

M.Sc ✓
18-19

ETHIRAJ COLLEGE FOR WOMEN
PG DEPARTMENT OF BIOCHEMISTRY
SYLLABUS
FOR
M.Sc BIOCHEMISTRY
UNDER CHOICE BASED CREDIT SYSTEM
(2018-2019)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI- 6000 08
PG DEPARTMENT OF BIOCHEMISTRY
BOARD OF STUDIES MEETING – M.Sc BIOCHEMISTRY

The Board of Studies meeting was held in the Department of Biochemistry on 20.04.2018.
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) ASSOCIATE PROFESSOR DEPARTMENT OF BIOCHEMISTRY UNIVERSITY OF MADRAS, GUINDY CAMPUS CHENNAI-6000 25	
3.	DR.K.A. FATHIMA 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.GEETHA RAMACHANDRAN (INDUSTRIAL REPRESENTATIVE)
SCIENTIST –E & HEAD
DEPARTMENT OF BIOCHEMISTRY & CLINICAL PHARMACOLOGY
NATIONAL INSTITUTE FOR RESEARCH IN TUBERCULOSIS
CHETPET
CHENNAI.-6000 31

6. DR. C.N.DEEPA
ASSISTANT PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

8. DR. V.MALATHI
ASSOCIATE PROFESSOR
DEPARTMENT OF BIOCHEMISTRY
ETHIRAJ COLLEGE FOR WOMEN
CHENNAI – 6000 08.

9. Ms. KALPANA KHATRI (ALUMNA)
M.Sc Batch (2015-2017)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI- 600008
PG DEPARTMENT OF BIOCHEMISTRY
M.Sc -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 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)

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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	Hours	Credits	CA marks	End semester	Total
1	I	Chemistry Of Life	15SP18/1C/CHL	4	4	40	60	100
2	I	Analytical Techniques	15SP18/1C/ABC	4	4	40	60	100
3	I	Human Physiology	15SP18/1C/HPH	4	4	40	60	100
4	I	Elective-Genetics	15SP18/1E/GNT	4	3	40	60	100
5	I	Elective- Biostatistics and Biochemical Calculations	15SP18/1E/BBC	4	3	40	60	100
6	I	Soft Skill- Personality Development		2	2	-	50	50
7	I	Core Practical – I	15SP18/2C/PL1	4	-	-	-	-
8	I	Core Practical – II	15SP18/2C/PL2	4	-	-	-	-

SEMESTER II

S.no	Semester	Course title	Course code	Hours	Credits	CA marks	End semester	Total
1	II	Enzyme Biochemistry	15SP18/2C/EBY	4	4	40	60	100
2	II	Metabolism And Regulation	15SP18/2C/MRG	4	4	40	60	100
3	II	Hormones And Signal Transduction	15SP18/2C/HST	4	4	40	60	100
4	II	Elective- Research Methodology	15SP18/2E/RMT	4	3	40	60	100
5	II	Extra Disciplinary Elective		4	3	40	60	100
6	II	Soft Skill- Foreign Language		2	2	-	50	50
7	II	Core Practical – I	15SP18/2C/PL1	4	4	40	60	100
8	II	Core Practical – II	15SP18/2C/PL2	4	4	40	60	100
9	II	Internship			2			

SEMESTER III

S.no	Semester	Course title	Course code	Hours	Credits	CA marks	End semester	Total
1	III	Molecular Biology	15SP18/3C/MOL	4	4	40	60	100
2	III	Clinical Biochemistry & Biomedical Instrumentation	15SP18/3C/CBI	4	4	40	60	100
3	III	Elective - Pharmacology	15SP18/3E/PCY	4	3	40	60	100
4	III	Extra disciplinary elective		4	3	40	60	100
5	III	Soft skill - Computing Skills	15SP18/3S/CSK	2	2	-	50	50
6	III	Core Practical- III	15SP18/4C/PL3	4	-	-	-	-
7	III	Core Practical- IV	15SP18/4C/PL4	4	-	-	-	-
8	III	Project	15SP18/4C/PRO	4	-	-	-	-

SEMESTER IV

S.no	Semester	Course title	Course code	Hours	Credits	CA marks	End semester	Total
1	IV	Immunology	15SP18/4C/IMG	5	4	40	60	100
2	IV	Biotechnology	15SP18/4C/BIT	5	4	40	60	100
3	IV	Elective - Bioinformatics	15SP18/4E/BIF	4	3	40	60	100
4	IV	Soft skill- Presentation Skills	15SP18/4S/PSK	2	2	-	50	50
5	IV	Core Practical- III	15SP18/4C/PL3	5	4	40	60	100
6	IV	Core Practical- IV	15SP18/4C/PL4	5	4	40	60	100
7	IV	Project	15SP18/4C/PRO	4	4	40	60	100

The above courses of the PA program enrich the skills in employability / skill development / entrepreneurship which caters the needs of the students.

ELECTIVE SUBJECTS FOR OTHER DEPARTMENTS

S.no	Semester	Course title	Course code	Hours	Credits	CA marks	End semester	Total
1	II	Women and Health	15SP18/2E/WAH	4	3	40	60	100
2	III	Lifestyle Associated Diseases	15SP18/3E/LFD	4	3	40	60	100

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

THEORY

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

PRACTICAL

Model Exam	6hrs	20 marks
Internal VIVA		10 marks
Class Participation		10 marks

		40 marks

PROJECT

Periodical Submission	20 marks
Internal VIVA	10 marks
Participatory Learning	10 marks

	40 marks

• 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).

