary Heart disease, Human genetic diseases-Down's Syndrome, Klinefelter's Syndrome, Turner's Syndrome

**Unit V** (12 hrs)

Neurogenetics-Genetic basis of Schizophrenia and Alzhemiers Disease

Pharmacogenetics-Genes and Drugs, Dose determination, Drug metabolism- Cytochrome P450, Multi drug resistance gene polymorphisms,SNPs,

## RECOMMENDED BOOKS

- Genetics- Verma & Agarwal, S. Chand & Company, 9<sup>th</sup> edition
- Applied genetics – C. Emmanuel, S. Ignacimuthu & S. Vincent, MJP Publishers, First Edition
- Medical genetics-G.P.Pal, A.I.T.B.S publishers, first Edition

## REFERENCE BOOKS

- A History of Genetics- Sturtevant, Cold Spring Harbor Laboratory and Electronic Scholarly Publishing
- Mendelian Inheritance in man- McKusick, John Hopkins University Press, 12<sup>th</sup> Edn
- Molecular Cell Biology-Baltimore, 4<sup>th</sup> Edition, W.H. Freeman Company

## Journals :

Journal of Genetics

Journal of Human Genetics

International Journal of Genetics and Genomics

Genetics Research International

## Website :

[www.eupedia.com](http://www.eupedia.com) > Genetics

[www.genetics.org/](http://www.genetics.org/)

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## SEMESTER I

### ELECTIVE-COMPUTERS AND BIOSTATISTICS

**TEACHING HOUR: 60 Hours**

**CREDITS: 3**

**COURSE CODE: 15SP15/1E/CBS**

**LTP: 3 10**

#### OBJECTIVES:

- To Study the use of computers in Document preparation ,Statistical Analysis And Presentation
- To study the role of statistical analysis in Interpretation of experimental results.

#### COURSE OUTLINE:

##### UNIT I

**(12 hours)**

Computer fundamentals - Basic architecture , memory units, auxiliary storage devices ,input devices, output devices.

Windows Operating system, MS Office MS Word – Basics, creating a document/template, tables

##### UNIT II

**(12 hours)**

MS Excel – basics ,functions ,inserting formulae, data sort ,data filters ,creating charts, & Statistical analysis .

MS Powerpoint- creating presentation, inserting graphs/pictures/tables, smart arts, slide show.

##### UNIT III

**(12 hours)**

Biostatistics- An outline of statistical investigations, types of data, Methods of data collection, Population and sample, Types of sampling- advantages & disadvantages .Presentation of data in the form of tables and charts- Line graph, Pie chart, bar graph.

##### UNIT IV

**(12 hours)**

Statistical measures – Measures of Central tendency- Mean, Median , Mode( Individual data, discrete series & continuous series). Measures of variability- Range, Quartile deviation, Standard deviation (Individual data, discrete series & continuous series), Skewness and kurtosis

##### UNIT V

**(12 hours)**

Analysis of data - Correlation & Regression, Testing of hypothesis, Level of significance, Type I & Type II errors. Student's t test , ANOVA (One way), Duncan multiple range test, Chisquare test.

## RECOMMENDED BOOKS

1. Introduction to Biostatistics – N. Gurumani, MJP publishers
2. Introduction to computers & MS office – Vikas Publishing House

## REFERENCE BOOKS

1. Theory and problems of Statistics – Schaum's Outline Series
2. Biostatistical analysis – Jerrold H Zar, Pearson Publishers

### Journals:

Statistics and Computing

Computational Statistics & Data Analysis

The International Journal of Biostatistics

International Journal of Statistics and Systems

### Website :

[www.biostat.ucsf.edu/sites.html](http://www.biostat.ucsf.edu/sites.html)

<https://www.cs.uri.edu/>

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## SEMESTER II

### ENZYME BIOCHEMISTRY

**TEACHING HOURS: 60 Hours**

**CREDITS: 4**

**COURSE CODE: 15SP15/2C/EZB**

**LTP: 3 1 0**

**OBJECTIVE:**

To study the classification, kinetics, properties, functions and enzyme techniques. Detailed Study of these makes the student to understand the mechanism of biocatalytic reactions.

**COURSE OUTLINE:**

**UNIT-I (12hrs)**

**Classification of enzymes**, Enzyme units, Activation energy, Specificity and Active site. Factors affecting enzyme activity- Substrate concentration, Enzyme concentration, pH, Temperature, Modulators, Applications of enzymes in food and pharmaceutical industries.

**UNIT-II (12hrs)**

**Trapping of ES Complex**, Mapping of active site by chemical modification. Site directed mutagenesis of enzymes - a brief outline. Mechanism of enzyme activity-covalent catalysis, proximity and orientation effects, acid-base catalysis, structure and mechanism of action of Chymotrypsin.

**UNIT-III (12hrs)**

**Coenzyme** - structure and function, cofactors, reactions involving CoA, TPP, PLP, NAD/NADP, FMN/FAD, Biotin. Multienzyme systems - mechanism of action of Pyruvate dehydrogenase complex.

**UNIT-IV (12hrs)**

**Michaelis menten equation**, **Line weaver burk plot**, Eadie Hofstee plot, Hanes plot, Eisenthal and Cornish Bowden plot, Briggs Haldane modifications. Determination of  $K_m$  and  $V_{max}$ , Enzyme turn over. Bisubstrate reactions-single and double displacement reactions. Enzyme inhibition- competitive, Uncompetitive and Noncompetitive inhibition with derivation. Allosteric enzymes-K series and V series enzymes, MWC and KNF models and Feed back inhibition with example.

