

B. Sc. Biochemistry

Syllabus

AFFILIATED COLLEGES

Program Code: 22H

2021 – 2022 onwards

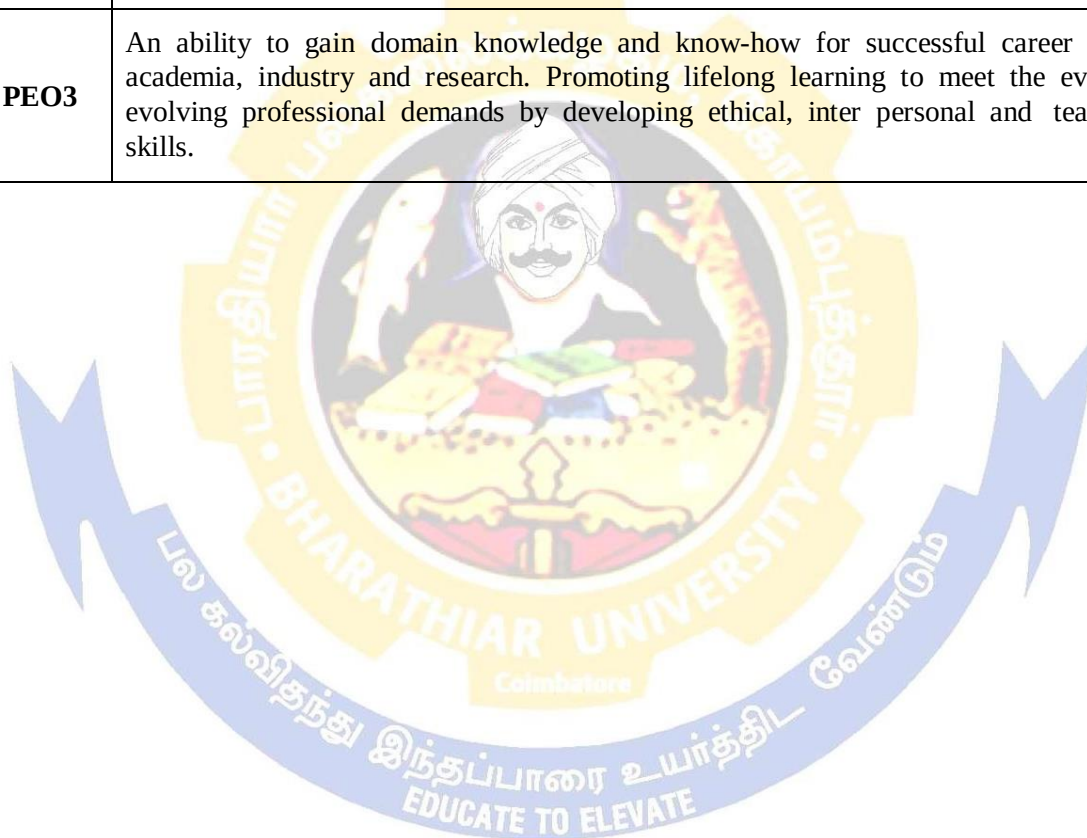


BHARATHIAR UNIVERSITY

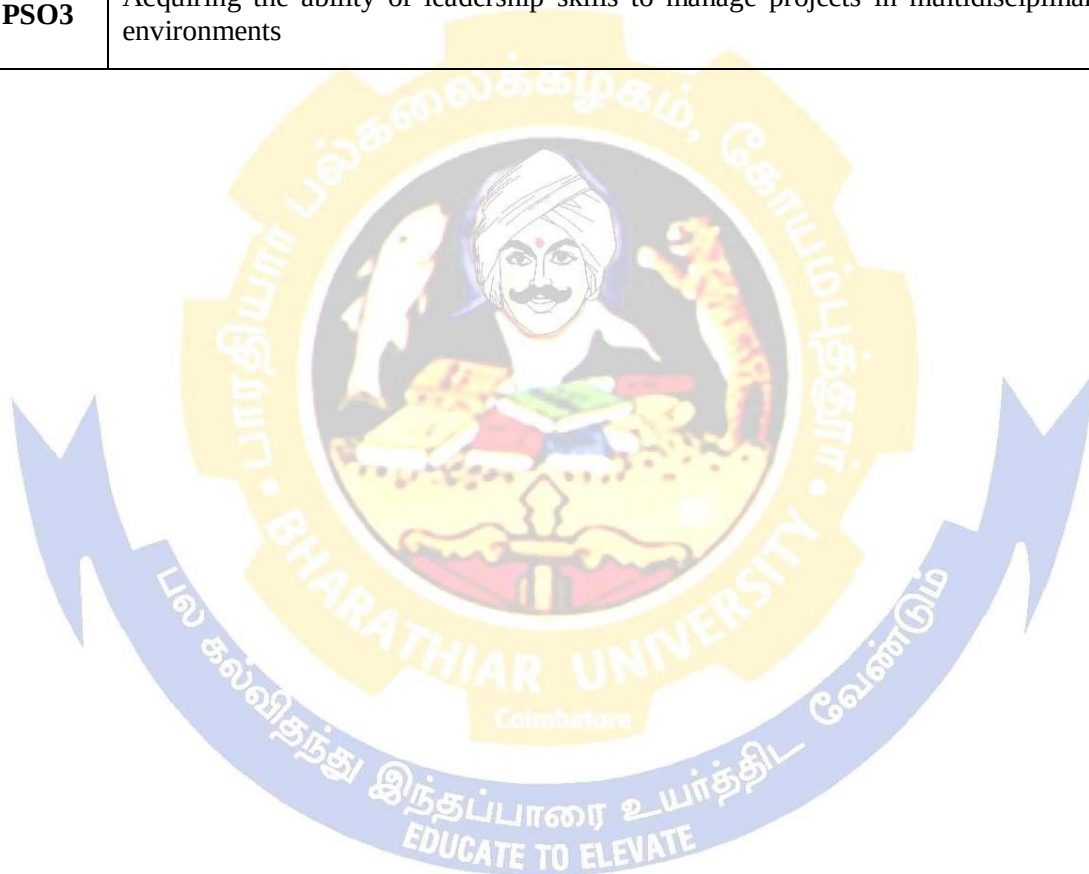
(A State University, Accredited with “A” Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking: **Times** -801-1000, **Shanghai** -901-1000, **URAP** - 982)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The B.Sc Biochemistry program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	An ability to apply fundamental knowledge related to sciences in an interdisciplinary manner for providing innovative solutions to need based problems for global impact
PEO2	An ability to critically analyze scientific data, draw objective conclusions and apply this knowledge for human welfare. Students should be able to demonstrate expertise and ethical perspective on areas related to Biochemistry
PEO3	An ability to gain domain knowledge and know-how for successful career in academia, industry and research. Promoting lifelong learning to meet the ever evolving professional demands by developing ethical, inter personal and team skills.



Program Specific Outcomes (PSOs)	
After the successful completion of Bsc.Biochemistry program, the students are expected to	
PSO1	Ability to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by humankind.
PSO2	Ability to contribute effectively in the development of the ethical practices, societal contributions, and leading to responsible and competent professionals
PSO3	Acquiring the ability of leadership skills to manage projects in multidisciplinary environments



Program Outcomes (POs)	
On successful completion of the B.Sc program, the graduates will be able to acquire :	
PO1	Broad knowledge in biochemistry
PO2	Meaningful applications for better healthcare and economic development
PO3	Constant updation of application oriented skills
PO4	Technical skills in diagnosing Covid-19 related issues
PO5	Sole responsibility in contributing the public to lead better life through extension activities
PO6	Critical thinking and problem-solving skills
PO7	Provision for an inspiring, exciting and collaborative scientific environment
PO8	Values of professionalism and dedication
PO9	intelligent strategies and biochemical approaches in problem solving methods
PO10	Global competence with confidence in all the sectors of life science

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B. Sc. Biochemistry (CBCS PATTERN)

(For the students admitted from the academic year 2021-2022 and onwards)

Scheme of Examination

Part	Title of the Course	Course / Subject Code	Hour s/ Wee k	Examination				Credits
				Durat ion in Hour s	Maximum Marks			
					CIA	CEE	Total	
Semester I								
I	Language – I	11T/M/H/ F	6	3	50	50	100	4
II	English – I	12E	6	3	50	50	100	4
III	Core Paper I – Biomolecules	13A	3	3	50	50	100	4
III	Core Paper II - Cell Biology	13B	3	3	50	50	100	4
III	Core Biochemistry Practical – I	23P	2	-	-	-	-	-
III	Allied A : Paper I – Chemistry	1AH	6	3	30	45	75	3
III	Allied Chemistry Practical	2PH	2	-	-	-	-	-
IV	Environmental Studies *	1FA	2	3	-	50	50	2
	Total		30	18	230	295	525	21
Semester II								
I	Language – II	21T/M/H/ F	6	3	50	50	100	4
II	English – II	22E	6	3	50	50	100	4
III	Core Paper III - Biomedical Instrumentations	23A	5	3	50	50	100	4
III	Core Biochemistry Practical – I	23P	3	3	50	50	100	4
III	Allied A : Paper II – chemistry	2AH	6	3	30	45	75	3
	Allied Practical – Chemistry	2PH	2	3	25	25	50	2
IV	Value Education – Human Rights *	2FB	2	3	-	50	50	2
	Total		30	21	255	320	575	23
Semester III								
I	Language – III	31T/M/H/ F	6	3	50	50	100	4
II	English – III	32E	6	3	50	50	100	4
III	Core Paper IV - Enzyme and Enzyme Technology	33A	3	3	50	50	100	4
III	Core Paper V – Microbiology	33B	3	3	50	50	100	4
III	Core Biochemistry Practical – II	43P	2	-	-	-	-	-
III	Allied B: Paper I – Basic Mathematics	3AA	6	3	30	45	75	3

IV	Skill based Subject I – Bioinformatics and Medical coding	3ZA	2	3	30	45	75	3
IV	Tamil** / Advanced Tamil* (OR) Non-major elective - I (Yoga for Human Excellence)* / Women's Rights*	3FD	2	3	50	50	50	2
	Total		30	21			600	24
	Semester IV							
I	Language – IV	41T/M/H /F	6	3	50	50	100	4
II	English – IV	42E	6	3	50	50	100	4
III	Core Paper VI – Intermediary Metabolism	43A	4	3	50	50	100	4
III	Core Biochemistry Practical – II	43P	3	6	30	45	75	3
III	Allied B : Paper II – Computer	4AR	3	3	25	25	50[#]	2
III	Practical – Computer	43Q	2	3	25	25	50	2
IV	Skill based Subject 2 - Basics of Information Technology	4ZB	2	3	25	25	50[#]	2
	NAAN MUTHALVAN-Digital Skills for Employability – Office Fundamentals http://kb.naanmudhalvan.in/Special:FilePath/Microsoft_Course_Details.xls	-	2	-	25	25	50^{##}	2
IV	Tamil**/Advanced Tamil* (OR) Non-major elective -II (General Awareness*)	4FA	2	3	50	50	50	2
	Swatch Bharat- Summer internship @		-	-	-	-	-	-
	Total		30	27	280	345	625	25
	Semester V							
III	Core Paper VII – Human Physiology	53A	4	3	50	50	100	4
III	Core Paper VIII – Clinical Biochemistry	53B	4	3	50	50	100	4
III	Core Paper IX – Molecular Biology	53C	4	3	50	50	100	4
III	Core Paper X – Genetic Engineering and Bioprocess Technology	53D	4	3	50	50	100	4
III	Biochemistry Practical – III	63P	4	-	-	-	-	-
III	Biochemistry Practical – IV	63Q	4	-	-	-	-	-
III	Elective – I	-	3	3	30	45	75	3
IV	Skill based Subject 3 – Basics of Patent and Bioethics	5ZC	3	3	30	45	75	3
	Total		30	18	260	290	550	22

Semester VI									
III	Core Paper XI – Plant Biochemistry and Plant Therapeutics	63A	4	3	50	50	100	4	
III	Core Paper XII – Medicinal Chemistry	63B	4	3	50	50	100	4	
III	Biochemistry Practical – III	63P	4	6	30	45	75	3	
III	Biochemistry Practical – IV	63Q	4	6	30	45	75	3	
III	Elective – II	-	4	3	30	45	75	3	
III	Elective – III	-	4	3	30	45	75	3	
IV	Skill Based Subject 4 - Practical – Bioinformatics	6ZP	6	6	30	45	75	3	
V	Extension Activities**		-	-	50	-	50	2	
IV	NAAN MUTHALVAN - Employability Readiness		-	-	-	-	-	-	
Total			30	30	300	325	625	25	
Grand Total							3500	140	

Note

* No Continuous Internal Assessment (CIA). Only University Examinations.

** No University Examinations. Only Continuous Internal Assessment (CIA)

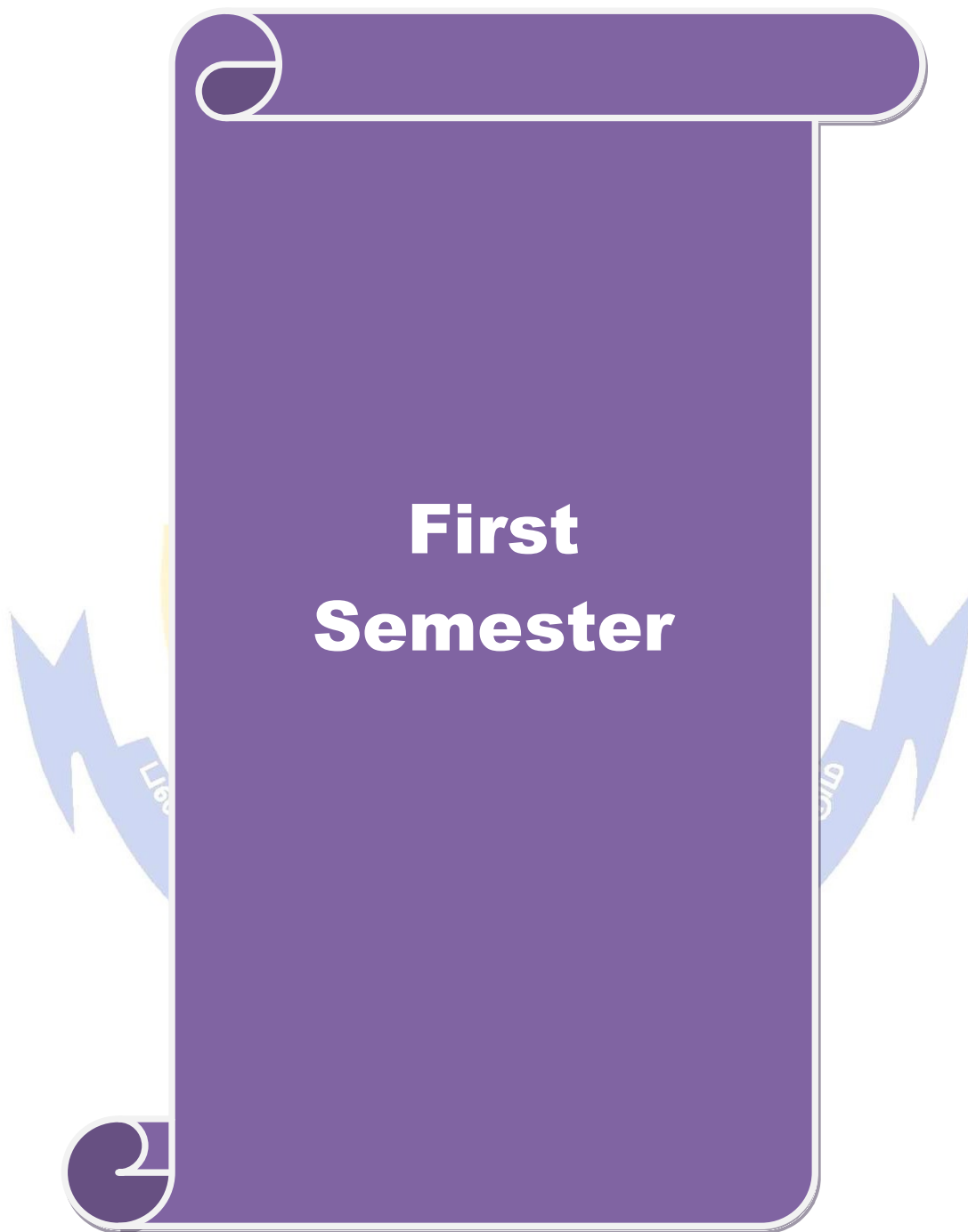
@ Swatch Bharat Summer internship- extra 2 credits would be given. It is mandatory

English II/ Allied B : Paper II – Computer and Skill based Subject 2 – Basics of Information Technology -

University semester examination will be conducted for 50/45 marks respectively. (As per existing pattern of Examination) and it will be converted for 25 marks.

NaanMudhalvan – Skill courses- external 25 marks will be assessed by Industry and internal will be offered by respective course teacher.

List of Elective papers (Colleges can choose any one of the papers as electives)			Course / Subject Code
Elective - I	A	Immunology and Immunotechniques	5EA
	B	Introduction to Biomaterials	5EB
	C	Nutritional Biochemistry	5EC
Elective - II	A	Plant and Animal Biotechnology	6EA
	B	Nanomaterials and Nanomedicine	6EB
	C	Health and Hygiene	6EC
Elective - III	A	Clinical laboratory technology	6ED
	B	Nanobiotechnology	6EE
	C	Sports Biochemistry	6EF



Course code	13A	Core Paper I – Biomolecules	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in Biomolecules		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Learn the elements present in Biomolecules						
2. For each group of biomolecule, learn the name of its generic monomer (simple unit), polymer (complex structure) and their function.						
3. Learn the importance of Vitamins and Minerals						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	A thorough knowledge about the structure, chemistry and function of carbohydrates					K1
2	In depth knowledge about the significance of the complex lipids					K2
3	An understanding about the importance of proteins and peptides					K2
4	A knowledge about the salient features of nucleic acids					K2
5	A knowledge about the importance of vitamins and minerals.					K1
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Unit:1		Carbohydrates	10 hours			
Carbohydrates: Definition, classification, Haworth projections. Monosaccharides- Structure, chemistry and functions. Action of acids and alkalies on sugars- Aldose (Glucose) and Ketose (Fructose). Disaccharides- Structure, chemistry and function – Sucrose, Lactose, Maltose and Cellobiose. Trisaccharides-Structure of Raffinose. Polysaccharides- Chemistry and functions Homopolysaccharides-starch, glycogen and cellulose. Heteropolysaccharides-hyaluronic acid, chondroitin sulfate and heparin. Blood group substances.						
Unit:2						
Unit:2		Lipids	9 hours			
Lipids; Definition, classification of lipids, simple, compound and derived. Simple lipids-Physical and chemical properties of fats. Characterisation of fat – Saponification number, acid number, Iodine number and RM number. Compound lipids-Structure and function of phospholipids, glycolipids and lipoproteins. Derived lipids - Fatty acids-saturated and unsaturated. Essential fatty acids. Steroids-Structure of cholesterol.						
Unit:3						
Unit:3		Amino acids and peptides	08 hours			
Amino acids and peptides. Definition, amino acids as Ampholytes. Structure and classification of amino acids based on chemical nature, chemical reaction of amino acids due to carbonyl and amino groups. Essential amino acids. Peptides; Structure and properties. Determination of primary structure of peptides-Glutathione, Oxytocin and Vasopressin.						