TEMPLATE FOR EVALUATION PATTERN

Semester	Course Code	Course Title	Continuous assessment				Total
			Test I	Test II	Seminars /Quiz/Assignment/Field Visit	Participatory Learning	
I	Chemistry Of Life	15SP18/1C/CHL	10	10	10	10	40
I	Analytical Techniques	15SP18/1C/ABC	10	10	10	10	40
I	Human Physiology	15SP18/1C/HPH	10	10	10	10	40
I	Elective-Genetics	15SP18/1E/GNT	10	10	10	10	40
I	Elective-Biostatistics and Biochemical Calculations	15SP18/1E/BBC	10	10	10	10	40
II	Enzyme Biochemistry	15SP18/2C/EBY	10	10	10	10	40
II	Metabolism And Regulation	15SP18/2C/MRG	10	10	10	10	40
II	Hormones And Signal Transduction	15SP18/2C/HST	10	10	10	10	40
II	Elective-Research Methodology	15SP18/2E/RMT	10	10	10	10	40
III	Molecular Biology	15SP18/3C/MOL	10	10	10	10	40
III	Clinical Biochemistry & Biomedical Instrumentation	15SP18/3C/CBI	10	10	10	10	40
III	Elective - Pharmacology	15SP18/3E/PCY	10	10	10	10	40
IV	Immunology	15SP18/4C/IMG	10	10	10	10	40
IV	Biotechnology	15SP18/4C/BIT	10	10	10	10	40
IV	Elective – Bioinformatics	15SP18/4E/BIF	10	10	10	10	40

TEMPLATE FOR EVALUATION PATTERN

Semester	Course Code	Course Title	Continuous assessment			
			Model exam	Internal VIVA	Class Participation	Total
I & II	Core Practical I	15SP18/2C/PL1	20	10	10	40
I & II	Core Practical II	15SP18/2C/PL2	20	10	10	40
III & IV	Core Practical III	15SP18/4C/PL3	20	10	10	40
III & IV	Core Practical IV	15SP18/4C/PL4	20	10	10	40

ELECTIVE PAPERS OFFERED FOR OTHER DEPARTMENTS

Semester	Course Code	Course Title	Continuous assessment				
			Test I	Test II	Seminars /Quiz/Assignment/Field Visit	Participatory Learning	Total
II	15SP18/2E/WAH	Women and Health	10	10	10	10	40
III	15SP18/3E/LFD	Lifestyle Associated Diseases	10	10	10	10	40

SEMESTER I

CHEMISTRY OF LIFE

TEACHING HOURS: 60 Hours

Credits: 4

COURSE CODE: 15SP18/1C/CHL

LTP: 3 1 0

Objective:

- To enable the students to understand the biomolecules which support life.

COURSE OUTLINE:

UNIT-I: (12hrs)

Carbohydrates - Classification, Structure and biological importance of Monosaccharides, 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)

A, B and Z types of DNA, topology of DNA- writhe, twist and linking number, types of RNA- rRNA, tRNA, mRNA and other types – Structure and functions.

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 (GroEL-ES system)

UNIT-III: (12hrs)

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

UNIT IV: (12hrs)

Biological Membranes - Function of biomembranes, features - fluidity, cold acclimatization, self sealing nature, selective permeability. Membrane composition - Membrane lipids, lipid bilayer, Membrane carbohydrates, Membrane proteins, Membrane asymmetry, Flip flop movement- flippases, floppases, Membrane model-Fluid Mosaic model. RBC membrane as a model.

UNIT-V

(12hrs)

Transport process- Simple diffusion, Osmosis, Facilitated diffusion- gated channels, Active transport - Uniport, Symport, Antiport- Na^+ , K^+ ATPase, Ca^{2+} ATPase, Proton pump. Glucose transport in erythrocytes, Specialised membrane pores- Porins, Ionopores- Valinomycin-mobile carrier ionophore, Gramicidin-channel forming ionophores

RECOMMENDED BOOKS:

1. Principles of Biochemistry- Lehninger, Nelson & Cox, 2nd Edition, W. H. Freeman Publication 2004
2. Biochemistry- Voet & Voet, 3rd Edition, John Wiley and sons Publication
3. Biochemistry- Stryer 6th Edition, Freeman Publications, 2002.

REFERENCE BOOKS:

1. Harper's Biochemistry- Murray, 26th Edition, 2003
2. Biochemistry- Zubay, 4th Edition, 1998

JOURNALS :

1. International Journal of Chemical and Life sciences
2. International journal of biochemistry and biomolecules
3. The BioChemistry : An Indian Journal
4. Indian journal of biochemistry

WEB SITE:

1. www.journals.elsevier.com/bioorganic-and-medicinal-chemistry/
2. 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 TECHNIQUES

TEACHING HOURS: 60 Hours

CREDITS: 4

COURSE CODE: 15SP18/1C/ABC

LTP: 3 1 0

Objective:

To enable the students to gain fundamental knowledge of analytical techniques

COURSE OUTLINE:

UNIT I (12hrs)

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

Centrifugation Techniques - Basic principles of Sedimentation, Preparative and Analytical centrifugation, Differential and Density gradient centrifugation, Separation of sub cellular organelles.

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: Potentiometry - Ion selective Electrodes, Amperometry- Clarkes oxygen electrode, Biosensors, Polarography

UNIT III (12hrs)

Electrophoresis - General principle, Factors affecting Electrophoretic separation, Isoelectric focussing, SDS PAGE, 2D PAGE, 3 D gel electrophoresis, 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, Scintillation counter, Autoradiography, List of radioisotopes in Diagnosis, Prognosis and 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-Visible Spectrophotometry, Fluorimetry, Atomic absorption spectroscopy, Flame emission spectroscopy, IR Spectroscopy, nephelometry, luminometry.

Magnetic particle Separation – SEP box

RECOMMENDED TEXTBOOKS:

1. Principles and techniques of practical Biochemistry – Keith Wilson and John Walker , 7th Edition, Cambridge University Press.2004
2. Biophysical Chemistry Principles and Techniques – Upadhyay & Upadhyay Nath, Himalaya Publishing House, Reprint 2006.