**UNIT-V (12hrs)**

**Homogenization technique for enzyme isolation**, separation methods of cellular organelles, purification of enzymes-chromatography, electrophoresis, dialysis, criteria of purity of enzymes. Fast reactions and Stop flow reactions (in brief). Immobilized enzymes- its preparation and applications. Abzymes, Ribozymes, Isoenzymes, Artificial enzymes.

### RECOMMENDED BOOKS:

1. Enzymes- Trevor Palmer, 4<sup>th</sup> Ed., Ellis Horwood Ltd
2. Principles of Biochemistry- Lehninger, 6<sup>th</sup> Edition, W.H. Freeman and Co.
3. Biochemical Calculations- Irwin Segel - 2<sup>nd</sup> Edition
4. Enzyme Technology- Anusha Bhaskar, MJP publishers.

### REFERENCE BOOKS:

1. Enzymes- Boyer, 3<sup>rd</sup> edition, Academic press
2. Biochemistry- Metzler, 2<sup>nd</sup> edition, Academic press

### Journals :

Indian journal of biochemistry

Indian Journal of Biochemistry and Biophysics

International Journal of Biochemistry

International Journals of Biotechnology and Biochemistry

### Web site:

[study.com/academy/topic/enzymatic-biochemistry.html](http://study.com/academy/topic/enzymatic-biochemistry.html)

[www.britannica.com/science/enzyme](http://www.britannica.com/science/enzyme)

### Question paper pattern :

The pattern of question paper shall be as follows:

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

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

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

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



## SEMESTER II

### METABOLISM AND REGULATION

Teaching hours : 60 hours  
course code: 15SP15/2C/MAR

CREDITS: 4  
LTP: 3 1 0

**Objective:** Students gain knowledge on the metabolism of macromolecules, regulation and associated clinical disorders.

#### COURSE OUTLINE:

**Unit I** ( 12 hrs)

**Carbohydrate metabolism and regulation**-Glycolysis ( Aerobic and Anaerobic ), Paster effect, Shuttle systems ,Gluconeogenesis, Glycogenesis, Glycogenolysis, Citric acid cycle, HMP shunt , Uronic acid pathway

**Unit II** ( 12 hrs)

**Aminoacid metabolism and regulation**-General Pathways of aminoacid degradation, mechanism of transamination ,decarboxylation ,oxidative and non oxidative deamination , Biosynthesis of phenylalanine, methionine and specialized products-epinephrine, norepinephrine, SAM, serotonin, melanin. Glucose –alanine cycle, urea cycle.

**Unit III** ( 12 hrs)

**Lipid metabolism and regulation** –Oxidation of saturated, unsaturated ,odd and even numbered fatty acids, Alpha and Omega oxidation , Ketogenesis, Biosynthesis of saturated and unsaturated fatty acids , mitochondrial chain elongation,Glucose- Fatty acid cycle

**Unit IV** ( 12 hrs)

Lipid Metabolism and regulation- Metabolism of triacylglycerol, Phospholipid and Spingolipids, Cholesterol biosynthesis and degradation.

Interrelationship of carbohydrate ,protein and fat metabolism –Role of acetyl coA and TCA cycle.

**Detoxification mechanism**-oxidation,reduction,hydrolysis and conjugation

**Unit V** ( 12 hrs)

**Nucleotide metabolism** and regulation- Denovo synthesis and Salvage pathway of purine and pyrimidine nucleotides , degradation of purine and pyrimidine nucleotides , Inhibitors

## RECOMMENDED BOOKS

1. Harper's Biochemistry- Murray et al, 26<sup>th</sup> Edition
2. Text book of biochemistry- Zubay, 3<sup>rd</sup> Edition, WCB publishers
3. Principles of biochemistry – Lehninger, Nelson and Cox 6<sup>th</sup> Edition, W.H. Freeman and Co.
4. Text book of Biochemistry- Lubert Stryer, 4<sup>th</sup> edition, W.H. Freeman and Co.

## REFERENCE BOOKS

1. Text book of Biochemistry- Voet & Voet, 3<sup>rd</sup> Edition, John Wiley & Sons
2. Biochemistry- Garrett & Grisham, Saunders College Publishing house

## JOURNALS:

Indian journal of biochemistry & biophysics

Biochemistry & Analytical Biochemistry

Biomolecules

Endocrinology & Metabolism International Journal

## Website:

[www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov) > NCBI > Literature > Bookshelf

[www.amazon.com](http://www.amazon.com) > Books > Science & Math > Biological Sciences

## Question paper pattern :

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PART A	Definition and structures	20
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**PART C: 2 out of 4 questions, each from different units (2X20=40)**

## SEMESTER II

### HORMONES AND SIGNAL TRANSDUCTION

TEACHING HOURS: 60

CREDITS: 4

COURSE CODE: 15SP15/2C/HOR

LTP: 3 1 0

#### Objective:

To make the students understand about the endocrine glands, their functioning and signaling processes.

#### COURSE OUTLINE:

##### UNIT I: (12 hours)

Endocrine glands; hormones – classification, circulation in blood. Receptors – classification; Cell surface and intra cellular receptors,

Hypothalamus – TRH, GnRH, GHRH, CRH, somatostatin, dopamine; Pituitary hormones – TSH, ACTH, endorphins, somatotropin, LH, FSH, Prolactin, oxytocin, vasopressin.

##### UNIT II: (12 hours)

Thyroid hormones, parathyroid hormone, calcitonin, calcitriol; Regulation of Calcium and phosphorus homeostasis.

##### UNIT III: (12 hours)

Pancreatic hormones – Insulin, glucagon. Adrenal hormones – epinephrine, cortisol, aldosterone. Gonadal hormones – Estrogen, Progesterone, Testosterone.