Unit:4	Nucleic acids	08 hours
Nucleic acids; Structure of Purines and Pyrimidines; Nucleotides and Nucleosides. DNA: double helix: A, B and Z forms; DNA denaturation and renaturation. RNA: types, unusual bases. DNA as genetic material		
Unit:5	Vitamins and Minerals	08 hours
Vitamins: Definition, Classification. Fat soluble vitamins- sources, structure and physiological functions; Water soluble vitamins-sources, structure and physiological functions. Minerals: Mineral requirement, essential macro minerals and essential micro minerals, sources and functions.		
	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars (self study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Deb, A.C., Fundamentals of Biochemistry, New Central Agency, Calcutta, 2016.	
2	Jain J.L, Fundamentals of biochemistry, S.Chand Publication 6th Edition, 2005	
3	Ambika Shanmugam, Fundamentals of Biochemistry for Medical Students, Seventh Edition, Lippincott Williams and Wilkins Publications	
4	Satyanarayana.U., Fundamentals of Biochemistry, Allied & Books Pvt Ltd, Calcutta, 2019	
Reference Books		
1	Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, W H Freeman Publishers, 7 th Edition, 2017	
2	Lubert stryer, Biochemistry, Freeman and company, 9th Edition, 2019	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	onlinecourses.swayam2.ac.in/cec20_bt12	
2	onlinecourses.swayam2.ac.in/cec20_bt19	
3	onlinecourses.swayam2.ac.in/cec20_ag10	
Course Designed By: Dr S.Vennila		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	M	M	M	M	M	M	S
CO2	S	L	S	M	M	M	M	M	M	S
CO3	S	L	S	M	M	M	M	M	M	S
CO4	S	L	S	M	M	M	M	M	M	S
CO5	S	L	S	M	M	M	M	M	M	S

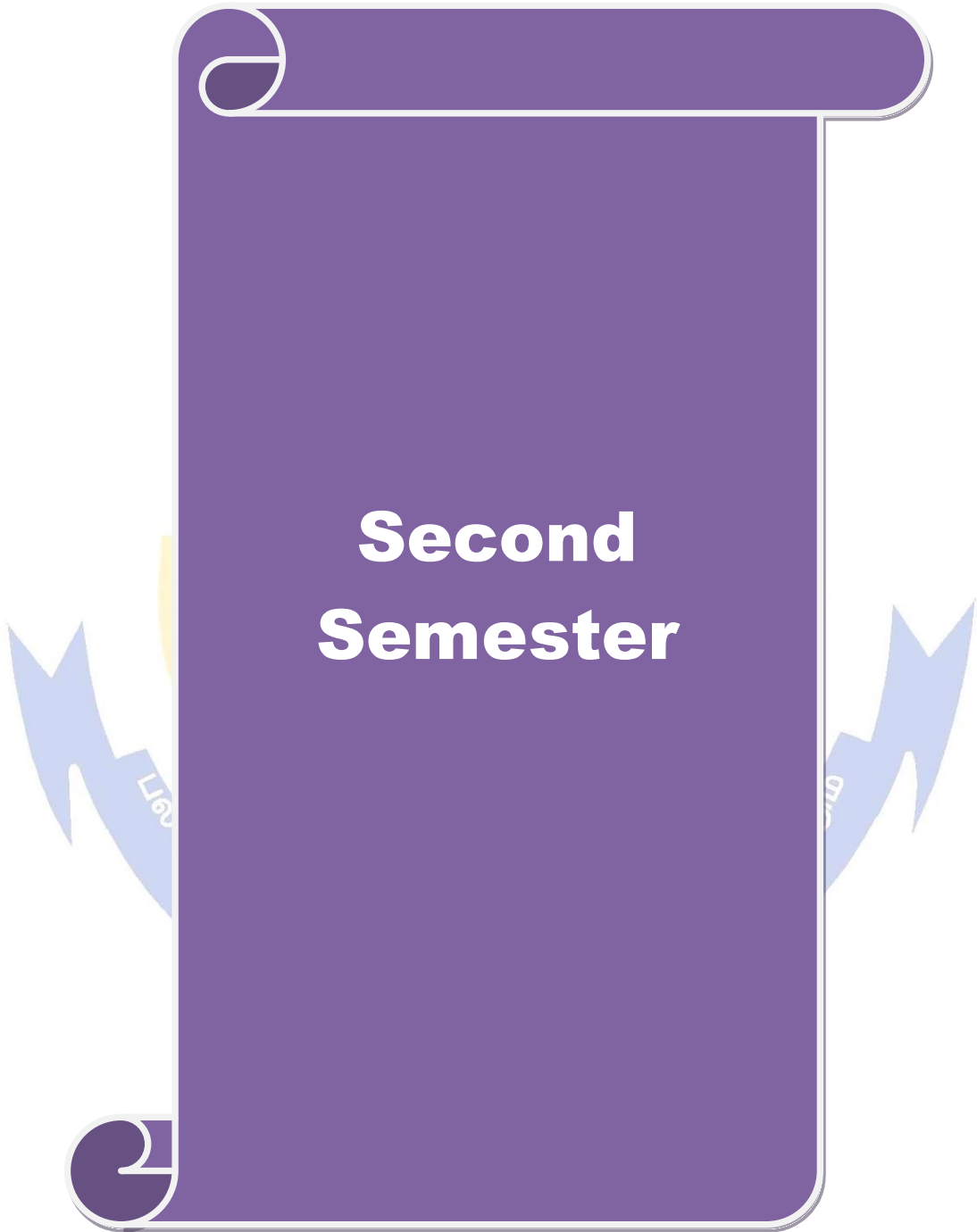
*S-Strong; M-Medium; L-Low

Course code	13B	Core Paper II - Cell Biology	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in structure of cells		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the structure and purpose of basic components of Prokaryotic and Eukaryotic cells.						
2. Enable the students to get themselves aware on how different tissue types are combined to form organs and how the organs function which follows from the structure and function of the constituent tissue.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	The overview of cells and cell cycle					K2
2	The structure and transport of molecules across biological membranes					K1,K2
3	The various cell organelles with their functions and actions					K2
4	The relationship between cellular and genetic organization and biological functions					K2,K4
5	The application of cell biology in cancer research..					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
An Overview of cells						
09 hours						
An Overview of cells – Origin and evolution of cells. Cell theory, Classification of cells – Prokaryotic cells and Eukaryotic cells. Comparison of prokaryotic and eukaryotic cells. Molecular composition of cells: - Water, Carbohydrates, lipids nucleic acids and proteins. Cell Cycle: Phases, Meiotic and Mitotic division.						
Unit:2						
Cell Membrane						
09 hours						
Cell Membrane – Fluid mosaic model of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their role. Transport across membranes – Diffusion - active and passive diffusion.						
Unit:3						
Endoplasmic reticulum						
09 hours						
Endoplasmic reticulum – Types, structure and function. Golgi apparatus – Structure and function. Lysosome – Structure and functions. Morphology and functions of peroxisomes and glyoxisomes. Ribosomes – Types structure and function.						
Unit:4						
Nucleus						
08 hours						
Nucleus: Structure and function. Chromosomes, chromatin structure. Mitochondria – Structure and functions. Cytoskeleton: Types of filaments and their functions. Microtubules – Chemistry and functions – Cilia and flagella.						
Unit:5						
Oncogenesis						
08 hours						
Oncogenesis: Development and causes of cancer, Types of cancer, Properties, early detection, Treatment. Oncogenes: Retro viral, proto, tumor suppressor gene						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Cooper M 2000. The cell molecular approach, ASM Press, 2 nd Edition	
2	Cell Biology. Organelle structure and function, David E Sadava, Jones Bartlett Publishers.	
3	Principle of cell and molecular biology 2nd edition – Lewis J Kleinsmith, Valerie M Kish.	
4	Ajoy Paul, TB of Cell & Molecular Biology 4th edn, Allied & Books pvt ltd, Calcutta, 2018	
Reference Books		
1	DeRobertis, EDP, E.M.F Robertis, 8th edition 2017. Cell and molecular biology, Saunders Company	
2	Harvey Lodish, Baltimore. Arnold Berk et al 2000. 4rd edition. Molecular cell biology.	
3	Lewin' s Genes XII, 2017, Jocelyn E Krebs, Elliott S.Goldstein, and Stephen T.Kilpatrick Jones, Bartlett Publishers, 12 th revised edition	
4	Cell Biology, 2013, Gerald Karp, wiley 7 th edition	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	onlinecourses.swayam2.ac.in/cec20_ma14	
2	onlinecourses.swayam2.ac.in/cec20_ma13	
Course Designed By: Dr S.Vennila		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	M	M	M	M	S
CO2	S	M	S	M	M	M	M	M	M	S
CO3	S	M	S	M	M	M	M	M	M	S
CO4	S	M	S	M	M	M	M	M	M	S
CO5	S	M	S	M	M	M	M	M	M	S

*S-Strong; M-Medium; L-Low



Second Semester

Course code	23A	Core Paper III - Biomedical Instrumentations	L	T	P	C
Core/Elective/Supportive		Core	3	1	-	4
Pre-requisite	Basic Knowledge in tools of Biochemistry		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Students learnt the principles, Instrumentation and applications of the instruments.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	The concepts and the preparation of expressing various strength of the solutions					K3
2	The principle and the applications of chromatographic techniques					K2
3	The principle and the applications of Electrophoretic techniques					K2
4	The principle and the applications of spectroscopic techniques					K2
5	The application of radioisotopes in biological field					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
		Buffers	15 hours			
pH meter- pH scale, Henderson- Hasselbalch equation, Buffer solutions, Buffer systems of blood-Hb, Protein and Phosphate buffer system. Various ways of expressing and conversion of concentration of solutions-molality, molarity, normality, mole fraction. Simple problems to be worked out.						
Unit:2						
		Chromatography Techniques	15 hours			
Chromatography-principle, materials, methods & applications of paper chromatography, TLC, GLC, Adsorption, Ion-exchange, Affinity chromatography and Molecular sieve. HPLC, FPLC and GC-MS [principles only].						
Unit:3						
		Electrophoretic Techniques	15 hours			
Electrophoresis-principles, instrumentation and applications of paper electrophoresis, agarose gel, starch gel, SDS-PAGE, immuno electrophoresis, isoelectric focusing; ELISA (Principles Only). Centrifuges- Principle, Types and its applications. Clinical Auto analyzer – Principle and applications.						
Unit:4						
		Biomolecular Techniques	14 hours			
Principle, Instrumentation and application of Colorimetry, Spectrophotometry, Fluorimetry and Flame photometry. ECG, EEG, CT-Scan, Doppler, MRI scan- Principle and application only.						
Unit:5						
		Tracer Techniques	14 hours			
Tracer and other Techniques-Radioactive decay, units of Radioactivity, detection and measurement of Radioactivity, GM counter, Scintillation counter, Auto radiography. Applications of Radio isotopes in biological and medical sciences. Safety Aspects and hazards of radioactivity						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	75 hours
Text Book(s)		
1	Sharma B.K. (1981) 11th Edition. Instrumental method of chemical analysis.	
2	David T. Plummer, 3rd Edition (1998), An Introduction to Practical Biochemistry	
3	Keith Wilson, Kenneth H. Goulding, 3rd Edition 1992.A Biologists guide to Principles and Techniques of practical Biochemistry. Cambridge University Press.	
4	Wilson .K and Walker 2012, Practical Biochemistry-Principles and technics of Biochemistry and Molecular Biology 7 th edition Cambridge Press India,	
Reference Books		
1	Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurement- 2nd Edition.	
2	Kudesia V.P. Sawhaney H., (1989) Instrumental method of chemical analysis.	
3	Campbell I.D Biophysical Technic, 2012, JohnWiley & Sons, USA	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	onlinecourses.nptel.ac.in/noc20_bt29	
2	onlinecourses.nptel.ac.in/noc20_cy32	
Course Designed By: Dr S.Vennila		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	L	M	M	M	S	S
CO2	S	S	S	M	L	M	M	M	S	S
CO3	S	S	S	M	L	M	M	M	S	S
CO4	S	S	S	M	L	M	M	M	S	S
CO5	S	S	S	M	L	M	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code	23P	Core Biochemistry Practical – I	L	T	P	C
Core/Elective/Supportive		Core	-	-	4	4
Pre-requisite		Basic Knowledge in Biomolecules and bioseparation techniques	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. able to analyse the given carbohydrate systematically						
2. able to analyse amino acids systematically						
3. able to characterize lipids						
4. able to analyse biomolecules by separation techniques						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Facilitate students to identify the sugars					K2
2	Facilitate students to identify the aminoacids					K2
3	Characterize lipids					K2
4	Analyze biomolecules by separation techniques					K4
K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create						
Unit:1						
Analysis of carbohydrates					26 hours	
a) Monosaccharides-Glucose, Fructose, Galactose, Mannose, Pentose.						
b) Disaccharides-Sucrose, Maltose and Lactose.						
c) Polysaccharides-Starch and Dextrin.						
Unit:2						
Analysis of Amino acids					18 hours	
a) Histidine b) Tyrosine c) Tryptophan d) Methionine e) Cysteine f) Arginine						
Unit:3						
Lipid Analysis (Group Experiments)					8 hours	
a) Determination of Saponification number.						
b) Determination of Acid number.						
Unit:4						
Demonstration Experiments					8 hours	
a) Preparation of buffer and its pH measurements using pH meter.						
b) Separation of amino acids by Paper chromatography and TLC.						
Total practical hours					60 hours	
Text Book(s)						
1	Laboratory manual in biochemistry by J.Jayaraman, Wiley Eastern Publishers.					
2	Biochemical Methods- Sadasivam and Manickam, 3 rd Edition, New Age International Publishers					
Reference Books						
1	David T. Plummer, An introduction to practical biochemistry.3 rd Edition. Mc GRAW-Hill Publishing company Ltd.					
2	Pattabiraman, Laboratory manual in biochemistry.					
Course Designed By: Dr S.Vennila						

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	S	S	S	S
CO2	S	S	S	M	M	S	S	S	S	S
CO3	S	S	S	M	M	S	S	S	S	S
CO4	S	S	S	M	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low





Third Semester

Course code	33A	Core Paper IV - Enzyme and Enzyme Technology	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in proteins and its structure		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to: To enable the students to learn about the different types of enzymes and its isolation and purification which will pave the ways in which the students can enter in research field						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	The structure of the enzyme and its classification					K1,K2
2	Understanding the kinetics of the enzyme					K2
3	The mechanism of action of enzymes and co-enzymes					K2
4	The production, Purification and characterization of immobilized enzymes					K3
5	Applications of enzymes					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Enzymes			9 hours			
Introduction, Definition, International Classification of enzymes, Numbering and nomenclature. Enzyme units. Definition of active sites. Theories proposed – Lock and Key or template model and induced fit model, ordered and random binding of substrate. Enzyme specificity – Group specificity, optical specificity. Enzyme as proteins Structure: Primary, Secondary, Tertiary and Quaternary structure with reference to examples.						
Unit:2						
Enzyme Kinetics And Enzyme Inhibitors			9 hours			
Enzyme Kinetics: Derivation of Michalies-Mentons equation, transformation of MM equation, Line-Weaver Burk plot and Eadie Hoffste plot. Effect of pH, Temperature, enzyme activity, turn over number of enzymes. Briggs and Haldane Theory (Rapid Equilibrium and Steady state Theory) Enzyme Inhibition: Competitive, non-competitive and un-competitive inhibition. Regulatory enzymes, allosteric enzymes and covalent modification of enzymes Isoenzymes. Ribozymes, Abzymes (Concepts and clinical Applications only).						
Unit:3						
Mechanism Of Enzyme Action And Coenzymes			8 hours			
Definition-Co enzymes and Metal Cofactors Structure and functions of TPP, NAD, NADP, FAD, FMN, Coenzyme A, Multienzyme Complex: Pyruvate dehydrogenase. Mechanism of enzyme action: General acid base catalysis and covalent catalysis Mechanism of action of chymotrypsin. Determination of enzymatic reactions-Enzyme assay (any one)						

