courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
DEPARTMENT OF BIOCHEMISTRY (ID: SP15)
M.Sc BIOCHEMISTRY
SEMESTER I
PROGRAMME PROFILE

Sem	Course Code	Title of the Paper	Credits	Hours /Work	Total Hours	CA	SA	Total
I	15SP18/1C/CHL	Chemistry Of Life	4	4	60	40	60	100
I	15SP18/1C/ABC	Analytical Techniques	4	4	60	40	60	100
I	15SP18/1C/HPH	Human Physiology	4	4	60	40	60	100
I	15SP18/1E/GNT	Elective-Genetics	3	4	60	40	60	100
I	15SP18/1E/BBC	Elective- Biostatistics and Biochemical Calculations	3	4	60	40	60	100
I	PG18/1S/PEW	Soft Skill- Personality Enrichment for Women	2	2	30	-	50	50
I	15SP18/2C/PL1	Core Practical – I	-	4	60	-	-	-
I	15SP18/2C/PL2	Core Practical – II	-	4	60	-	-	-
II	15SP18/2C/EBY	Enzyme Biochemistry	4	4	60	40	60	100
II	15SP18/2C/MRG	Metabolism And Regulation	4	4	60	40	60	100
II	15SP18/2C/HST	Hormones And Signal Transduction	4	4	60	40	60	100
II	15SP18/2E/RMT	Elective- Research Methodology	3	4	60	40	60	100
II		Extra Disciplinary Elective	3	4	60	40	60	100
II		Soft Skill- Foreign Language	2	2	30	-	50	50

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

II	15SP18/2C/PL1	Core Practical – I	4	4	60	40	60	100
II	15SP18/2C/PL2	Core Practical – II	4	4	60	40	60	100
II	II	Internship	2	2				
III	15SP18/3C/MOL	Molecular Biology	4	4	60	40	60	100
III	15SP18/3C/CBI	Clinical Biochemistry & Biomedical Instrumentation	4	4	60	40	60	100
III	15SP18/3E/PCY	Elective - Pharmacology	3	4	60	40	60	100
III		Extra disciplinary elective	3	4	60	40	60	100
III	15SP18/3S/CSK	Soft skill - Computing Skills	2	2	30	-	-	50
III	15SP18/4C/PL3	Core Practical- III	-	-	60	-	-	-
III	15SP18/4C/PL4	Core Practical- IV	-	-	60	-	-	-
III	15SP18/4C/PRO	Project	-	4	60	-	-	-
IV	15SP18/4C/IMG	Immunology	4	5	75	40	60	100
IV	15SP18/4C/BIT	Biotechnology	4	5	75	40	60	100
IV	15SP18/4E/BIF	Elective – Bioinformatics	3	4	60	40	60	100
IV	15SP18/4S/PSK	Soft skill- Presentation Skills	2	2	30	-	-	50
IV	15SP18/4C/PL3	Core Practical- III	4	5	75	40	60	100
IV	15SP18/4C/PL4	Core Practical- IV	4	5	75	40	60	100
IV	15SP18/4C/PRO	Project	4	4	60	40	60	100

ELECTIVE SUBJECTS FOR OTHER DEPARTMENTS

S.n	Course code	Course title	Credits	Hours/Work	Total	CA	SA	Total

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

o					Hours			
1	15SP18/2E/WAH	Women and Health	3	4	60	40	60	100
2	15SP18/3E/LFD	Lifestyle Associated Diseases	3	4	60	40	60	100

SEMESTER I

ELECTIVE- BIOSTATISTICS AND BIOCHEMICAL CALCULATIONS

TEACHING HOUR: 60 Hours   **COURSE CODE: 15SP18/1E/BBC**

CREDITS: 3   **LTP: 3 10**

COURSE OBJECTIVES:

- To study the role of statistical analysis in Interpretation of experimental results.
- To develop competency and expertise in the application of statistical methods applied to biological data
- To enable students use appropriate statistical softwares
- 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, Osmalarity, 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 Km and Vmax, Specific activity and enzyme purification. Biomolecules – problems based on length of the protein in extended and folded