##### UNIT IV: (12 hours)

Molecules involved in signal transduction, GPCR, G proteins – Mechanism of action, Role in bacterial toxin action; CAMP mediated signal transduction processes; Visual transduction – Role of cGMP and rhodopsin. Ras proteins and Receptor tyrosine kinase mediated signal transduction – MAP Kinase, JAK/STAT, Wnt signaling.

##### UNIT V: (12 hours)

Role of Calcium and phosphoinositides in signal Transduction; IP3 – DAG pathway; PI-3 Kinase pathway; Calcium – cellular levels, transport, calmodulin, TroponinC; Interaction of Calcium calmodulin complex.

#### Recommended Textbooks:

1. Williams Text Book of Endocrinology – Lorsen *et al* Saunders; 12 edition

2. Molecular Cell Biology – Lodish and Berk W. H. Freeman; 6th edition

**Reference Books:**

1. Endocrine Physiology- Susan .Porterfield Mosby; 4 edition
2. Basic Clinical Endocrinology – Greenspan, McGraw Hill Education; 9 edition
3. Signal Transduction- Bastien D. Gomperts, Ijsbrand M. Kramer, Peter E.R. Second Edition, Academic Press

**Journals :**

Indian Journal of Endocrinology and Metabolism

Journal of Cell Signaling

Journal of signal transduction

International Journal of Endocrinology and Metabolism

**Website :**

[www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov) > NCBI > Literature > Bookshelf

<http://www.springer.com/medicine/internal/journal/12020>

**Question paper pattern :**

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PART C	Description/synthesis	40

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## SEMESTER II

### ELECTIVE - RESEARCH METHODOLOGY

TEACHING HOURS: 60

CREDITS: 4

COURSE CODE: 15SP15/2E/RES

LTP: 3 1 0

#### OBJECTIVE:

The student gains competence to carry out research work

#### COURSE OUTLINE:

#### UNIT I (12 HRS)

Types of Research - Fundamental & Applied, Descriptive & Analytical, Quantitative & Qualitative. Research bodies & funding agencies, Fellowships.

Thesis writing- Introduction, Review of Literature, Aim and scope, Materials and Methods, Results and Discussion, Summary and Conclusion, Bibliography- Harvard and Vancouver systems, Scientific writing for journals - Preparation of Abstract, Impact factor of journals, Citation index, Oral and poster presentation, Intellectual property rights- Introduction, Patent, Basis of patentability, Non patentable inventions, Methods to apply for patents.

#### UNIT II (12 HRS)

General approaches to Biochemical Investigations - Whole animal studies -Ethical committee clearance, Maintenance of animals, Control and experimental groups, Experimental design- CRD, RBD and latin square design. Experimental Induction of diseases. Organ perfusion and tissue slice techniques. Experiments with human volunteers - Clinical trials, Ethical clearance, Institutional Ethical committee.

#### UNIT III (12 HRS)

Cell lines- finite and continuous cell lines (stem cells and transformed cell lines) Maintenance and experiments with cell lines, MTT assay for anticancer activity.

Cell sorting and cell counting - Flow cytometry (FACS and coulter counter).

Abnormal chromosome analysis- karyotyping, COMET assay. Experiments with isolated compounds - Sequence analysis-DNA and amino acid sequencer

#### UNIT IV (12 HRS)

Preparation of plant extracts- Methods for extraction of Phytochemicals- maceration, infusion, percolation, digestion, decoction, hot continuous extraction (Soxhlet), ultrasound extraction (sonication). Plant secondary metabolites- tannins, flavanoids & alkaloids - isolation and separation

Free radicals, Free radical induced damages , Lipid peroxidation , Antioxidants , Enzymic and non enzymic antioxidants, Phytochemicals as antioxidants, **Methods to assess Anti oxidant activity- FRAP, ABTS,DPPH.**

#### UNIT V

(12 HRS)

Spectroscopy - X ray diffraction , Mass spectroscopy , IR spectroscopy, ESR and NMR spectroscopy , ORD and CD

Nanobiology - Preparation of nanoparticles and biological applications.

#### Recommended textbooks

1. Principles and techniques of practical biochemistry – Keith Wilson and John Walker , 7<sup>th</sup> Edition, Cambridge University Press.
2. BioPhysical Chemistry Principles and Techniques - Upadhyay& Upadhyay Nath, Himalaya Publishing House.

#### Reference Textbooks

Instrumental methods of Chemical Analysis- Chatwal Anand, Himalaya Publishing House

#### Journals :

International Journal of Science and Research Methodology

International Journal of Advances in Software Engineering & Research Methodology

#### Website

[processresearchmethods.org/](http://processresearchmethods.org/)

<https://explorable.com/research-methodology>

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## SEMESTER I & II

### PRACTICAL -I

**TEACHING HOURS: 120 Hours**

**CREDITS:4**

**COURSE CODE: 15SP15/2C/PR1**

**LTP: 0 0 4**

### CHROMATOGRAPHIC SEPARATIONS

1. Paper chromatographic separation of amino acids
2. Paper chromatographic separation of Sugars
3. Thin layer chromatographic separation of lipids
4. Separation of plant pigments by adsorption chromatography
5. Gel permeation chromatography ( Group experiment)
6. Affinity Chromatography( Group experiment)
7. HPLC ( Demonstration)

### FOOD ANALYSIS

8. Determination of moisture content
9. Determination of Ash content
10. Estimation of Iron content
11. Estimation of Protein
12. Isolation and estimation of Starch
13. Isolation and estimation of Glycogen
14. Estimation of Sterol
15. Estimation of Riboflavin