Unit:4	Enzyme Technology	9 hours
Immobilized enzymes: Source and techniques of immobilization. Effect of immobilization on enzyme activity. Application of immobilized enzymes. Industrial Production of enzymes: Amylase, Proteases Industrial uses of enzymes Enzyme data Repositories and their types and classifications		
Unit:5	Uses Of Enzymes In Analysis	8 hours
Enzymes as Biosensors – Calorimetric biosensors, Potentiometric biosensors, Amperometric biosensors, Optical biosensors and immunosensors. It's Principle, technique, mechanism and examples. Enzyme engineering: Artificial enzymes. Antioxidant enzymes.		
	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Satyanarayana.U., Fundamentals of Biochemistry, Allied & Books Pvt Ltd, Calcutta, 2019	
2	Jain J.L, Fundamentals of biochemistry, S.Chand Publication 6th Edition, 2005	
Reference Books		
1	Trevor Palmer and Philip Bonner 2 rd edition, 2008, Understanding enzymes. East west publisher	
2	Enzymes – Dixon and Webb	
3	Enzyme Technology – Chapline & Bucke	
4	Alan Welshman, 2 nd edition, Hand book of enzyme biotechnology	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	Enzymes - https://nptel.ac.in/courses/102/102/102102033/	
2	https://nptel.ac.in/content/storage2/courses/102101007/downloads/PPT/LEC-07-PPT.pdf	
3	Enzymes Assay - https://nptel.ac.in/courses/104/105/104105032/	
Course Designed By: Dr D.Chandra Prabha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	M	S	S
CO2	S	S	S	S	M	S	S	M	S	S
CO3	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	M	S	S	M	S	S
CO5	S	S	S	S	M	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	33B	Core Paper V – Microbiology	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic Knowledge in structure of prokaryotic cells		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the structure and types of microorganisms						
2. Learn the economical uses of microorganisms						
3. Learn about the pathogenesis of various microbes in the environment						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to understand :						
1	Basics in microscopy, culture methods and staining techniques					K2
2	Morphology of bacteria, algae and fungi					K2
3	Morphology of virus					K2
4	Microbial diseases, their etiology and prevention					K2
5	Pathogenesis of microbes in water, soil and food					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Historical Development Of Microbiology		9 hours				
Historical development of microbiology ; microscopy, principle and uses of light microscope, phase contrast and electron microscopes, sterilization techniques ; culture methods ; pure culture: Isolation and maintenance ; culture media - selective and enrichment media. Staining and smearing: Simple staining, Negative staining, and Gram's staining, Acid - fast staining and spore staining. Growth curve and generation time. Microbial Nutrition						
Unit:2						
Prokaryotes And Eukaryotes		9 hours				
Prokaryotes: - Morphology of bacteria; component parts; cell wall structure . Eukaryotes: - Morphological characteristics and importance of algae; Characteristics, reproductive structures and importance of fungi						
Unit:3						
Morphology Of Viruses		9 hours				
Morphology of viruses, classification and cultivation of viruses; plaque assay. Phages: - T ₄ Phages stages - lifecycle; synthesis and assembly of protein Lambda Phages - Life cycle; switch between lysogeny and lytic cycle. RNA viruses: - Influenza and Corona virus , HIV. DNA viruses: - Oncogenic viruses						
Unit:4						
Microbial Diseases		8 hours				
Microbial diseases: - Normal human micro flora; host - parasitic interaction ; epidemics; exo and endotoxins. Air borne diseases: - Aetiology, symptoms and prevention of Tuberculosis, Diphtheria, Polio - myelitis and Influenza, Waterborne diseases:- Aetiology, symptoms and pathogenesis of Typhoid, Cholera, Bacillary dysentery and Hepatitis. Direct contact disease: - Aetiology and symptoms of Rabies						

Unit:5	Microbiology Of Water, Soil and Food	8 hours
Water microbiology: - Microbes in water, Bacteriological examination of water; purification of drinking water.		
Soil microbiology: - Symbiotic and Non- symbiotic Nitrogen fixing organisms: Rhizosphere and phosphate solubilizing microbes		
Food microbiology ; Microbiology of food borne diseases- Botulism, Salmonellas, Staphylococcal poisoning Perfringens poisoning and Mycotoxins		
	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Pelczar J, R E. C .S John Noel R Krieg, Microbiology: MC Graw Hill Book Company, 2006, 5 th edition.	
2	Anantha Narayanan R; C .K Jayaram panicker, 10 th edition, Text Book of Microbiology - Orient Longman Publication, 2017.	
Reference Books		
1	Prescott L. M; J.H Harley and D. A Klein, Microbiology, C. Brown Publishers, 2006, 5 th edition	
2	Ronald M. Atlas, Microbiology-Fundamentals and Applications, Macmillan Publishing Company, New York, 1993.	
3	Joanne M.Willey, Linda Sherwood, Christopher.J woolverton, 2017, Prescott's Microbiology, 10 th Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/102/103/102103015/	
2	https://nptel.ac.in/courses/105/107/105107173/	
3	https://nptel.ac.in/content/storage2/courses/105104102/Lecture%2023.htm	
Course Designed By: Dr D.Chandra Prabha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	S	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	M	S	M	S	S	S
CO4	S	S	S	S	M	S	M	S	S	S
CO5	S	S	S	S	M	S	M	S	S	S

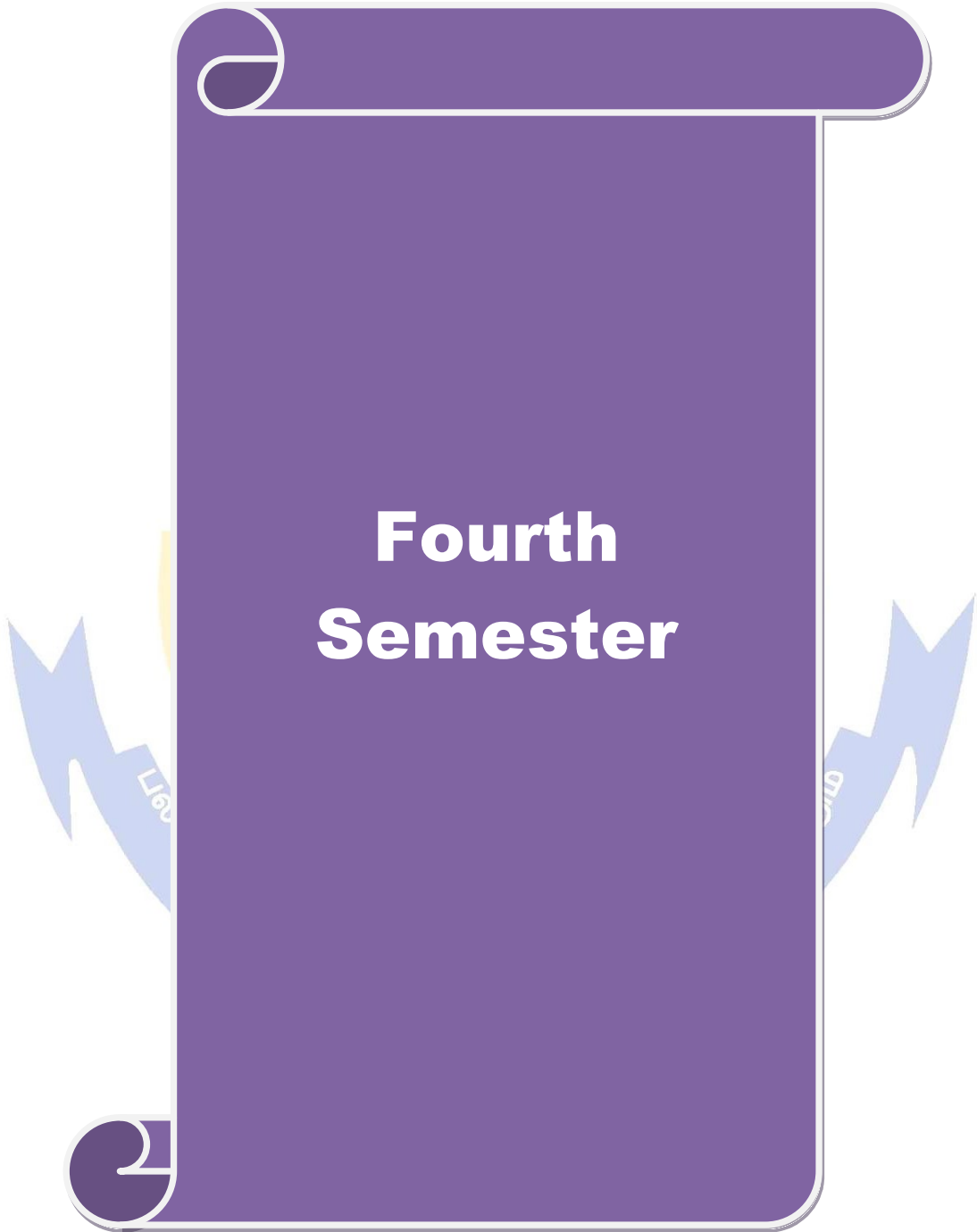
*S-Strong; M-Medium; L-Low

Course code	3ZA	Skill based Subject I – Bioinformatics and Medical coding	L	T	P	C
Core/Elective/Supportive	Skill based subject		2	1	-	3
Pre-requisite	Basic Knowledge in biological databases and coding		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Through knowledge on biological databases						
2. Drug designing and docking protocols						
3. Understanding the importance of medical transcription						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to understand :						
1	the concepts and applications of biological databases					K2
2	the principle and applications of various search tools					K2
3	the concepts of drug designing					K2
4	the concepts of terminologies in medical coding					K2
5	the guidelines of medical transcriptionist					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
BioInformatics			6 hours			
Introduction, definition, objectives and scope. Application of BioInformatics. Biological databases:						
Primary protein database – SWISS PROT, TrEMBL, PIR, PDB.						
Primary nucleic acid database – EMBL, GEN BANK, DDBJ.						
Unit:2						
Tools for database search			6 hours			
FASTA- Histogram, Sequence listing, Search and Programs.						
BLAST – Algorithm, Services, MEGA BLAST, PHI BLAST, PROTEIN BLAST, GAPPED BLAST, PSI BLAST						
Unit:3						
Protein Primary structure analyses and prediction			6 hours			
Protein Primary structure analyses and prediction, BioInformatics and drug design:						
Introduction, approaches – ligand based, target based. Methods of drug designing – CAMD, docking program						
Unit:4						
Introduction to medical terminology			5 hours			
Medical terminology -root words, prefix, suffix, abbreviations, symbols. Documentation of medical records, ICD (International classification of Diseases)						
Unit:5						
Medical coding			5 hours			
Introduction to medical coding, medical transcription, Medico legal issues, Medical Transcription software, Essentials of Medical Transcription guidelines						
Contemporary Issues						
			2 hours			
Expert lectures, online seminars – webinars(self study)						
			Total Lecture hours		30 hours	

Text Book(s)	
1	Rastogi.S.C, Namita – Mendiratta and Parag Rastogi, (2004) BioInformatics – Concepts, Skills and applications
2	Mani.K and Vijayraja (2005), BioInformatics – A practical approach
Reference Books	
1	Westhead D.R, Parish J.H and Twyman R.M. (2003) Instant notes in BioInformatics, 1 st Edition
2	Attwood.T.K. Parry D.J. and Smith (2001). Introduction to BioInformatics, 1 st Indian Report.
3	Alok Gha, Priyanka Arora- Medical Transcription Made easy.
4	Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CM- Coding guidelines made easy- 2017.
5	Besty J Shiland- Medical terminology and anatomy for ICD-10.
6	Karen Smiley- Medical willing and coding for dummies, 2 nd edition.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/102/106/102106065/
2	http://www.digimat.in/nptel/courses/video/102106065/L65.html
3	https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes
Course Designed By: Dr D.Chandra Prabha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	M	S	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	M	S	M	S	S
CO4	S	S	S	S	S	M	S	M	S	S
CO5	S	S	S	S	S	M	S	M	S	S

*S-Strong; M-Medium; L-Low



Fourth Semester

Course code	43A	Core Paper VI – Intermediary Metabolism	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic Knowledge in structure of biomolecules		Syllabus Version		2021-2022	
Course Objectives:						
Provides much information related to carbohydrate, fat and protein metabolism that takes place in our body.						
1. Interrelationship between carbohydrate, fat and protein metabolism.						
2. Role of purine and pyrimidines in nucleic acid metabolism.						
3. Various disorders related to each metabolism						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to understand :						
1	Concepts of thermodynamics and the mechanism of energy transfer in ETC					K2
2	Fate of the dietary carbohydrates					K3
3	Fate of the dietary lipids					K3
4	Fate of the dietary proteins					K3
5	Interrelation among the carbohydrates, fat and protein metabolism					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Bioenergetics			10 hours			
Free energy and the laws of thermodynamics; Role of high energy compounds as energy currency of the cell; free energy of hydrolysis of ATP and other organophosphates. The basic metabolic pathways, anabolic, catabolic and amphibolic pathways.						
Electron transport chain: - Role of respiratory chain in mitochondria; in energy capture; respiratory control.Oxidative phosphorylation: - Mechanism of oxidative phosphorylation; Chemiosmotic theory; uncouplers of oxidative phosphorylation						
Unit:2						
Fate of absorbed carbohydrates			14 hours			
Fate of absorbed carbohydrates. Glycolysis: - Pathways and energetics; Oxidation of pyruvate to acetyl CoA. TCA Cycle: - Pathway and energetics; anaplerotic reaction. Gluconeogenesis; Pasteur effect .Glycogenesis and glycogenolysis. Pentose Phosphate Pathway (HMP shunt). Glucuronic Acid Cycle and glyoxylate cycle (Entner- Duodoroff pathway)						
Metabolism of other hexoses: - Fructose and galactose						
Unit:3						
Blood lipids and fate of dietary lipids			14 hours			
Oxidation of fatty acids: - Carnitine cycle; beta oxidation. Alpha oxidation and omega oxidation. Biosynthesis of propionyl CoA. Biosynthesis of saturated fatty acids: - Extra – mitochondrial in a microsomal system for synthesis of fatty acids. Biosynthesis of unsaturated fatty acids: - Monounsaturated and polyunsaturated fatty acids. Biosynthesis and degradation: - Lecithin, cephalin, inositol, phosphatidyl serine, cholesterol						
Unit:4						
Fate Of Dietary Proteins			10 hours			
Fate of dietary proteins, metabolic nitrogen pool. Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination, amino – acid decarboxylation, catabolism of carbon skeleton of amino acids. Catabolism of glycine, phenylalanine and tyrosine. Interrelationship between carbohydrates, fat and protein metabolism						

Unit:5	Metabolism of purines and pyrimidines	10 hours
.Metabolism of purines: - de novo synthesis, salvage pathways; catabolism. Metabolism of pyrimidines: - de novo synthesis, salvage pathways; catabolism.		
	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	Garrett and Grisham – Biochemistry. Saunders College Publishers, 1995.	
2	Murray, K. Robert, et al., - Harper’s Biochemistry. 29th edition, 2012	
Reference Books		
1	Voet and Voet - Biochemistry. 4 th Edition. 2010 John Wiley and Sons,	
2	Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M.,W.H. Freeman and Company, New York.	
3	Mathews, Freeland and Miesfeld - Biochemistry – a short course.Wiley & sons. 1996.	
4	Harper’s Biochemistry (2012) 29th ed., Murray, R.K., Granner, D.K., Mayes and P.A.,Rodwell, V.W., Lange Medical Books/McGraw Hill.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/104/105/104105102/	
2	http://www.nptelvideos.in/2012/11/biochemistry-i.html	
3	https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf	
Course Designed By: Dr D.Chandra Prabha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	S	S
CO2	S	S	S	S	M	S	M	M	S	S
CO3	S	S	S	S	M	S	M	M	S	S
CO4	S	S	S	S	M	S	M	M	S	S
CO5	S	S	S	S	M	S	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code	43P	Core Biochemistry Practical - II	L	T	P	C
Core/Elective/Supportive	Core		-	-	3	3
Pre-requisite	Basic Knowledge in colorimetry and titrimetry		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Learn about the Biochemical methods for analyzing the biological components						
2. Know about enzyme assays						
3. Able to acquire knowledge about the separation techniques						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Expertise in estimation of various biomolecules.				K2,K4	
2	Expertise in enzymic analysis				K2,K3	
3	Acquire knowledge about the separation techniques				K2,K5	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Colorimetry				32 hours	
1. Estimation of Glucose by O-Toluidine						
2. Estimation of phosphorus by Fiske-Subbarow method						
3. Estimation of Urea by DAM-TSC method						
4. Estimation of Uric acid by Carraway method						
5. Estimation of Iron by Wong's method						
6. Estimation of Protein by Lowry's method						
7. Estimation of Creatinine by Picric acid method						
8. Estimation of RNA by Orcinol method.						
Unit:2	Titrimetry				12 hours	
1. Estimation of Ascorbic acid – Dye method						
2. Estimation of Chloride – Vanslyke's method						
3. Estimation of Reducing sugar by Benedict's method						
Unit:3	Enzymes (Group Experiment)				8 hours	
1. Assay of salivary amylase activity.						
2. Assay of lipase activity.						
Unit:4	Separation Techniques (Demonstration)				8 hours	
1. Separation of serum protein by electrophoresis						
2. Agarose Gel Electrophoresis						
3. Column packing.						
Total practical hours					60 hours	
Text Book(s)						
1	Pattabiraman, Laboratory manual in bio-chemistry.					
2	J.Jayaraman, Practical bio-chemistry.					

Reference Books	
1	David T. Plummer, An introduction to practical bio-chemistry
Course Designed By: Mrs S.Seethalakshmi	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low



Course code	4ZB	Skill based Subject 2 - Basics of Information Technology	L	T	P	C
Core/Elective/Supportive		Skill Based Subject	2	1	-	3
Pre-requisite		Basic Knowledge in Information technology	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Have a fundamental knowledge on information technology and database system						
2. Provide basics of internet and networking						
3. Understand the functioning of Cyber security, AI and IoT						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understood the fundamentals of information technology and importance of database system					K2
2	Understood the basics of internet and concepts of networking					K2
3	Understood the fundamental functioning of Cyber security					K2
4	Understood the fundamental functioning of AI					K2
5	Understood the fundamental functioning of IoT					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Fundamentals of Information technology and Database systems					8 hours	
Fundamentals of Information technology: Definitions of Compilers, Linker, Loaders, Assembler and Interpreter.						
Database systems; Definitions: Data abstraction, Instances, Schemes, Entity, Entity set: Strong and weak entity sets, Primary key, Foreign key, Super key.						
Unit:2						
Internet and Networking					9 hours	
Internet: Evolution of Internet-Internet terminologies: WWW, FTP, HTML, HTTP, Gopher, E-mail browsers,						
Networking: Network architectures, Topologies, LAN, WAN, MAN AND Components of a network: Hubs, Routers, Repeaters, Bridges, Modems and cables.						
Unit:3						
Artificial Intelligence (AI)					8 hours	
Introduction to AI – Fundamentals – Need for AI –Foundations of AI – AI environment – Application domains of AI – AI tools – Challenges and Future of AI.						
Unit:4						
Internet of Things					9 hours	
Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT – Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT						
Unit:5						
Cyber Security					9 hours	
Cyber Crime and Information Security – Classification of Cyber Crimes - Types of Cyber Attacks - Cyber crime and Indian IT Act 2000 – Security Methods						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Leon A and Leon M Fundamentals of Information technology.	
2	Date C.J. Introduction to Database systems.	
3	Andrew S. Tanenbaum Computer networks.	
Reference Books		
1	Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, 4th Edition,Vikas Publishing House, 2011	
2	Atul Kahate, “Cryptography and Network Security”, McGraw Hill, 2013.	
3	P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0, 2020	
3	Arshdeep Bahga, Vijay Madisetti, „Internet of Things: A Hands-On Approach“, 2014. ISBN: 978-0996025515	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105166/	
2	https://nptel.ac.in/courses/106/105/106105031/	
3	https://nptel.ac.in/courses/106/106/106106129/	
4	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs24/	
Course Designed By: Mrs S.Seethalakshmi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	M	S	S	M	S	S
CO2	M	S	S	S	M	S	S	M	S	S
CO3	M	S	S	S	M	S	S	M	S	S
CO4	M	S	S	S	M	S	S	M	S	S
CO5	M	S	S	S	M	S	S	M	S	S

*S-Strong; M-Medium; L-Low



Fifth Semester

Course code	53A	Core Paper VII – Human Physiology	L	T	P	C
Core/ Elective / Supportive	Core		3	1	-	4
Pre-requisite	Basic Knowledge in parts of human body		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Learn about the various alimentary parts of human body						
2. Understand the endocrinal activities						
3. Learn about the functions of vital organs						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Visual cycle and Skeletal system					K2
2	Blood and Digestive system					K2
3	Respiratory and Excretory System					K2
4	Nervous system and Endocrine system					K2
5	Human Reproductive system					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Total 60						
Unit:1	Physiology of Vision and Skeletal Muscle				10 hours	
Physiology of vision: Structure of eye, image formation and defects of the eye, Receptor mechanism of the eye, photopigments, Visual cycle and color adaptation						
Skeletal Muscle: Structure of skeletal muscle, contraction of muscle fibre, chemical changes during muscle contraction, sources of energy of muscle contraction.						
Unit:2	Blood and Body Fluids, Digestive System				14 hours	
Blood and Body fluids: Composition and function, Red blood cells, Hemoglobin, White blood cells and platelets. Blood coagulation, blood groups and blood transfusion. Formation and functions of lymph. Body buffers.						
Digestive system: Secretion of digestive juices, digestion and absorption of carbohydrates, proteins and fats. Gastro intestinal hormones.						
Unit:3	Respiratory System and Excretory System				15 hours	
Respiratory system: Diffusion of gases in lungs, transport of oxygen from lungs to tissues through blood, factors influencing the transport of oxygen. Transport of CO ₂ from tissues to lungs through blood, factors influencing the transport of CO ₂ .						
Excretory System: Mechanism of formation of urine, composition of urine, Micturition. Renal regulation of acid balance, hormone of the kidney.						
Unit:4	Nervous System and Endocrine System				10 hours	
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, Neuro transmitters.						
Endocrine system: Chemical nature of hormones, mechanism of action of hormones –						

intracellular receptor mechanism and second messenger mechanism (cAMP, cGMP, Ca. ²⁺) Structure function and deficiency symptoms of hormones of pituitary, thyroid, parathyroid and adrenal glands. Functions of pancreatic hormones.		
Unit:5	Reproductive System	9 hours
Male Reproductive system: 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		
	Contemporary Issues	2 hours
Expert lectures, Online seminars, webinars (self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	Chatterjee, C.C - Human Physiology – CBS publishers, 12 th edition, 2018	
2	Lecture notes on human physiology, M. M. Muthiah Vol II, 1991.	
Reference Books		
1	Saradha Subramaniam. Text book of human physiology.	
2	Chatterjee. C. Text book Medicinal Chemistry.	
3	Guyton, Text book of Medical physiology.	
4	Agarwal G.R & Agarwal B.P. Text book of Biochemistry (Agarwal physiological chemistry)	
5	Murray. R.G. Harper's Biochemistry, 29 th edition	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/127/106/127106001/	
2	https://nptel.ac.in/courses/127/106/127106001/	
3	https://nptel.ac.in/content/storage2/courses/122103039/pdf/mod3.pdf	
4	https://www.vedantu.com/biology/human-excretory-system	
Course Designed By: P.A.Vasundra Devi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	M	S
CO3	S	S	S	S	S	S	S	M	M	S
CO4	S	S	S	S	S	S	S	M	M	S
CO5	S	S	S	S	S	S	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	53B	Core Paper VIII – Clinical Biochemistry	L	T	P	C
Core/ Elective / Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in metabolism of biomolecules		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Understand about clinical metabolism						
2. Know about the significance of diagnostic bio chemistry						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Carbohydrate metabolism					K2
2	Lipid metabolism					K2
3	Disorders of Amino acid metabolism					K2
4	Gastric, pancreatic and intestinal functions					K2
5	Liver function tests and Kidney function tests					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Total 60						
Unit:1	Disorders of Carbohydrate metabolism.					10 hours
Normal sugar level in blood, renal threshold and regulation of blood glucose concentration. Hypoglycemia; Definition and causes. Hyperglycemia; Definition and causes. Diabetes mellitus; Introduction, aetiology, types of diabetes mellitus, clinical pathology and diagnosis. Urine testing, random blood sugar and GTT Acute and chronic complications of Diabetes mellitus Glycosuria- Differential diagnosis of glycosuria, Fructosuria, Pentosouria, Galactosemia and Glycogen storage diseases						
Unit:2	Disorders of Lipid Metabolism.					10 hours
Plasma lipids and lipoproteins. Introduction Hyperlipoproteinemia-Types I, II, III, IV and V Alpha lipoproteinemia. Hypolipoproteinemia- A beta lipoproteinemia, Hypo beta lipoproteinemia. Tangier's disease and LCAT deficiency. Atherosclerosis, Fatty liver and hyper lipidemia. Hypercholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach's disease, Niemann-Pick disease.						
Unit:3	Disorders of Amino Acid Metabolism					15 hours
Plasma protein abnormalities; Total plasma (Serum) protein, Fibrinogen, Albumin, Pre-albumin and Globulins. Abnormal non-protein nitrogen; Urea, Uric acid, Creatinine and Ammonia, Porphyria. Amino acid metabolism: Cystinuria, phenylketonuria, maple syrup disease, alkaptonuria, Albinism and Hartnup disease. Disorders of Purine and pyrimidine metabolism Disorders of Purine metabolism: Normal level of uric acid in blood and urine, miscible uric acid pool, hyper uricemia and Gout; Hypouricemia – Xanthinuria and Liathiasis. Disorders of pyrimidine metabolism: Orotic acid urea.						

Unit:4	Gastric, Pancreatic and Intestinal Functions.	9 hours
Gastric function: Introduction, tests of gastric function – The insulin stimulation test, determination of Gastrin in serum and Tubeless gastric analysis. Pancreatic Function: Introduction, pancreatic function tests, serum amylase and lipase. Intestinal function: Introduction, test of monosaccharide absorption (xylose excretion test) and determination of total protein (Lowry's method).		
Unit:5	Liver Disease And Liver Function Tests	14 hours
Introduction, bilirubin metabolism and jaundice, liver function tests. Estimation of conjugated and total bilirubin in serum (Diazo method). Detection of bilirubin and bile salts in urine (Fouchet's test and Hay's sulphur test). Thymol turbidity test, prothrombin time, serum enzymes in liver disease – serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). Kidney function test: Introduction, Physical examination of urine, elimination tests, clearance tests; inulin clearance, Creatinine clearance test and urea clearance test, Renal blood flow and filtration fraction. Free Radicals and Oxidative Stress Applications of Artificial Intelligence in Medicines		
	Contemporary Issues	2 hours
Expert lectures, Online seminars, webinars(Self-study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	Burtis A. Carl and Edward R.Ashwood, Tietz text book of clinical chemistry W.B.Saunders company, 2 nd edition, 1994	
2	MN Chatterjea and Rana Shinde, Text Book of Medical Biochemistry, Jaypee Brothers Medical Publishers (P) LTD, New Delhi, 8 th Edition, 2012	
Reference Books		
1	Philip.D.Mayne, Clinical Chemistry in diagnosis and treatment. ELBS Publication, 6 th edition, 1994.	
2	Montgomery, Conway, Spector, Biochemistry – A case oriented approach. The C.V.Moshby Company, 5 th edition, 1990.	
3	Clinical Biochemistry, 5 th edition, 2013, Allan Gaw, Michael Murphy, Rajee Srivastava, Robert Cowan, Denis O Reilly	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate-metabolism	
2	https://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests	
3	https://onlinecourses.nptel.ac.in/noc20_ge13/preview	
Course Designed By: P.A.Vasundra Devi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	S	S	S	S
CO2	S	S	S	S	M	M	S	S	S	S
CO3	S	S	S	S	M	M	S	S	S	S
CO4	S	S	S	S	M	M	S	S	S	S
CO5	S	S	S	S	M	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code	53C	Core Paper IX – Molecular Biology	L	T	P	C
Core/ Elective / Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in Genetic materials and proteins		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Promote knowledge about synthesis of Genetic Materials and Proteins						
2. Learn about gene repair mechanism and gene mutation						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Replication and DNA repair mechanism					K2
2	Transcription Process					K2
3	Genetic code and Translation Process					K2
4	Recombination Mechanisms and Gene Regulations					K2
5	Gene Mutations					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Total 60						
Unit:1	DNA Replication				10 hours	
Evidences for DNA as genetic material: - Experimental proof DNA replication in prokaryotes; Formation of DNA from nucleotides; Semiconservative mechanism and experimental proof; RNA priming; Bidirectional replication; theta mode, rolling circle model. Enzymology of DNA replication; Initiation, elongation and termination; Fidelity of replication. Differences in eukaryotic replication; Inhibitors of replication [names only]. DNA repair mechanism: - Excision repair, mismatch repair, photo activation and SOS repair.						
Unit:2	Transcription				10 hours	
Prokaryotic transcription: - Central dogma; RNA polymerases; Initiation, elongation and termination of transcription. Role of eukaryotic RNA polymerases. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription.						
Unit:3	Translation				14 hours	
Genetic code: - Experimental evidences; Features of genetic code. Composition of prokaryotic and eukaryotic ribosomes. tRNA - structure; activation of amino acids, coding and non - coding strands of DNA. Translation: - Initiation, elongation and termination of protein synthesis; Inhibitors of protein synthesis. Post - Translational modifications of proteins.						
Unit:4	Recombination				10 hours	
Recombination in bacteria: - Transformation, Transduction and Conjugation. Recombination: - Mechanism; forms of recombination, Holliday model for homologous recombination Prokaryotic gene regulation: - Operon model; lac operon - positive and negative control; trp operon - repression and attenuation						

Unit:5	Gene Mutations and Bacterial Transposons	14 hours
Gene mutations:- Types - Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations – Ames test; reversion techniques; selection of mutants; Auxotrophs; Replica plating; Penicillin cycling. Bacterial transposons:- Insertion sequences; Mechanism of transposition in bacteria		
	Contemporary Issues	2 hours
Expert lectures, Online seminars, webinars(Self-study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	David Freifelder, Molecular Biology, Reprint, 2020, Narosa Publishing House,	
2	Lehninger's Principles of Biochemistry, 6 th Edition, 2015 Macmillan publishers.	
Reference Books		
1	Gardner, Simmons, 8 th edition, Principles of Genetics 1994.	
2	Weaver, F., Robert, Hedrick, W. Philip, Genetics, W.C. Brown Publishers 1997, 3 rd ed.	
3	Harvey Lodish, David Baltimore – Molecular Cell Biology, 4 th Edition	
4	Bruce Alberts – Molecular Biology of the Cell, 4 th Edition	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/content/storage2/courses/102101007/downloads/HANDOUTS/LECTURE-02-Handout.pdf	
2	DNA NPTEL https://nptel.ac.in/content/storage2/courses/104103018/pdf/mod4.pdf	
3	https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod1.pdf	
Course Designed By: P.A.Vasundra Devi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	M	M	S
CO2	S	S	S	S	M	S	S	M	M	S
CO3	S	S	S	S	M	S	S	M	M	S
CO4	S	S	S	S	M	S	S	M	M	S
CO5	S	S	S	S	M	S	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	53D	Core Paper X – Genetic Engineering and Bioprocess Technology	L	T	P	C
Core/ Elective / Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in cloning and fermentation		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
4. To Understood the Concepts of gene cloning and Recombinants						
5. To Understood the Sequencing techniques and Applications of genetic engineering						
6. To Understood the Fermentation Process, Recovery and application						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Concepts of gene cloning					K2
2	Recombinants – Identification and collection					K2
3	Sequencing techniques					K2
4	Applications and limitations of genetic engineering					K2
5	Fermentation- Process, Recovery and application					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Basis of Gene Cloning				12 hours	
Restriction endonucleases – Types and Features; DNA Poymerases, Klenow DNA Polymerase I, Ligations; Linkers and Adaptors. Vectors of gene cloning: - Plasmid Vectors – Basic feature, pBR332. Bacteriophage vectors; Cosmids. Cloning hosts. Preparation of Plasmid DNA from bacteria.						
Unit:2	Introduction Of DNA Into Bacterial Cells And Hybridisation				12 hours	
Introduction of DNA into bacterial cells: Transformation of E. coli, selection of transformed cells, Identification of recombinants. Introduction of phage DNA into bacterial cell, Identification of recombinant phage. Genomic library and cDNA library. Hybridization probes; Southern, Northern and Western blotting techniques.						
Unit:3	Techniques and Applications				10 hours	
DNA sequencing: Outline of Sanger’s method – Applications. Next Generation Sequencing- Massively Parallel Signature sequencing (MPSS), DNA Nanoball Sequencing, Genetic Finger Printing – Oligonucleotide directed mutagenesis; Protein engineering. PCR – Technique and Applications. RT PCR-Principle, Technic and Application,						
Unit:4	Expression Vectors For E.Coli				11 hours	
Expression vectors for E.Coli:- Constituents; Examples of promoters – Expression cassettes – Problems caused in expression of eukaryotic genes: Fusion proteins: - Applications of gene technology: Recombinant insulin; Recombinant growth hormones. Cloning HBV surface antigen in yeast. Insect cells as host system. Safety aspects and hazards of genetic engineering.						

Unit:5	Bioprocess Technology	13 hours
Fermentation: Design of a commercial fermenter; Solid substrate fermentation: Media for industrial fermentations; Batch culture and fed – batch culture. Down – stream processing. Production of amino acids; SCP; Penicillin and alcohol.		
	Contemporary Issues	2 hours
Expert Lectures, Online seminars, webinars(Self-study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	R.W. Old & S.B. Primrose, Principles of Gene manipulation, Black well scientific publications, 1994	
2	Principles of Gene manipulation & Genomics,2013,Sandy B.Primrose, and Richard Twyman Wiley Blackwell, 7 th Edition	
3	Balasubramaniam, D, C.F.A., Bryce, K. Dharmalingam, J. Green, KunthalaJayaraman concepts in Biotechnology, COSTED – IBN university press, 1996.	
Reference Books		
1	T.A. Brown, Gene cloning and DNA Analysis- An introduction, Chapman and Hall, 2016, 7 th Edition.	
2	Glick.R, Bernard and Pasternak.J, Jack, Molecular Biotechnology, Asm press, Washington D.C, 3 rd Edition 2002.	
3	Glazier. N. Alexander, Hiroshnikaido, Microbial Biotechnology, W.H. Freeman & co., New york, 2 nd Edition 2007.	
4	Molecular Cloning: A Laboratory Manual (3 Volume Set): 4th Edition – 2013 by Michael R Green, Joseph Sambrook; Publisher: Viva Books Private Limited	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	http://www.hixonparvo.info/Gene%20Cloning.pdf	
2	https://nptel.ac.in/content/storage2/courses/102103013/pdf/mod3.pdf	
3	https://www.slideshare.net/Hemathangavel/massively-parallel-signature-sequencing-mpss?qid=cf12fac4-0c74-4ee0-bf34-4d2b9fa77817&v=&b=&from_search=1	
Course Designed By: Dr .V.Senthamarai Selvi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	M	M	S
CO2	S	S	S	M	S	S	S	M	M	S
CO3	S	S	S	M	S	S	S	M	M	S
CO4	S	S	S	M	S	S	S	M	M	S
CO5	S	S	S	M	S	S	S	M	M	S

*S-Strong; M-Medium; L-Low



Skill Based Subject

Course code	5ZC	Skill based Subject 3 – Basics of Patent and Bioethics	L	T	P	C
Core/ Elective / Supportive	SKILL BASED SUBJECT - III		2	1	-	3
Pre-requisite	Basic knowledge in patent, IPR and Bioethics		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. To understand patent system and current developments in the law on patents.						
2. To know the nature of patents and Bioethics.						
3. To understand the knowledge in bioethics and bio-law.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Provide information for role of Patent and protection of innovations					K2,K3
2	Adequate knowledge on patents and its laws for their future innovative idea.					K2,K3
3	Knowledge about the Patent, IPR and bioethics and related issues.					K2
4	Knowledge on Bioethics complications within research and understand different policies in ethics.					K2,K3
5	Understand the importance of Biosafety guidelines and practices.					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Patent			8 hours			
Patent – Definition, types of patent, issues related to patent, granting process of patent, rights provided by patent, patent protection						
Unit:2						
Intellectual Property Rights			9 hours			
Introduction to intellectual property rights (IPR)- Overview, meaning and types Copyright – Introduction, area covered by copyright, types of rights, need of protection of copy right Trade marks- introduction, types and function						
Unit:3						
Ethics ad Bioethics			8 hours			
Definition of Ethics and Bioethics, <u>Concept and Principles of Bioethics</u> , <u>Objective and Importance of Bioethics</u> , ethics in biosciences (positive and negative effects with classical examples – slow ripening fruits and controlled ripening) Awareness education on genetically engineered organisms						
Unit:4						
Containment Levels			9 hours			
Definition and types, their impact on environment – recommended biosafety levels for infectious agents, animal facilities Need for a good laboratory practice- aspiration and responsibility						
Unit:5						
Ethics In Clinical Trials And Good Clinical Practices			9 hours			
Ethics in clinical trials and good clinical practices (GCP) – Definition of clinical trials and GCP, general information about clinical trials, need to conduct clinical trials, phases of clinical trials, institutional setups for conducting clinical trials and ethics associated with it						

	Contemporary Issues	2 hours
Expert Lectures, Online seminars, webinars(Self-study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Copy right, Patent trade mark and related state, Doctrines cases and materials on the law of intellectual property, 7 th edition, Antony W Rodger, Foundation Press	
2	Bioethics and Biosafety – R. Rallipalli and Geetha Bali, APH publications, 2007.	
Reference Books		
1	Intellectual Property Rights – Padmanabhan, A First edition, 2012, Publisher- Lexis, Nexis- New Delhi-1	
2	Biological safety principles and practices- Fleming, DA., and Hunt, DL., 2000, ASM Press.	
3	IPR, Biosafety and Bioethics - Dr Goel Deepa, Shomini Parashkar by January 2013, Publisher : Pearson India	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/109/106/109106137/	
2	https://nptel.ac.in/courses/127/105/127105008/	
3	https://nptel.ac.in/courses/109/106/109106092/	
4	https://nptel.ac.in/courses/102/103/102103013/	
5	https://www.slideshare.net/sijiskariah/biosafety-50930344	
Course Designed By: Dr .V.Senthamarai Selvi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	M	S	S	S
CO2	S	S	S	S	M	M	M	S	S	S
CO3	S	S	S	S	M	M	M	S	S	S
CO4	S	S	S	S	M	M	M	S	S	S
CO5	S	S	S	S	M	M	M	S	S	S

*S-Strong; M-Medium; L-Low



Elective Courses

Course code	5EA	Elective IA - IMMUNOLOGY AND IMMUNO TECHNIQUES	L	T	P	C
Core/ Elective / Supportive		Elective	2	1	-	3
Pre-requisite		Basic knowledge in immune system and its functions	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
- To get a foundation knowledge for the future in immunology. - To learn the basic terminology and techniques in immunology. - To learn about the immune system is important to the humans.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the basics and concepts of immune system and its functions.					K2
2	Understand the basic concepts of immunology and immune reactions					K2
3	Knowledge on immune system and Immuno techniques					K2
4	Knowledge on immunological disease and immunotherapy.					K2
5	Understand to knowledge on transplantation and immunization techniques					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		Immunity			9 hours	
Historical development of the science of the immunology. Innate and acquired immunity, Antibody mediated and cell mediated response tolerance. Primary and secondary lymphoid organs. Structure of T, B and NK cells. Receptors on the surface of lymphocytes. Structure and functions of neutrophils, Macrophages – phagocytosis and inflammation, eosinophils and basophils.						
Unit:2		Antigen and Antibody			9 hours	
Antigen: Properties, Specificity and Cross reactivity, antigenicity, immunogenicity, antigen determinants, Haptens, adjuvants, Self antigens (MHC) an outline only. Antibodies: Properties, classes and subclasses of immunoglobulins: Structure, specificity and distribution, Clonal selection theory of antibody formation. Antigen-antibody interaction – Precipitation and agglutination – Definition and mechanism of formation. Complement component. Cytokines and their junctions.						
Unit:3		Immunotechniques			9 hours	
Precipitation in gel. Oudin procedure, oahley – Fulthope procedure, immune diffusion, Ouchterlony procedure, Immuno electrophoresis and electro immuno diffusion. Agglutination: Slide agglutination, Table agglutination, Widal test. Principle and application: RIA, ELISA, Flouresent antibody technique, monoclonal antibodies-plasma therapy, application.Flow Cytometry-Immunological Applications						
Unit:4		Allergy and Hypersensitivity			8 hours	
Allergy and Hypersensitivity – Type I, II, III and IV, their clinical manifestations. Immuno Disease: Rheumatoid arthritis, Myasthenia gravis.						