REFERENCE BOOKS:

1. Instrumental methods of Chemical Analysis- Chatwal& Anand, Himalaya Publishing House. Reprint 2005

JOURNALS :

Analytical Biochemistry

Biochemistry & Analytical Biochemistry

International Journal of Analytical Biochemistry Research

Analytical and Bioanalytical Chemistry

WEB SITE:

www.springer.com › Home › Chemistry › Analytical Chemistry

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

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SEMESTER I
HUMAN PHYSIOLOGY

TEACHING HOURS: 60 Hours

CREDITS: 4

COURSECODE: 15SP18/IC/HPH

LTP : 3 1 0

Objective

- Enable students to study the organ systems in detail
- 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, NPU. Basal metabolism- basal metabolic rate, factors affecting BMR, RQ, SDA. 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. CNS - Structure of the brain & Spinal Cord, PNS, ANS.

Unit – III: (12 Hrs)

Functional anatomy of kidney, renal blood flow, its determination, regulation. GFR – definition, measurement, filtration membrane, control of GFR. Tubular function – reabsorption, secretion and concentration. Nerve supply to urinary bladder, Micturition, Non excretory functions of kidney – Renin-Angiotensin system, erythropoietin synthesis.

Unit – IV (12 Hrs)

Structure of heart, cardiac cycle, heart sounds, vasomotor circulation, coronary circulation, blood pressure. Structure of muscle cells and muscle contraction. Respiratory system - Structure and Functions of the lungs - Gaseous exchange.

Unit – V (12 Hrs)

Anatomy of female reproductive system and Causes of female infertility (acquired and genetic), treatments, Gametogenesis, 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. Davidson's Principles and Practice of Medicine-Boon, Colledge & Walker, Elsevier 20th Edition 2006
2. A.K. Jain – Textbook of Medical Physiology, 4th Edition 2008.

REFERENCE BOOKS

1. Text Book of Medical Physiology. by Guyton and Hall, 11th Edition 2006, Press Pub Saunders.
2. Principles of Biochemistry- Voet, Voet & Pratt 4th Edition, John Wiley & Sons, 2013

JOURNALS :

1. International Journal of Advanced Physiology and Allied Sciences
2. American Journal of Physiology
3. Indian Journal of Physiology and Pharmacology
4. National Journal of Physiology, Pharmacy and Pharmacology

WEBSITE :

1. www.getbodysmart.com/ap/site/resourcelinks/links.html
2. advace.physiology.org/

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SEMESTER I

ELECTIVE-GENETICS

TEACHING HOUR: 60 Hours

CREDITS: 3

COURSE CODE: 15SP18/1E/GNT

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 of Aminoacid metabolism**- Phenyl ketoneuria, Alkaptonuria, Maple Syrup Disease, Genetics of 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 , Alzhemiers Disease, Parkinson's Disease

Pharmacogenetics-Genes and Drugs, Dose determination, Multi drug resistance gene polymorphisms, SNPs.

RECOMMENDED BOOKS

1. Cell Biology ,Genetics, Molecular Biology, Evolution & Ecology- Verma & Agarwal,S . Chand & Company, 2013 Reprint
2. Principles of Genetics – Gardner , Simmons and Snustad. John Wiley & Sons, 8th Edition 1993.
3. Genes VIII – Benjamin Lewin, Pearson Education Press, International Edition 2004.

REFERENCE BOOKS

1. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliottt , Kilpatrick ,Stephen : 2009 . Jones and Bartlett
2. Molecular Cell Biology-Baltimore, 5th Edition, W.H.Freeman Company, 2003.

JOURNALS :

1. Journal of Genetics
2. Journal of Human Genetics
3. International Journal of Genetics and Genomics
4. Genetics Research International

WEBSITE :

1. www.eupedia.com › Genetics
2. www.genetics.org/

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SEMESTER I

ELECTIVE - BIOSTATISTICS AND BIOCHEMICAL CALCULATIONS

TEACHING HOUR: 60 Hours

CREDITS: 3

COURSE CODE: 15SP18/1E/BBC

LTP: 3 10

OBJECTIVES:

- To study the role of statistical analysis in Interpretation of experimental results.
- To learn calculations for preparation of solutions and solve numerical problems

COURSE OUTLINE:

UNIT I

(12 hours)

Biostatistics- An outline of statistical investigations, types of data- based on source and nature of data, individual observations, discrete and continuous frequency data, Methods of data collection – experimental, survey and observation methods; Population and sample - Types of sampling - Advantages & disadvantages . Presentation of data in the form of tables – types of tables. Presentation of data in the form of diagrams and graphs.

UNIT II

(12 hours)

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

UNIT III

(12 hours)

Inferential Statistics - Correlation – types ; Pearsons and Rank correlation coefficient , Regression equations and regression lines; Testing of hypothesis – steps involved, Level of significance, Type I & Type II errors. Student's t test – one tailed and two tailed, paired and unpaired, ANOVA (One way), Duncan multiple range test, Chisquare test.

UNIT IV

(12 hours)

Units of measurement of concentration of solutions. Percentage solutions (w/w, w/v, v/v), Mole concept, Calculation of Molarity, Molality, equivalent concept, Normality, Osmolarity, Osmolality, Ionic strength. Hydrogen ion concentration – pH & pOH -Henderson Hasselbalch equation and related calculations. Calculations based on radioactivity - Half life & Isotope dilution, Calculations based on Beer Lambert's law.