## SEMESTER I & II

### PRACTICAL -II

TEACHING HOURS: 120 Hours

CREDITS: 4

COURSE CODE: 15SP15/2C/PR2

LTP 0 0 4

#### ISOLATION / SEPARATION METHODS

1. Separation of serum proteins by SDS –PAGE
2. Western Blotting
3. Isolation of DNA
4. Agarose Gel electrophoresis and Southern Blotting
5. Isolation of RNA ( Identification by Absorption Spectrum)
6. Isolation of mitochondria – Differential Centrifugation
7. Isolation of Chloroplast- density Gradient Centrifugation
8. IR spectroscopy

#### ENZYME ANALYSIS

9. Assay of Amylase
10. Assay of Protease
11. Assay of ATPase
12. Kinetic Studies- Alkaline Phosphate – Optimun pH and Temperature
13. Kinetic Studies- Alkaline Phosphate – Km, Vmax

#### PHYTOCHEMICAL ANALYSIS

14. Qualitative Analysis of Phytochemicals
15. Estimation of Lycopene
16. Estimation of Curcumin



**SEMESTER III**  
**MOLECULAR BIOLOGY**

**TEACHING HOURS : 60**

**CREDITS : 4**

**COURSE CODE: 15SP15/ 3C/MOB**

**L T P : 4 0 0**

**OBJECTIVE**

- Understanding molecular chemistry of life
- Understanding the molecular basis of cellular activities

**COURSE OUTLINE:**

**Unit I :** ( 12 hrs)

**Replication and Cell Division :** Replication-Replication in Prokaryotes – over view, Eukaryotic DNA replication , Enzymes of DNA replication – DNA polymerase, Helicase, Ligase, Topoisomerase, Telomerase , Licensing factors , D-Loop replication , Inhibitors of replication with medical applications .

Cell Division – **Cell cycle** , Cell cycle control of DNA replication, Cyclins, Cyclin dependent kinases, Cell cycle check points.

**Unit II :** (12 hrs)

**Gene Expression :** Transcription-Transcription in Prokaryotes – overview ,Eukaryotic Transcription , RNA polymerases, Promoters, Enhancers , Insulators, Silencers , Post Transcriptional modifications of t RNA, r RNA , mRNA – Capping, Tailing , Splicing, Reverse transcription.

**Translation-** Genetic code , Ribosomes, Prokaryotic Translation ( over view) , Eukaryotic translation , Post translational modifications , Inhibitors of translation with medical applications

**Protein sorting-** Targeting of proteins to ER, golgi, mitochondria, nucleus, Lysosomes.

**Unit III :** (12 hrs )

**Gene Regulation :** Prokaryotic Gene Regulation - Arabinose operon, Gene induction, Gene repression, Catabolite Repression, Tryptophan operon, Attenuation.

Eukaryotic Gene Regulation – Molecular mechanisms of eukaryotic transcription control, DNA methylation, Chromatin remodelling, Histone modifications, Gene Regulation by hormone

action - Response elements , RNA interference – Short Interfering RNAs ( Si RNAs), Micro RNAs ( miRNAs).

**Unit IV :** ( 12hrs)

Epigenetics : Hetero chromatin and Histone interactions , Telomeric Silencing , Polycomb, Trithorax, CpG islands, Genomic Imprinting, Epigenetics and inheritance , Prions, Prion diseases in mammals.

**Unit V :** ( 12 hrs)

Molecular Oncology : Cancer , Carcinogenesis, DNA mutations , DNA repair errors and cancer, Oncogenes, Proto oncogene activation, Oncogenic viruses, Growth factors and cellular proliferations , Apotosis and carcinogenesis , Metastasis, Tumor markers , molecular cancer diagnostics and therapeutics.

### **Recommended Text Books**

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

### **Reference Books**

1. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky , Lawrence, Matsudaira, Paul, Baltimore : 2006 , 4<sup>th</sup> Edition , W.H Freeman & Co .
2. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliottt , Kilpatrick ,Stephen : 2009 . Jones and Bartlett.

### **Journals**

1. International Journal of Genetics and Molecular Biology
2. International Journal of Biochemistry and Molecular Biology

### **Websites:**

[www.nature.com/nsmb](http://www.nature.com/nsmb)

[bmcmolbiol.biomedcentral.com](http://bmcmolbiol.biomedcentral.com)

### **Question paper pattern :**

The pattern of question paper shall be as follows:

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

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

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

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

## **SEMESTER III**

### **CLINICAL BIOCHEMISTRY & BIOMEDICAL INSTRUMENTATION**

**TEACHING HOURS : 60**

**CREDITS : 4**

**COURSE CODE: 15SP15/ 3C/CMI**

**L T P : 4 0 0**

**OBJECTIVE:** To enable the students to understand the concepts of etiology, pathophysiology, diagnosis and treatment of various clinical condition.

#### **COURSE OUTLINE:**

##### **Unit – I (12 hrs)**

**Overview of Infections, Genetic, Nutritional, & Immunological diseases. Environmental diseases-** Extremes of temperature (Hypothermia & Heat Stroke), High Altitude, Physical agents & Chemical pollutants.

Metabolic diseases – **Carbohydrate metabolism** (Galactosemia, Glycogen storage diseases) Lipid metabolism (Nieman Pick's disease, Tay Sachs's diseases, Gaucher's disease, Hyper and metabolic defects in Hypolipoproteinemias) Amino acid metabolism (Phenyl ketonuria, Alkaptonuria, Maple syrup urine disease) Prenatal diagnosis – Aminocentesis and Chronic villus. Nucleotide metabolism (Gout, LeschNyhan syndrome, Orotic aciduria).