Unit:5	Transplantation and Vaccination	8 hours
Transplantation: Allograft rejection: Graft Vs Host Diseases: Immuno suppressors: mechanism of graft rejection. Resistant to tumors: NK Cells: Tumor immuno therapy: Lymphoid tumors. Vaccination: Passive and active immunization: Recombinant vaccines: DNA vaccines. Benefits and adverse effects of vaccination. CD4 Cell count in HIV infection.		
Artificial Intelligence in Therapy		
	Contemporary Issues	2 hours
Expert Lectures, Online seminars, webinars(Self-study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Text book of microbiology – Ananthanarayanan. R. and Yayaraman Panikar, 10 th edition, 2017	
2	Cellular and Molecular Immunolgy – Abul K. Abbas, Andrew H. Lichtman , 9 th Edition – Elsevier, 2017.	
Reference Books		
1	Immunology – An introduction, Tizzard R Jan, 1995.	
2	Immunology – Roitt Ivann, Jonathan Brastoff, David Male, 2017, 13 th Edition	
3	Immunology – Janis Kuby, 8th edition. 2018	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/102/103/102103038/	
2	https://nptel.ac.in/content/storage2/courses/102103038/download/module6.pdf	
3	Plasma Therapy - https://www.slideshare.net/Tareqchowdhury/therapeutic-plasma-exchange-106849551	
4	Flow Cytometry - https://www.slideshare.net/richardhastings589/kumc-introduction-to-flow-cytometry?qid=9f5e0389-0114-49eb-925b-7c984e1e7935&v=&b=&from_search=1	
5	https://www.iitk.ac.in/che/pdf/resources/Flow-Cytometry-reading-material.pdf	
Course Designed By: Dr .V.Senthamarai Selvi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	M	S
CO2	S	S	S	S	S	M	S	S	M	S
CO3	S	S	S	S	S	M	S	S	M	S
CO4	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	M	S	S	M	S

*S-Strong; M-Medium; L-Low

Course code		Elective I B – Introduction to Biomaterials	L	T	P	C
Core/ Elective / Supportive		Elective	2	1	-	3
Pre-requisite		Basic knowledge in biomaterials	Syllabus Version	2021-2022		
Course Objectives:						
The main objectives of this course are to:						
1. Promote knowledge about synthesis of Genetic Materials and Proteins						
2. Learn about gene repair mechanism and gene mutation						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	First Generation Biomaterials					K2
2	Second Generation Biomaterials and their Properties					K2
3	Second Generation Biomaterials and their Applications					K2
4	DNA nanotechnology					K2
5	Advanced Techniques for Single molecule Detection					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Biomaterials		9 hours				
Biomaterials and biological materials - examples and uses: first generation biomaterials – general characteristics – naturally occurring biomaterials – pure metals – alloys – ceramics – polymers – composites						
Unit:2						
Second generation biomaterials		9 hours				
Second generation biomaterials and their properties – bioactive and biodegradable ceramics – biodegradable polymers – hydrogels						
Unit:3						
Third generation biomaterials		9 hours				
Third generation biomaterials – characteristics – biomaterials in tissue engineering – enzyme conjugates, DNA conjugates – DNA- protein Conjugates – microarray technologies – micronanotechnology – microfabrication – nanofabrication – interaction between biological materials, molecular – biomolecules and nanomaterials.						
Unit:4						
Nanobiotechnology		8 hours				
Nanobiotechnology – introduction – DNA nanotechnology – structural DNA assembly – nanopore and nanoparticles – biological arrays – nanopores for analytical applications – nanosensors – nanoscale organization – characterization – quantum size effects – nanobiosensors – sensors of the future.						
Unit:5						
Techniques		8 hours				
Microscopies – SEM – TEM – modern advances – microanalysis – optical detection of single molecules – applications in single molecule spectroscopy – single molecule DNA detection, sorting, sequencing – DNA nanoparticles studies by AFM – DNA computer – PCR amplification of DNA fragments – molecular surgery of DNA.						

	Contemporary Issues	2 hours
Expert lectures, Online seminars, webinars(Self-study)		
	Total Lecture hours	45 hours
Text Book(s)		
1	Nano: The essentials: Pradeep .T, 2017, Tata McGraw-Hill Publishing Company Ltd	
2	Nanoscale Technology in Biological Systems: Editors: Ralph et al, 2005, CRC Press.	
3	Nanoparticles assemblies and Superstructures: Nicholas A.Kotov, 2006, CRC Press	
4	Biomaterials: An introduction. 1992. By Park JB, Lakes RS	
Reference Books		
1	Micromachines as Tools for Nanotechnology: H.Fujitha, 2003, Springer Verlag.	
2	Nanobiotechnology: Concepts, Applications and Perspectives, C.M.Niemeyer& C.A. Mirkin, 2004, Willey VCH Verlag GMBH &co.	
3	Advances in Biomaterials, Drug delivery – AICHE. J 2003, 49(12): 2990 – 3006.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/118/107/118107015/	
2	https://nptel.ac.in/courses/113/108/113108071/	
3	Nanotechnology - https://nptel.ac.in/courses/113/106/113106093/	
4	Nanobiotechnology – https://nptel.ac.in/courses/118/107/118107015/#	
5	Nanobiotechnology - https://www.slideshare.net/ibadali14/nanobiotechnology-lecture-1?qid=12d6a742-4768-4081-b11a-58a894a5d1ed&v=&b=&from_search=2	
Course Designed By: Dr .V.Senthamarai Selvi		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	S	M	M	S
CO2	S	S	S	S	M	M	S	M	M	S
CO3	S	S	S	S	M	M	S	M	M	S
CO4	S	S	S	S	M	M	S	M	M	S
CO5	S	S	S	S	M	M	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code		Elective I C -NUTRITIONAL BIOCHEMISTRY	L	T	P	C
Core / Elective / Supportive		ELECTIVE	2	1	-	3
Pre-requisite		Basic knowledge in various types of nutrients and its function	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. To understand the main features of nutritional biochemistry						
2. To discuss the nutrients effects of and their functions in the body						
3. To understand the biochemical processes in nutritional research						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Explore scientific basis of nutrients and knowledge of nutritional biochemistry.					K2,K1
2	Capable of describing chemical composition of nutritional worth of food					K2,K3
3	Understood the Effects of methods Nutrient analysis and energy content					K2
4	Understood the scientific active constituents micro and macro nutrients					K2
5	Understood the components of foods based on knowledge of nutrients in diet and health					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Introduction To The Science Of Nutrition			9 hours			
Introduction to the science of nutrition – function of foods and its relation to nutritional and clinical health, essential nutrients, analysis of food, composition, food habits and food groups.						
Unit:2						
Carbohydrates			9 hours			
Carbohydrates- kinds, functions, food sources. Fats- kinds, functions, food sources, essential fatty acids and cholesterol. Proteins- kinds, functions, food sources, complete and incomplete proteins.						
Unit:3						
BMR			9 hours			
Biological value, Net protein Utilization Energy Basal metabolism, measurement of BMR, Factors affecting BMR, regulation of body temperature, energy needs, total energy requirements, estimation of energy requirements and value of foods. Balanced diet formulation- Assessment of nutritional status.						
Unit:4						
Mineral Nutrition			8 hours			
Mineral nutrition: Essential – micro and macro mineral nutrients, distribution, sources, functions and abnormalities. Vitamins – Definition, classification, sources, distribution, functions and abnormalities.						
Unit:5						
Nutrition At Various Stages Of Growth And Development			8 hours			
Nutrition at various stages of growth and development; diets for infants, children, adolescents, pregnant women, lactating mothers and older persons. Nutrition challenges of the future – food production and food storages, future foods, new protein foods, new fat foods and changing food habits.						

		Contemporary Issues	2 hours
Expert lectures, Online seminars, webinars (Self-study)			
		Total Lecture hours	45 hours
Text Book(s)			
1	Principles of Nutrition & Dietetics. Dr. M. Swaminathan. The Bangalore printing & publishing Company limited. 88, Mysore Road, Bangalore- 560018.		
2	Advanced Text Book on Food & Nutrition – Vol. I. Dr. M. Swaminathan, Second Edition.		
3	Advanced Text Book on Food & Nutrition volume-II. Dr. M. Swaminathan, Second Edition.		
Reference Books			
1	Normal and Therapeutic Nutrition- Corine Rohinson.		
2	Sri Lakshmi. E (2016)-Nutrition Science-New Age Publishers		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
1	https://onlinecourses.swayam2.ac.in/nce20_sc01/preview		
2	https://nptel.ac.in/content/syllabus_pdf/126104004.pdf		
3	https://www.slideshare.net/DrSubirKumar/food-nutrition-nutrients-diet-energy-consumption-bmi?gid=28af04db-ca98-4c07-bc56-abec1a9dcd27&v=&b=&from_search=4		
4	https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1_01-Relationship%20between%20Food,%20Nutrition%20and%20Health%201-A.pdf		
Course Designed By: Dr .V.Senthamarai Selvi			

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	M	M	S
CO2	S	S	S	M	S	M	S	M	M	S
CO3	S	S	S	M	S	M	S	M	M	S
CO4	S	S	S	M	S	M	S	M	M	S
CO5	S	S	S	M	S	M	S	M	M	S

*S-Strong; M-Medium; L-Low



Course code	63A	Core Paper XI – Plant Biochemistry and Plant Therapeutics	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in plant cell structure and photosynthesis		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. This course presents the plant cell structure and function.and photosynthesis						
2. Know the cycles of elements and phytohormones						
3. To enable the students to have a sound knowledge on the germination, senescence and secondary metabolites						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Mechanism of photosynthesis					K1
2	Cycles of elements					K2
3	Mode of action of phytohormones					K3
4	Biochemical changes during seed germination and senescence					K4
5	Biological function of secondary metabolites.					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
PLANT CELL			12 hours			
Structure and functions. Photo synthesis: - Photo synthetic pigments – chlorophyll, carotenoids and phycobillin. Light reactions – two kinds of chemical system – photo system I and II –evidences in support of light reaction – Hill’s reaction, Arnon’s work and Emerson effect. Dark reaction – Calvin’s cycle (C3 plants) Hatch – Slack cycle (C4 cycle) and CAM plants. Photo respiration.						
Unit:2						
CYCLES OF ELEMENTS			12 hours			
Nitrogen cycle: – Ammonification, nitrification, nitrate reduction and denitrification, nitrogen fixation- symbiotic and non-symbiotic nitrogen fixation. Sulphur cycle, phosphorus cycle and carbon cycle. Plant nutrition: Specific roles of essential elements and their deficiency symptoms in plants. Macro nutrients: - Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur, Phosphorus, Calcium, Potassium, Magnesium and Iron. Micro nutrients: - Manganese, Boron, Copper, Zinc, Molybdenum and Chlorine.						
Unit:3						
PLANT GROWTH REGULATORS			12 hours			
Chemistry, biosynthesis, mode of action and Practical applications of auxins, gibberellins, cytokinins, abscisic acid and Ethylene. Plant growth inhibitors and retardants.						
Unit:4						
PHOTO MORPHOGENESIS			11 hours			
Photo periodism. Phytochrome - Function in growth and development of plant. Biochemistry of seed germination. Senescence: Biochemical changes during senescence. Senescence process in life cycle of plants.						
Unit:5						
SECONDARY METABOLITES			11 hours			
Nature, distribution and biological functions of alkaloids, terpenes, flavonoids, poly phenols, tannins and steroids. Role of secondary metabolites in pathogens, insects, animals and mankind.						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W.	
2	Anderson and John Brardall, Black well Scientific Publications, 1994.	
Reference Books		
1	Plant Physiology –Devlin N. Robert and Francis H. Witham, CBS Publications.	
2	Plant Biochemistry and Molecular Biology – Hans Walter Heldt, Oxford University, 4 th Edition, 2010	
3	Russell Jones, Helen Ougham, Howard Thomas, Susan waaland,2012, The Molecular Life of Plants, Wiley Balckwell	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/an-introductory-chapter-secondary-metabolites	
2	https://www.toppr.com/guides/biology/plant-growth-and-development/plant-growth-regulators/	
3	https://byjus.com/biology/plant-cell/	
Course Designed By: Ms G.Sujitha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	S	M	S	S
CO2	S	S	S	S	M	M	S	M	S	S
CO3	S	S	S	S	M	M	S	M	S	S
CO4	S	S	S	S	M	M	S	M	S	S
CO5	S	S	S	S	M	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code	63B	Core Paper XII – Medicinal Chemistry	L	T	P	C
Core/Elective/Supportive	Core		3	1	-	4
Pre-requisite	Basic knowledge in therapeutic uses of drugs		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. General structural features of agents belonging to the therapeutic class & Relevant physicochemical properties						
2. This course presents to focus on the chemical principles used for drug discovery and it also covers human biology where ever relevant						
3. Course provides for the specific needs and interests of students wishing to obtain experience in a modern research program.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understood the development of the traditional and modern methods used for drug discovery; of how molecules interact.					K2
2	Learnt the fact that the pharmaceutical industry is by far the largest employer of medicine					K1
3	Learnt and developed skills in the use of reaction mechanisms					K2
4	how knowledge of reaction mechanisms can aid in understanding the mode of action of a drug					K3
5	The learnt method by which it can be synthesized, and developed.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1 INTRODUCTION AND RECEPTOR CONCEPT 12 hours						
Introduction to drugs, classification of drugs, passage of drugs across biological membrane; absorption and distribution of drugs; binding of drugs to plasma proteins. Drug receptor interaction, binding forces in drug receptor interaction, types of receptors. Receptor theories, isolation of receptors, consequences of drug receptor interaction						
Unit:2 DRUG METABOLISM AND ELIMINATION 12 hours						
Drug metabolism, methods of study of drug metabolism, microsomal drug metabolism, metabolism via hydroxylation, conjugation deamination, N-Oxidation, azo and nitro reduction, non-microsomal oxidation, Oxidative deamination, purine oxidation, dehalogenation, hydrolysis, action of choline esterase. Elimination of drugs from the body with reference to renal system						
Unit:3 CHEMOTHERAPY 12 hours						
Chemotherapy: Mode of action of sulfonamides, anti-metabolites of folate, purines and pyrimidines. Antibacterials - mode of action and resistance to penicillin, streptomycin, tetracycline and chloramphenicol. Antiviral, antimalarial and antiTB drugs.						
Unit:4 DRUGS ACTING ON CNS AND CARDIO-VASCULAR SYSTEM 11 hours						
CNS – structure and mode of action of barbiturates, salicylates, MAO inhibitors and drugs for Parkinson's disease.						