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

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 PublishersFourth Edition , First Indian Reprint 2003
2. Trueman's specific series UGC-CSIR .Life science (Biology), New edition 2012
3. Instrumental Methods of Analysis by Willard. CBS Publishers & Distributors; 7edition edition , 2004
4. Statistical Methods,by S. P. Gupta (Author) ,Sultan Chand & Sons (2012),ISBN-10: 8180549313,ISBN-13: 978-8180549311
5. Bioinstrumentation by MJ Reilly CBS PUBLISHERS AND DISTRIBUTORS PVT LTD. 1 edition (1 March 2016)ISBN-10: 9788123928395,ISBN-13: 978-8123928395

JOURNALS

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

e-LEARNING RESOURCES

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

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply the knowledge in identifying Data characteristics and form of distribution of data structure and its role in determining inferences	K1,K2
CO 2	Recognize when and why statistical tests	K2,K3,K4

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

	are neededand use technology to perform descriptive and inferential data analysis	
CO3	Determine the exact method of Data analysis for problem under investigation and make use of appropriate statistical software	K2,K3,K4
CO4	Apply the knowledge in the preparation chemical reagents used in laboratories and industries	K3,K4,K5
CO5	Apply the knowledge in eliminating the contamination by identifying the microbial growth studies and problems of biomolecules	K3,K4,K5

MAPPING OF CO WITH PSO

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

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

TEACHING METHODOLOGY:

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

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	Sec A – 10 x 2	50	20		**Question No.- is compulsory**
K3,K4	B – 5/8 x 8	500	40	100	**Section B/C-must be have 2 theory and 3problems(problems may be asked in**
K3,K4,K5	C – 2/4 x 20	1200	40		**revelant papers)**

SEMESTER II

ELECTIVE - RESEARCH METHODOLOGY

TEACHING HOURS: 60   **COURSE CODE: 15SP18/2E/RMT**
CREDITS: 3   **LTP: 3 1 0**

COURSE OBJECTIVE

1. To introduce students to research and thesis writing.
2. To introduce the various approaches to biochemical investigations.
3. To expose students to the preparation of plant extracts.
4. To impart knowledge on different cell line cultures used in research.
5. To impart knowledge on various types of spectroscopy.

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)**

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

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, Charecterisation- 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. Reprint2006
2. Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010

REFERENCE TEXTBOOKS

1. Instrumental methods of Chemical Analysis- Chatwal& Anand, Himalaya Publishing House. Reprint 2005
2. Principles and techniques of practical Biochemistry – Keith Wilson and John Walker , 7th Edition, Cambridge University Press.2004
3. Research methodology step by step guide for beginners –Ranjith kumar
4. Research methodology in social behavioural and life sciences-Herman J Ader
5. Hand book of Research methodology- Shanti Bhusan Misra

JOURNALS :

1.International *Journal of* Science and *Research Methodology*
2.International *Journal of* Advances in Software Engineering &*Research Methodology*

e-LEARNING RESOURCES
1. *processresearchmethods.org/*
2. https://explorable.com/research-methodology
3. http://www.scribbr.com
4. http://www.open.edu
5. http://www.macmillan .ihe.com

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply for research funding, fellowship and grants and write thesis.	K2,K3

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

CO 2	Explain stages of drug development and clinical trials .Maintain animals for research and toxicity studies ethically.	K3, K4
CO3	Discuss the methods of extraction from plants, free radical damage, lipid peroxidation and asses them.	K3,K4
CO4	Outline the fundamentals of nanotechnology, cell line studies, sequence analysis-DNA and amino acid sequencer.	K3, K4
CO5	Explain principle instrumentation and applications of sprectoscopy.	K1, K2

MAPPING OF CO WITH PSO

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

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

TEACHING METHODOLOGY:

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

QUESTION PAPER PATTERN

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	Sec A – 10 x 2	50	20		**Question No.- is compulsory**
K3,K4	B – 5/8 x 8	500	40	100	**Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)**
K3,K4,K5	C – 2/4 x 20	1200	40		

SEMESTER I & II

CORE PRACTICAL -I

TEACHING HOURS: 120 Hours   **COURSE CODE: 15SP18/2C/PL1**   **CREDITS:4**   **LTP: 0 0 4**

Course Objectives:
1. To impart Knowledge on the principle of Food analysis.
2. To impart Knowledge on the principle of various chromatographic techniques.
3. To train students in isolation and estimation of compounds from food sources.
4. To train students in using different instruments and kits.
5. Train students to separate biomolecules with appropriate chromatographic methods.