##### **Unit – II (12 hrs)**

**Blood disorders-** Pathophysiology and diagnosis of Anaemia, Thalassemia, Sickle cell anaemia, Porphyria.

Cardiovascular disease – disorders of heart rate and rhythm, Atherosclerosis, Myocardial infarction, Hypertension, diseases of the heart valves, diseases of myocardium.

**Diabetes** – Aetiology and Pathogenesis- investigations. Long term complications and management

##### **Unit – III (12 hrs)**

**Kidney diseases-** Renal stones, Glomerulonephritis, Renal failure. Respiratory diseases- chronic obstructive pulmonary disease, diffuse pulmonary lung disease. Liver diseases- Jaundice, Fatty liver, Cirrhosis, Liver failure, Cholecystitis. Neurological diseases- Acute stroke, Parkinsons disease, Alimentary and Pancreatic diseases – Peptic ulcer, Coeliac sprue, Pancreatitis.

**Unit – IV****(12 hrs)**

Diagnostic procedures – X-ray, angiography. Types of Scan- ultrasound , CAT,PET,MRT, tests based on electrical activity – ECG,EEG, Blood pressure measurement , Respiratory gas analyzer , Spirometer.

**Unit – V****(12 hrs)**

Therapeutic procedure – **Blood banking**, Dialysis unit- Hemo and peritoneal dialysis, Ventilator , pacemaker, Defibrillator, Artificial valves, Heart lung machine, Lithotriptors, Laser applications in medicine, short wave and micro wave diathermy, Radiotherapy equipment.

**Recommended books**

1. Principles and practice of medicine-Davidson
2. Biomedical Instrumentation-khandpur

**Reference books**

1. Clinical Chemistry in diagnosis and treatment (VI edition)- Philip D.Mayne

**Journals**

1. Journal of Medical and Biological Engineering
2. Journal of Bioengineering & Biomedical Science
3. International Journal of Biomedical and Clinical Engineering
4. International Journal of Biomedical Engineering and Technology

**Website**

<http://www.journals.elsevier.com/journal-of-pharmaceutical-and-biomedical-analysis>

<http://www.aami-bit.org/>

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PART A	Definition and structures	20
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**PART C: 2 out of 4 questions, each from different units (2X20=40)**

**SEMESTER III**

**PHARMACOLOGY**

**TEACHING HOURS : 60**

**CREDITS : 4**

**COURSE CODE: 15SP15/ 3E/PHC**

**L T P : 4 0 0**

**OBJECTIVE :**To understand the mechanism of action of various drugs and their side effects.

**COURSE OUTLINE:**

**UNIT- I (12 hrs)**

Introduction to Pharmacology – Preview of drug development and regulations. Pharmacokinetics – routes of drug administration, absorption, distribution, metabolism, excretion. Factors modifying effects of drugs. Pharmacodynamics – types of drug receptors, drug-receptor interaction & Signal transduction, efficacy, receptor regulation and drug tolerance, lethal dosage, LD 50 dose response relationship.

**UNIT – II (12 hrs)**

Anti bacterial agents- sulfonamides-  $\beta$  lactam antibiotics, amino glycosides, antifungal agents, antiviral agents, antiprotozoal agents.

Drugs for helminthiasis. Anti mycobacterial drugs- TB and Leprosy. Drugs acting on haemopoietic system – anti coagulants, and coagulants.

**UNIT- III (12 hrs)**

Cardiovascular drugs- drugs for Hypertension, hyperlipoproteinaemia, Ischemic heart diseases. Drugs for renal function- Diuretics and antidiuretics.

Drugs for Gastrointestinal system – peptic ulcer, diarrhoea, Irritable Bowel Syndrome, hemorrhoids and Constipation.

**UNIT- IV (12 hrs)**

Drugs for Central Nervous system – Sedatives and Hypnotics, antiepileptics. Analgesics – opioids & non opioids, Drugs for CNS degenerative disorders – Parkinson's and Alzheimer's disease. Drugs for autonomic nervous system disorders- agonist and antagonists of Cholinergic and Adrenergic system.

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

Drugs for respiratory disorders –bronchial Asthma and Cough. Drugs for endocrine disorders- Thyroid dysfunction, adrenocorticosteroids. Drugs used for Immunomodulation- Immunostimulant and immunosuppressant. Chemotherapy by Neoplastic drugs – Agents for Chemotherapy, Biological response modifiers.

**Recommended books**

1. Pharmacology(III edition)-George .M Brenner and Craig .W. Stevcvans. Elsevier Publication.
2. Pharmacology and Pharmacotherapeutics (XIX Edition)- R.S satoskar, SD Bhandkar

**Reference books**

1. Pharmacology(III edition)- Don.A Ballington, Mary.M Laughlin. CBS publisher
2. Text book of medicinal Chemistry(volume I and II)-V. Alagarswamy, Elsevier Publications.
3. **Journals**
  1. Journal of Pharmacy and Pharmacology
  2. Journal of Clinical & Experimental Pharmacology
  3. International Journal of Pharmacy and Pharmaceutical Sciences
  4. International Journal of Pharmacological Research

**Website**

<https://www2.bc.edu/~anderswb/pharmacologyonlineresources.html>  
[libguides.utep.edu](http://libguides.utep.edu) › UTEP Library Research Guides › Pharmacology

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

## SEMESTER III

### COMPUTING SKILLS IN BIOCHEMISTRY

TEACHING HOURS: 30 Hours

Credits: 2

COURSE CODE: 15SP15/3S/CSB

LTP: 1 1 0

#### Objective:

- Ability to perform fundamental calculations in practical biochemistry and biophysical chemistry.