Cardio-vascular disease: Structure and mode of action of cardiac glycosides, heparin and coumarin.		
Unit:5	DRUGS OF PLANT ORIGIN	11 hours
Drug dependents and abuse – management of self-poisoning. Cancer chemotherapy- cytotoxic drugs. Immunosuppressive drug therapy.		
	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	Satoskar, R.S.Bhandarkar, S.D and S.S. Ainapure, 25th edition, 2017. Pharmacology and pharamacotherapeutics. Popular Prakashnan Bombay.	
2	William Foye (2012), 7th edition, Principles of medicinal chemistry	
Reference Books		
1	Patrick.L.Graham (2013), An introduction to medicinal chemistry, 5 th edition Oxford University Press	
2	Grahame, D.G.Smith and Aronson, J.K. Oxford T.B of clinical pharmacology and drug therapy, 3 rd edition, 2002	
3	Tripathi.K.D (2013) Essentials of Medical Pharmacology, 7 th edition, Jaypee Brothers, Medical Publishers, New Delhi	
4	Shargel et al. 2012, Appllied biopharmaceutics and Pharmacokinetics, 6 th edition, McGraw Hill	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://swayam.gov.in/ndl_noc20_cyl6/preview	
2	https://nptel.ac.in/courses/104/106/104106106/	
Course Designed By: Ms G.Sujitha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	S	M	M	S
CO2	S	S	S	S	M	M	S	M	M	S
CO3	S	S	S	S	M	M	S	M	M	S
CO4	S	S	S	S	M	M	S	M	M	S
CO5	S	S	S	S	M	M	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	63P	Biochemistry Practical – III	L	T	P	C
Core/ Elective / Supportive		Core	-	-	4	4
Pre-requisite		Basic knowledge in clinical lab technology	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Learn about the Biochemical methods for analyzing the biological components in Urine and Serum.						
2. Know about enzyme assays						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Biomolecules in Urine					K5
2	Biomolecules in Serum					K5
3	Enzyme activities in Serum					K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Total 60						
Unit:1		Urine Analysis			30 hours	
Estimation of Creatinine by picric acid method.						
1. Estimation of Urea by DAM-TSC method						
2. Estimation of Uric acid by Caraway's method						
3. Estimation of Calcium by Permanganate method						
4. Estimation of Phosphorus by Fiske-Subbarow method						
Unit:2		Blood Analysis			55 hours	
Estimation of Urea in serum by DAM –TSC method						
1. Estimation of Uric acid in serum by Caraway method						
2. Estimation of Creatinine in serum by picric acid method						
3. Estimation of Phosphorus in serum by Fiske-Subbarow method						
4. Estimation of Iron in serum by Wong's method						
5. Estimation of Glucose in serum by O- Toluidine method						
6. Estimation of Alkaline phosphatase in serum						
7. Estimation of Acid phosphatase in serum						
8. Estimation of Cholesterol in serum by Zak's method						
Unit:3		Kit Method: (Demonstration Experiment)			15 hours	
1. Estimation of SGOT						
2. Estimation of SGPT						
3. Estimation of Triglycerides						
4. Estimation of Hemoglobin						
		Total practical hours			100 hours	
Text Book(s)						
1	David T. Plummer, An introduction to practical bio-chemistry					
2	Pattabiraman, Laboratory manual in bio-chemistry					

Reference Books	
1	J.Jayaraman, Practical bio-chemistry
Course Designed By: Dr .V.Senthamarai Selvi	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

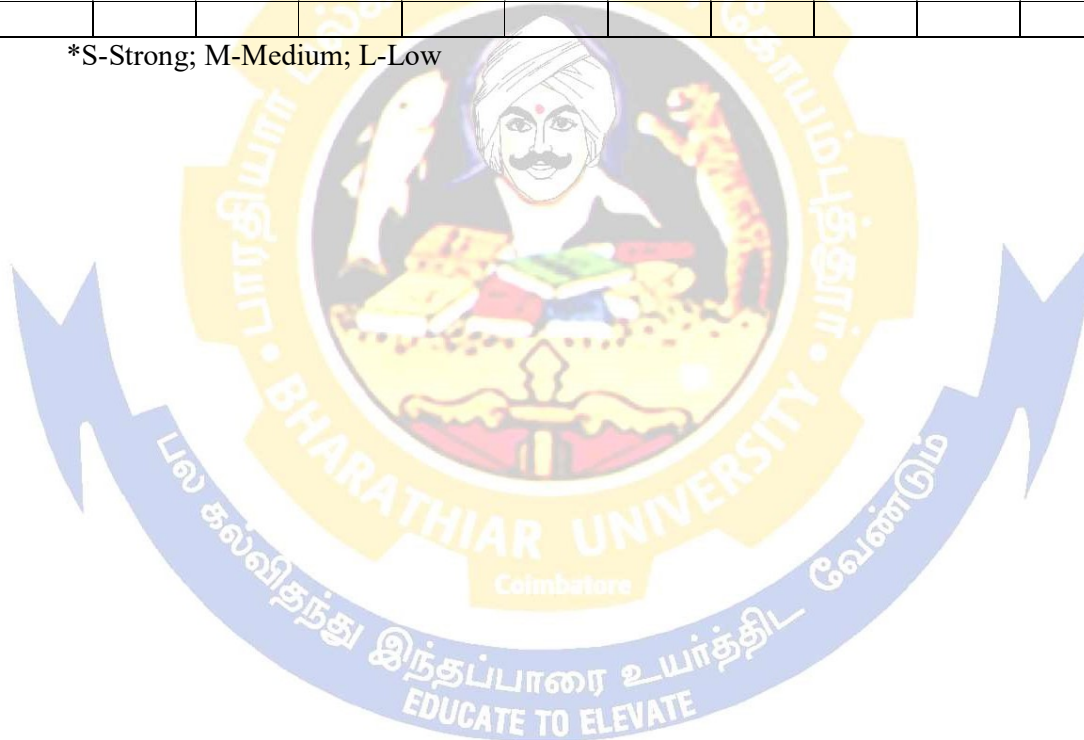


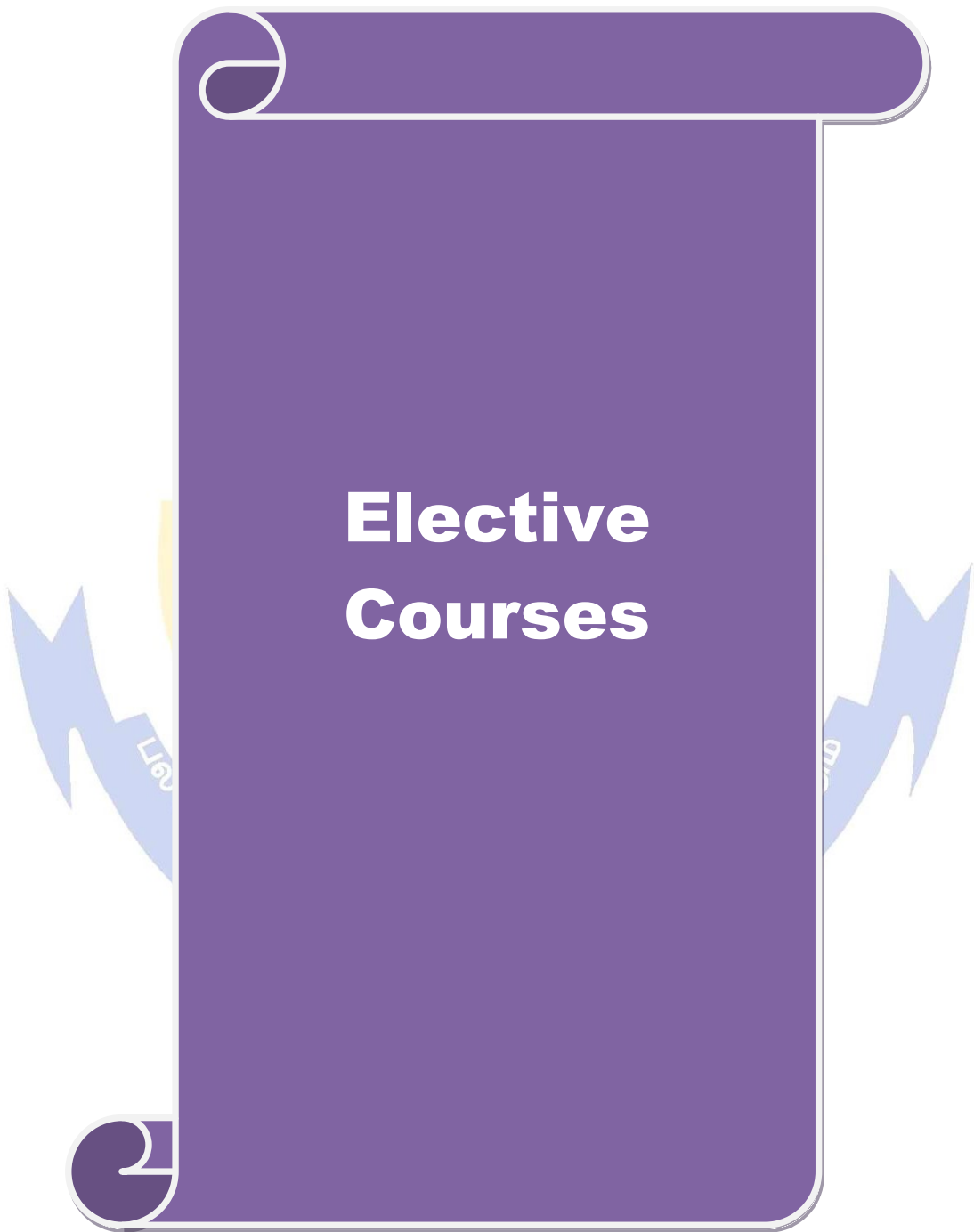
Course code	63Q	BIOCHEMISTRY PRACTICAL – IV	L	T	P	C
Core/ Elective / Supportive	Core Practical		-	-	4	4
Pre-requisite	Basic knowledge in microbiological, immunological, enzyme assay and hematology techniques		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to: To understand the basic handling of microbiological techniques. To practice on enzyme technology and basics Immunological techniques To Understand and practice on Hematology techniques						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Develop skills on handling Microbial techniques				K3	
2	Impart knowledge Skills on enzyme assay techniques				K3, K4	
3	Practice on basics Immunological assay				K3, K4	
4	Develop skills on Plant compounds and basic knowledge on PTC				K3	
5	Knowledge practice on Hematology techniques				K3, K4	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create						
Unit:1						
Microbiology			18 hours			
1. Microscopic measurements of microorganisms; 2. Hanging drop techniques. 3. Simple staining; 4. Gram staining; 5. Endospore staining; 6. Negative staining; 7. Fungal staining						
Unit:2						
Enzymes			40 hours			
8. Preparation of crude enzyme extract. 9. Effect of pH on the activity of acid phosphatase and catalase. 10. Effect of temperature on the activity of acid phosphatase and catalase. 11. Effect of enzyme concentration on the activity of acid phosphatase and catalase. 12. Effect of substrate concentration on the activity of acid phosphatase and catalase.						
Unit:3						
Immunology			8 hours			
13. RA factor (Kit method) 14. Pregnancy test – Gravindex test (Kit method)						
Unit:4						
Plant Biochemistry			20 hours			
15. Estimation of Chlorophyll; 16. Estimation of Starch Demonstration on plant tissue culture 17. Preparation of media; sterilization; 18. Initiation of callus culture						
Unit:5						
Physiology			14 hours			
19. Identification blood group 20. Enumeration of RBC 21. Enumeration of WBC 22. Differential staining method 23. Bleeding time and clotting time determination.						
			Total practical hours			100 hours

Text Book(s)	
1	Biochemical Methods by S. Sadasivam and Manickam
2	Practical Microbiology by RC.Dudey and Maheswari
3	Experimental Procedures in Life Sciences, S.Rajan and R.Selvi Christy, CBS Publishers & Distributors Pvt Ltd,2018
Course Designed By: P.A.Vasundra Devi	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low





Elective Courses

Course code	6EA	Elective – II A- Plant and Animal Biotechnology	L	T	P	C
Core/Elective/Supportive		Elective	2	1	-	3
Pre-requisite		Basic Knowledge in plant and animal tissue culture	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to: This course presents the plant and animal tissue culture methods, explains the mechanism of gene transfer, Methods of selection, Production of novel proteins and their applications.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understood the components of culture media and various tissue culture techniques.					K2
2	Learnt about the technique of genetic engineering in plants and animals.					K2
3	Learnt about the synthesis and applications of recombinant proteins from cell cultures.					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		Plant Tissue Culture			12 hours	
Plant tissue culture: - Media composition, nutrients & growth regulators, MS medium & B5 medium. Callus & suspension culture. Initiation & differentiation of PTC. Micropropagation:- Methods, Production of haploid plants, phytochemicals from plant tissue culture.						
Unit:2		Protoplast Technology			12 hours	
Protoplast technology:- Isolation, fusion of protoplasts, Electroporation, Biolistics, Regeneration of plants from protoplasts. Gene Transfer in plants:- Ti plasmid vectors, mechanism of T- DNA transfer, Vir genes. Transgenic plants: - Herbicide, Virus, Pest resistance plants, Male infertility, Genetic engineering of plant oils.						
Unit:3		Mammalian Cell Culture			12 hours	
Mammalian cell culture:- Establishment of cell in culture: Requirements for invitro growth; importance of serum. Cell-lines; cell transformation – properties of transformed cells, cell separation, Mass cultivation of cells: suspension culture; immobilized cultivation.						
Unit:4		Genetic Engineering of Animal Cells			11 hours	
Genetic Engineering of Animal cells: - Mammalian cell culture in protein production. Gene transfer into mammalian cells, Selectable markers pSV plasmids; retroviral vectors; Expression vectors; reporter genes.						
Unit:5		Animal Biotechnology			11 hours	
Animal Biotechnology:- Artificial insemination and embryo transfer, Invitro fertilization (IVF): embryo cloning. Human embryo research, transgenic mice, Gene therapy; the Human Genome Project. Recombinant proteins from cell cultures: - Interferons, Viral vaccines, Hybridoma technology- Monoclonal antibodies- production and applications.						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		-
	Total Lecture hours	60 hours
Text Book(s)		
1	D. Balasubramanian and others, Concepts in Biotechnology, Universal press India 1996.	
2	BIOTOL series, Invitro cultivation of animal cells- Butler worth Heineman, 2004	
3	Walsh Gary and Headon R. Denis, Protein Biotechnology. John Wiley publishers, 1994.	
Reference Books		
1	Plant tissue culture; Razdan; Oxford IBH publishers, 2003,2 nd edition	
2	Freshney; Animal cell culture; IRL press .2010, 6 th edition	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/102/103/102103016/	
2	https://nptel.ac.in/courses/102/104/102104059/	
Course Designed By: Ms G.Sujitha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	M	M	S	S
CO2	S	S	S	S	S	M	M	M	S	S
CO3	S	S	S	S	S	M	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code		Elective II B -Nanomaterials and Nanomedicine	L	T	P	C
Core/Elective/Supportive		Elective	2	1	-	3
Pre-requisite		Basic knowledge in nanomaterials and its applications	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. To foundational knowledge of the nanomedicine and related fields.						
2. To make the students acquire an understanding the nanomaterials and applications						
3. To help them understand in broad outline of nanomaterials and nanomedicine.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Learn about the background on Nanomaterials and Nanomedicine					K2
2	Understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment					K2
3	Apply their learned knowledge to develop Nanomaterials					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Biological Materials			12 hours			
Structure property relationship of Biological materials: tissues, bones and teeth, collagen rich tissues, elastic tissues, nanostructured collagen mimics in tissue Engineering. Biopolymers: Preparation of nanobiomaterials – Polymeric scaffolds collagen, Elastins: Mucopolysaccharides, proteoglycans, cellulose and derivatives; Dextran; Alginates; Pectins; Chitin						
Unit:2						
Cardiovascular Implants			12 hours			
Cardiovascular implants: Role of nanoparticles and nanodevices in blood clotting; Blood rheology; Blood vessels; Geometry of blood circulation; Vascular implants; Cardiac pacemakers; blood substitutes; Biomembranes.						
Unit:3						
Polymeric Implant Materials			12 hours			
Polymeric implant materials: Polyolefin; polyamides (nylon); Acrylic polymers (bone cement) and hydrogels; Fluorocarbon polymers; Natural and synthetic rubbers, silicone rubbers; High strength thermoplastics; deterioration of polymers. Biomaterials for Ophthalmology: Contact lenses; Optical implants for glaucoma; adhesives; artificial tears; Protection gears.						
Unit:4						
Metallic and Ceramic Implant Materials			11 hours			
Metallicand ceramic implant materials: Bone regeneration, Nano crystalline structures of Bone and Calcium phosphate cements. Cobalt-based alloys; Titanium and its alloys, Nanoparticles relating to Aluminium oxides: Hydroxyapatite; Glass ceramics; ceramic implants; carbon implants. Nano dental materials.						
Unit:5						
Nanoparticles			11 hours			
Metallicand ceramic implant materials – metal nanoparticles and drug delivery vehicles – Nanoshells – Tectodentrimers Nanoparticle drug systems – Diagnostic applications of nanotechnology.						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	SV Bhat, Biomaterials (2nd Edition), Narosa Publishing House, New Delhi – 2005.	
2	JB Park, Biomaterials Science and Engineering, Plenum Press, New York, 1984 ChallaS.S.R.Kumar, Joseph Hormes, CarolaLeuschmal	
Reference Books		
1	Nanofabrication towards biomedical applications Willey – VCHVerlag GmbH &Co, KGaA.	
2	Freshney; Animal cell culture; IRL press.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/102/106/102106057/	
2	https://nptel.ac.in/courses/113/104/113104009/	
Course Designed By: Ms G.Suiitha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	S	S
CO2	S	S	S	S	M	S	M	M	S	S
CO3	S	S	S	S	M	S	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code		Elective II C -Health and Hygiene	L	T	P	C
Core/Elective/Supportive	Elective		2	1	-	3
Pre-requisite	Basic knowledge in health and hygiene		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. This course is aimed at providing food safety, health and hygiene information and prevent food poisoning.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understood the components of health concepts					K2
2	Learnt about the nutrition, environment, maternal and child health					K2
3	Learnt about the mental health and healthcare programmes					K2
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Concepts of Health				12 hours	
Concepts of health:- Who definition of health; Positive health; Determinants of health; Responsibility for health. Health service philosophies:- Health case; Health system; Levels of health case. Concepts of disease and concept of causation – germ theory of disease; Epidemiological triad; Multifactorial causation; Web of causation						
Unit:2	Nutrition and Health				12 hours	
Nutrition and Health – Food defined; Nutrition defined; Classification of foods; Nutrients – Sources and functions of Proteins, fats, carbohydrates; sources and functions of vitamins and minerals. Nutritional Profiles of principle foods; cereals, Millets, Vegetables, Fruits, Milk, and Milk products, Fish and meat, alcoholic beverages, egg, soft drink. Balanced Diet – PEM Malnutrition and its effects – Kwashiorkor and Marasmus.						
Unit:3	Environment and Health				12 hours	
Environment and Health – Basic health requirements in the environment – Water – Sources and uses of water, Water pollution, Water related diseases and purification of water. Air – Composition and cause of discomfort; Air pollution – Source, Air pollutants, need for proper ventilation. Housing – Social goals of housing and criteria for healthful housing.						
Unit:4	Maternal and child Health				11 hours	
Maternal and child Health:- Mother and child – one unit; Intranatal card; Post natal child care – care of the mother, complications of post portal period, restoration of mother to optimum health, Breast feeding; congenital malformations – Definition, incidence, Risk factors, Prenatal diagnosis and prevention. Family planning methods – Family planning definition, Natural family planning methods –BBT Cervical mucous method. Artificial family planning methods – Hormonal contraceptives – go nodal steroids; oral pills, Depot formulations.						

Unit:5	Mental Health	11 hours
Mental Health – Types and causes of mental illness – Preventive aspects; Alcoholism and drug dependence – Definition, agent factors, Host factors, symptoms, environmental factors, prevention, Treatment and Rehabilitation. Health care programmes in India – National AIDS control programme and National Immunization programme.		
	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1 Park. K., Social and preventive medicine, Bhanot publishers, 18th edition, 2005.		
2 Turk and Turk., Social and preventive medicine.		
Reference Books		
1 Ashtekar. S., Health and Healing – A Manual of Primary health care, orient Longmans publishers. 2001.		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1 https://www.youtube.com/watch?v=KoDiuL6NggQ		
2 https://nptel.ac.in/content/storage2/courses/109101007/downloads/LECTURE_NOTES/Module%2016/lec25.pdf		
Course Designed By: Ms G.Sujitha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	M	S
CO3	S	S	S	S	S	M	S	M	M	S

*S-Strong; M-Medium; L-Low

Course code	6ED	Elective III A -CLINICAL LABORATORY TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Elective	2	1	-	3
Pre-requisite		Basic Knowledge in clinical laboratory test	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. The aim and objective of various clinical laboratory test						
2. The significance of various test and interpretation in diseased conditions.						
3. This course has been designed to understand the blood disorders, its lab diagnosis and various type of laboratory test.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Students shall understand on the various clinical tests.					K1
2	Understand the significance of various test and interpretation in diseased conditions					K2
3	Apply the fundamentals to diagnostic tests.					K3
4	To analyze and interpret the values for both normal and disease conditions.					K4
5	Understand the basic tests can be done in home (Self Analysis)					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		COLLECTION & ANALYSIS			12 hours	
Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste: Non infectious waste , biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines						
Unit:2		BLOOD ANALYSIS			12 hours	
Blood Sugar Analysis- glucometer based analysis, HbA1C, NPN-urea, uric acid, Creatinine Clinical chemical test -Ca, P, Fe, Cu, CSF analysis.						
Unit:3		ENZYMES, ENZYMES, IMMUNOGLOBULINS			12 hours	
Enzymes: Acid phosphatases, LDH, CPK, CPK-MB, Alpha amylase, Hormones – T3, T4, TSH, LH Immunoglobulins – IgA, IgM, IgE						
Unit:4		PRECIPITATION & AGGLUTINATION TEST			11 hours	
Serodiagnostic procedures – precipitation tests, VDRL test, Widal Test, (Slide and Tube method) Brucella agglutination test, ASO test, RA test, CRP test. RIA, ELISA, Fluorescent antibody technique. Complement fixation test, skin test – Montaux test, Lepramin test.						
Unit:5		BLOOD BANK			11 hours	
Blood group and Rh factor – methods of grouping, & reverse grouping , Basic blood banking procedures- cross matching, Different screening test, including Coomb's test – direct & indirect, separation of blood components, preparation of red cell suspension, Blood transfusion & hazards						

	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars(self study)		
	Total Lecture hours	60 hours
Text Book(s)		
1	Jacques Wallach, Interpretation of Diagnostic Test – A Synopsis, 9 th Edition, Little brown and company, 2011	
2	Joan Zilva and Pannall P.R., Clinical Chemistry and diagnosis and treatment, PG Publishing Pvt Ltd, 1995.	
Reference Books		
1	Varley, H. (1985), Practical clinical BioChemistry, 4th Edition.	
2	Tietz, N. (2018) Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th edition, W.B. Saunders Company	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.youtube.com/watch?v=QNYIX5Ne9lQ	
2	https://www.slideshare.net/doctorrao/agglutination-tests-and-immunoassys	
3	https://microbenotes.com/introduction-to-precipitation-reaction/	
Course Designed By: Ms G.Sujitha		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	M	S	M	S
CO2	S	S	S	S	M	M	M	S	M	S
CO3	S	S	S	S	M	M	M	S	M	S
CO4	S	S	S	S	M	M	M	S	M	S
CO5	S	S	S	S	M	M	M	S	M	S

*S-Strong; M-Medium; L-Low

Course code		Elective III B- Nano Biotechnology	L	T	P	C
Core/Elective/Supportive	Elective		2	1	-	3
Pre-requisite	Basic Knowledge in nanoparticles		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to: 1.This course will enable the students to know about basics of nanoparticles.. 2. Application in human health and welfare. 3.Merits & Demrits of Nanomaterials						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Enable the students to gain knowledge on nanobiometrics, nanocomposites, nanoanalytics.					K1
2	Understand the basis on processing of nanoparticles and their functions.					K2
3	Apply the fundamental knowledge on naturally occurring nanoparticles and its application various organs.					K3
4	Analyse the types of nanoparticles and its beneficial application in technology.					K4
5	Understand about semiconductors					K2
K1 - Remember; K2 - Undestand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	Interdiciplinary Areas Of Biotech And Nanoscience.				12 hours	
Interdiciplinary areas of Biotech and Nanoscience. It is a field that concerns the utilization of biological systems. Cells, Cellular components. Nucleic acids and proteins refinement and application of instruments – to generate and manipulate nanostructured materials to basic and applied studies						
Unit:2	Interphase Systems				12 hours	
Interphase systems pertaining to biocompatible inorganic devices for medical implants – microfluidic systems – microelectronic silicon substrates.						
Unit:3	Nanoparticles				12 hours	
Protein based nanostructures building blocks and templates – Proteins as transducers and amplifiers of biomolecular recognition events – nanobioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.						
Unit:4	DNA				11 hours	
DNA based nanostructures - Topographic and Electrostatic properties of DNA and proteins – Hybrid conjugates of gold nanoparticles – DNA oligomers – use of DNA molecules in nanomechanics and computing.						
Unit:5	Semiconductor				11 hours	
Semiconductor (metal) nanoparticles and nucleic acid and protein based recognition groups – application in optical detection methods – Nanoparticles as carrier for genetic material.						
	Contemporary Issues				2 hours	
Expert lectures, online seminars – webinars(self study)						
	Total Lecture hours				60 hours	

Text Book(s)	
1	K.Goser, P. Glosekotter, J. Dienstuhl Nanoelectronics and Nanosystems: From transistors to molecular devices. Overseas Press India Pvt.Ltd Springer.2008
2	RohitMajumdar- Nanotechnology Basic science and Emerging Technologies 1 st edition Cyber tech publications 2008.
Reference Books	
1	Mick Wilson, Kamali Kannagara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Overseas Press, 2008
2	Bhushan, Bharat, Springer Handbook of Nanotechnology, 3 rd Edition, 2010.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc19_mm21/preview
2	https://swayam.gov.in/nd1_noc20_bt41
Course Designed By: Ms G.Sujitha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	S	M	S	S
CO2	S	S	S	S	M	M	S	M	S	S
CO3	S	S	S	S	M	M	S	M	S	S
CO4	S	S	S	S	M	M	S	M	S	S
CO5	S	S	S	S	M	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		Elective III C -Sports Biochemistry	L	T	P	C
Core/Elective/Supportive	Elective		2	1	-	3
Pre-requisite	Basic Knowledge in benefits of sports		Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. The students will have the knowledge about the benefits of the sports in the human body.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To enable the students understand the functioning of human physiology during sports and exercise					K1
2	Understand the Physiological changes that occurs during sports. types of organic materials and its significance					K2
3	To apply the fundamentals of various food components in role of sports.					K3
4	To analyse about the Nutritional requirements for sports					K4
5	Formulate new nutrition for sports persons.					K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
SPORTS, EXERCISE & GAMES			12 hours			
Introduction, calisthenics, Gymnastics, combative and swimming; Yogasana and its importance – Padmasana, Vajrasana, Dhunurasana, and Suryanamaskar; Track and field events – Running and Jumping Team events –Kabaddi.						
Unit:2						
SKELETAL MUSCLE SYSTEM & METABOLIC SYSTEMS IN EXERCISE			12 hours			
Skeletal muscle types; - relation with different types of activities; strength, power and endurance of muscles Muscle metabolic systems in exercise; Recovery of muscle metabolic systems after exercise.						
Unit:3						
CARDIO RESPIRATORY SYSTEM			12 hours			
Muscle blood flow and cardiac output during exercise; Oxygen consumption and pulmonary ventilation in exercise; Hypoxia and hypercapnia						
Unit:4						
PHYSICAL FITNESS ASSESMENT			11 hours			
Body composition; body fat percentage by skin fold method, BMI; Ideal weight and assessment of musclemass.						
Unit:5						
NUTRITION FOR SPORTS AND EXERCISE			11 hours			
Nutritional considerations for sports person:-Carbohydrate: Energy source for sports and exercise; carbohydrates composition for pre-exercise, during and recovery period. Fat: Role as an energy source: effect of fasting and fat ingestion Protein: Protein requirement during exercise, recovery process and protein supplement. Vitamins: Role of B-complex vitamins. Minerals: Role of Potassium and sodium.						
Contemporary Issues						
2 hours						
Expert lectures, online seminars – webinars(self study)						
Total Lecture hours			60 hours			

Text Book(s)	
1	B.N. Dash, Health and Physical Education ,Neelkamal Publications PvtLtd. 2009.
2	M. Swaminathan, Essentials of Food and Nutrition Vol I –II.2001.
Reference Books	
1	Guyton, Human Physiology and Mechanism of Disease, 5 th Edition, W. B. Saunders Publication.1991.
2	Kraure and Mohan,Food, Nutrition and Diet Therapy, 6 th Edition, W. B. Sounders Company, London,2005.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_ed04/preview
2	https://nptel.ac.in/content/storage2/courses/109101007/downloads/LECTURE_NOTES/Module%209/lec11.pdf
3	https://www.coursera.org/lecture/science-exercise/1-skeletal-muscle-structure-function-IJoQy
Course Designed By: Ms G.Sujitha	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	S	M	S
CO2	S	S	S	S	M	S	M	S	M	S
CO3	S	S	S	S	M	S	M	S	M	S
CO4	S	S	S	S	M	S	M	S	M	S
CO5	S	S	S	S	M	S	M	S	M	S

*S-Strong; M-Medium; L-Low



Skill Based Subject

Course code		Skill Based Subject 4 - Practical – Bioinformatics	L	T	P	C
Core/Elective/Supportive		Skill based subject	-	-	3	3
Pre-requisite		Basic Knowledge in Bioinformatics online tools	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. The students will have the knowledge about insilico techniques and structure prediction tools						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Acquire skill on working tools of docking					K2
2	Gain knowledge on various insilico techniques					K2
3	Get accustomed to structure prediction tools					K3
4	Visualize different types of biomolecules					K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1	PRACTICAL I-BIOINFORMATICS				40 hours	
• Docking program. • Biological Databanks Sequence Databases, Structure Databases, Specialised Databases. • Data retrieval tools and methods. • Database file formats. • Molecular visualization						
Unit:2	PRACTICAL II				40 hours	
• Gene structure and function prediction (using Gen Scan, GeneMark). • Sequence similarity searching (NCBI BLAST). • Protein sequence analysis (ExPASy proteomics tools). • Analysis of protein and nucleic acids sequences • Sequence analysis using EMBOSS or GCG Wisconsin Package						
		Total hours	80 hours			
Reference Books						
1	Bio-informatics a practical approach by K.Mani and N.Vijayaraj, Aparna publications, Coimbatore.					
2	Mani.K.and Vijayaraj,N. Bioinformatics a Practical Approach.					
Course Designed By: Dr D.Chandra Prabha						

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low



Allied Courses

Course code	1AH	Allied Chemistry - I	L	T	P	C
Allied		Allied I – Paper - I	4		-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version	2021-2022		
Course Objectives:						
The main objectives of this course are to:						
1. Explain the conducting properties of metals.						
2. Outline the reactivity of boron compounds, the principles of bonding, hybridisation and stereochemistry						
3. To imbibe the knowledge of silicones, fuel gases, dyes and their industrial applications						
4. To inculcate the chemistry behind day to day used items like toiletries, detergents etc						
5. Explain the physical chemistry behind the reaction rates and solutions.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the properties metals and their conductivity, the principle behind the synthesis and applications of boron compounds.					K1-K4
2	Understand about silicones fuels gases and their industrial applications. The theory behind colours and dyes, their preparation and dyeing.					K2-K4, K6
3	Understand the bonding and structure of various hydrocarbons and electronic effects. Appericiate the optical properties of compounds and how it determines the compounds nature itself					K1-K4
4	Explain the chemistry behind toiletries and cleaning agents.					K2-K5
5	Understand the kinetics benind chemical reactions and the nature of solutions					K1-K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		Conductivity of Metals and Boron Compounds			12 hours	
1. Conductivity of metals: Band theory, Explanation of thermal and electrical conductivity of metals, limitations, Definition and examples of conductors, semiconductors and insulators.						
2. Boron compounds: Structure, preparation, properties and uses of NaBH ₄ , Diborane and Borazole						
Unit:2		Industrial and Dye Chemistry			12 hours	
1. Industrial Chemistry: Synthesis, properties and uses of silicones. Fuel gases: composition and uses of natural gas, water gas, semi water gas, carbureted water gas, producer gas, oil gas.						
2. Dye Chemistry: Terms: Chromophore – auxochrome - bathochromic shift - hypsochromic shift - hyperchromic effect - hypsochromic effect - Dyes: Azo and triphenenyl methane dyes - Preparation of Methyl Orange and Malachite green						
Unit:3		Covalent Bonding and Stereoisomerism			12 hours	
1. Covalent bond: Orbital overlap – hybridization - geometry of organic molecules- CH ₄ , C ₂ H ₄ , and C ₂ H ₂ . Definition with example: Inductive, Electromeric, Mesomeric, hyperconjugative and steric effect.						
2. Stereoisomerism: Conditions of optical activity - optical isomerism of lactic acid and tartaric acid - geometrical isomerism of maleic and fumaric acids.						

Unit:4	Chemistry of Toiletries and Cleaning Agents	12 hours
1. Toiletries: Bath soap – shower gel - water softeners - tooth pastes-ingredients - their characteristic functions-mouth washes-shaving creams-after shave preparations.		
2. Cleaning Agents: Detergents - classification - formulation-cleansing action-optical brightners-bleachers-phenoyls - hand sanitizer.		
Unit:5	Physical Chemistry: Solutions and Kinetics	12 hours
1. Solutions: Raoult's law - Deviation from ideal behaviour - positive deviation - Negative deviation - Fractional distillation.		
2. Kinetics: Rate - order - molecularity - pseudo first order - determination of order by graphical method - Effect of temperature on the rate - Energy of activation		
	Total Lecture hours	60 hours
Text Book(s)		
1	Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, S.Chand & Co.	
2	Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons.	
3	Principles of physical chemistry, B.P. Puri, L.R. Sharma and M.S. Phathanian, S.Chand & Company	
Reference Books		
1	Advanced Organic Chemistry, B.S.Bahl, Arun bahl, S.Chand & Co.,	
2	Perfumes, Cosmetics and Soaps, W.A.Poucher (Vol.3), 9th Edition, Springer Science Business Media, 1993.	
3	Handbook of Cosmetic Science and Technology, Barel, A.O.; Paye, M.; Maibach, H.I.(2014), CRC Press.	
4	Pharmaceutics and Cosmetics, Gupta, P.K.; Gupta, S.K.(2011), Pragati Prakashan	
5	Chemical Process Industries, R. Norris Shreve and Joseph A.Brink,Jr.,4 th Edition, McGraw Hill, 1977.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/104/103/104103071/	
2	https://www.youtube.com/watch?v=zdmEaXnB-5Q	
3	https://www.britannica.com/science/band-theory	
4	https://www.chem.purdue.edu/gchelp/solutions/whatis.html	
Designed By: Dr. S. P. Rajasingh		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	M	S	S	S	S
CO2	S	S	S	S	S	M	S
CO3	M	M	S	S	S	M	S
CO4	S	S	S	S	M	M	S
CO5	S	S	M	S	S	M	M

*S-Strong; M-Medium; L-Low

Course code	2AH	Allied Chemistry - II	L	T	P	C
Allied		Allied I – Paper - II	4		-	3
Pre-requisite		Higher Secondary Level Chemistry	Syllabus Version	2021-2022		
Course Objectives:						
The main objectives of this course are to:						
1. To explain bioinorganic chemistry in biological systems.						
2. Appreciate the need for paints and explosives.						
3. To understand the role of polymers and rubbers to mankind.						
4. Show the importance of fertilizers and the unavailability of insecticides in agriculture.						
5. Explain the electrochemistry and electrical storage.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Appreciate the role of metals in biological system and their therapeutic effects					K1-K3
2	Understand about the importance of paints and the need for explosives as well as the bad face of war.					K2-K5
3	Understand the importance of polymers and rubbers in our day to day life					K1-K4
4	Appreciate the need for fertilizers and insecticides in the Agricultural sector					K2-K5
5	Understand the importance of electrochemistry and energy storage devices					K2-K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1						
Cordination Chemistry and The Importance of Metals			12 hours			
1. Coordination chemistry: Chelation examples - Hemoglobin – Chlorophyll - Applications of EDTA in qualitative and quantitative analysis.						
2. Metals in Health: Application of therapeutic chelating agents- Metal-based drugs cis-platin, carboplatin, platinum anti-cancer drugs, gadolinium MRI contrast agents, Gold arthritic agents						
Unit:2						
Paints and Explosives			12 hours			
1. Paints: classification – constituents – Pigment Volume Concentration – Distemper – Varnishes – Lacquers - Pigments – name and formula of different coloured pigments and their uses – Toners – Nano paints						
2. Explosives: classification – characteristics – chemistry of Nitrocellulose – nitroglycerine - gun powder - RDX – mustard gas – phosgene - nerve gas – Screening smokes						
Unit:3						
Polymers and Rubbers			12 hours			
1. Polymers: Preparation, properties and uses of: Poly olefins – Polythene – PTFE – PVC – Polypropylene – Polystyrene						
2. Rubbers: Natural and synthetic rubbers: Constitution of natural rubber – Butyl – Buna-N – Neoprene – Thiocol – Polyurethane – Silicone rubbers						
Unit:4						
Agricultural Chemistry – Fertilizers and Insecticides			12 hours			
1. Fertilizers: Classification of fertilizers- Preparation and uses of Urea, DAP, NPK, SSP, TSP and bio-fertilizers (vermicompost, coircompost, panchakavia) – types and advantages of biofertilizers						
2. Insecticides: Classification of insecticides – Structure and effects of dinitro phenols, DDT, methoxychlor and BHC – comparison of artificial pesticides and bio-pesticide.						