COURSE OUTLINE
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)

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Analyse the Moisture and Ash content of foods	**K4,K5**
CO 2	Estimate Iron, Copper, Starch, Glycogen, Sterol and Riboflavin in food samples	**K4,K5**
CO3	Separate Biomolecules by appropriate chromatographic methods	**K4,K5**

MAPPING OF CO WITH PSO

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	**3**	**3**	**3**	**3**	**3**

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

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

<div align="center">

SEMESTER I & II

CORE PRACTICAL -II

</div>

TEACHING HOURS: 120 Hours   **COURSE**   **CODE:**
15SP18/2C/PL2   **CREDITS: 4**
LTP 0 0 4

COURSE OBJECTIVES:
1. Train students in protein separation and blotting techniques.
2. Train students in isolation of nucleic acids from biological sources
3. To enable students to carry out isolation of organelles like mitochondria, chloroplast from biological sources.
4. To expose and train students in Enzyme kinetic studies.
5. Train students in Phytochemical analysis.

COURSE OUTLINE
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

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Separate proteins ,isolate nucleic acids and organelles from biological sources	K4,K5
CO 2	Carry out enzyme kinetic assays	K4,K5
CO3	Analyze and identify phyto constituents	K4,K5

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

MAPPING OF CO WITH PSO

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	**3**	**3**	**3**	**3**	**3**

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

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

SEMESTER III

CLINICAL BIOCHEMISTRY & BIOMEDICAL INSTRUMENTATION

TEACHING HOURS : 60   **COURSE CODE: 15SP18/ 3C/CBI**
CREDITS : 4   **LT P : 4 0 0**

COURSE OBJECTIVE

1. To give an overview of diseases with emphasis on metabolic and environmental diseases.
2. To impart knowledge on Blood disorders, cardiovascular and respiratory diseases.
3. To impart knowledge on common Kidney, liver, Intestinal and pancreatic diseases.
4. To expose students to various methods to diagnose different diseases.
5. To expose students to common therapeutic procedures.

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, Taysach'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 ,Sickle cell anaemia, Thalassemia,, Porphyria.Cardiovascular diseases – Disorders of heart rate and rhythm, Diseases of the heart valves, Diseases of myocardium, Hypertension,Atheroschlerosis, 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 6 th Edition . Indian Reprint 2010
2. Clinical Biochemistry- Metabolic and Clinical aspects- William J Marshall 2nd Edition.
3. Practical clinical Biochemistry –Methods and interpretation –Ranjana Chawla
4. Hand book of clinical Biochemistry –Swaminathan Ramaswamy Iyer
5. Clinical Biochemistry and metabolic medicine-Martin Andrew Crook

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

e-LEARNING RESOURCES

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

1. http://www.journals.elsevier.com/journal-of-pharmaceutical-and-biomedical-analysis
2. http://www.aami-bit.org/
3. http://Elsiever .com
4. http://Longdom.org
5. http://www.manchester.ac.uk.list

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Compare different diseases etiologically.	K1,K2
CO 2	Discuss the etiology, pathology and manifestations of disorders, cardiovascular and respiratory diseases.	K2, K3
CO3	Explain the etiology, pathology and manifestations of common Kidney, liver, Intestinal and pancreatic diseases.	K2, K3
CO4	Discuss the principle and working of various diagnostic tools: identify and use appropriate diagnostic method for each disease and interpret the results.	K3,K4
CO5	Explain the principle and working of various therapeutic instruments; identify and use appropriate therapeutic method for each disease.	K3, K4

MAPPING OF CO WITH PSO

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

AVERAGE	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**

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

TEACHING METHODOLOGY:

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

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	**Question No.- is compulsory**
K3,K4	**B – 5/8 x 8**	**500**	**40**		**Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)**
K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		

SEMSETER IV

ELECTIVE- BIOINFORMATICS

TEACHING HOURS : 60   **COURSE   CODE: 15SP18/ 4E/BIF**
CREDITS : 3   **L T P : 3 1 0**

COURSE OBJECTIVE

1. To impart knowledge on the fundamentals of Bioinformatics and various biological databases.
2. To expose the students to various methods of sequence analysis and its applications.
3. To introduce the principles of Genomics and High-throughput technologies.
4. To introduce   the fundamentals of Proteomics with special reference to Protein structure Prediction.
5. To Impart knowledge the role of insilico tools in Drug designing and development.

COURSE OUTLINE:

Unit I   **(12 hrs)**

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

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&Wuncsh, 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 - (Phylip). 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, *Abintio* 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.