#### COURSE OUTLINE:

Unit – I (10 hrs)

Units of measurement of concentration of solutions. Calculation of Molarity, Molality, Normality, Percentage solutions (w/w, w/v, v/v) Osmolarity, Osmolality, Ionic strength. Calculation of moles, equivalents, millimoles, milliequivalents.

Unit – II (10 hrs)

Calculations based on Acid base Chemistry, Radioactivity, Biochemical Kinetics, energetics.

Unit – III (10 hrs)

Calculation – enzyme kinetics. Calculation for biological molecules, Spectroscopy.

#### Recommended Books:

Biochemical calculation 2<sup>nd</sup> edition – Irwin Segal

Wiley student press

#### Reference Books :

Trueman's specific series UGC-CSIR .Life science (Biology )

#### JOURNALS

1. *PLOS Computational Biology*.
2. *Journal of Biophysical Chemistry*

#### WEBSITE :

1. [www/spdbv.vital-it.ch/TheMolecularLevel/Biochem/](http://www/spdbv.vital-it.ch/TheMolecularLevel/Biochem/)



## SEMESTER IV

### IMMUNOLOGY

TEACHING HOURS : 60  
CREDITS : 4

COURSE CODE: 15SP15/ 4C/IM  
L T P : 4 0 0

#### OBJECTIVE

To impart to the students the importance and implications of the immune system.

#### COURSE OUTLINE:

##### Unit – I (12 hrs)

**Types of Immunity-** Native Immunity – determinants, Anatomical, Physiological Barriers , Phagocytosis. Inflammation – acute ,chronic , local & systemic inflammation. Anti inflammatory agents. Adaptive Immunity – types. Cells of Immune system – T &B Lymphocytes, NK Cells , mononuclear phagocyte , dendritic cells .Organs of the Immune system – Structure & function –Thymus, Bone marrow , Lymph node, Spleen, MALT , GALT, and Lymphatic system. Clonal selection theory

##### Unit – II (12 hrs)

**Antigens** – factors affecting antigenicity , epitopes ,adjuvants and haptens. **Antibodies-** basic structure, fine structure, effector functions, classes and biological activities. B cell Receptor, and organization and expression of Ig genes- B cell development, multigene organization, DNA rearrangements , generation of Ab diversity.

##### Unit – III (12 hrs)

Antigen – Antibody interaction- strength, precipitation , agglutination, Coombs & Complement fixation test. Major histocompatibility complex – General organization, Major Histocompatibility Complex genes- human/mice, Major Histocompatibility Complex and disease susceptibility.

**Antigen processing and presentation** – Cytosolic and endocytic pathway. T cell- Maturation, activation and differentiation. TCR- structure, rearrangement,. B cell-activation and differentiation, T & B cooperation. Monoclonal antibody production and applications.

##### Unit – IV (12 hrs)

**Complement system** – complement activation- classical, alternative and lectin pathway . complement deficiencies. Hypersensitivity reaction- Type I , II, III &IV. Autoimmunity- organ specific- Insulin dependent Diabetes Mellitus , Graves disease. Systemic- systemic lupus erythematosus, multiple sclerosis.

**Unit – V****(12 hrs)**

Vaccines – Types- Bacterial, Viral , Toxoids .Purified macromolecules, recombinant vector vaccines, DNA vaccines, multivalent sub unit vaccines.

Overview of clinical transplantation- graft rejection- acute & chronic. Immunosuppressive therapy, Immune tolerance. Cancer and Immune system- tumours of the Immune system- tumour antigens, cancer immune therapy . Blood transfusion

**Recommended Text books:**

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

**Reference Books**

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

**Journals**

*Journal of Immunology Research.*

*Journal of Immunology*

*International Journal of Immunology*

*International Journal of Immunology and Immunotherapy*

**Website :**

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

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

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## SEMESTER- III

### BIOTECHNOLOGY

TEACHING HOURS : 60

COURSE CODE: 15SP15/ 4C/BTC

CREDITS : 4

L T P : 4 0 0

**OBJECTIVE:** To enable the students to have an understanding of practical aspects of recombinant DNA technology and applications of biotechnology in agriculture ,pharmaceutical and clinical sectors.

#### COURSE OUTLINE:

##### UNIT-I

(12 hrs)

Introduction to biotechnology, r-DNA technology – Enzymes,Methodology -Linkers ,adaptors and Vectors – Plasmid( PBR 322, PUC18) Phage vectors (  $\lambda$  phage vector, M 13 )Viral vector-(SV40, adenovirus). Plant vectors(Ti & Ri)artificial chromosomal vector(BAC, YAC). Shuttle vectors, exprerssion vectors. Selection of host- prokaryotic and eukaryotic host.

##### UNIT-II:

(12 hrs)

Natural and artificial methods of gene transfer. Selection of recombinants in plants and animals-marker gene, reporter gene, Insertional inactivation, $\alpha$  complementation,Colony hybridization method,plague lifting method,Immunological method. Expression of cloned gene, collection and purification of recombinants proteins.

##### UNIT-III:

(12 hrs)

Isolation of gene of interest. Gene library- c-DNA, genomic and gene library. Amplification of gene- PCR- RAPD,RFLP.

Animal biotechnology- Animal cell culture. Culture media- Natural, artificial, serum and serum free media, cell lines- finite cell lines, continuous cell lines,Transformed cell lines. Stem cell culture, organ culture. Application of animal cell culture and transgenic animals-Production and application,knock out models and application.

Medical biotechnology- production of insulin, interferon, hepatitis B Vaccine. Gene therapy,Diagnosis-DNA finger printing, DNA Probes in diagnosis of Tuberculosis, malaria, HIV.

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

**Plant biotechnology-** Plant tissue culture- Types of culture, application of plant tissue cultures- micropropagation, somoclonal variation, embryo rescue and cryopreservation.