Unit:5	Electrochemisry, Fuel cells and Energy Storage	12 hours
1. Electrochemistry: EMF (Definition) - Daniel cell - Reference electrode - Standard Hydrogen Electrode (SHE) -Saturated Calomel Electrode (SCE). Determination of pH - glass electrodes		
2. Fuel cell and Energy storage: Hydrogen - Oxygen fuel cell – Batteries: Lead-storage battery - Batteries of future:Lithium ion batteries.		
	Total Lecture hours	60 hours
Text Book(s)		
1	Principles of physical chemistry, B.P. Puri, L.R. Sharma and M.S. Phathania, S.Chand & Company	
2	Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons.	
3	Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, S.Chand & Co.	
4	Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication Co. 2014.	
Reference Books		
1	Environmental Chemistry, A.K.De, 6th Edition, New Age International, New Delhi, 2006	
2	A Text Book of Environmental Chemistry and Pollution Control, S.S. Dara–S. Chand Publication 2012.	
3	Chemical Process Industries, R. Norris Shreve and Joseph A.Brink,Jr.,4 th Edition, McGraw Hill, 1977.	
4	History of fertilizer chemistry by T.P. Hignett, SPRINGER ,1985	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc19_cy26/preview	
2	https://nptel.ac.in/courses/126/105/126105014/	
3	https://nptel.ac.in/content/storage2/courses/103107086/module1/lecture1/lecture1.pdf	
4	https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf	
5	https://nptel.ac.in/courses/113105028/	
6	https://www.youtube.com/watch?v=no4vRKvKxcU	
7	https://www.youtube.com/watch?v=5XKpJ24P-KE	
Designed By: Dr. S. P. Rajasingh		

Mapping with Programme Outcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	M	S	S	S
CO2	S	S	S	M	S	M	S
CO3	S	M	S	S	S	S	M
CO4	S	S	S	M	S	M	S
CO5	S	S	M	S	S	S	S

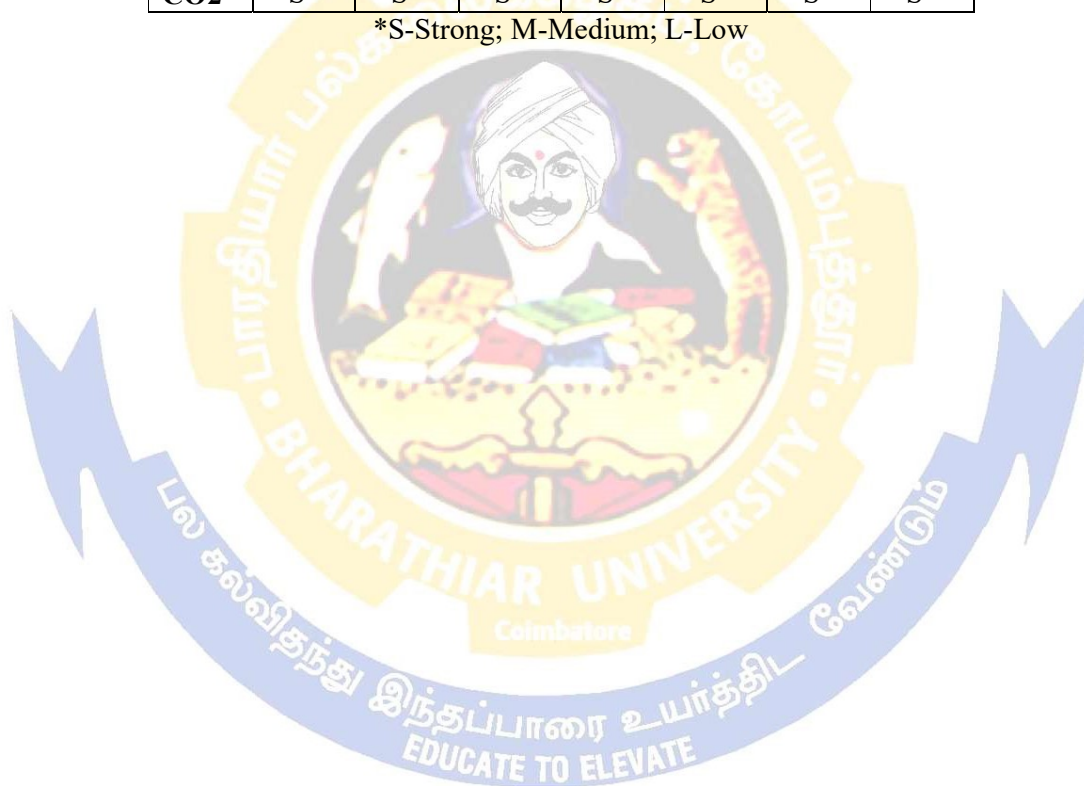
*S-Strong; M-Medium; L-Low

Course code	2PH	Chemistry Practical	L	T	P	C
Allied		Allied Chemistry	-	-	2	3
Pre-requisite		Higher Secondary Level Lab Knowledge	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
1. Inculcate the students how to handle the basic laboratory apparatus and perform tests.						
2. Impart the first-hand knowledge and experience on estimation of an ion, acid and base.						
3. Provide the student knowledge on analysis of an unknown organic substance using Preliminary and confirmation test.						
4. Make the student skilful enough and prepare for a position in an analytical laboratory or a company.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Estimate the amount of ion present in the given solution through volumetric analysis				K1-K6	
2	Find the groups/elements and characters present in the given organic substance through qualitative analysis				K1-K6	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Part I		VOLUMETRIC ANALYSIS			30 hours	
1. Estimation of sodium hydroxide using standard sodium carbonate.						
2. Estimation of hydrochloric acid- standard oxalic acid.						
3. Estimation of oxalic acid- standard sulphuric acid.						
4. Estimation of ferrous sulphate- standard Mohr salt solution.						
5. Estimation of oxalic acid- standard ferrous sulphate.						
Part II		ORGANIC ANALYSIS			30 hours	
Systematic Qualitative Analysis of given Organic Substance and Report on the following						
1. Detection of Elements (N, S, Halogens).						
2. To distinguish between aliphatic and Aromatic.						
3. To distinguish between saturated and unsaturated.						
4. Functional group tests for phenols, acids (mono and di), aromatic primary amine, amide, diamide, carbohydrate, Functional groups characterized by confirmatory test.						
			Total Practical hours		60 hours	
Text Book(s)						
1	Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017					
2	Practical Chemistry, Pandey D.N., sultan chand publishers, 2018					
Reference Books						
1	Vogels Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989					
2	Vogels Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 1989					

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/104/106/104106108/
2	https://www.youtube.com/watch?v=n4esSHxz J8
3	https://www.toppr.com/guides/chemistry/organic-chemistry/qualitative-analysis-of-organic-compounds/
4	https://www.youtube.com/watch?v=7bmQkQW8bbs
5	https://www.youtube.com/watch?v=wRAo-M8xBHM
Designed By: Dr. S. P. Rajasingh	

Mapping with Programme Outcomes							
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low



code	3AR	Allied B-paper I-Basic Mathematics	L	T	P	C
Core/Elective/Supportive		Allied	2	1	-	3
Pre-requisite		Students should have the basic understanding of Algebra, Matrix, Differentiation, and Integration & Central Tendency.	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to:						
4. Students will understand the Binomial Series, Logarithmic Series & Summation of the Series.						
5. Students will understand the types of Matrices, Inverse of the Matrix, Eigen values & Vectors, Simultaneous Linear Equations.						
6. Students will understand about Differentiation & Integration.						
7. Students will gain knowledge about Central Tendency & Correlation						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Student can understand, apply & analyze about binomial, exponential, logarithmic & summation series.				K2,K3,K4	
2	Students can apply the inverse matrix problem in cryptography				K3	
3	Remember & Understand about differentiation				K1, K2	
4	Understand the integration by parts				K2	
5	Students can apply the Central Tendency in real life.				K3	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		Series			16 hours	
Binomial, Exponential and Logarithmic series (Statement only) – Applications to summation of series only.						
Unit:2		Matrix			18 hours	
Quadratic Equation – Matrices – Determinant of a matrix – Inverse of a matrix – Characteristic equation of a matrix – Eigen values – Solutions of simultaneous linear equations in three variables using matrices						
Unit:3		Differentiation			18 hours	
Differentiation of algebraic – Exponential logarithmic and trigonometric functions – physical interpretations of derivatives with reference of velocity and acceleration – Application of differentiation of maxima and minima (simple problems)						
Unit:4		Integration			18 hours	
Partial differentiation (Simple problems) – Integration of simple algebraic, exponential and trigonometric functions – substitution method – Integration by parts						
Unit:5		Central Tendency & Correlation			18 hours	
Measures of central tendency – Mean, Median, Mode - Measures of dispersion – Quartile deviation Mean deviation - Standard deviation - Correlation – Karl pearson's coefficient of correlation – rank correlation.						

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	90 hours
Reference Books		
1	Calculus – Volume I – T.K.Manickavasagam Pillai and others	
2	Calculus – Volume II – T.K.Manickavasagam Pillai and others.	
3	Algebra – T.K. Manickavasagam Pillai and others.	
4	Statistical Methods – S.P.Gupta.	
Related Online Contents Websites		
1	https://youtu.be/1plMO7ChXMU	
2	https://youtu.be/MSTSBW8LPRM	
3	https://youtu.be/XrGM0OANzaE	
4	https://youtu.be/mOlgbB_BmF2s	
Course Designed By: Mrs R.Gokilamani		

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	M	S	S	M	S	S
CO3	M	S	S	S	M	S	S	M	S	S
CO3	M	S	S	S	M	S	S	M	S	S
CO4	M	S	S	S	M	S	S	M	S	S
CO5	M	S	S	S	M	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Code	4AR	Allied B-paper II-COMPUTER	L	T	P	C
Core/Elective/Supportive		Allied	2	1	-	3
Pre-requisite		Basic Knowledge in computer	Syllabus Version		2021-2022	
Course Objectives:						
The main objectives of this course are to: 1. To inculcate knowledge on C concepts. This subject seeks to introduce students to philosophy, culture and visual art. It discusses the interrelatedness of key philosophical, cultural and artistic ideas and encourages a scholarly way of thinking.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Students will be able to understand about the Characteristics of Computers, Flowcharts and Algorithms				K2,K3,K4	
2	Students will be able to understand C Programming Language, variables, expressions and operators				K3	
3	Students will be able to understand about Input, Output function and conditional and Compound Statements				K1, K2	
4	Students will be able to understand about Arrays				K2	
5	Students will be able to understand about Functions and Strings				K3	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
Unit:1		Computer Algorithms:	10 hours			
Algorithms – Characteristics of computers - An illustrative computer algorithm. Developing Algorithms: Flowcharts - A simple model of a computer flowcharting examples						
Unit:2		Programming Preliminaries	12 hours			
: High level languages - C Language - Description of Programming languages - Structure of C programming language – constants - scalar variables – declaring Variable names - defining constants - Defining variables - Various Expressions and operators						
Unit:3		Functions	12 hours			
Input function - Output function – compound and conditional statements - While loop – do.while loop - for loop. Simple Programs using above verbs.						
Unit:4		Arrays	12 hours			
Arrays - Rules for arrays - multiple subscripts in arrays - Multi-dimensional arrays - for loop with arrays - Simple programs						
Unit:5		Logical Operators	12 hours			
. Logical operators and expressions - switch statement - break Statement - continue statement - label - goto statement. Functions - defining function - using function - rules - arrays in functions- Character data type - manipulation of strings						

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars - webinars		
	Total Lecture hours	60 hours
Reference Books		
1	COMPUTER ROGRAMMING IN C : V.Rajaraman (PHI Publication)	
2	PROGRAMMING IN ANSI C : E.Balagurusamy (Tata McGraw Hill Pub.)	
3	PROGRAMMING IN ANSI C : Ashok N.Kamthane (Pearson Education)	
Related Online Contents [MOOC, SWAYAM, Websites]		
1	https://nptel.ac.in/courses/106/104/106104128/	
2	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-cs91/	
3	https://nptel.ac.in/courses/106/106/106106210/	
Course Designed By: Dr.G.Sathyavathy		

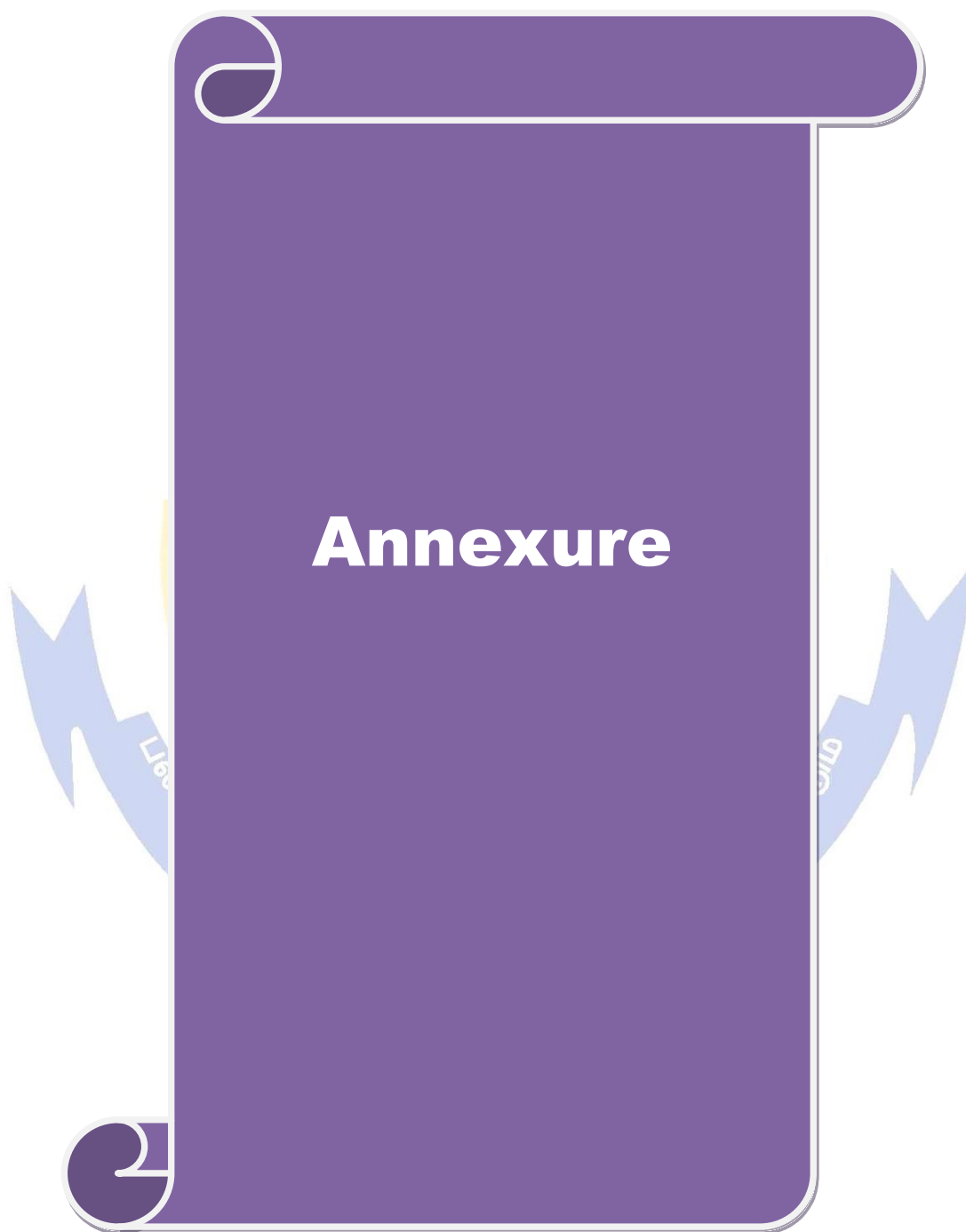
Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	M	S	S	S	S	S
CO3	M	S	S	S	M	S	S	S	S	S
CO3	M	S	S	S	M	S	S	S	S	S
CO4	M	S	S	S	M	S	S	S	S	S
CO5	M	S	S	S	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Code	43Q	Allied B- Computer Practical	L	T	P	C
Core/Elective/Supportive	Allied		-	-	2	2
Pre-requisite	Basic computer knowledge	Syllabus Version	2021-2022			
Course Objectives:						
The main objectives of this course are to:						
1. To develop students computing skills in the area of C programming						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Students will be able to do programs using Conditional Statements				K2,K3	
2	Students will be able to do programs using relational operators				K4	
3	Students will be able to do programs using Functions				K3	
4	Students will be able to do programs using Strings				K1,K2	
5	Students will be able to do programs using Arrays				K2,K3	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
LIST OF PROGRAMMES						
						28
1. Write a C program to find the largest among the three given numbers.						
2. Write a C program to print the given FIVE digit number in reverse order.						
3. Write a C program to print first 50 terms of Fibonacci sequence.						
4. Write a C program to find the smallest number in the given set of N numbers						
5. Write a C program to find the given word is palindrome or not						
6. Write a C program to count the number of positive , negative and zero integers from the set of N numbers.						
7. Write a C program to sort the given set of N numbers in ascending order.						
8. Write a C program to find the addition and subtraction of the given two square matrices						
9. Write a C program to find the multiplication of the given two square Matrices.						
10. Write a C program to count the number of words and number of characters in a sentence						
Contemporary Issues						2 hours
Expert lectures, online seminars - webinars						
Total Lecture hours						30 hours
Reference Books						
1	COMPUTER ROGRAMMING IN C : V.Rajaraman (PHI Publication)					
2	PROGRAMMING IN ANSI C : E.Balagurusamy (Tata McGraw Hill Pub.)					
3	PROGRAMMING IN ANSI C : Ashok N.Kamthane (Pearson Education)					
Course Designed By:Dr G.Sathyavathy						

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	S	S	S	M	S
CO3	M	S	S	M	M	S	S	S	M	S
CO3	M	S	S	M	M	S	S	S	M	S
CO4	M	S	S	M	M	S	S	S	M	S
CO5	M	S	S	M	M	S	S	S	M	S

*S-Strong; M-Medium; L-Low



Mission

- Developing broad based knowledge in concepts and principles of biochemistry through a rich collegial atmosphere that will equip our graduates with transferable skills and an awareness of research ethics.
- Moulding and promoting the students to translate our scientific inventions into meaningful applications for better healthcare and economic development of Nation.
- Constantly updating academic, management, and research oriented education in Biochemistry
- To identify and develop intelligent problem solving strategies in local and global issues
- Enhance the Entrepreneurship skills in Biochemistry-related areas and to provide opportunities for career development