UNIT V

(12 hours)

Problems based on microbial growth - number of divisions, growth rate and doubling time; Enzymes – problems based on K_m and V_{max} , Specific activity and enzyme purification. Biomolecules – problems based on length of the protein in extended and folded conformations,

number of aminoacids in a given molecular weight, number of nucleotides, codons in a given DNA

RECOMMENDED BOOKS

1. Biochemical calculations– Irwin Segal 2nd edition, 1975
2. Introduction to Biostatistics – N. Gurumani, MJP publishers , 2nd Edition, 2005

Reference Books :

1. Biostatistical analysis – Jerrold H Zar, Pearson Publishers Fourth Edition , First Indian Reprint 2003
2. Trueman's specific series UGC-CSIR .Life science (Biology), New edition 2012

JOURNALS

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

WEBSITE :

1. www.biostat.ucsf.edu/sites.html
2. <https://www.cs.uri.edu/>

JOURNALS:

1. Statistics and Computing
2. Computational Statistics & Data Analysis
3. The International Journal of Biostatistics
4. International Journal of Statistics and Systems

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SEMESTER II

ENZYME BIOCHEMISTRY

TEACHING HOURS: 60 Hours

CREDITS: 4

COURSE CODE: 15SP18/2C/EBY

LTP: 3 1 0

OBJECTIVE:

- To study the classification, kinetics, properties, functions and enzyme techniques.
- To enable student to understand the mechanism of biocatalytic reactions.

COURSE OUTLINE:

UNIT-I (12hrs)

IUB Classification of enzymes, Enzyme units, Activation energy, Progressive curve of uncatalysed and enzyme catalysed reaction, 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. Mechanism of enzyme activity-covalent catalysis, proximity and orientation effects, acid-base catalysis, structure and mechanism of action of Chymotrypsin.

UNIT-III (12hrs)

Coenzymes - structure and function (reactions involving CoA, TPP, PLP, NAD/NADP, FMN/FAD, Biotin. Role of metal cofactors in enzyme catalysis (Carbonic anhydrase). 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 ATCase as an 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. Methods to investigate the kinetics – Rapid reaction technique (stopped and continuous flow technique). Immobilized enzymes- methods of immobilization and applications. Abzymes, Ribozymes, Isoenzymes (LDH, CK), Artificial enzymes.

RECOMMENDED BOOKS:

1. Understanding Enzymes- Trevor Palmer, East West Press Reprint Edition 2004
2. Principles of Biochemistry- Lehninger, 4th Edition, W.H. Freeman and Co. 2004
3. Enzyme Technology- Anusha Bhaskar, MJP publishers, 2014

REFERENCE BOOKS:

1. Principles of Biochemistry- Voet, Voet & Pratt 4th Edition, John Wiley & Sons, 2013

JOURNALS :

1. Indian journal of biochemistry
2. Indian Journal of Biochemistry and Biophysics
3. International Journal of Biochemistry
4. International Journals of *Biotechnology and Biochemistry*

WEB SITE:

1. study.com/academy/topic/enzymatic-biochemistry.html
2. 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

CREDITS: 4

COURSE CODE: 15SP18/2C/MRG

LTP: 3 1 0

OBJECTIVE:

- Students gain knowledge on the metabolism of macromolecules and regulation.

COURSE OUTLINE:

Unit I (12 hrs)

Carbohydrate metabolism and regulation—Glycolysis (Aerobic and Anaerobic), 2,3 Bisphospho glycerate cycle. Pasteur 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.Lipoprotein metabolism.

Interrelationship of carbohydrate ,protein and fat metabolism –Central role of Acetyl CoA . Electron transport chain and Oxidative phosphorylation.

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, 26th Edition, 2003
2. Text book of biochemistry- Zubay, 4th Edition, WCB publishers, 1998
3. Principles of biochemistry – Lehninger, Nelson and Cox 4th Edition, W.H. Freeman and Co. 2004
4. Biochemistry- Berg, Tymoczko & Stryer, 6th edition, W.H. Freeman and Co. 2007, 1999

REFERENCE BOOKS

1. Principles of Biochemistry- Voet, Voet & Pratt 4th Edition, John Wiley & Sons, 2013
2. Biochemistry- Garrett & Grisham, Saunders College Publishing house, 2nd Edition, 1999.

JOURNALS:

1. Indian Journal of Biochemistry & Biophysics
2. Biochemistry & Analytical Biochemistry
3. Biomolecules
4. Endocrinology & Metabolism International Journal

WEBSITE:

1. www.ncbi.nlm.nih.gov › NCBI › Literature › Bookshelf
2. www.amazon.com › Books › Science & Math › Biological Sciences

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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: 15SP18/2C/HST

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. Hypothalamus – TRH, GnRH, GHRH, CRH, Somatostatin, Dopamine; Pituitary hormones – TSH, ACTH, Endorphins, Somatotropin, LH, FSH, Prolactin, Oxytocin, Vasopressin. Pancreatic hormones – Insulin, Glucagon. (structure, functions and associated disorders.)

Unit II: (12 hours)

Thyroid hormones (Biosynthesis), **Parathyroid hormone**, calcitonin, calcitriol; Regulation of Calcium and phosphorus homeostasis. **Adrenal hormones** – Epinephrine, Cortisol, Aldosterone. **Gonadal hormones** – Estrogen, Progesterone, Testosterone.

Unit III: (12 hours)

Receptors – Classification; Cell surface and Intra cellular receptors,

Role of Calcium and phosphoinositides in Signal transduction; IP3 – DAG pathway; PI-3 Kinase pathway; Calcium – cellular levels, transport, calmodulin, Troponin C; Interaction of Calcium calmodulin complex.

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..

Unit V: (12 hours)

Ras Proteins and receptor Tyrosine kinase mediated Signal transduction – MAP Kinase, Cytokine receptors - JAK/STAT, Wnt pathway, Notch-Delta signaling pathway.

RECOMMENDED TEXTBOOKS:

1. Williams Text Book of Endocrinology – Larsen Kronenberg, Melmed and Polonsky, 10th Edition, 2003.
2. Molecular cell biology – Lodish , Harvey, Berk, Arnold, Zipursky , Lawrence, Matsudaira, Paul, Baltimore : 2006 , 4th Edition , W.H Freeman & Co .