Transgenic plants and application- Insect resistant crop, viral resistant crop, salinity and drought resistant crop. Improvement of crop yield and quality- longer shelf life of fruits and vegetables.

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

Industrial Biotechnology : Fermentation, Bioreactors- types. Downstream processing.

Production of Vitamin B12, Penicillin, Single cell protein. Bio fuels- methane, bio diesel and bio hydrogen.

Environmental Biotechnology – Bioremediation – Extrinsic and intrinsic. Phytoremediation, Bioleaching, biological odour control- Bioscrubbers, biofilters, biotrickling filters.

**Recommended Books:**

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

**Reference books :**

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

**Journals:**

International Journal of Biotechnology

International Journal of Biotechnology & Biochemistry

**Website :**

[biotechlearn.org.nz/](http://biotechlearn.org.nz/)

[www.ms-biotech.wisc.edu/biotech-websites.cfm](http://www.ms-biotech.wisc.edu/biotech-websites.cfm)

[www.gate2biotech.com/instantnotes-](http://www.gate2biotech.com/instantnotes-)

**Question paper pattern :**

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<b>COMPONENT</b>	<b>NATURE OF THE QUESTION</b>	<b>MAXIMUM MARKS</b>
PART A	Definition and structures	20
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## SEMESTER IV

### BIOINFORMATICS

**TEACHING HOURS : 60**

**COURSE CODE: 15SP15/ 4E/BIM**

**CREDITS : 3**

**L T P : 3 1 0**

**OBJECTIVE:** To study the fundamentals of genomics, proteomics, and its applications.

#### COURSE OUTLINE:

##### Unit I

(12 hrs)

Introduction to bioinformatics: Principles, challenges and applications. Major Bioinformatics Resources: NCBI, EBI, ExPASy; Biological databases - Nucleic acid sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot, prosite, NRDB; Structure Databases: PDB, NDB, Genome Databases – SGD, ACeDB; Metabolic pathway database (KEGG); literature databases - PubMed, PublicLibrary of Sciences (PLoS); Data retrieval systems - Entrez, DBget, SRS;

##### Unit II

(12 hrs)

Sequence Analysis: Basic concepts of sequence analysis; gap penalties, scoring matrices -PAM and BLOSUM. Global and local alignment; pairwise alignment – dot plot, dynamic programming (Needleman&Wuncsh, Smith & Waterman algorithms), hash coding algorithm, heuristic tools (FASTA, BLAST). MSA - Progressive algorithms for MSA (CLUSTALW, Phylip). Phylogenetic analysis, Definition and description of phylogenetic trees and various types of trees, Method of construction of Phylogenetic trees [distance based method (UPGMA) and Maximum Parsimony]. Motif and Domain analysis - SMART, ProDom

##### Unit III

(12 hrs)

Proteomics: Fundamentals of proteomics- Prediction of protein sorting, modification and interaction. Protein secondary structure prediction methods (Chou-Fasman). Protein secondary structure classification databases: CATH, SCOP. Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition, Abintio Method. 3-D structure visualization - rasmol.

##### Unit IV

(12 hrs)

Genomics: Structural genomics - Genome mapping, sequencing, Assembly, Annotation (gene prediction methods), comparison. Functional Genomics (EST, SAGE, Microarray) Human Genome Project; RNA Secondary structure prediction

##### Unit V

(12 hrs)

Drug Discovery and design: Steps in drug development. Chemical Structure Representation (SMILE). Chemical databases: ChemBank, PUBCHEM. Lipinski's rule of five. Quantitative

Structure Activity Relationship.Computer aided rational drug design – SBDD, LBDD. Pharmacogenomics.

**Recommended Books :**

Text book of Bioinformatics – Sharma & munjal

Bioinformatics data bases & algorithms- N.Gautham

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

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

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

Essential Bioinformatics by Jin Xiong

**Journals:**

Journal of Bioinformatics and Computational Biology

Journal of Proteomics & Bioinformatics

American Journal of Bioinformatics Research

International Journal of Bioinformatics Research and Applications

**Website :**

[www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)

[www.ebi.ac.uk](http://www.ebi.ac.uk)

[www.bioinformatics.org/wiki/General\\_information\\_websites](http://www.bioinformatics.org/wiki/General_information_websites)

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## ESSENTIALS OF PRESENTATION SKILLS

TEACHING HOURS :30

CREDITS : 2

COURSE CODE: 15SP15/ 4S/EPS

L T P : 1 1 0

### OBJECTIVE:

- To enhance the oral and written communication skills of the students

### COURSE OUTLINE:

#### Unit – I

Language & Communication – Verbal & Non Verbal communication , distinctive features of speech , listening skills . Preparation and facing an Interview. Participation in group discussion.

#### Unit – II

Distinct feature of writing, difference between speech and writing- descriptive , narrative , expository & argumentative writing .

#### Unit – III

Resume preparation , Technical writing – Memoronde notice, Minutes of the meeting , laboratory and field notebook maintenance . scientific report writing.

### RECOMMENDED BOOKS

1. L.Hamp-Lyone & B.Heasely ; study writing; a course in written English for academic and Professional purpose, Cambridge union press.
2. Daniel G Riovdan Steven A panley “ Technical Report & writing today – Biztaentric

### REFERENCE BOOKS

1. Contemporary Business Communication, Scot offer, Biztantre 5 edition (2004)

### JOURNALS

1. Birmingham Business Journal

### WEBSITE

1. Entj.oxfordjournal.org



## SEMESTER IV

### PRACTICAL III

**COURSE CODE: 15SP15/ 4C/PR3**

**CREDITS : 5**

**L T P : 0 0 5**

#### **Group Experiments**

Hematology – Total RBC, WBC, Platelet count , Differential count

b) ESR, PCV, Hb (Hb Indices – MCV, MCH, MCHC )

c) Blood grouping

d) Urine analysis – Qualitative

e) Serum sodium & Potassium – flame photometry

f) Enzyme assay – LDH (Kit based)

g) ELISA (demo)

#### **2 Colorimetry**

a) Glucose (kit based)

b) Urea (kit based)

c) Creatine (kit based)

d) Bilirubin (kit based)

e) Total Cholesterol (kit based)

f) HDL (kit based)

g) Uric acid (kit based)

h) Estimation of Protein (routine method)

i) Estimation of Phospholipid

j) Estimation of free fatty acid

k) Estimation of Triglyceride

## **SEMESTER IV**

### **PRACTICAL IV**

**COURSE CODE: 15SP15/ 4C/PR4**

**CREDITS : 5**

**L T P : 0 0 5**

#### **1.Immunology (group experiments)**

- Ouchterlony – double diffusion
- Antibody titre
- Cross over immunoelectrophoresis

#### **2.Molecular Biology (group experiments)**

- Isolation of Genomic & Plasmid DNA
- Restriction digestion & Ligation
- PCR
- Transformation – GFP Cloning

#### **3.Colorimetry :Assay of antioxidants**

- Estimation of reduced glutathione
- Estimation of TBARS
- Estimation of Vitamin C
- Estimation of Vitamin E
- Assay of Catalase
- Assay of Superoxide dismutase

#### **4.Antioxidant activity of Phytochemicals**

- DPPH assay
- Nitrogen oxide scavenging assay
- FRAP assay

**SEMESTER II**  
**ELECTIVE - WOMEN AND HEALTH**  
**(FOR OTHER DEPARTMENTS)**

**TEACHING HOURS: 60**

**CREDITS: 3**

**COURSE CODE: 15SP15/2E/WOM**

**LTP: 3 1 0**

**Objective:** To create awareness about the female physiology and health aspects.

**COURSE OUTLINE:**

**UNIT I: (12 hours)**

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

**UNIT II: (12 hours)**

Pregnancy-vaccines and diagnostic tests during pregnancy. Foetal testing – amniocentesis, foetal blood sampling – diseases identified. Complications associated with pregnancy – Gestational diabetes, ectopic pregnancy, eclampsia, miscarriage and still birth, nutrition during pregnancy. Development of foetus in different trimesters.

**UNIT III: (12 hours)**

Parturition – different types. Significance of breast feeding, nutrition during lactation, vaccination for infants, infant nutrition. Contraception methods and sexually transmitted diseases-AIDS, syphilis, Gonorrhoea-symptoms, Diagnosis and treatment.

**UNIT IV: (12 hours)**

Health problems in women – anemia, varicose veins, skin and hair problems, cancers – breast cancer, cervical cancer and ovarian cancer - symptoms, diagnosis and treatment.

Socio economic factor and women health

**UNIT V: (12 hours)**

Balanced diet for women – carbohydrates, lipids, proteins, vitamins and minerals – sources, requirements and deficiency diseases. Physical activity – calorie expenditure for various activities, aerobics and yoga.

**Recommended Books :**

1. Human Anatomy and Physiology-Elaine .N marieb Pearson publisher 9th edn
2. Understanding nutrition- Eleanor,noss,Whitney. 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:**

Women's Health Issues

Journal of Womens health care

International Journal of Womens health

Health care for Women International

**Website:**

[www.healthywomen.org/](http://www.healthywomen.org/)

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

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## LIFESTYLE ASSOCIATED DISEASES

TEACHING HOURS :60

COURSE CODE: 15SP15/ 3E/LID

CREDITS : 3

L T P : 4 0 0

### OBJECTIVE

To understand the health problems associated with modern lifestyle.

### COURSE OUTLINE:

#### UNIT-I

(12hrs)

Modern lifestyle habits- sedentary lifestyle, stress, sleeping habits- cause and complications, smoking, alcoholism, drugs- risk factors, electronic gadgets- radiation and health.

#### UNIT-II (12hrs)

Food habits and health- junk food- facts and its effects, carbonated drinks, ready to eat foods, acidity, obesity, eating disorder- anorexia, bulimia nervosa, amoebiasis, constipation and piles- cause, symptoms and treatment.

#### UNIT-III (12hrs)

Modern costume and cosmetics- health hazards of tight clothing, high heels, hair coloring, tattooing and face bleach, types and complications of breast implant and liposuction.

#### UNIT-IV (12hrs)

Lifestyle diseases- causes, symptoms and treatment of cancer- breast, cervical and prostate, liver diseases- cirrhosis, diabetic mellitus, oxidative stress and anti oxidants.

#### UNIT-V (12hrs)

Lifestyle diseases- causes, symptoms and treatment of kidney diseases- nephritis, pulmonary diseases- COPD, allergic sinusitis, rhinitis, Heart disease- Atherosclerosis.

### Recommended Text books:

Guide to prevention of life style diseases- M.Kumar &R.Kumar

Human physiology – Elaine N.Marieb

### Reference Books

Understanding Nutrition – Eleanor, Noss, Whitney

Encyclopedia of Women health – Parvesh Handa

### Journals

Journal of Lifestyle diseases and management

National Journal of Integrated Research in Medicine

An International Journal of Medicine

American Journal of Preventive Medicine

### Website :

[www.livestrong.com](http://www.livestrong.com) › Diseases and Conditions

[www.med-health.net/Lifestyle-Diseases.html](http://www.med-health.net/Lifestyle-Diseases.html)

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