REFERENCE BOOKS :
1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004
2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999
4. Essential Bioinformatics – Jin Xiong, Cambridge University Press, 2006.

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

5. Understanding Bioinformatics- Jeremy O. Baun and Marketa.J.

JOURNALS:

1. *Journal* of *Bioinformatics* and Computational Biology
2. Journal of Proteomics & Bioinformatics
3. *American Journal* of *Bioinformatics* Research
4. Journal of Bioinformatics and Computational biology
5. Bioinformatics and Computational biology

e-LEARNING :

1. www.ncbi.nlm.nih.gov
2. www.ebi.ac.uk
3. www.bioinformatics.org/
4. www.Expasy.org
5. www.Scripps.edu

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the computational methods in Biology; retrieve information from Biological databases.	K1,K2, K3
CO 2	Analyse sequences and find relationships using computational tools	K2, K3, K4
CO3	Discuss genomic data and Use appropriate tools in genomic research	K2,K3, K4,K5
CO4	Explain the concepts in proteomics; Predict protein structure and chacterise it.	K3, K4,K5
CO5	Discuss the steps in drug development; use of appropriate insilico tools in each step.	K3, K4,K5

MAPPING OF CO WITH PSO

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

CO1	2	2	3	3	2
CO2	2	3	2	3	3
CO3	2	3	3	2	3
CO4	2	3	3	3	3
CO5	2	3	3	3	3
AVERAGE	**2**	**2.8**	**2.8**	**2.8**	**2.8**

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

TEACHING METHODOLOGY

Lecture (Chalk A0nd Talk)

E Content ,Videos

Group Discussion

Quiz-Seminar

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	**Sec A – 10 x 2**	**50**	**20**	**100**	**Question No.- is compulsory** **Section B/C-must be have 2 theory and 3problems(problems may be asked in revelant papers)**
K3,K4	**B – 5/8 x 8**	**500**	**40**		
K3,K4,K5	**C – 2/4 x 20**	**1200**	**40**		

SEMESTER III &IV

CORE PRACTICAL III

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

TEACHING HOURS: 135   **COURSE CODE: 15SP18/ 4C/PL3**   **CREDITS : 4**
L T P : 0 0 5

COURSEOBJECTIVES:
1. To have hands on training in hematological parameters
2. To estimate the minerals using flame photometry
3. To use the diagnostic kits and Uristix
4. To demonstrate ELISA
5. To determine the levels of biological compound using colorimeter and spectrophotometer

COURSE OUTLINE

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

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Estimate the total RBC, WBC, Platelet count , Differential count, ESR, PCV, Hb (Hb Indices – MCV,MCH,MCHC) and Blood grouping	K4,K5
CO 2	Use ELISA and kit methods to estimate the biological compounds	K4,K5
CO3	Use Colorimeter, Spectrophotometer, Flame photometer to estimate compounds in the biological specimens	K4,K5

MAPPING OF CO WITH PSO

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	3	3	3	3	3

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

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

SEMESTER III & IV
CORE PRACTICAL IV

TEACHING HOURS: 135   **COURSE   CODE: 15SP18/**
4C/PL4   **CREDITS:4**
LTP: 0 0 5

OBJECTIVES:
1. To Analyze Biological compounds using Immunological Techniques.
2. Hands on training in Molecular Biology Techniques.
3. To use the diagnostic kits for Transformation.
4. To demonstrate PCR
5. To determine the levels of Antioxidants using colorimeter and spectrophotometer

COURSE OUTLINE:
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

courses having focus on employability / entrepreneurship / skill development year-wise during last five years:

- DPPH assay

- Nitrogen oxide scavenging assay

- FRAP assay

COURSE OUTCOME

CO . NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain Oucterlony double diffusion Cross over Immunoelectrophoresis,Isolation of Genomic and Plasmid DNA,Restriction digestion and Ligation,PCR and transformation.	K4,K5
CO 2	Assay Antioxidants in serum	K4,K5
CO3	To Analyse antioxidant activity of Phytochemicals.	K4,K5

MAPPING OF CO WITH PSO

CO/PO	PSO1	POS2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
AVERAGE	3	3	3	3	3

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

TEACHING METHODOLOGY:

1. Hands on training on the experiments
2. Demonstration of the experiments

courses having focus on employability / entrepreneurship / skill development year-wise during last five years: