

VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).

An ISO 9001: 2008 Certified Institution
(Affiliated to Periyar University, Approved by AICTE, recognized u/s 2 (f) & 12 (B) & Re-accredited with 'A' by NAAC)
Recognized under section 2(f) and 12(B) of UGC Act, 1956
An ISO 9001:2008 (Certificate Institution)



DEPARTMENT OF BIOCHEMISTRY

M.Sc., BIOCHEMISTRY

SYLLABUS AND REGULATIONS

FOR CANDIDATES ADMITTED FROM 2020-2021
ONWARDS UNDER AUTONOMOUS CBCS AND OBE
PATTERN

VIVEKANANDHA EDUCATIONAL INSTITUTIONS
Angammal Educational Trust
Elayampalayam, Tiruchengode (Tk.), Namakkal (Dt.)

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COLLEGE VISION AND MISSION

Vision

- To evolve into a center of excellence in higher education through creative and innovative practices to social equity for women.

Mission

- To provide sufficient learning infrastructure to the students to pursue their studies.
- To provide good opportunity for higher education and conducive environment to the students to acquire education.
- To provide quality academic programs training activities and research facilities.
- To facilitate industry-institute interaction.

DEPARTMENT

Vision

To be recognized as a centre for excellence in Biochemistry that provides an atmosphere to acquire skills in identifying the link between biological and human resources and transform it to enhance the quality of life.

Mission

- To help the students to gain more knowledge through visit to research Institutions, Industries, and hospitals through Job training and project work.
- To give an opportunity to students to meet eminent scientists working in various fields of Biochemistry by way of invited lectures, seminars & workshops
- Designing strategies and catalysts for making chemical bonds in new ways
- To provide opportunities to get hands on experience in –
 - Research oriented education in Biochemistry
 - Programming and application skills in Bioinformatics and Drug Designing
 - Molecular Biology and Biotechnology
 - Apprenticeship in industries and service agencies
 - Entrepreneurship in Biochemistry-related areas.
- Promote research based projects/activities in the emerging areas of technology convergence.

PROGRAMME EDUCATIONAL OBJECTIVES

1. To make the graduates to afford fundamentals and applications of current biochemical concepts at an advanced level.
2. To promote research in the thrust areas of Biochemistry ranging in wide areas like structural biology, gene regulation and to connect various field through Biochemistry
3. To equip with the up-to-date skills of evolving technologies as per industrial forecast

PROGRAMME SPECIFIC OBJECTIVES (PSO)

1. To provide students with learning experiences that help instill deep interests in learning Biochemistry; develop broad and balanced knowledge and understanding of biomolecules, like biochemical concepts, principles and theories related to Biochemistry and equip students with appropriate tools of analysis and with theoretical technical and analytical skills to tackle issues and problems in the field of Biochemistry.

2. To equip the graduates with the ability to prepare to a fast changing situations by gaining strength to learn and apply the new skills with competency and to provide students with the knowledge and skill base that make them undertake further studies in Biochemistry and related areas or I multidisciplinary areas that help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

3. To expose the students to a wide range of careers that combine biology, plants and medicine and render graduates with some work experience, as summer internship and a research project in a research laboratory to further boost the career prospects.

PO and Knowledge level

PO No	PROGRAMME OUTCOME	Knowledge Level
PO1	Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.	K2
PO2	Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.	K1
PO3	Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.	K4
PO4	Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.	K3
PO5	Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.	K5
PO6	Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.	K6
PO7	Cooperation/Team work: Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.	K6
PO8	Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.	K4
PO9	Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.	K2
PO10	Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.	K3
PO11	Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.	K6
PO12	Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to	K5

	effectively engage in a multicultural society and interact respectfully with diverse groups.	
PO13	Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.	K3
PO14	Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.	K6
PO15	Lifelong learning: Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.	K6

IV. ELIGIBILITY FOR ADMISSION

- Candidates seeking admission to the first year M.Sc., Degree Course could have a Bachelors Degree in Science with Biochemistry, Chemistry, Botany, Zoology, Nutrition and dietetics or Food and Nutrition or Food Sciences as the main subject or a Bachelors Degree in Agriculture and Life sciences as main subject of this University or any other qualification accepted as equivalent there to are eligible for admission to M.Sc., Degree course.

V. DURATION OF THE COURSE

- The course duration shall be two years consisting of 4 semesters. Each academic year shall be divided into 2 semesters. The first academic year shall comprise the first and second semesters, and the second academic year the third and fourth semesters respectively. The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University. Each subject will have six hours of lecture per week apart from practical training at the end of each semester.

VI. ASSESSMENT

- Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers. A

candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when his / her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously by the teacher concern and the Internal Assessment Marks will be as follows:

Distribution Of Continuous Assessment Marks (25/40)

Activity	Marks (25)	Activity	Marks (40)
Attendance	5	Attendance	5
CA Test I	2.5	CA Test I/Review	5
CA Test II	2.5	CA Test II/Review II	5
Model	10	Model/Model Presentation	10
Assignment	5	Observation note and result in lab	15
25			40

Distribution of attendance mark

S. No.	Percentage	Marks	
		Theory	Practical
1	76-80	1	2
2	81-85	2	4
3	86-90	3	6
4	91-95	4	8
5	96-100	5	10

A. EXTERNAL ASSESSMENT (EA)

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and valued by the external examiners with the help of the teacher concern.

The pattern of assessment is as follows:

Distribution Of Final Assessment Marks (75/60)

Section	Activity	Marks (75)	Activity	Marks (60)
A	Five marks (5) (Either or)	25	Record work	5
B	Ten marks (10) (Either or)	50	Viva Voce	5
			Spotter	20
			Experiment I	15
			Experiment II	15
	Total	75	Total	60

VII. PASSING MINIMUM

INTERNAL

There is no passing minimum for CIA

EXTERNAL

In the University Examinations, the passing minimum shall be 50 % out of 75 Marks (38 Marks).

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

- a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
- b) 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.
- c) 50% and above but below 60% shall be declared to have passed the examinations in second class.
- d) All the remaining successful candidates shall be declared to have passed the examinations in third class.
- e) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for University rank.

IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than two academic years comprising of four semesters and passed the examinations prescribed and fulfilled such conditions as have been prescribed therefore.

X. PROCEDURE IN THE EVENT OF FAILURE

Candidates fail in any subject would be permitted to appear for each failed subject or subjects in the subsequent EA. However, final year students failed in one or two subjects would be allowed to appear for a supplementary exam within a month of the final result.

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2018-19 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2018-19 and thereafter.

XII. TRANSITORY PROVISIONS.

Candidates who have undergone the PG Course of study before 2018-19 shall be permitted to appear for the examinations under those regulations for a period of two years i.e., upto and inclusive of the examination of April/May 2020-2021. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

Supplementary examination will be conducted within a month. In case of failure she has to complete within 5 years. (3+2)

XII. COURSE PATTERN
VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
SYLLABUS FRAME WORK

Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
YEAR I													
Semester I							Semester II						
Core Paper I	5	4	3	25	75	100	Core Paper V	5	4	3	25	75	100
Core Paper II	5	4	3	25	75	100	Core Paper VI	5	4	3	25	75	100
Core Paper III	5	4	3	25	75	100	Core Paper VII	5	4	3	25	75	100
Core Paper IV	5	4	3	25	75	100	Elective I	5	3	3	25	75	100
Practical – I	5	4	6	40	60	100	Practical-III	5	4	6	40	60	100
Practical – II	5	4	6	40	60	100	Practical – IV	5	4	6	40	60	100
Total	30	24	24	180	420	600	Total	30	23	24	180	420	600
I YEAR TOTAL								60	47	48	360	840	1200
YEAR II													
Semester III							Semester IV						
Core Paper VIII	5	4	3	25	75	100	Core Paper XI	5	5	3	25	75	100
Core Paper IX	5	4	3	25	75	100	Core Paper XII	5	4	3	25	75	100
EDC	5	4	3	25	75	100	Core Paper XIII	5	4	3	25	75	100
Core Paper X	4	4	3	25	75	100	Project Work	15	4	6	40	60	100
Practical – V	5	4	6	40	60	100							
Practical – VI	4	3	6	40	60	100							
Internship Training Programme		2		40	60	100							
Human Rights	2	2	3	25	75	100							
Total	30	27	27	245	555	800	Total	30	17	15	115	285	400
II YEAR TOTAL								60	44	42	360	840	1200
TOTAL CREDIT FOR THE COURSE								120	91	90	720	1680	2400

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF BIOCHEMISTRY
CBCS AND OBE PATTERNSYLLABUS - PG
(For candidates admitted from 2019-2020 onwards)**

Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
YEAR I													
Semester I							Semester II						
Paper I - Biopolymers	5	4	3	25	75	100	Paper V – Intermediary Metabolism and Regulation	5	4	3	25	75	100
Paper II – Cellular Biochemistry	5	4	3	25	75	100	Paper VI – Molecular Biology	5	4	3	25	75	100
Paper III –Enzymology and Enzyme technology	5	4	3	25	75	100	Paper VII – Immunology and Immunotechnology	5	4	3	25	75	100
Paper IV – Analytical Biochemistry	5	4	3	25	75	100	Elective II – Plant Biochemistry and Plant Biotechnology Endocrinology	5	3	3	25	75	100
Practical I	5	4	6	40	60	100	Practical III	5	4	6	40	60	100
Practical – II	5	4	6	40	60	100	Practical – IV	5	4	6	40	60	100
Total	30	24	24	180	420	600	Total	30	23	24	180	420	600
I YEAR TOTAL								60	47	48	360	840	1200
YEAR II													
Semester III							Semester IV						
Paper VIII –Advanced Clinical Biochemistry	5	4	3	25	75	100	Paper XI – Neuroscience	5	5	3	25	75	100
Paper IX – Research Methodology	5	4	3	25	75	100	Paper XII – Bioinformatics and Nanotechnology	5	4	3	25	75	100
Paper X –Genetic Engineering and Fermentation Technology	5	4	3	25	75	100	Paper XIII – Human Physiology	5	4	3	25	75	100
EDC -	4	4	3	25	75	100	Project Work	15	3	6	40	60	100
Practical - V	5	4	6	40	60	100							
Practical – VI	5	4	6	40	60	100							
Internship Training Programme		2		40	60	100							
Human Rights	1	1	3	25	75	100							
Total	30	27	27	245	555	800	Total	30	16	15	115	285	400
II YEAR TOTAL								60	43	42	345	840	1200

I YEAR I SEMESTER BIOPOLYMERS

Paper : Core I
Hours/Week : 5
Credit : 4
Paper Code : **18P1BC01**

Total Hours : 75
Exam Hours : 03
Internal : 25
External : 75

SUBJECT DESCRIPTION:

Biopolymers deal with the brief information on the structure, functions and behavioral properties of biomolecules.

OBJECTIVES:

The main objective of the course is to study about carbohydrates, proteins, lipids, and nucleic acids and their structure and properties in advanced level.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Familiarize about the definition, occurrence, and types of various biomolecules	K2
CO2	Recall and understand the classification, chemistry and functions of macro and micro nutrients.	K2
CO3	Imbibe and interpret the chemical reactions of monosaccharides, amino acids and structural organization of various biomolecules.	K3
CO4	Evolve the physiological functions and significance of macro and micro nutrients.	K4
CO5	Correlate the need of macro and micronutrients with the metabolic and physiological functions of the human body.	K4

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	S	S	S	M	M	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	M	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M	S	M	M	M	S
CO4	S	S	S	M	S	S	S	S	S	M	S	S	S	S	S
CO5	S	M	M	S	M	M	S	M	S	M	S	S	M	M	S

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Carbohydrates: Introduction, Classification, and Properties of carbohydrates, Bacterial cell wall Polysaccharides, Amino sugars and Deoxy sugars, Glycosaminoglycans-Structure and biological role of Hyaluronic acid, Chondroitin sulphate and Heparin, Sialic acid - Structure and Significance, Biological importance of Proteoglycans and Glycoproteins.

Unit II – (15 Hrs.): Proteins and Amino Acids: Classification, Structure, Function, Properties of Amino acids and Proteins, Amino acid sequencing, biological importance of selenocysteine and desmosine, Ramachandran plot, Structure and Function of Hb, myoglobin, Actin, Myosin, Keratin, Collagen and Elastin, Transport of amino acid in to mitochondria. DNA binding proteins - helix-

turn-helix, zinc-finger motif, leucine zipper – direct interactions, Techniques for characterizing nucleic acid- protein complex- gel retardation assay. Disease related to protein folding – Alzheimer’s and mad cow disease, Protein denaturation.

Unit III – (15 Hrs.): Lipids: Classification, Structure, Properties and Functions of lipids, Transport and hydrolysis of triglycerol, Plant and animal sterols, Fatty acids - Types and significance, Structure and functions of cholesterol, Lipid peroxidation and antioxidants, Lipoproteins - Classification, composition and functions

Unit IV – (15 Hrs.): Nucleic Acids: Structure and properties of nitrogenous bases and nucleotides, Cot value and Cot curve, Chemical synthesis of DNA, Major classes of RNA-Structure and biological functions of mRNA, rRNA, tRNA, snRNA, hnRNA, DNA histone proteins, chromatin, non-histone proteins, Methylated bases of DNA and DNA super coiling, Properties of DNA- buoyant density, viscosity, denaturation and renaturation.

Unit V – (15 Hrs.): Vitamins and Minerals - Definition, Classification of Fat soluble vitamins (A,D,E,K) and Water soluble vitamins (B complex vitamins & Vitamin C) - Sources, Chemical nature, functions and deficiency symptoms. Minerals: Requirements, macro and micro minerals (sources and functions).

TEXT BOOKS:

1. Deb, A.C (2004). **Fundamentals of Biochemistry**. 8th Edition, New Central Book Agency,
2. Jain, J.L & Jain, (2005) **Fundamentals of Biochemistry**. Sixth Edition, S.Chand & Company, New Delhi.
3. U.Sathayanarayana, (2006). **Biochemistry**. 3rd Edition by Books and Allied (P) Ltd., India.

REFERENCE BOOKS

1. Murray, K.R. Granner, K.D. Mayes, P.A. and Rodwell W.V. (2009). **Harper’s Biochemistry**. 23rd Edition, Prentice Hall International Inc., New Jersey.
2. Nelson, D.L. and Cox, M.M (2008). **Lehninger Principles of Biochemistry**. 5th Edition, W.H. Freeman and Company, New York.
3. Bery J.M., Tymoezko J.L. and Stryer L. (2008) **Biochemistry**, 5th Edition, W.H. Freeman and Company, New York.

WEB OF RESOURCES

1. <http://ull.chemistry.uakron.edu/genobc/>.
2. <http://www.biology.arizona.edu/biochemistry/biochemistry.html>.
3. <https://www.sciencedirect.com/topics/neuroscience/dna-binding-protein>
4. <https://biologydictionary.net/nucleic-acid/>
5. <https://www.helpguide.org/harvard/vitamins-and-minerals.htm>

PEDOGOGY: CHALK and Talk , PPT

YEAR I – SEMESTER I
CELLULAR BIOCHEMISTRY

Paper	: Core II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P1BC02	External	: 75

SUBJECT DESCRIPTION:

This course presents to focus on the different cellular signaling pathways, cellular organelles and organization its biochemistry.

OBJECTIVES:

The objective of the course is to understand the relationship between cellular organelles and cellular signaling in research.

OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Discuss the structure, differentiation of eukaryotes and prokaryotes and also cell cycle, check point interpretation, differentiation between mitosis and meiosis	K2
CO2	Illustrate the cell organelles structure and functions such as nucleus, chloroplast, mitochondria, endoplasmic reticulum, ribosome and lysosome etc.	K3
CO3	Apply the knowledge cell signaling of oncology markers such as P ⁵³ , Bcl2, Bax, AFP and IL-1 e and their clinical interpretation	K4
CO4	Describes the critical based knowledge of membrane architecture and their types of models, and membrane transporters- like ion channels, symporters, and antiporters etc.	K5
CO5	Evaluate and hypothesis of extra cellular matrix, gap junction and cell to cell communication and also signal transtrduction pathways such as G protein-coupled receptor and TrkA receptor etc.,.	K6

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	S	L	M	L	L	M	L	S	S	M	L	L	M
CO2	M	M	M	M	S	M	M	S	L	M	M	M	L	L	M
CO3	S	S	L	M	L	M	L	S	L	M	L	M	S	S	S
CO4	S	S	L	M	M	M	S	L	M	L	M	S	M	L	L
CO5	L	M	L	S	M	M	M	M	M	L	M	M	M	S	S

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Cellular Organelles: Definition, Structure and functions of cells-prokaryotes and eukaryotes, Morphology and function of Cytoplasm, endoplasmic reticulum, ribosomes, golgi apparatus, lysosomes, mitochondria, nucleus, chromosomes, chromosome organization, centrioles, chloroplasts, peroxisomes and glyoxysomes; Intracellular compartments and protein sorting, Intracellular vesicular traffic, Autocrine, Paracrine and endocrine.

Unit II – (15 Hrs.): Cell cycle : Cell division - mitosis and meiosis, cell cycle - phases of cell cycle, and regulation of cell growth and cell cycle,. Cytoskeleton - Structure and composition of cytoskeleton, Actin filament, intermediate filament and microtubule, Self assembly and dynamic structure of cytoskeletal filaments, regulation of cytoskeletal filaments, Molecular motor, Cytoskeleton and cell behaviour, molecular motors, micro tubular associated proteins - role in intracellular motility

Unit III – (15 Hrs.):Cellular Interaction and signaling : Cell-Cell interaction - Collagen, hyaluronan & proteoglycans, laminin, integrins and fibronectins, Cell-Cell adhesion - Specialised junctions, Desmosomes, Gap junctions, Adhesion molecules – Cadherins, Connexins.Cell-Cell signaling – Types, Cell Signaling molecules and their receptors, functions of cell surface receptors, pathways, intra and extracellular signal transduction and second messengers (G – protein coupled receptors, receptor tyrosine kinases), cAMP, cGMP

Unit IV – (15 Hrs.):

Programmed Cell Death and cancer signaling : cell growth and apoptosis, Apoptosis – PI3K-Akt, NF-KB, Ras-Erk IGF-1 and NOTch signaling Pathways, regulators, effectors in apoptosis, oncology: oncogenes, causes, malignant non-malignant tumor, Properties of tumor cells, Tumor suppressor genes, human chorionic gonadotropin, cancer antigen 125, carcinoembryonic antigen (CEA), prostate-specific antigen, alpha-fetoprotein cancer markers. Carcinogenic effect of chemicals and radiation. Methods of studying the cell surface, re-constititional studies; fluorescence assisted methods e.g. flow cytometry

Unit V – (15 Hrs.): Membrane Architecture and Functions: Membrane bilayer - Models, Membrane lipids - fluidity, Asymmetry phase transition, Liposomes Membrane proteins - Types, Orientation, Bacteriorhodopsin, Porins-aquaporin, RBC ghosts, solubilisation of proteins, lipid anchored proteins carbohydrates and cell surface carbohydrates – Lectins, Membrane transport - ion channels, symporters and antiporters, Transport of water, glucose and amino acids.

TEXT BOOKS:

1. Rastogi,S.C. (2003), 2nd Edition, **Cell and Molecular Biology**. New Age International Publishers,New York.
2. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. (2000) **Molecular Cell Biology**, New York: W. H. Freeman
3. Gerald Karp, (2008).**Cell and Molecular Biology**. 5th Edition, John Wiley and Sons New Jersey.
4. Ajay Paul, (2009).**Text Book of Cell and Molecular Biology**. 2th Edition, Books and Allied (P) Ltd, Kolkata.
5. VK Agarwal and PS Varma , (2000). Cell Biology and Molecular Biology, Chand & Company, New Delhi.

REFERENCE BOOKS

1. Lodish, H. Baltimore, and *et al.*, (2008).**Molecular Cell Biology**. 6th Edition. W.H.Freeman and Co, NY.
2. Garrette, Grisham (1994) **Principles of Biochemistry**, Saunders College Publishing Co. USA.
3. Geoffrey, M. Cooper, Robert E. Hausman, **The Cell:A Molecular Approach**.4th Edition,Asm Press,USA.
4. **Bruce Albert et al.**, *Molecular biology of the cell*, Garland publications, New York & London, 3rd edition, 1994.
5. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin C. Raff, Keith Roberts, Peter Walter (2007), **Molecular Biology of the Cell**, Garland Science, Taylor & Francis Group.

WEB SOURCES:

1. <https://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookCELL2.html>
2. <https://www.physics.uoguelph.ca/~dutcher/download/.../1.pdf>
3. <https://www.khanacademy.org/.../cells/cell-cell-interactions/.../cell-cell-interactions-ho...>
4. https://en.wikipedia.org/wiki/Programmed_cell_death
5. <https://www.cellsignal.com/contents/science/key-signaling-networks-in-cancer/cancer-research>

PEDOGOGY: CHALK and Talk , PPT

YEAR I – SEMESTER I
ENZYMOLGY AND ENZYME TECHNOLOGY

Paper	: Core III	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P1BC03	External	: 75

SUBJECT DESCRIPTION:

Enzymology and Enzyme Technology deal with the knowledge on enzymes, classification structure kinetics and applications.

OBJECTIVES

The Students should update their knowledge about the enzyme and its role in all stages of metabolism and biochemical reaction. This course will describe a clear idea about an isolation of enzyme, characteristic properties, production on bench scale to pilot scale and their application in bio-industries.

COURSE OUTCOMES

Course No	Course Outcome	Knowledge Level
CO1	Know about the key structural and energetic factors which increase enzyme stability	K2
CO2	Understand about the role of enzyme as a catalyst in biological process	K2
CO3	Interpret the optimum pH, Temperature , Concentration of enzyme for certain enzyme catalysed reaction	K3
CO4	Learn about the logistic and sensible entrapment technique to improve the state of enzyme immobilization	K3
CO5	Familiarize about the application of enzyme technology in industrial sector	K4

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Enzymology: Introduction, Nomenclature and classification of enzymes by IUB system, enzyme characteristics, monomeric, oligomeric and multienzyme complex. Active site, models of enzyme action – lock and key and koshland induced fit model. Investigations of active site structure. Isoenzymes, abzymes and ribozymes. Multienzyme systems. Enzyme units and enzyme turnover.

Unit II – (15 Hrs.): Enzyme Kinetics: MM Kinetics, LB plot, Eadie - Hofstee plot and Hanes-woolf plot. Factors affecting enzyme activity (pH, temperature, substrate and enzyme concentration and activators) - Bisubstrate reactions - Enzyme inhibition- Reversible and irreversible. Feedback inhibition -Allosteric inhibition and regulation, concerted and sequential models for allosteric enzymes, positive and negative co-operativity with special reference to aspartate transcarbamoylase.

Unit III – (15 Hrs.): Enzyme Catalysis & Coenzymes: Acid-base catalysis, covalent catalysis and metal ion catalysis. Mechanisms of action of lysozyme, chymotrypsin, ribonuclease and carboxypeptidase. Metal activated enzymes and metalloenzymes. Coenzymes – TPP, PLP, FMN, FAD, NAD, NADP, CoA, Biotin and tetrahydrofolate.

Unit IV – (15 Hrs.): Enzyme Technology: Definition, types of immobilization – adsorption, covalent binding, entrapment, liposomes, cross linking and microencapsulation. Effect of immobilization on enzyme activity and application of immobilized enzyme. Biosensors- calorimetric biosensors, potentiometric biosensors, Amperometric biosensors, optical biosensors, Piezo-electric biosensors and thermometric biosensor. Enzyme engineering – Artificial enzymes and antioxidant enzymes.

Unit V – (15 Hrs.): Enzyme Purification and Applications: Objectives and strategies of enzyme purification – source – methods of homogenization and separation based on size, polarity and binding sites – purification (Adenylate kinase from pig muscle). Enzymes as analytical agent, therapeutic agents and diagnostic reagents, Enzymes in industry like textile & leather industries and food industries. medical application of enzymes

TEXT BOOKS**TEXT BOOKS**

1. Cornish-Bowden A. (2012) Fundamentals of Enzyme Kinetics, Wiley-VCH GmbH, Germany.
2. Price n.C. and Steven, V. (2002) Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins, 3rd Edition, Oxford University Press.
3. Khan, M Y nad khan, F (2015) Principles of Enzyme Technology, PHI learning

REFERENCE BOOKS

1. Buchholz, K., Kasche, V. and Bornscheur, L.T. (2012) Bioatalyst and Enzyme Technology, Wiley-VCH VerlagGmnH, Gerany.
2. Paler, T. (1995) Understanding of Enzymes, 4th Edition, prentice Hall.
3. Nelson, D.L. and Cox, M.M (2013). Lehninger Principles of Biochemistry. 7th Ed. W.H. Freema and Company, New York.
4. Voet, D and Voet, G, Fundamentals of Biochemistry, John Wiley and Sons, New York.

WEB SOURCES

www.ebi.ac.uk/enzymeportal

<http://expasy.org/enzyme/>.

<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>.

www1.lsbu.ac.uk/water/enztech/inhibition.html

<https://www.khanacademy.org/...enzymes/enzyme.../basics-of-enzyme-kinetics-graphs>

PEDOGOGY: CHALK and Talk , PPT

YEAR I – SEMESTER I
ANALYTICAL BIOCHEMISTRY

Paper	: Core IV	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P1BC04	External	: 75

SUBJECT DESCRIPTION:

Analytical Biochemistry deal with the principles, instrumentation, working and application of the instruments commonly used in the laboratories.

OBJECTIVES:

To make the students learn about buffers, centrifugation techniques, chromatography, electrophoresis and spectroscopy studies.

COURSE OUTCOMES:

Course No	Course Outcome	Knowledge Level
CO1	Obtain knowledge about pH, buffers , difference between invivo and invitro studies and types of centrifugation techniques	K2
CO2	Apply the knowledge about the separation and analysis of macromolecules and their fragments, based on their size and charge.	K3
CO3	Implement chromatography techniques for the separation of the individual compound from the mixture of compound.	K3
CO4	Explore the various spectroscopic techniques for studying the structures of atoms and molecules	K4
CO5	Appraise the attributes of naturally decaying atoms and their multiple applications across many aspects of modern day life	K5

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	L	L	L	M	S	M	L	L	M	L	L
CO2	M	M	M	S	M	M	L	M	M	S	L	L	S	L	L
CO3	M	M	M	S	M	M	L	M	M	S	L	L	S	L	L
CO4	M	L	S	M	M	L	L	S	M	M	L	M	M	L	L
CO5	L	L	M	M	S	S	S	M	L	L	S	S	L	M	M

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): pH, Buffers and centrifugation: Definition and determination of pH, Henderson-Hasselbalch equation, Measurement of pH, pH electrode, Biological buffers, types of buffer system, In vivo and in vitro studies, organ and tissue slice techniques, tissue homogenization, Methods of cell disruption. Basic principles of sedimentation, types of centrifuges and rotors, Preparative ultracentrifugation, differential centrifugation, density-gradient and analytical ultracentrifugation and its applications in determination of molecular weight.

Unit II – (15 hrs) Electrophoresis and blotting techniques : Electrophoresis techniques – Principle, technique and applications of paper, Native PAGE gels, SDS-PAGE, Isoelectric focusing, Pulse field electrophoresis, Capillary electrophoresis, Immunoelectrophoresis. Separation of cell organelles 2D gel electrophoresis. Hybridization probes - Southern, western and Northern blotting techniques.

Unit III – (15 Hrs.): Chromatography: Definitions, General principles, Instrumentation and application of Chromatography – Paper, Column, Thin layer chromatography, Ion- Exchange, Molecular sieve (gel filtration), Affinity, High-performance liquid chromatography (HPLC), Gas-liquid chromatography (GLC), FPLC, HPTLC, FTIR.

Unit IV – (15 Hrs.): Spectroscopic Technique: Basic principles, wave number, wave laws of absorption, absorption spectrum, instrumentation and applications of UV, visible and IR spectrophotometers, Electron spin resonance, Nuclear Magnetic Resonance, Mass Spectrometry, Molecular analysis using light scattering and Atomic absorption spectroscopy, Flame Photometry – principle, instrumentation and applications, Electron microscope – principle, instrumentation and application of SEM and TEM. Colorimetry, fluorimetry.

Unit V – (15 Hrs.): Radioisotopes and Microscopy: X-ray diffraction - Principle, theory of operation and application, Circular dichroism (CD) – principles, theory of operation and applications, Radioisotopic techniques- Principle and applications of GM Counter, Liquid and Solid Scintillation Counter and autoradiography, applications of radioactive isotopes in biological research, radiation hazards. Microscopy: basic principles, light, brightfield, phasecontrast, fluorescent, electron microscopy-TEM, SEM, preparation of specimen, microtomy fixation and staining, flow cytometry and FACS.

TEXT BOOKS

1. Wilson. K and Walker. J. (2010), Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, New York, USA.
2. Upadhyay, A., Upadhyay, K., and Nath, N., (2014), Biophysical chemistry – principle & techniques, Himalaya publishing House, Mumbai.
3. Gurdeep, R. Chatwal and Aanand. S.K. (2009). Instrumental Methods of Chemical Analysis, Himalaya publishing House, New Delhi.

REFERENCE BOOKS

1. Foster, L.E. (2007), Nanotechnology Science, Innovation and opportunity (First edition), Pearson Education, Inc, New York.
2. Pattabhi, V and Gautham, (2015), Biophysics, Narosa Publishing House PVT Ltd, New Delhi.
3. Rathi, R. (2007), Core Concept of Nanotechnology with application spectrum (First Edition), SBS Publishers and Distribution Pvt Ltd, New Delhi.
4. Sharma. P.K. (2008), Origin and Development of Nanotechnology (first edition), Vista International publishing House Mumbai, New Delhi.

5. Wilson, K and Goulding, KH (1987). A Biologist Guide to Principles and Tecchniques of Practrical Biochemistry, 3rd edition, Edward Arnold Publishers. Londen, UK.

WEB OF RESOURCE:

1. www.centrifugebybeckman.com
2. www.axis-shield-density-gradient-media.com/training-1new.
3. <http://hyperphysics.phy-astr.gsu.edu/hbase/nuclear/radact.html>
4. www.austincc.edu/.../
5. <https://www.dnalc.org/resources/animations/gelectrophoresis.html>

PEDOGOGY: CHALK and Talk , PPT

**YEAR I – SEMESTER I
CORE PRACTICAL - I**

Paper	: CoreBiochemistry Practical I	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: 18P1BCP01	External	: 60

COURSE OUTCOMES:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the concepts of separation of amini acids and carbohydrates	K1 & K2
CO2	Demonstrate the level of glucose, Ascorbic acid, Lecithine	K1 & K2
CO3	Learn the isolation of compounds like starch, Glycogen etc	K1, K2 & K3

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

1. Isolation and estimation of glycogen from liver.
2. Isolation and estimation of Starch from Potato.
3. Isolation and estimation of DNA from liver
4. Estimation of RNA
5. Isolation of lecithin from egg yolk.
6. Estimation of ascorbic acid from fruit
7. Estimation of lactose from milk
8. Separation of Amino acids, Sugars by Paper Chromatography (Ascending, Descending and Circular).
9. Estimation of Calcium from milk by titrimetry.
10. TLC FLORIMETRY

REFERENCE BOOKS:

1. Harold Varley, (1980). **Practical Clinical Biochemistry, Volume I and II.** 5th Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). **Laboratory Mannual in Biochemistry.** 2nd Edition .New Age International (P) Limited. New Delhi
3. Sadasivam S and Manickam P. (2005) **Biochemical Methods.** 2nd Edition. New Age International (P) Limited. New Delhi.

**YEAR I – SEMESTER I
CORE PRACTICAL - II**

Paper	: Core Biochemistry Practical II	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: 18P2BCP02	External	: 60

COURSE OUTCOMES:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the concepts of buffer, separation techniques of biomolecules.	K1 & K2
CO2	Demonstrate marker enzyme by kit method	K1 & K2
CO3	Optimize the enzyme activity in terms of pH, substrate, temperature, and enzyme concentration.	K1, K2 & K3

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

Enzyme Studies:

I. Kinetic (Effect of pH, Temperature and Substrate concentration-MM Plot, V max) studies of

1. Peroxidase
2. Amylase
3. Urease
4. Alanine Phosphatase
5. Acid Phosphatase (Effect of pH and Temp)
6. Catalase

II. Immobilised Enzyme Reactions

7. Immobilisation of peroxidase/Acid phosphatase by matrix entrapment, ionic and cross linking

III. Separation of Isoenzymes

Separation of LDH by SDS-PAGE

REFERENCE BOOKS:

1. Harold Varley, (1980). **Practical Clinical Biochemistry, Volume I and II.** 5th Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry.** 2nd Edition .New Age International (P) Limited. New Delhi
3. Sadasivam S and Manickam P. (2005) **Biochemical Methods.** 2nd Edition. New Age International (P) Limited. New Delhi.

YEAR I – SEMESTER II
INTERMEDIARY METABOLISM AND REGULATION

Paper	: Core V	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P2BC05	External	: 75

SUBJECT DESCRIPTION:

Intermediary metabolism and regulation deals with the metabolic reactions of biomolecules, energy production through different mechanism and various regulatory mechanisms that control metabolic reactions under normal condition.

OBJECTIVE:

The objective of the paper is to make the students to study about bioenergetics of important metabolic pathways and metabolic changes of molecules in the body. Also to know about the Interrelationship between carbohydrate, fat and protein metabolism. To analyse the fate of nucleic acids and porphyrins in the biological system.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Explore knowledge on biological oxidation, redox potential, ETC and mitochondrial shuttle mechanism.	K1 & K2
CO2	Demonstrate the important carbohydrate metabolic pathways and understand alternate pathways for glucose oxidation, anaerobic	K1 & K2
CO3	Highlight about types of fatty acid oxidation, biosynthesis of TGs, Phospholipids and prostaglandins and various regulatory mechanism involved. Understand the concepts of metabolism of	K1, K2 & K3
CO4	Describe the types and significance of anabolic and catabolic reactions of amino acids, interrelationship between carbohydrate, lipid & protein metabolism and understand the specialized products from amino acids.	K3 & K4
CO5	Demonstrate the fate of nucleic acids and porphyrins in the biological system.	K3 & K4

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
CO4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
CO5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Bioenergetics and Biological Oxidation: Introduction, Free energy, laws of thermodynamics, Enzymes involved in redox reactions, Electron transport chain - organization and role in electron capture, Mechanism of Electron transport chain and oxidative phosphorylation, Chemiosmotic theory, Inhibitors of respiratory chain and oxidative phosphorylation, Uncouplers and Ionophores, Regulation of oxidative Phosphorylation, Mitochondrial transport systems - ATP/ADP exchange, malate / glycerophosphate shuttle.

Unit II – (15 Hrs.): Carbohydrate Metabolism: An overview of carbohydrate metabolism - glycolysis and gluconeogenesis, energetic - Regulation of glycolysis and gluconeogenesis, Metabolism of glycogen and its regulation, HMP shunt, TCA cycle steps and its regulation, glyoxalate pathway, Cori cycle, Anaplerotic reactions, Metabolism of fructose, galactose and mannose, Lactose and glycoprotein synthesis.

Unit III – (15 Hrs.): Lipid Metabolism: An overview of fatty acid metabolism - fatty acid synthesis and Regulation control of cetyl CoA carboxylase, Oxidation of saturated and unsaturated fatty acids, Oxidation of fatty acids with even and odd numbered carbon atoms, Alpha, beta and omega oxidation, biosynthesis and regulation of triacylglycerols, cholesterol, phosphatidyl choline, sphingomyelin, Biosynthesis and regulation of prostaglandins, Eicosanoids, thromboxanes and leucotriens, Ketogenesis and its control.

Unit IV – (15 Hrs.): Amino acid Metabolism: An overview of gamma glutamyl cycle, An overview- Methionine methyl donor (SAM pathway), Urea cycle and its regulation, Degradation of amino acids- transamination, decarboxylation, oxidative and non-oxidative deamination, Catabolism of amino acids- carbon skeleton of amino acids to amphibolic intermediates, Inter relationship between carbohydrates, proteins and fat metabolism, Conversion of amino acids to specialized products: Serotonin, GABA, dopamine, epinephrine, nor-epinephrine, melanin, creatinine and creatine.

Unit V – (15 Hrs.): Porphyrin Metabolism: Regulation, biosynthesis and degradation of Hb, chlorophyll and cytochrome, Nucleic acid metabolism - Biosynthesis and degradation of purine and pyrimidines (De novo and Salvage pathway), Regulation of Pyrimidine biosynthesis - aspartate carbamoyl transferase, Biosynthesis and degradation of porphyrin, formation, transport and excretion of bile pigment.

TEXT BOOKS

1. Nelson, David, L. and Cox, (2008). **Lehninger principles of Biochemistry**. 5th Edition, W.H. Freeman and Co., New York.
2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). **Fundamentals of Biochemistry**, 3rd Edition. John Wiley & Sons, New Jersey.
3. Lubert Stryer, (1995). **Biochemistry**. 4th Edition .WH freeman and co, Sanfrancisco.
4. Thomas, M. Devlin, (1997). **Text book of Biochemistry**. 4th Edition A John Wiley, Inc Publication, New York.

REFERENCE BOOKS

1. Devlin, T.M. (2002) **Textbook of Biochemistry with Clinical Correlations**. John Wiley sons, INC. New York.
2. Robert Murray, Bender, (2012) **Harper's Illustrated Biochemistry**. McGraw Hill.

WEB SOURCES

- www.britannica.com/science/glyoxylate-cycle
<https://www.uic.edu/classes/phar/.../transaminationofaminoacid.htm>
www.slideshare.net/YESANNA/transamination-deamination

MOLECULAR BIOLOGY

Paper : Core VI
 Hours/Week : 5
 Credit : 4
 Paper Code : **18P2BC06**

Total Hours : 75
 Exam Hours : 03
 Internal : 25
 External : 75

SUBJECT DESCRIPTION:

Molecular Biology deal with the central dogma of life and its regulation.

OBJECTIVE:

To make the students understood the synthesis of genetic material, RNA and proteins, gene repair mechanism and gene mutation. To make the students learn about the techniques used in identifying gene mutation.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Illustrate the molecular mechanism of DNA replication in prokaryotes and eukaryotes and DNA repair mechanisms	K2
CO2	Explain the stages of transcription and post transcriptional processing	K3
CO3	Analyze the decoding process of mRNA for protein designing principle	K4
CO4	Formulate the protein targeting, transport, translocation and regulation of gene expression	K6
CO5	Categorize the different types of DNA recombination and mutation	K5

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): DNA Replication and DNA damage & repair mechanisms: Types of replication, evidence for semi conservative replication, Meselson and Stahl experiment, replications in circular chromosomes - Cairns model, rolling circle model, Enzymology of Replication, Replication in prokaryotes and eukaryotes- inhibitors of replication. DNA damage - different types, DNA repair - direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, mismatch repair, recombination error and SOS repair.

Unit II – (15 Hrs.): Transcription: Prokaryotic RNA polymerase, Initiation of transcription, chain elongation, chain termination, Eukaryotic RNA polymerases, Conserved sequences of eukaryotic promoters, Transcriptional factors and basal eukaryotic transcription complex, Enhancers, Transcriptional termination in eukaryotes, Post transcriptional processing of Pre-mRNA – addition of Cap to the 5' end, Polyadenylation of the 3' end, RNA splicing and processing of Pre-mRNA, Inhibitors of transcription, Reverse transcription.

Unit III – (15 Hrs.): Translation: Genetic code - salient features of genetic code, structure of tRNA, activation of enzymes, binding of amino acids to tRNA, wobble mechanism and its significance, composition of prokaryotic and eukaryotic ribosomes, prokaryotic and eukaryotic protein biosynthesis - initiation, elongation, translocation and termination, Inhibitors of protein synthesis, Post translational modification of proteins.

Unit IV – (15 Hrs.): Protein Transport and Regulation of Gene Expression: Protein targeting, translocation, heat shock proteins, glycosylation, SNAPs and SNAREs, bacterial signal sequences, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin TAG protein destruction, gene expression and regulations, molecular mechanism of regulation, prokaryotes - operon model, lac, trp, arabinose operons, repression and attenuation, eukaryotes - C value paradox, repetitive DNA, gene dosage and gene amplifications.

Unit V – (15 Hrs.): DNA Recombination and Mutation: Homologous recombination, Site specific recombination and DNA transposition. Types of mutation- Base substitution, insertion, deletion, inversion, duplication, translocation, mutagens.

TEXT BOOKS

1. Ajoy Paul, Text book of Cell and Molecular Biology 4th Edition, Books and Allied (P) Ltd, Kolkata, 2015.
2. Rastogi.S.C. Cell and Molecular Biology, India Binding House, U.P., 2nd edi. 2010.

REFERENCE BOOKS

1. David L. Nelson and Michael Cox, Lehninger Principles of Biochemistry, WH Freeman Publisher, 7th ed., 2017
2. Freifelder. D., Essentials of Molecular Biology, Jones and Bartlett Publications Inc., London 3rd Edition, 1998.
3. De Robertis E.D.P and E.M.F. De Robertis, Cell And Molecular Biology, Walters Kluwer Publisher, 8th ed., 2010.
4. Gerald Karp, Janet Iwasa and Wallace Marshall, Karp's Cell and Molecular Biology, Wiley Publisher, 9th ed., 2019.
5. Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick, Lewin's GENES XII, Jones and Bartlett Publishers, 12th Revised edition, 2017.

WEB SOURCES

1. <https://microbenotes.com/prokaryotic-dna-replication-enzymes-steps-and-significance/>
2. <https://microbenotes.com/rna-splicing/>
3. <https://www.sparknotes.com/biology/molecular/translation/section3/>
4. <https://www.khanacademy.org/science/biology/gene-regulation/gene-regulation-in-bacteria/a/the-trp-operon>
5. <https://www.nature.com/articles/nrm2008>

PEDOGOGY: CHALK and Talk , PPT

ENDOCRINOLOGY

Paper	: Elective I	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18P2BCE01	External	: 75

SUBJECT DESCRIPTION:

Endocrinology deal with the endocrine system of human body, mechanism of action on endocrine system and hormonal actions

OBJECTIVE:

To make the students understand clearly on various alimentary parts of human body. Learnt more the endocrinal activities, learn about the mechanisms and actions of vital organs.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Explain the hormones, neuroendocrine, hormone secretion, mechanism of hormone action I and II and also communication between the chemical messenger and endocrine system	K2
CO2	Illustrate the pituitary gland, hormones, pathology and their feedback mechanism	K3
CO3	Apply the knowledge of hormonal disease like thyroids hormones and their medication	K4
CO4	Describes the critical knowledge of synthesis, chemistry and action of	K5
CO5	Evaluate the male and female reproductive system, synthesis of hormones, pathology and also treated with infertility	K6

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Hormones-Introduction, hormones and homeostasis, neuroendocrine integration in homeostasis, Classes of chemical messengers, hormone secretion, transport and clearance, Feed back control of secretion, Mechanism of hormone action-Type I and II, Second messengers -postoglandine, Cytosolic hormone receptors, Eicosonoids and hormone action.

Unit II – (15 Hrs.): Pituitary Hormones-Anatomy of pituitary gland, hormones of the pituitary, pathophysiology, Endocrine hypothalamus- structure, hypophysiotropic hormones, control of hypothalamic hormone secretion, feedback mechanisms, mechanism of action, Neurohypophysis - Synthesis, chemistry and control of neurohypophyseal hormone secretion, mechanism of action and pathophysiology of oxytocin, vasopressin, Somatotropins and somatomedins, Growth factors-

neurotropic growth factors, hematopoietic growth factors.

Unit III – (15 Hrs.): Thyroid and Parathyroid Gland- Synthesis and chemistry of hormones, control of thyroid hormone secretion, circulation and metabolism, physiological function, mechanism of action, Physiological function of vitamin D, Pathophysiology, Mechanism of action of calcium homeostasis and pathophysiology. Melanotropic hormones- chemistry, functions of MSH, mechanism of action and pathophysiology, Pineal gland - melatonin, melatonin secretion and circulation, functions of pineal gland and mechanism of action.

Unit IV – (15 Hrs.): Pancreas- Endocrine pancreas, insulin, glucagons and somatostatin, Pancreatic peptide – chemistry, physiological function and mechanism of action, Pathophysiology, Catecholamines - synthesis, chemistry and metabolism, Neurohormones- endorphins-source, chemistry, control of secretion, physiological function, mechanism of action and pathophysiology.

Unit V – (15 Hrs.): Reproductive Endocrinology- Male and female reproductive system- source, chemistry, synthesis, metabolism of hormones, physiological function, mechanism of action and pathophysiology. Sex differentiation and development, endocrinology of pregnancy, parturition and lactation, puberty and hormone control, human infertility-reasons, therapy and treatment.

TEXT BOOKS

1. Murray, K.R., Granner, K.D., Mayes, P.A. and Rodwell, W.V. (2009) **Harper's**

Biochemistry, 28th Ed, Appleton & Lange Stamford, Connecticut.

2. Guyton, A.C. and Hall, J.E (2006), **Textbook of Medical Physiology**, 11th Edition, Saunders Co. Pennsylvania.

REFERENCE BOOKS

1. Foye, O.W., Lemke, J.L. and William D.A. (1995), **Medicinal Chemistry**, B.I. Waverly Pvt. Ltd., New Delhi.

2. West, E.S., Todd, W.R., Mason, H.S. and Van Brugge, T.J. (1966), **Biochemistry**. 4th Edition, The Macmillan Company, London.

WEB OF RESOURCE:

https://en.wikipedia.org/wiki/Endocrine_system

www.medicinenet.com > ... > thyroid az list > medterms medical dictionary az list

www.btf-thyroid.org > Info

www.healthline.com/human-body-maps/pituitary-gland

PEDOGOGY: CHALK and Talk , PPT

YEAR I – SEMESTER II
IMMUNOLOGY AND IMMUNOTECHNOLOGY

Paper	: Core VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P2BC07	External	: 75

SUBJECT DESCRIPTION:

Immunology and Immunotechnology deal with the immunity, cells and organs of immune system, mechanism of how immune cells act, to understand infectious diseases and interaction with the host's immune system.

OBJECTIVE:

To understand about immunity and its types, cells and organs, MHC and its significances and disorders and techniques in immune biology.

Course No	Course Outcome	Knowledge Level
CO1	To obtain the knowledge of the immune system is a host defense system comprising many biological structures and processes within an organism that protects against disease.	K1 & K2
CO2	To concentrate on the antigen and antibody reactions and immunological techniques.	K1 & K2
CO3	Understanding about the two branches of immune system such as humoral immunity and cellular immunity, cytokines and complement system.	K1, K2 & K3
CO4	Clear about the hypersensitivity reaction or intolerance with undesirable reactions produced by the normal immune system, including allergies and	K3 & K4
CO5	To obtain the knowledge about the hybridoma technology is to produce large numbers of identical antibodies (also called monoclonal antibodies) and a recombinant DNA technology that involves inserting the DNA encoding an antigen that stimulates an immune response.	K3 & K4

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	M	M	M	S	S	M	S	M	M	M	S	S	S
CO2	S	S	M	M	M	S	S	S	S	S	S	M	M	S	S
CO3	S	M	M	M	S	S	S	S	S	M	S	M	S	S	L
CO4	S	S	S	M	S	S	S	S	M	M	M	M	S	M	L
CO5	S	S	M	S	M	S	S	S	M	M	M	M	S	S	M

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Overview of Immunology and Cells and Organs of Immune system: Historical perspective, Basic concepts of immunology-types of immunity-Innate and Adaptive Immunity, components of immune system, Cells of the Immune System, Hematopoiesis, Organs of Immune system –Primary and Secondary lymphoid organs.Phagocytosis

Unit II – (15 Hrs.): Antigen and Antibodies: Antigens, Haptens, Epitopes Cross-Reactivity, Properties of the immunogen, Adjuvants, Antibodies- Structure, theories of antibody formation, side chain and clonal selection theory, Antibody classification and Biological activities, MHC Antigen processing and presentation, Monoclonal Antibodies- Production and Application, cytokines, complement system

Unit III – (15 Hrs.): Antigen –Antibody interactions: Principles and Applications - Strength of Antigen-Antibody interactions, Cross-Reactivity, Precipitation reactions, Agglutination reactions, Radiimmunoassay, ELISA, Western Blotting, Immunofluorescence, Humoral immune response- B Cell maturation, activation, differentiation and proliferation, Cell mediated immune response - T-cell maturation, activation and differentiation, HypersensitivityTypes and clinical manifestations, Immunotolerance, autoimmune disorders - type I DM.

Unit IV – (15 Hrs.):Pathophysiology of Immune System: Immunology disorders- B cell deficiencies, T cell deficiencies, secondary immunodeficiency diseases – AIDS, HIV lifecycle, pathogenesis, immunological abnormalities, diagnosis and treatment, Transplantation immunology- allograft, typing – HLA typing and GVH reaction, organ transplantation and immune suppressive therapy

Unit V – (15 Hrs.): Immune System in Disease: Vaccines, Quantification of Antibody and Tumor Immunology, Isolation and characterization of immune cells, Macrophage culture and assay of macrophage activation, Tumor immunology - immune surveillance, tumor antigens, immune response to tumors, immunotherapy of tumors.Sars, mars, covid Benefits and adverse effects of vaccination, Recombinant Vaccines

TEXT BOOKS

- 1.Tizard(1984).**An Introduction Immunology:** Tizard K, Saunders college Publishing
- 2.Immunology Roitt. Brostoff and David(1998). **Immunology**, 4th Edition, Mosby Times Mirror Int Pub Ltd.
3. KubyRichard, (2000). **Immunology**, 4th Edition, W.H. Freeman and Company, NewYork.
- 4.Janeway Jr.Paul., (2001). **The Immune System in Health and Disease.** Travels and Co.,

REFERENCE BOOKS

1. KubyRichard, (2000). **Immunology**, 4th Edition, W.H. Freeman and Company, NewYork.
2. Stites D.P. Stobo, J.D.Fundanberg. H.A and Wells. J.V. (1990) **Basic and Clinical Immunology.** 6th Edition Los AtlasLange.

WEB OF REFERENCE:

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www.ebi.ac.uk/interpro/potm/2005_2/Page1.htm
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PEDOGOGY: CHALK and Talk , PPT

PLANT BIOCHEMISTRY AND PLANT BIOTECHNOLOGY

Paper	: Elective – II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18P2BCE02	External	: 75

SUBJECT DESCRIPTION:

Plant biochemistry and Plant biotechnology deal with the plant and animal tissue culture methods, and mechanism of gene transfer, Methods of selection, Production of novel proteins and their applications.

Course No	Course Outcome	Knowledge Level
CO1	To obtain the knowledge of the state the importance of photosynthesis, factors affecting photosynthesis, the photosynthetic pigment, and describe the biochemistry of photosynthesis.	K1 & K2
CO2	To make the students understand the components of culture media and various tissue culture techniques. Learnt about the technique of genetic	K1 & K2
CO3	Define respiration and itemize detailed processes of cell respiration and gaseous exchange in flowering plants;	K1,K2 & k3
CO4	Clear about the list and describe the features of phloem translocation	K3 & K4
CO5	To obtain the knowledge about plant and animal tissue culture methods, mechanism of gene transfer Methods of selection, Production of novel proteins and their applications.	K3 & K4

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Photosynthesis: Photosynthetic apparatus, organisation of thylakoid, role of chlorophylls, carotenoids and other photosynthetic pigments, light absorption and energy conservation, Light – properties of both particle and wave, light absorption by pigment molecules, Photosystems I and II, Electron transport pathways in chloroplast membranes, ATP synthesis in chloroplasts, cyclic and noncyclic photophosphorylation

Unit II – (15 Hrs.): Carbon Reactions & Transpiration: C3, C4 and CAM plants - Calvin cycle; Hatch-Slack pathway, Photorespiration in plants, biochemical basis of PR pathway – C2 cycle, Pathways of glucose oxidation in plants, starch biosynthesis and degradation, metabolic

transport between organelles, Overview of lipid and protein metabolism in plants, Transpiration-Types, theories of transpiration, mechanism and factors affecting transpiration.

Unit III – (15 Hrs.): Nitrogen Fixation: Symbiotic and non-symbiotic - Symbiotic nitrogen fixation in legumes by Rhizobia, biochemistry and molecular biology of nitrogen fixation, enzymology of nitrogen fixation, regulation of *nif* and *nod* genes of nitrogen fixation, Interaction between nitrate assimilation and carbon metabolism, Sulphur chemistry and functions, reductive sulfate assimilation pathway, Synthesis and functions of glutathione and its derivatives, Interrelationship between photosynthesis and nitrogen metabolism.

Unit IV – (15 Hrs.): Structure of Plant Genes: Structure, transport, distribution, mechanism of action and physiological effects of Auxin, gibberellins, cytokinins, abscisic acid, ethylene, Phytochrome, Biological clock, Fruit ripening, senescence

Unit V – (15 Hrs.): Plant Cell Culture: Tissue culture media – composition and preparation, Micropropagation, somoclonal variation, Callus, Protoplast culture - isolation and purification of protoplasts, Protoplast fusion, genetic modification of protoplasts, Anther, pollen and ovary culture for production of haploid plants and homozygous lines, Uses of haploids in plant breeding. Secondary metabolites

TEXT BOOKS

1. Heldt, HW. (2005), **Plant Biochemistry**. 3rd Edition, Elsevier Academic Press Publication, USA.
2. Lea, P.J. and Leegood, R.C. (1999). **Plant Biochemistry and Molecular Biology**. 2nd Edition, Wiley and Sons, New York.
3. Harborne, J.B. (1989). **Methods in Plant Biochemistry in Plant Phenolics**. Academic Press, London, UK.
4. Goodwin Ane Mercer, (2003). **Introduction to Plant Biochemistry**. 2nd Edition, CBS Publishers, New Delhi.

REFERENCE BOOKS

1. Hans, Walter-Heldt, (1997). **Plant Biochemistry and Molecular Biology**. 3rd Edition Academic Press, California.
2. Narayanaswamy, S. (1999). **Plant Cell and Tissue Culture**. 2nd Edition, Tata McGraw Hill Publishing Company Ltd, New York.

WEB REFERENCES:

1. www.biology4kids.com/files/plants_photosynthesis.html
2. www.slideshare.net/BiologyIB/photosynthesis-powerpoint-3983595
3. http://www.slideshare.net/shivam_hayabusa/production-of-secondary-metabolites
4. www.slideshare.net/JonathanOLEary/photosynthesis-power-point
5. <https://en.wikipedia.org/wiki/Photophosphorylation>

PEDOGOGY: CHALK and Talk , PPT

**YEAR I – SEMESTER II
CORE PRACTICAL – III**

Paper	: Core Practical III	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: 18P3BCP03	External	: 60

COURSE OUTCOMES:

Course No	Course Outcome	Knowledge Level
CO1	Get an insight into estimation of chlorophyll, alkaloid, flavonoid from leaves and its results interpretation	K1 & K2
CO2	Get an insight into isolation of solanine, caffeine and its results identification	K1 & K2
CO3	Get an insight into plant tissue culture and its methods, Get an insight into extraction of pectin from orange peel and its results identifications	K1, K2 & K3

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

I. PHYTOCHEMICAL ANALYSIS

1. Qualitative analysis of secondary phytochemicals in medicinal plants
2. Estimation of chlorophyll in leaves
3. Determination of aldehydes in lemon oil
4. Extraction and confirmation
 - a. Pectin from orange peel
 - b. Caffeine from tea
 - c. Solanine from potato

II. PLANT TISSUE CULTURE

1. Sterilization and media preparation
2. Callus Induction and micro propagation
3. Isolation of protoplasts
4. Protoplast Culture
5. Anther culture
6. Somatic Embryogenesis

III QUANTITATIVE ANALYSIS

1. Estimation of total alkaloids
2. Estimation of total phenols
3. Estimation of total flavonoids
4. Estimation of Phytosterols

REFERENCES

1. David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3rd Edition. All India Publishers and Distributors. Chennai.
3. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2nd Edition. New Age International (P) Limited. New Delhi
4. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2nd Edition. New Age International (P) Limited. New Delhi.

**YEAR I – SEMESTER II
CORE PRACTICAL – IV**

Paper	: Core Practical IV	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: 18P3BCP04	External	: 60

COURSE OUTCOMES:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the concepts agarose gel electrophoresis	K1 & K2
CO2	Demonstrate the level of DNA, RNA by oricinol and Diphenylamine method	K1 & K2
CO3	Learn the isolation of genomic DNA, RNA	K1,K2 & k3

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

1. Estimation of **isolation and estimation of DNA**
2. Estimation of **isolation and estimation of RNA**
3. Agarose Gel Electrophoresis
4. Isolation of plasmid DNA
5. Isolation of Genomic DNA
6. Isolation of RNA from yeast
7. Restriction digestion of DNA
8. Preparation of competent cell and Transformation
9. PCR, RT PCR– Demonstration
10. Southern Blotting –Demonstration

REFERENCES

1. David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3rd Edition. All India Publishers and Distributors. Chennai.
3. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2nd Edition. New Age International (P) Limited. New Delhi
4. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2nd Edition. New Age

International (P) Limited. New Delhi.

YEAR II – SEMESTER III
ADVANCED CLINICAL BIOCHEMISTRY

Paper	: Core VIII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P3BC08	External	: 75

SUBJECT DESCRIPTION:

Advanced Clinical Biochemistry deal with the diagnostic importance of various metabolic disorders and to know the clinical aspects of various metabolic disorders.

Course No	Course Outcome	Knowledge Level
CO1	Recognize the basic principles and practices of clinical laboratory-Automation, Laboratory safety	K1 & K2
CO2	Execute disorders of carbohydrate metabolism and lipid metabolism	K3
CO3	Distinguish about disorders of amino acids and nucleic acid metabolism	K4
CO4	Interpret the Renal function test, Liver function test, Gastric function test, Cerebrospinal fluid	K3 & K4
CO5	Categorize Porphyrinuria, porphyrinuria and Disorders of erythrocyte metabolism	K4 & K6

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	S	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	S	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	S	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Basic principles and practices of clinical laboratory: Collection of specimens – Blood, Urine, CSF, Amniotic fluids. Laboratory safety – first aid in laboratory accident, Toxic chemicals and biohazards, Automation in clinical laboratory – Precision, Quality assurance, clinical validation. Automation and computerization water and electrolytes homeostasis.

Unit II – (15 Hrs.): Disorders of carbohydrate and lipid metabolism (Hyperglycemia and Hypoglycemia): Diabetes Mellitus, Diabetes insipidus, Renal Threshold Value, Insulin receptors Glycogen storage disease, Mucopolysaccharidosis, Lipids and lipoprotein abnormalities - Lipidosis, hypercholesterolemia, Plasma lipoproteins – albuminuria Taysach's and Niemann picks diseases, Atherosclerosis.

Unit III – (15 Hrs.): Disorders of amino acids metabolism: Inborn errors of Branched chain amino acids-

Maple Syrup Disease, Aromatic amino acids-Alkaptunuria, Tyrosinaemia, Aliphatic amino acids, Disorders of Purine and Pyrimidine metabolism-Gout, Lesch Nyhan syndrome.

Unit IV – (15 Hrs.): Clinical Tests: Renal function test - Osmolarity and free water clearance, acute and chronic renal failure, nephritic syndrome, dialysis, Liver function test - Clinical significance of AST, ALT, ALP and Gamma glutamyl transpeptidase, Jaundice, Pancreatic function test, Gastric function test- Peptic Ulcer, Cerebrospinal fluid – Blood-brain barrier, composition of CSF and chemical changes in CSF.

Unit V – (15 Hrs.): Haematological Tests: Disorders of mineral metabolism- phosphorus, Potassium, Iron, Copper, Calcium, Sodium - Porphyria, porphyrinuria. Disorders of erythrocyte metabolism- hemoglobinopathies, thalassemia and anemia, Classification of anemia.

TEXT BOOKS

1. N.W. Teitz, (1994). *Textbook of Clinical Chemistry and Molecular Diagnostics*, Fifth Edition W.B. Saunders company
2. Harold Varley (1988). *Practical Clinical Biochemistry*, volume I and II 4th Edition, CBS Publishers New Delhi
3. Foye, O.W., Lemke, J.L. and William D.A. (1995). *Medicinal Chemistry*, B.I. Waverly Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. Philip. D. Mayne (1994). *Clinical Biochemistry in Diagnosis and Treatment* 6th Edition ELBS Publication
2. A.C. Guyton & J.E. Hall, (2006). *Text Book of Medical Physiology* 11th Edition Harcourt Asia.
3. Medical laboratory technology by Kanai L mukherjee and Swarajit gosh. 2ND EDITION 2014 PUBLISHED BY mc.Graw hill education (India) Pvt ltd, New Delhi.

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1. www.medicinenet.com > ... > diabetes az list > diabetes mellitus index
2. www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309..
3. www.niams.nih.gov >
4. www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf
5. www.arup.utah.edu/education/automation.php

PEDOGOGY: CHALK and Talk , PPT

YEAR II – SEMESTER III
GENETIC ENGINEERING AND FERMENTATION TECHNOLOGY

Paper	: Core X	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P3BC10	External	: 75

SUBJECT DESCRIPTION:

Genetic Engineering and Fermentation technology deal with the basis of gene cloning, vectors, genetic engineering techniques and large scale production of biochemical by fermentation technology.

OBJECTIVE:

The objective of the course is to learn about the basics of genetic engineering, vectors, methods of gene cloning. Techniques and application of gene technology, Fermentation technology and its application in fermented food preparation.

COURSE OUTCOMES:

Course No	Course Outcome	Knowledge Level
CO1	Define the basics of gene cloning, enzymes involved in genetic engineering techniques and genomic DNA libraries.	K2
CO2	Outline the techniques involved in sequencing, molecular markers and gene transfer techniques	K2
CO3	Applications of genetic engineering and genome editing techniques	K3
CO4	Perceive fermentation screening, media preparation and knowledge about fermentors	K4
CO5	Production of products like antibiotics, enzymes and fermented foods	K4

Mapping with Programme Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	S	S	M	L	S	M	L	L	L	L
CO2	S	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	S	M	S	M	L	L	S	S	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	S	S	L	M	S	S
CO5	S	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:**Unit I****15 Hours**

Introduction to Genetic Engineering: Molecular tools of GE – Restriction endonucleases its types, and applications, DNA ligases, Alkaline phosphatase, reverse transcriptase and Topoisomerase. Vectors – plasmids, bacteriophage lambda, M13, cosmids, phagemids, bacterial and yeast artificial chromosome, plant

viral vector – CaMV, animal viral vector – retroviral vector, shuttle vector, expression vector, Strategies and steps involved in Gene Cloning, cDNA and Genomic DNA library.

Unit II

15 Hours

Techniques in Genetic engineering: DNA sequencing – DNA/RNA labelling, Maxam and Gilbert method, Dideoxynucleotide method, next generation sequencing, Chromosome walking, Automated DNA sequencing, DNA fingerprinting, Molecular markers - RFLP, RAPD, AFLP, STR and SNP. *In-situ* hybridization, Site-directed mutagenesis, PCR. Methods of gene transfer – transformation, conjugation, electroporation, liposome-mediated gene transfer, transduction, direct transfer of DNA.

Unit III

15 Hours

Applications of Genetic engineering: Production of recombinant therapeutic proteins – recombinant insulin, growth hormone, interferons, vaccine – hepatitis B surface antigen, GE of *B.thuringiensis* toxin genes and GE for improved biocontrol agent - baculovirus. Concept of gene therapy – types, applications – gene therapy for SCID, ADA, CF, Anti-sense therapy, Genome editing- CRISPR-Cas, gene targeting.

Unit IV

15 Hours

Zymology: Pasteur and fermentation, Strain - screening, development, preservation, storage. Inoculum preparation, production medium, sterilization -equipment, media and air. Fermentor - factors, configuration – batch, semi continuous, continuous stirred – tank, tubular, fluidised bed, computer application in fermentation technology. Downstream processing – stages.

Unit V

15 Hours

Application of fermentation technology: Production of antibiotics - penicillin, streptomycin, tetracyclin, organic acids – citric acid, lactic acid and vinegar, enzymes - extracellular amylase, proteases, pectinase, solvents – ethanol, glycerol, aminoacids - glutamic acid and lysine, vitamins - vitamin B12 and vitamin C , SCP , fermented food - Sauerkraut, yoghurt.

TEXT BOOKS

1. Brown T.A., (2012), Gene cloning and DNA Analysis: An Introduction, 7th edition, Wiley-Blackwell.
2. Watson, W.H.Freeman(1992). **Recombinant DNA** 2nd Edition.Freeman and Co., NY
3. A.H.Patel (2008). Industrial Microbiology 11th Edition. Macmillan India Ltd, New Delhi

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1. Peter J.Russell., (2013) Genetics, 5th Edition, person Benjamin Cummings, New york
2. S.B. primrose and R.m.Twyman (2006) **Principles of Gene Manipulation and Genomics (2006)** 7th Edition. Blackwell pub., NY.
3. SmitaRastogi and neelamPathak (2014) Genetic Engineering 6th Edition Oxford University Press, New Delhi.

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1. <https://www.biologydiscussion.com/dna/recombinant-dna-technology/cloning-vectors-used-in-recombinant-dna-technology-3-cloning-vectors/12102>
2. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/chromosome-walking>
3. <https://www.yourgenome.org/facts/what-is-crispr-cas9>
4. <https://www.biologydiscussion.com/industrial-microbiology-2/fermentor-bioreactor-history-design-and-its-construction/55756>
5. <https://www.sciencedirect.com/topics/food-science/sauerkraut>

PEDOGOGY: CHALK and Talk , PPT

**YEAR II – SEMESTER III
RESEARCH METHODOLOGY**

Paper : Core IX
Hours/Week : 5
Credit : 4
Paper Code : **18P3BC09**

Total Hours : 75
Exam Hours : 03
Internal : 25
External : 75

SUBJECT DESCRIPTION:

Research Methodology deal with the knowledge on the basic concepts of research and its methodologies and identify appropriate research topics.

OBJECTIVE:

To understand basic concepts of research and its methodologies and identify appropriate research topics. Select and define appropriate research problem and parameters and prepare a project proposals.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Understood about basic concepts of research and its methodologies and identify appropriate research topics	K2
CO2	Provide the importance and need for research.	K2
CO3	Understood about basic concepts of research designs, ethics in scientific research.	K3
CO4	Understood about basic concepts of data collection and analysis of scientific data using software along with ethical issues in human gene therapy and human cloning.	K4
CO5	Select and define appropriate research problem and parameters	K5

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	S	S	M	S	S	S	M	S	S	S	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S	M
CO3	S	S	M	M	M	S	M	S	M	M	S	S	M	S	S
CO4	S	S	M	M	M	S	M	S	M	M	S	M	S	S	M
CO5	S	S	M	S	S	S	S	S	S	S	M	S	S	S	M

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Scientific Research & Writing: Importance and need for research, Ethics and scientific research, Formulation of hypothesis, Types and characteristic designing a research work, Scientific writing – Characteristics, Logical format for writing thesis and papers, Essential features of abstract, introduction, review of literature, materials and methods, and discussion, Effective illustration - tables and figures, Reference styles - Harvard and Vancouver systems.

Unit II – (15 Hrs.): Measures of central tendency: Arithmetic mean, median, mode, quartiles, deciles and percentiles, Measures of variation - range, quartile and Quartile deviation, mean deviation, standard deviation, Correlation analysis - Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's rank method, Regression analysis- Regression line, Regression equation.

Unit III – (15 Hrs.): Probability- Definition, concepts, Addition and Multiplication theorems (proof of the theorems not necessary) and calculations of probability, Theoretical, distributions, Binomial, Poisson, Fit a Poisson distribution, Normal distribution - importance, properties, conditions and constants of the distribution (proof not necessary), Simple problems.

Unit IV – (15 Hrs.): Sampling distribution and test of significance: Testing of hypothesis, errors in hypothesis testing, standard error and sampling distribution, sampling of variables (large samples and small samples), Student's 't' distribution and its applications, Chi - square test & goodness of fit.

Unit V – (15 Hrs.): Bioethics And Patenting: Declaration of Bologna, Ethics in animal experimentation, CPCSEA guidelines - Animal care and technical personnel environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia, Composition of (Human) institutional Ethical Committee (IEC) - General ethical issues, Specific principles for chemical evaluation of drugs, herbal remedies and human genetic research, Ethics in food and drug safety, Environmental release of microorganisms and genetically engineered organisms, Ethical issues in human gene therapy and human cloning. IPR

TEXT BOOKS

1. R.A. Day **How to Write a Scientific Paper**. Cambridge University Press.
2. Alley, Michael (1987). **The Craft of Scientific Writing**. Englewood Cliffs. N.N. Prentice
3. M.C. Sharma (1997). Desk Top Publishing on PC, BPB Publications,

REFERENCE BOOKS

1. Contemporary issues in Bioethics, Beauchamp & Leroy, 1999. Wardsworth Pub. Co. Belmont, California.
2. Ethical Guidelines for Biomedical Research on Human Subjects (2000). ICMR, New Delhi.
3. Biostatistics – A foundation for analysis in health Science Danien.

WEB RESOURCES

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2. www.wipo.int/wipo_magazine/en/2006/04/article_0003.html
3. www.ijme.in/182ar82.html
4. <https://en.wikipedia.org/wiki/Database>
5. www.tutorialspoint.com/database_tutorials.htm

PEDOGOGY: CHALK and Talk , PPT

**YEAR II – SEMESTER III
CORE PRACTICAL V**

Paper	:Core Practical - V	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: 18P3BCP05	External	: 60

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the collection and storage of blood	K1 & K2
CO2	Estimate the amount of Glucose, Serum protein, urea, uric acid, Creatinine, Bilirubin	K1 & K2
CO3	Learn the qualitative analysis of normal and pathological constituents in urine.	K1, K2 & k3

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

A. COLLECTION AND ANALYSIS OF BLOOD

1. Collection of venous blood
2. Estimation of blood glucose by O-Toluidine Method.
3. Estimation of serum proteins by Lowry and Biuret Method.
4. Estimation of A/Gratio in serum.
5. Estimation of blood urea by DAM method.
6. Estimation of serum uric acid by Phosphotungstate Method.
7. Estimation of serum creatinine by Alkaline Picrate Method.
8. Estimation of serum cholesterol by Zlatkis, Zak and Boyle method.
9. Estimation of serum bilirubin by Evelyn Malloy method.

B. URINE ANALYSIS

1. Qualitative analysis of normal and pathological constituents in urine.
2. Estimation of urea in urine by DAM method.
3. Estimation of creatinine in urine by Alkaline Picrate Method
4. Estimation uric acid in Urine by Phosphotungstate Method.
5. Estimation of Calcium in urine by Clark Method
6. Estimation of Chloride in urine by Schales & Schales Method

REFERENCES

1. David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3rd Edition. All India Publishers and Distributors. Chennai.
3. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2nd Edition. New Age International (P) Limited. New Delhi
4. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2nd Edition. New Age International (P) Limited. New Delhi.

**YEAR II – SEMESTER III
CORE PRACTICAL VI**

Paper	:Core Practical - III	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: 18P3BCP06	External	: 60

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the methods of bleeding-Tail vein puncture, Intravenous, Retro orbital, cardiac vein puncture	K1 & K2
CO2	Demonstrate Rh typing and Identification of blood group	K1 & K2
CO3	Learn the Immunodiffusion –Single radial and double diffusion and Immuno electrophoresis – Counter Current immunoelectrophoresis	K1,K2 & k3

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

1. Preparation of serum and plasma from peripheral Blood
2. Identification of blood cells
3. Isolation of peripheral blood mononuclear cells.
4. Identification of blood group & Rh typing
5. Preparation of Blood antigens
6. Testing for typhoid antigens by Widal slide test
7. Pregnancy Test (Slide Test)
8. Immunodiffusion –Single radial and double diffusion
9. Immunoelectrophoresis – Counter Current immunoelectrophoresis
10. Western blot analysis– Demo
11. CRP

12. Preparation of antigen and Routes of immunization (Intra-peritoneal, Sub-cutaneous, Intra-muscular, Intra- nasal, Oral) demo
13. Methods of bleeding (Tail vein puncture, Intravenous, Retro orbital, cardiac vein puncture) demo

REFERENCES

1. David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3rd Edition. All India Publishers and Distributors. Chennai.
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4. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2nd Edition. New Age International (P) Limited. New Delhi.

YEAR II – SEMESTER IV
IV SEMESTER M.Sc., BIOCHEMISTRY
NEUROSCIENCE

Paper	: Core XI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	:18P4BC11	External	: 75

SUBJECT DESCRIPTION:

Neuroscience deal with the understanding of the functions of various sensory organs in human system, biochemical aspects behind diseases associated with the nervous system and effect of drug therapy.

OBJECTIVE:

To enable the students to gain knowledge about the structure and functions of the nervous system and have basic understanding of the nervous system and effect of drug therapy

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Discuss the structure of nervous system, neurons and neurotransmitters receptors like cholinergic, exhibitory and inhibitory nerve impulse	K2
CO2	Understand a broad fundamentals neurohormones, neurotransmitters and neuronal behavior such as cognitive, movement and sleeping	K3
CO3	Analyses critical knowledge skills by a analyzing and evaluation of neuronal sensory and visual sensation	K4
CO4	Explain the knowledge of treated drugs action for neurological disease	K5
CO5	Hypothesis and evaluate the neurological diseases such as Dementia, Schizophrenia, Parkinson disease and Alzheimer's disease etc. and their clinical interpretation	K6

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Introduction Nervous system- Classification, General functions of autonomic and somatic nervous system, Neuron – Structure and function, types of neurons, excitation and action potential, Neuroglia - structure and fuctions, olfactory signal transduction, Synapse- structure and functions.

Unit II – (15 Hrs.): Brain and Spinal cord-Structure and functions, Brain metabolism and metabolic

adaptation, Neurohormones and neuromodulators, Neurotransmitters-structure and types, Receptors for neurotransmitters - cholinergic, adrenergic, nicotinic and muscarinic, excitatory and inhibitory transmission, conduction of nerve impulse, acetylcholine mechanism.

Unit III – (15 Hrs.): Sensory systems and behavior -Somatic sensation -Perception of pain, Analgesia system in the brain and spinal cord, Special senses- Vision, photoreceptors, Visual cycle - Rod cell adaptation, Color vision - role of cone cell, Color blindness, Mechanism of hearing, Biochemical aspects of taste and olfactory, Neuronal behavior -sleep, learning and memory

Unit IV – (15 Hrs.): Neurodegenerative Diseases and action of Drugs -Dementia, Schizophrenia, Huntington's disease, amyotrophic lateral sclerosis, Parkinsonism disease and Alzheimer's disease, Neuromuscular diseases - Muscular dystrophy, tetanus and botulism. Magnetic resonance imaging, electroencephalogram, Positron emission tomography, CNS depressants (sedative, hypnotics), CNS stimulants, analgesics, antipsychotics and mood stabilizing drugs, Drug therapeutic actions of Huntington's disease, Parkinsonism and Alzheimer's disease.

Unit V- (15 Hrs.): Pharmaceutical Biochemistry- Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics. Absorption, Distribution, Metabolism and Excretion of drugs, Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.

TEXT BOOKS:

- 1.Arthur C.Guyton and John E. Hall. 2007. **Text Book of Medical Physiology**. [Eleventh Edition]. Elsevier Publications, New Delhi. .
2. Gerald. J. Tortora and Sandra Reynolds. 2003. **Principles of Anatomy and Physiology**. [Tenth Edition]. John Wiley and Sons. Inc. Pub. **New York..**
3. Tripathi, K. D. 1999. **Essentials of Medical Pharmacology**. [Fourth Edition]. Jaypee Brothers Medical Publishers. New Delhi
- 4.Gerard J Tortora and Bryan derrickson **Principles of anatomy and physiology**, 14 th Edition.

REFERENCE BOOKS:

- 1.George I. Siegel, 2000. **Basic Neurochemistry**. [Seventh Edition]. Academic Press, New Delhi.
2. Kathleen J. W. Wilson and Anne Waugh. 1998. **Anatomy and Physiology in Health and Illness**. [Eighth Edition]. Churchill Livingstone, New York.

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<https://www.pjms.com.pk/issues/aprjun107/article/article4.html>
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PEDOGOGY: CHALK and Talk , PPT

YEAR II – SEMESTER IV
BIOINFORMATICS & NANOTECHNOLOGY

Paper	: Core XII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P4BC12	External	: 75

SUBJECT DESCRIPTION:

Bioinformatics and Nanotechnology deal with the understanding of Biological databases, Tools for database search, Protein structure analyses and prediction and drug design.

OBJECTIVE:

Analysis of gene and protein sequences to reveal protein evolution and alternative splicing, the development of computational approaches to study and predict protein structure to further understanding of function, the analysis of mass spectrometry data to understand the connection between phosphorylation and cancer, the development of computational methods to utilize expression data to reverse engineer gene networks in order to more completely model cellular biology, and the study of population genetics and its connection to human disease.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Students learn about Biological databases	K1 & K2
CO2	Tools for database search system.	K1 & K2
CO3	Protein structure analyses and prediction and drug design and nanoparticles	K1, K2 & K3
CO4	An ability to design and conduct experiments, as well as to analyze and interpret data	K3 & K4
CO5	Characterization methods for nanomaterials, understanding and critiquing nanomaterial safety and handling methods required during characterization	K4 & K5

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	M	S	L	S	M	S	S	M	S	L	M	M	S
CO2	S	S	S	S	S	S	S	S	M	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	M	S	S	M	M	M	S
CO4	S	S	M	M	S	M	M	S	M	M	M	M	M	M	S
CO5	S	S	S	S	M	S	M	S	S	L	M	M	S	M	S

S- Strong; M-Medium; L-Low

CONTENT:**Unit I – (15 Hrs.): Introduction of Bioinformatics Database searches**

Introduction of Bioinformatics –DNA sequences and their types (cDNA, ESTs, STS Sequence-Tagged Site (STS) and GSS Genome Survey Sequences) RNA sequencing method and their application. Protein sequencing of Sanger's method

Unit II (15 Hrs.): Biological Sequence and Databases

Sequence Databases : Nucleotide Sequence Databases –GenBank, EMBL,– Protein Sequence Databases – SWISS-PROT, UniProt PIR — Genome Databases – GOLD, TIGR - Structure databases – PDB, MMDB, – Protein Structure Visualization Tools: RasMol, Swiss PDB Viewer

UNIT III(15 Hours) :Modeling, Designing and Genome Analysis

Homology modeling, three-dimensional structure prediction, energy based prediction of protein structures, modeling software (Modeller). Design of ligands, drug-receptor interactions, automated structure construction methods, AUTODOCK. Human genome analysis, Whole genome analysis – shotgun sequencing. Genome identification Feature based approach – ORF's; Primer Designing; Vector designing; APE

UNIT IV (15 Hours) : Nanotechnology

Introduction of Nanotechnology, synthesis of nanoparticles- Top to bottom (Laser ablation and Ball milling method), Bottom to up (Sol-gel and Laser pyrolysis). Nanostructures (1 Dimension, 2 Dimension and 3 Dimension), Nanoscale Characterization- Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic force microscopy and X-Ray Diffraction delete

UNIT V (15 Hours):Applications of Nanotechnology

Application in Medicine, Agriculture, Environment (air and water pollution), Nanodevice, Cosmetics, Bioengineering, Nanofabrics, Nanofuels, Nanocomputers

TEXT BOOKS

1.Functional and computational Aspects **Genomic and proteomics** – sandarsunai

Bioinformatics-concepts,Skill and Application-S,C Rastogi ,Namitamendritta,Paragrastogi (2000).

2. **Protein Biochemistry and Proteomics**(2006).Hubert Rehn, Academic press

3. Harshawaedhan .P.Bal **Bioinformatics** Principles and Application

4. JanuszM.Bujnicki (2008) **Practical Bioinformatics** Springer Berlin.

REFERENCE BOOK

1. Nanotechnology –**Fundamentals and Application** –MansiKarKare

2. Liebler,Humana(2002) **Introduction to proteomics:Tools for new biology**Liebler,Humana W.CBS pub.,

WEB REFERENCE

<https://en.wikipedia.org/wiki/Nanomaterials>

<https://gmwgroup.harvard.edu/pubs/pdf/936.pdf>

www.crnano.org/whatis.html

www.metabolomicdiscoveries.com/

PEDOGOGY: CHALK and Talk , PPT

**YEAR II – SEMESTER IV
HUMAN PHYSIOLOGY**

Paper : Core XIII
Hours/Week : 5
Credit : 4
Paper Code : **18P4BC13**

Total Hours : 75
Exam Hours : 03
Internal : 25
External : 75

SUBJECT DESCRIPTION:

Human Physiology deal with the understanding of biological, physiological activities along with the mechanism of action of various organs and its anatomy.

OBJECTIVE:

The objective of the subject is to make the students learn about various parts of alimentary parts of human body. Learnt more specific on the nervous activities.

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Distinguish the anatomy, biological, physiological activities along with the mechanism of action of eyes and muscles.	K1 & K2
CO2	Demonstrate about digestive system and its regulation alimentary parts of human and body fluids	K3
CO3	Discriminate respiratory system and excretory system.	K5
CO4	Assess the Sympathetic parasympathetic nervous system and synaptic transmission	K4
CO5	Interpret about male and female reproductive system and its physiological function, hormonal regulation	K5

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Physiology of vision: Structure of eye, image formation and defects of the eye, Receptor mechanism of the eye, photopigments, Visual cycle and colour adaptation Muscle; Types of muscle. Structure of skeletal muscle. proteins - myosin, actin, troponin, tropomyosin and other proteins. Action potential, Reflex action, Mechanism and regulation of contraction and relaxation of skeletal muscle

Unit II – (15 Hrs.): Digestive and cardiovascular system: Digestive secretions - composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestions and absorption of carbohydrates, lipids, proteins and nucleic acids. Circulatory system – structure and functions of heart, ECG, Cardiac Cycle

Unit III – (15 Hrs.): Respiratory system: Diffusion of gases in lungs, transport of oxygen from lungs to tissues through blood, factors influencing the transport of oxygen, Transport of CO₂ from tissues to lungs through blood, factors influencing the transport of CO₂, Excretory System - Structure and functions of kidney, Nephron, Mechanism of urine formation, Renal Transplantation, Dialysis.

UNIT IV-(15 Hrs.): Nervous system: Structure of neuron, resting potential and action potential, Propagation of nerve – impulses, Structure of synapse, synaptic transmission (electrical and chemical theory), Structure of Neuro muscular junction and mechanism of neuro muscular transmission, neurotransmitters.

Unit V – (15 Hrs.): Reproductive biology: Structure of testis, Spermatogenesis, functions of testis, Female Reproductive system - Ovarian cycle, Structure and hormones of ovaries, menstrual cycle, menopause, pregnancy and lactation, Steroids as contraceptives.

TEXTBOOKS

1. Textbook of Medical Physiology (2011) 10th ed., Guyton, A.C. and Hall, J.E., Reed Elsevier India Pvt. Ltd. (New Delhi). ISBN: 978-1-4160-4574-8.

2. Chatterjee A.C (2004) **Human Physiology**,. Volume I & II. 11th Edition Medical agency allied, Calcutta

3. Vander's Human Physiology (2008) 11th ed., Widmaier, E.P., Raff, H. and Strang, K.T., McGraw Hill International Publications (New York), ISBN: 978-0-07-128366-3.

4. M.M.Muthiah **Text book of biochemistry, Lecture notes on human physiology** Vol II 1991.

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1. William. F. Ganong, (2003) **Review of Medical Physiology**, 14th Edition, A Lange Medical book.

2. Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W., (2012) **Harper's Biochemistry** 29th ed., Lange Medical Books/McGraw Hill. ISBN:978-0-07-176-576-3.4

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