REFERENCE BOOKS:

1. Endocrine Physiology- Susan .Porterfield, Mosby Publishers, 3rd Edition 2007.
2. Principles of Biochemistry- Voet ,Voet & Pratt 4th Edition, John Wiley & Sons,2013

JOURNALS :

1. Indian Journal of Endocrinology and Metabolism
2. Journal of Cell Signaling
3. Journal of signal transduction
4. International Journal of Endocrinology and Metabolism

WEBSITE :

1. www.ncbi.nlm.nih.gov > NCBI > Literature > Bookshelf
2. <http://www.springer.com/medicine/internal/journal/12020>

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

SEMESTER II

ELECTIVE - RESEARCH METHODOLOGY

TEACHING HOURS: 60

CREDITS: 3

COURSE CODE: 15SP18/2E/RMT

LTP: 3 1 0

OBJECTIVE:

- The student gains exposure to various aspects of Biochemical Research

COURSE OUTLINE:

Unit I : (12 HRS)

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

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, H Index, 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-IAEC, CPCSEA. Maintenance of animals, Control and experimental groups, Experimental design- CRD, RBD and latin square design..Experiments with animals models- Metabolism of xenobiotics, Toxicity studies, Experimental Induction of diseases. Organ perfusion and tissue slice techniques. Experiments with human volunteers -, Ethical clearance, Institutional Ethical committee., Consent form, Stages of drug development, Clinical trials

Unit III : (12 HRS)

Preparation of plant extracts-Solvents used. Methods for extraction- Maceration, Infusion, Percolation, Digestion, Decoction, Hot continuous extraction (Soxhlet), Ultrasound extraction (sonication). Plant secondary metabolites- Tannins, Flavanoids & Alkaloids - Isolation and Characterization

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

Unit IV : (12 HRS)

Different Cell lines and Current research using cell lines, MTT assay. Cell sorting and Cell counting - Flow cytometry (FACS and Coulter counter). Experiments with Cell isolates - Sequence analysis-DNA and Amino acid sequencer, Comet Assay

Nanotechnology – Classification, Preparation using biological material, Characterisation- Zeta potential, AFM, DLS and Biological applications – Drug delivery (Dendrimers, Liposomes)

Unit V:

(12 HRS)

Spectroscopy – Principle, Instrumentation and applications of - ESR, NMR spectroscopy
X ray diffraction, Circular Dichorism and Mass Spectroscopy

RECOMMENDED TEXTBOOKS

1. BioPhysical Chemistry Principles and Techniques – Upadhyay & Upadhyay Nath, Himalaya Publishing House. Reprint 2006
2. Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010

REFERENCE TEXTBOOKS

2. Instrumental methods of Chemical Analysis- Chatwal& Anand, Himalaya Publishing House. Reprint 2005
3. Principles and techniques of practical Biochemistry – Keith Wilson and John Walker, 7th Edition, Cambridge University Press.2004

JOURNALS :

4. International Journal of Science and Research Methodology
5. International Journal of Advances in Software Engineering & Research Methodology

WEBSITE

1. processresearchmethods.org/
2. <https://explorable.com/research-methodology>

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

SEMESTER I & II

CORE PRACTICAL -I

TEACHING HOURS: 120 Hours

CREDITS:4

COURSE CODE: 15SP18/2C/PL1

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 Copper content
12. Isolation and estimation of Starch
13. Isolation and estimation of Glycogen
14. Extraction and Estimation of Sterol
15. Estimation of Riboflavin –Fluorimetry (Group Experiment)
16. Food sample Characterization- IR Spectroscopy (Group Experiment)

SEMESTER I & II

CORE PRACTICAL -II

TEACHING HOURS: 120 Hours

CREDITS: 4

COURSE CODE: 15SP18/2C/PL2

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

ENZYME ANALYSIS

8. Assay of Amylase
9. Specific activity of ATPase
10. Kinetic Studies- Alkaline Phosphatase – Optimun pH and Temperature, Km, Vmax

PHYTOCHEMICAL ANALYSIS

11. Qualitative Analysis of Phytochemicals
12. Estimation of Tannins
13. Estimation of Flavanoids
14. Estimation of Alkaloids

SEMESTER III
MOLECULAR BIOLOGY

TEACHING HOURS : 60

COURSE CODE: 15SP18/ 3C/MOL

CREDITS: 4

LTP : 4 0 0

OBJECTIVE :

- Understanding molecular chemistry of life and 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 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,

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 :Types of Cancer , Causes , Properties of Cancer cells ,Apoptosis and carcinogenesis ,Tumor viruses- Hepatitis B & C Virus, Adeno virus , Oncogenes – Proto Oncogenes ,Retro viral Oncogenes, Tumor Suppressors, Molecular cancer diagnostics and therapeutics.

RECOMMENDED TEXT 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
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 , 4th Edition , W.H Freeman & Co .
2. Lewin's Genes X– Krebs Jocelyn, Lewin Benjamin , Goldstein ,Eliott , Kilpatrick ,Stephen : 2009 . Jones and Bartlett.

JOURNALS

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

WEBSITES:

1. www.nature.com/nsmb
2. bmcmolbiol.biomedcentral.com

Question paper pattern :

The pattern of question paper shall be as follows:

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PART A	Definition and structures	20
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PART C	Description/synthesis	40

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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: 15SP18/ 3C/CBI

L T P : 4 0 0

OBJECTIVE:

- To enable the students to understand the concepts of etiology, pathophysiology, diagnosis and treatment of various Clinical conditions.

COURSE OUTLINE:

Unit – I (12hrs)

Overview of diseases: Infectious, Nutritional, Metabolic & Environmental diseases. **Metabolic diseases** – Carbohydrate metabolism (Galactosemia, Glycogen storage diseases) - **Diabetes** – Aetiology, Pathogenesis and investigations. Long term complications and management. Lipid metabolism (Niemen Pick's disease, Taylach's diseases, Gaucher's disease, Hyper and Hypolipoproteinemias). Nucleotide metabolism (Gout, LeschNyhan syndrome, Orotic aciduria. **Environmental diseases** - Extremes of temperature (Hypothermia & Heat Stroke), High Altitudes.

Unit – II (12hrs)

Blood disorders - Anaemia – Iron deficiency anaemia, Megaloblastic anaemia, Aplastic anaemia, Sick cell anaemia, Thalassemia, Porphyria. **Cardiovascular diseases** – Disorders of heart rate and rhythm, Diseases of the heart valves, Diseases of myocardium, Hypertension, Atherosclerosis, Myocardial infarction **Respiratory diseases** - Chronic obstructive pulmonary disease, Diffuse pulmonary lung disease.

Unit – III (12 hrs)

Kidney diseases - Renal stones, Glomerulonephritis, Renal failure; **Liver diseases**- Jaundice, Fatty liver, Cirrhosis, Liver failure, Cholecystitis; **Alimentary and Pancreatic diseases** – Peptic ulcer, Coeliac sprue, Pancreatitis.

Unit – IV (12 hrs)

Diagnostic procedures – X-ray, Angiography. Types of Scan- Ultrasound, CAT, PET, MRI, Tests based on electrical activity – ECG, EEG, Blood pressure measurement, Respiratory gas analyzer, Spirometry.

Unit – V (12hrs)

Therapeutic procedures – **Blood banking**, Dialysis unit- Hemo and Peritoneal dialysis, Ventilator, Pacemaker, Defibrillator, Artificial valves, Heart lung machine, Lithotriptors, Radiotherapy equipment.

RECOMMENDED BOOKS

1. Davidson's Principles and Practice of Medicine-Boon, Colledge & Walker, Elsevier 20th Edition 2006
2. Handbook of Biomedical Instrumentation- R.S. Khandpur, Tata Mc GrawHill Publications Second Edition 2003

REFERENCE BOOKS

1. Teitz Fundamentals of Clinical Chemistry – Burtis, Ashwood & Brunz 6th Edition . Indian Reprint 2010

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

1. <http://www.journals.elsevier.com/journal-of-pharmaceutical-and-biomedical-analysis>
2. <http://www.aami-bit.org/>

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SEMESTER III

ELECTIVE -PHARMACOLOGY

TEACHING HOURS : 60

COURSE CODE: 15SP18/ 3E/PCY

CREDITS : 3

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 –
Microsomal cytochrome P 450 system, Excretion, Factors modifying effects of drugs.
Pharmacodynamics – Types of Drug receptors, Drug- receptor interaction and Drug tolerance,
Drug- Drug Interactions

UNIT – II

(12 hrs)

Anti Infective agents- Sulfonamides- β lactam antibiotics, Amino glycosides, Antifungal agents, Antiviral agents, Antiprotozoal agents, Antiretroviral drugs

Drugs for helminthiasis. Anti mycobacterial drugs for TB. Drugs acting on haemopoietic system – Anti coagulants and coagulants.

UNIT- III

(12 hrs)

Cardiovascular Drugs- Drugs for Hypertension, Hyperlipoproteinemias, Ischemic heart diseases. Drugs for renal function- Diuretics and antidiuretics. Antidiabetic dfrugs

Drugs for Gastrointestinal system – Drugs for Peptic ulcer, Diarrhoea, Irritable Bowel Syndrome, Hemorrhoids and Constipation.

UNIT- IV

(12 hrs)

Drugs for Central Nervous system – Sedatives, Hypnotics and 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 – Drugs for Bronchial Asthma and Cough. Drugs for Endocrine disorders- Drugs for Thyroid dysfunction, Adrenocorticosteroids and their antagonists. Drugs affecting fertility and reproduction-Classification.Hormone replacement therapy –androgens, estrogens, antiandrogens, antiestrogens and contraceptives .Chemotherapeutic agents.

RECOMMENDED BOOKS

1. Pharmacology(III edition)- George.M Brenner and Craig.W.Stevans. Elsevier Publication, 2010.
2. Pharmacology and Pharmacotherapeutics - R.Satoskar andSD Bhandkar, Saurabh Printers, Revised XIX Edition, 2005.

REFERENCE BOOKS

1. Pharmacology- Don.A Ballington,Mary.M Laughlin.CBS publisher III edition First Indian Reprint 2008
2. Essentials of Medical Pharmacology – Tripathi. JP Publishers, 7th Edition 2013.

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

1. <https://www2.bc.edu/~anderswb/pharmacologyonlineresources.html>
2. 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

TEACHING HOURS: 30 Hours

Credits: 2

COURSE CODE: 15SP18/3S/CSK

LTP: 1 1 0

Objective:

To enable the students to understand the basics of computer and its uses.

COURSE OUTLINE:

UNIT I

(10 hours)

Computer fundamentals - Basic architecture , Memory units, Auxiliary storage devices ,
Input devices, Output devices.

Windows Operating system, MS Office - MS Word – Basics

UNIT II

(10 hours)

MS Excel – Basics , Data sort ,Data filters , Functions ,Inserting formulae, Creating charts, & Statistical analysis .

MS Powerpoint- Creating presentation, Inserting graphs/pictures/tables, Smart arts, Slide show.

UNIT III

(10 hours)

Basics of Internet: IP address, URL, www, Web Browsers, Search Engines, Networks, Communication protocols – TCP/IP, FTP, HTTP.

Recommended Books:

Essentials of MS office – Sanjay Saxena, Vikas Publications, First Edition, 2002.

Fundamentals of Information Technology – Alexis Leon & Francis Leon, Tech World, 1999.

Reference Books :

Computer Fundamentals – Anita Goel, Pearson publication

JOURNALS

Computers- Open Access Journal

WEBSITE :

Academic.brooklyn.cuny.edu

SEMESTER IV

IMMUNOLOGY

TEACHING HOURS : 75

COURSE CODE: 15SP18/ 4C/IMG

CREDITS : 4

L T P : 5 0 0

OBJECTIVE:

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

COURSE OUTLINE:

Unit – I

(15 hrs)

Types of Immunity- Native Immunity – Determinants, Anatomical, Physiological Barriers, Phagocytosis. Inflammation – Acute, Chronic, Local & Systemic inflammation. Anti-inflammatory agents. Adaptive Immunity – types. Organs of the Immune system – Structure & function – Thymus, Bone marrow, Lymph node, Spleen, MALT, GALT, and Lymphatic circulation.

Unit – II

(15 hrs)

Antigens – Nature, Factors affecting antigenicity, Epitopes, Adjuvants and Haptens. **Antibodies**-Structure, Effector functions, Classes and biological activities. B cell development, B cell receptor - Multigene organization, DNA rearrangements and generation of Antibody diversity. Clonal selection theory

Unit – III

(15 hrs)

Over view of Diagnostic Immunology-Precipitation and Agglutination tests. Coombs, CFT, ELISA, Immunofluorescence, Immunohistochemistry. Major Histocompatibility complex – General organization and HLA antigens. MHC complex and Disease susceptibility.

Antigen processing and presentation – Cytosolic and Endocytic pathway. T cell mediated immunity-TCR- Structure, Rearrangement, Maturation, Differentiation, Activation and Cell mediated cytotoxicity.

Unit – IV

(15 hrs)

B cell mediated immunity-B cell Activation, T & B cooperation. Monoclonal antibody Production and applications.

Complement system – Complement activation- Classical, Alternative and Lectin pathway. Complement deficiencies. Hypersensitivity reactions- Type I, II, III & IV. Autoimmunity- Organ specific- Insulin dependent Diabetes Mellitus, Graves disease. Systemic- Systemic lupus erythematosus, Multiple sclerosis.

Unit – V

(15 hrs)

Vaccines – Types- Whole organism vaccines, Purified macromolecules, Recombinant vector vaccines, DNA vaccines and 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.

Recommended Text books:

1. Immunology - Goldsby, Kindt, Osborne and Kuby, W.H.Freeman & Company, 5th Edition 2003.
2. Textbook of Microbiology- Ananthanarayanan and Panickers. University Press, 9th Edition, 2013.

Reference Books

1. Immunology –Roitt , Brostoff and Male, Mosby Publishers, 3rd Edition 1993.

JOURNALS

1. *Journal of Immunology Research.*
2. *Journal of Immunology*
3. *International Journal of Immunology*
4. *International Journal of Immunology and Immunotherapy*

Website :

1. www.whfreemen.com/kuby
2. www.immunologylink.com

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

SEMESTER- IV

BIOTECHNOLOGY

TEACHING HOURS : 75

COURSE CODE: 15SP18/4C/BIT

CREDITS : 4

L T P : 5 0 0

OBJECTIVE:

- To enable the students to have an understanding of practical aspects of Recombinant DNA technology
- Students learn applications of Biotechnology in the field of Agriculture ,Pharmaceutical and Clinical sectors.

COURSE OUTLINE:

UNIT-I

(15hrs)

Introduction to Biotechnology, r-DNA technology – Methodology ,Enzymes, Linkers ,Adaptors and Vectors – Plasmid(PBR 322, PUC18) Phage vectors (λ phage vector, M 13)Viral vector-(SV40, Adenovirus). Plant vectors (Ti & Ri) ,Artificial chromosomal vector(BAC, YAC), Shuttle vectors, Expression vectors. Selection of host- Prokaryotic and Eukaryotic host.

UNIT-II:

(15 hrs)

Isolation of gene of interest. Gene library- c-DNA, Amplification of gene- Designing of Primers PCR- RAPD,RFLP. Natural and Artificial methods of gene transfer. Selection of recombinants in plants and animals- Marker gene, Reporter gene, Insertional inactivation, α complementation,Colony hybridization method, Plaque lifting method, Immunological method. Expression of cloned gene, Collection and Purification of recombinant proteins.

UNIT-III:

(15hrs)

Tissue Engineering- Animal cell culture. Culture media- Natural, artificial, serum and serum free media, Cell support materials, Tissue modeling, Embryonic stem cell engineering, Transgenic mice, Gene knock out.

Medical Biotechnology- Production of insulin, Interferon, Hepatitis B Vaccine. Gene therapy , DNA Probes in diagnosis of Tuberculosis, Malaria, HIV.

UNIT-IV:

(15 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 crops, Viral resistant crops ,Salinity and Drought resistant crops .Improvement of crop yield and quality- longer shelf life of fruits and vegetables

UNIT-V:**(15hrs)**

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, Sewage/Waste water treatment.

RECOMMENDED BOOKS:

1. Biotechnology – U.Sathyanarayana , Books and Allied Pvt Ltd, 8th Print, 2013.
2. Textbook of Biotechnology- Dr.PRakash S. Lohar, MJP publisher, 2012

REFERENCE BOOKS :

1. Molecular Biotechnology- Glick and Pasternick, 3rd Edition, ASM Press, 2003.
2. Principles of Gene Manipulation, Old & Primrose, 5th Edition, Blackwell Science, 1996.

JOURNALS:

1. International Journal of Biotechnology
2. International Journal of Biotechnology & Biochemistry

WEBSITE :

1. Biotechlearn.org.nz/
2. Www.ms-biotech.wisc.edu/biotech-websites.cfm
3. www.gate2biotech.com/instantnotes-

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)

SEMSETER IV

ELECTIVE- BIOINFORMATICS

TEACHING HOURS : 60

COURSE CODE: 15SP18/4E/BIF

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, ExPASy; Biological databases - Nucleic acid sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot, Prosite; Structure Databases: PDB, NDB, Genome Databases – SGD, ACeDB; Metabolic pathway database (KEGG); Literature databases - PubMed, Public Library of Sciences (PLoS); Data retrieval systems - Entrez, DBget.

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 & Wunsch, Smith & Waterman algorithms), Hash coding algorithm, Heuristic tools - FASTA, BLAST. MSA – Progressive alignment algorithms for MSA – CLUSTAL W. 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 - (PhyIip). Motif and Domain analysis - SMART, ProDom

Unit III

(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 IV

(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, Abinitio Method. 3-D structure visualization - Rasmol.

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 :

1. Text book of Bioinformatics – Sharma & Munjal, Rastogi Publications, 1st Edition 2008.
2. Bioinformatics Data bases & Algorithms- N.Gautham, Narosa Publishing, Reprint 2009.
3. Essential Bioinformatics – Jin Xiong, Cambridge University Press, 2006.

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 Ouellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999

JOURNALS:

1. Journal of Bioinformatics and Computational Biology
2. Journal of Proteomics & Bioinformatics
3. American Journal of Bioinformatics Research

WEBSITE :

1. www.ncbi.nlm.nih.gov
2. www.ebi.ac.uk
3. www.bioinformatics.org/wiki/General_information_websites

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PRESENTATION SKILLS

TEACHING HOURS :30

CREDITS : 2

COURSE CODE: 15SP18/ 4S/PSK

L T P : 1 1 0

OBJECTIVE:

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

COURSE OUTLINE:

Unit – I (10hrs)

Language & Communication – Verbal & Non Verbal communication , Distinctive features of speech , Listening skills .Oral and Poster presentation.

Unit – II (10hrs)

Resume preparation .Participation in Group discussion. Preparation and facing an Interview. Difference between Speech and Writing-Distinct features of Writing Descriptive , Narrative , Expository & Argumentative writing .

Unit – III (10hrs)

Technical Writing- Laboratory and Field book maintenance . Scientific report writing. Recording minutes of the meeting, Preparation of case studies . Scientific editing ,Preparation of proposal for grants.

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
3. Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010

REFERENCE BOOKS

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

JOURNALS

Birmingham Business Journal

WEBSITE

Entj.oxfordjournal.org

SEMESTER III & IV

CORE PRACTICAL III

TEACHING HOURS: 135

COURSE CODE: 15SP18/ 4C/PL3

CREDITS : 4

L T P : 0 0 5

GROUP EXPERIMENTS

- a) Hematology – Total RBC, WBC, Platelet count , Differential count
- b) ESR, PCV, Hb (Hb Indices – MCV,MCH,MCHC)
- c) Blood grouping
- d) Urine analysis – Uristix
- e) Serum sodium & Potassium – Flame photometry
- f) Enzyme assay – LDH (Kit based)
- g) ELISA (demo)

2 COLORIMETRY

- a) Urea (kit based)
- b) Bilirubin (kit based)
- c) Total Cholesterol (kit based)
- d) HDL (kit based)
- e) Uric acid (kit based)
- f) Estimation of Protein
- g) Estimation of Phospholipid
- h) Estimation of free fatty acids
- i) Estimation of Triglyceride
- j) Estimation of Glucose by OT method
- k) Estimation of Creatinine

SEMESTER III & IV

CORE PRACTICAL IV

TEACHING HOURS: 135

COURSE CODE: 15SP18/4C/PL4

CREDITS : 4

LTP: 0 0 5

1. IMMUNOLOGY (GROUP EXPERIMENTS)

- Ouchterlony – Double diffusion
- Cross over Immunoelectrophoresis

2. MOLECULAR BIOLOGY (GROUP EXPERIMENTS)

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

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: 15SP18/2E/WAH

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 factors affecting Women's health

UNIT V:

(12 hours)

Balanced diet for Women – Carbohydrates, Lipids, Proteins, Vitamins and Minerals – Sources, Requirements and Deficiency diseases. Physical activity – Calorific value of food, Food pyramid and food groups, Fitness and Health-Aerobics and Yoga.

RECOMMENDED BOOKS :

1. Human Anatomy and Physiology-Elaine N marieb Pearson publisher 3rd edn, 1995.
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:

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/

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SEMESTER III

ELECTIVE-LIFESTYLE ASSOCIATED DISEASES

(For other departments)

TEACHING HOURS :60

CREDITS: 3

COURSE CODE: 15SP18/ 3E/LFD

LTP: 4 0 0

OBJECTIVE:

- To understand the health problems associated with modern lifestyle.

COURSE OUTLINE:

Unit I

(12hrs)

Modern lifestyle habits- Sedentary lifestyle-Obesity and hypertension, Stress related disorders- Causes ,Complications and Management, Sleeping disorders- Types ,Causes and Complications, Smoking, Alcoholism, Drugs- Risk factors, Electronic gadgets- Radiation and Health.

Unit -II

(12hrs)

Food habits and health- Junk food- Facts and ill effects, Carbonated drinks, Ready to eat foods, Acidity, Obesity, Eating disorders- Anorexia, Bulimia nervosa. Amoebiasis, Irritable bowel Syndrome. Constipation and Piles- Causes, Symptoms and Treatment ,

Unit-III

(12hrs)

Health hazards of Costumes and Cosmetics- 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 Breast, Cervical and Prostate cancer, Liver cirrhosis, Hepatitis, Diabetes Mellitus, Free radicals 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:

1. Guide to prevention of life style diseases- M.Kumar &R.Kumar
2. Human physiology – Elaine N.Marieb, 3rd Edition, 1995.

REFERENCE BOOKS

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

JOURNALS

1. Journal of Lifestyle diseases and management
2. National Journal of Integrated Research in Medicine
3. An International Journal of Medicine
4. American Journal of Preventive Medicine

WEB SITE :

1. www.livestrong.com › Diseases and Conditions
2. www.med-health.net/Lifestyle-Diseases.html

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