DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(Autonomous)
Reaccredited with "A++"by NAAC
College withPotential forExcellence, Linguistic Minority Institution
Affiliated to University of Madras
Arumbakkam, Chennai – 600 106

DEPARTMENT OF BIOCHEMISTRY

BSc Biochemistry
Program code 11

Choice Based Credit System (CBCS) Outcome Based Education (OBE)

Syllabus effective from 2024-25 Batch onwards

INSTITUTION

VISION

TO IMPART KNOWLEDGE BY ESCALATING TO ACTIVE LEARNING FROM ROTE LEARNING THAT-

Ignites Wisdom

Challenges Status Quo

Strengthens Social Equality

Elevates Human Values and Universal Oneness

Recognizes Indian Tradition and Culture

MISSION

Curriculum that makes student competent to contribute economically and intellectually.

Offer an environment of learning that encourages innovation and excellence.

Promote research and development

Best of facilities with the Best of technology

Provide an environment for all round growth of the student

Quality in every activity undertaken by the student and the faculty

Instilling pride in serving the society and in being the citizen of this country.

DEPARTMENT OF BIOCHEMISTRY

VISION

To be the center for excellence in Biochemistry by/and producing students highly skilled in the latest tools
and technologies and making them to enhance the quality of life. To become a leader in near future in biochemistry by integrating teaching & learning, learning & skills, skills & employability, learning & research and research & service.

MISSION

M1	To provide better understanding of the subject with sound knowledge in theory & practical
M2	To cultivate the ability to apply creativity and independent thinking resulting in bridging the gap between industry and academicsto meet the industrial demands.
M3	To follow a multidisciplinary research strategy by harnessing all the available resources
M4	To apply the biochemical knowledge in solving human life and environment related problems.

PROGRAM EDUCATION OBJECTIVES (PEOs)
UNDER GRADUATE

Our programme will produce graduates who

PEO l	have a strong foundation to pursue higher academic degree of his /her choice.
PEO2	be well informed of the job/career option in healthcare and life sciencebased e-sector jobs.
PEO3	Will exhibit effective communication and will be capable of working in teams.
PEO4	Will adopt ethical attitude towards social challenges and will be responsible towards environmental issues.

PEO to Mission Statement Mapping

MISSION STATEMENTS	PEO1	PEO2	PEO 3	PEO4	PEO5
M1	3	3	3	3	3
M2	3	3	3	3	3
M3	3	3	3	3	3
M4	3	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAM OUTCOMES (PO) IN RELATION TO GRADUATE ATTRIBUTES

PO FOR BSc BIOCHEMISTRY

By the end of the programme, the graduates will be able to	
PO1	To participate in various types of employment, development activities and publicdiscourses particularly in response to the needs of the community one serves
PO2	To understand the need and have the competencies to support local, regional and national development
PO3	To develop critical and analytical thinking
PO4	To develop conceptual understanding , problem solving and application of skills
PO5	To provoke entrepreneurship among the students along with strong ethics and communication skills
PO6	To develop a questioning mind in diverse environments for better outcomes
PO7	To engage in lifelong learning and enduring proficient progress

Mapping of POs TO PEOs

PEO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**	**PO7**
PEO 1	3	3	3	3	3	3	3
PEO 2	3	3	3	3	3	3	3
PEO 3	3	3	3	3	3	3	3
PEO 4	3	3	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

PROGRAM SPECIFIC OUTCOMES (PSO) IN RELATION TO GRADUATE ATTRIBUTES
BSc BIOCHEMISTRY

After successful completion of 3years BSc programme the students will be able to	
PSO1	Become knowledgeable in the field of Biochemistry and apply the principles of the same to the needs of the Employer / Institution
PSO2	Gaining a wide knowledge on role of proteins, carbohydrates, nucleic acids, enzymes in the cell with their clinical importance.
PSO3	Acquiring analytical and hands on skills to perform research in the area of Biochemistry.
PSO4	Students will be able to comprehend the knowledge in the biochemical, analytical, biostatistical , computational areas.
PSO5	Integrating the concepts of Metabolism, Clinical Biochemistry, and Immunology, nutritional to illuminate acquaintance on health and disease.
PSO6	Use library search tools to locate and retrieve scientific information about a technique or topic related to biochemistry Use online data bases and source appropriately to study genetic disease Equipped to record and interpret digital data
PSO7	Identify problems related to environment. Analyze and derive valid conclusions with contemporary knowledge in biochemistry and computers

Mapping of POs TO PSOs (BSc Program)

PSO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
PSO 1	3	3	3	3	3	3	3
PSO 2	2	3	2	3	3	3	1
PSO 3	3	2	3	3	2	2	2
PSO 4	2	2	2	2	1	1	1
PSO 5	3	2	3	3	3	1	3
PSO 6	3	1	3	3	1	3	3
PSO 7	2	3	3	3	2	3	3

3-Strong Correlation2- Medium Correlation 1- Low Correlation

SCHEME OF IBSC BIOCHEMISTRY
SEMESTER I

Part	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours	Marks		
			L	T	P	S			CIA	ESE	Total
Part I	Ability enhancement compulsory skills	Language –I	3	0	0	0	3	4	50	50	100
Part II	Ability enhancement compulsory skills	English –I	3	0	0	0	3	4	50	50	100
Part III	Core Paper I	Nutritional Biochemistry	4	0	0	0	4	6	50	50	100
	AlliedPaper I	Chemistry- I	3	0	0	0	3	6	50	50	100
	Core Practical I	Core Practical I Nutritional Biochemistry	0	0	3	0	3	3	50	50	100
	Allied Practical I	Allied Chemistry Practical –I	0	0	3	0	2	3	50	50	100
Part IV	NME	Basics of Medical Terminologies	2	0	0	0	2	2	50	50	100
	Soft Skills	Soft Skills – I	3	0	0	0	3	2	50	50	100
Total							**23**	**30**	**400**	**400**	**800**

SCHEME OF I B.Sc BIOCHEMISTRY

SEMESTER II

Part	Course Category	Course	Credit Distribution				Overall Credits	Total Contact hours / week	Marks		
			L	T	P	S			CIA	ESE	Total
Part I	Ability enhancement compulsory skills	Language –II	3	0	0	0	3	4	50	50	100
Part II	Ability enhancement compulsory skills	English –II	3	0	0	0	3	4	50	50	100
Part III	Core paper -II	Cell Biology	4	0	0	0	4	6	50	50	100
	Core Practical II	Core practical – II Cell Biology	0	0	3	0	3	3	50	50	100
	Allied Paper II	Chemistry II	3	0	0	0	3	6	50	50	100
	Allied Practical II	Allied Chemistry Practical –II	0	0	2	0	2	3	50	50	100
Part IV	NME II	Prevention and management of lifestyle disorders	2	0	0	0	2	2	50	50	100
	Soft skills	Soft skills II	3	0	0	0	3	2	50	50	100
TOTAL							**23**	**30**	**400**	**400**	**800**

SCHEME OF II B.Sc BIOCHEMISTRY

SEMESTER III

Part	Course category	Course	Credit Distribution				Overall Credits	Total contact hours / week	Marks		
			L	T	P	S			CIA	ESE	Total
Part I	Ability enhancement compulsory skills	LanguageIII	3	0	0	0	3	6	50	50	100
Part II	Ability enhancement compulsory skills	English III	3	0	0	0	3	4	50	50	100
Part III	Core paper III / skill Enhancement	Chemistry of Biomolecules	3	0	1	0	4	6	50	50	100
	Allied –III	Microbiology	3	0	0	0	3	5	50	50	100
	Core Practical III	Core practical III Chemistry of Biomolecules	0	0	3	0	3	3	50	50	100
	Allied- Practical III	Allied Practical III Microbiology	0	0	2	0	2	3	50	50	100
Part -IV	Soft Skills	Soft Skills – III	3	0	0	0	3	2	50	50	100
		EVS					-	1			
Total							**21**	**30**	**350**	**350**	**700**

SCHEME OF II B.SC BIOCHEMISTRY

SEMESTER IV

Sl. NO	Course category	Course	Credits Distribution				Over all credits	Total Contact Hours/ week	Marks		
			L	T	P	S			CIA	ESE	Total
Part I	Ability enhancement compulsory skills	Language –IV	3	0	0	0	3	6	50	50	100
Part II	Ability enhancement compulsory skills	English –IV	3	0	0	0	3	4	50	50	100
Part III	Core paper -IV/ Skill Enhancement	Biochemical Techniques	4	0	0	0	4	6	50	50	100
	Core Practical IV	Core practical –IV Biochemical Techniques	0	0	3	0	3	3	50	50	100
	Allied-IV	Biostatistics and Computer applications	3	0	0	0	3	5	50	50	100
	Allied-Practical IV	Allied Practical IV - Biostatistics and Computer applications	0	0	2	0	2	3	50	50	100
Part IV		Soft skill II	3	0	0	0	3	2	50	50	100
		EVS	2	0	0	0	2	1	50	50	100
		Internship/ Field work					-	-	-	-	-
TOTAL							**23**	**30**	**400**	**400**	**800**

NOTE: Internship /fieldwork is offered in summer vacations, the credits and mark will be included in the grade sheet of the subsequent semester(V)

SCHEME OF III B.SCBIOCHEMISTRY

SEMESTER V

Part	Course category	Course	Credit Distribution				Overall Credits	Total Contact hours / week	Marks		
			L	T	P	S			CIA	ESE	Total
Part III	Core paper -V	Enzymes	4	0	0	0	4	5	50	50	100
	Core paper-VI	Intermediary Metabolism	3	1	0	0	4	5	50	50	100
	Core paper VII	Human Physiology	4	0	0	0	4	5	50	50	100
	Core paper-VIII/ skill Enhancement	Molecular Biology	3	1	0	0	4	5	50	50	100
	Open Elective paper-I	Therapeutic nutrition	4	1	0	0	5	5	50	50	100
	Core Practical V	Core Practical V- Enzymology Molecular biology and Physiology	0	0	3	0	3	5	50	50	100
	Internship						1	-	-	-	-
Part IV	Value Education						2		50	50	100
TOTAL							**27**	**30**	**350**	**350**	**700**

SCHEME OF III B.SC., BIOCHEMISTRY

VI SEMESTER

	Course category	Course	Credit Distribution				Overall Credits	Total Contact Hours/ Week	Marks		
			L	T	P	S			CIE	ESE	Total
Part III	Core paper-IX	Research Methodology	3	0	1	0	4	5	50	50	100
	Core paper-X	Clinical Biochemistry	4	0	0	0	4	5	50	50	100
	Elective paper-IIA/B/C	A)Principles of Biotechnology B)Immunology C) Basics of Medical Laboratory Technology	5	0	0	0	5	5	50	50	100
	Elective paper-IIIA/B/C	A)Food standard and quality control A) Phytomedicine B) Bioinformatics	4	1	0	0	5	5	50	50	100
	Core PracticalVI	Core Practical – VI-Clinical Biochemistry	0	0	3	0	3	5	50	50	100
	Core Project	Project Viva voce-Dissertation	0	0	2	0	2	5	50	50	100
Part V		Extension activity					1				
TOTAL							**24**	**30**	**300**	**300**	**600**

TOTAL NO OF CREDITS -BSc Biochemistry

Part	Title	No of Subjects x No of credits	Total Credits
I	Language	4X3	12
II	English	4X3	12
III	Core Paper	10x 4	60
	Core Practical	6X 3	
	Core Project	1X2	
	Allied Paper	4 x 3	20
	Allied Practical	4 x 2	
	Electives	3X5	15
IV	BASIC/ADVANCED TAMIL/NME	2 X2	04
	Soft Skill	4X3	12
	Environmental studies	1X2	02
	Value education	1X2	02
	Internship/Field work(2 weeks)	1X1	01
V	Extension Activity	1 x1	01
	Total	**141**	

Extra Credits- Value added courses – 2 Credits / 30 hours

I BSc Biochemistry
FIRST SEMESTER

Course Title: NUTRITIONAL BIOCHEMISTRY (CORE PAPER –I)

Course code	**2411101**	**Credits**	**04**
L:T:P:S	**4:0:1:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO Statement
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.
CO3	Exposure to the nature and biomedical significance of vitamins and minerals present in food
CO4	Analyzing the biological importance of major and minor trace elements (Minerals) in the food
CO5	Understanding the correlation between importance of nutrients and life style disorders viz. diabetes mellitus, renal failure and cardiovascular diseases. Apply knowledge of the role of nutrition and healthy diet for disease prevention.

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	1	3	3	3	3
CO2	3	3	1	3	3	3	3
CO3	3	3	2	2	3	3	3
CO4	3	3	2	2	3	3	3
CO5	3	3	1	3	3	3	3

Correlations : 3 Strong 2 Medium 1 Low

S.No	Content of Module	Hrs	COs
MO1	Definition of Nutrition. Basic food groups - Energy yielding, Body building and protective foods. Basic concepts of energy expenditure, Unit of energy, BMR-Factors affecting BMR, Measurements of energy food Stuffs by bomb calorimeter. Calorific value of proteins, carbohydrates and fats, RQ of foods. SDA.	**12**	**CO1**
MO2	**N**utritional aspects of carbohydrates. Significance of fiber in the diet; Nutritional Aspects of proteins - Dietary sources, RDA, Physiological role; significance of essential amino acids, Protein energy malnutrition in children; Nutritional Aspects of lipids – Dietary sources, RDA, Physiological role; significance of essential fatty acids, MUFAs, and PUFAs.	**13**	**CO2**
MO3	Vitamins- Classification. function, RDA dietary source & deficiency diseases of water soluble vitamins Vit B1, B2, B5,B6, B9 and B12 and Fat soluble vitamins – A, D, E& K	**17**	**CO3**
MO4	Minerals- Dietary source, RDA, function & deficiency symptoms of Calcium, Phosphorus, Iron, Iodine, Sodium, Chlorine and Potassium-Supplementation of calcium, Iron rich foods	**18**	**CO4**
MO5	Diabetes mellitus-Definition. Symptoms and types. Dietary management for Diabetes Mellitus.Renal failure- Definition, Causes and types (acute & chronic). Dietary management for renal failure patients	**15**	**CO5**

RECOMMENDED BOOKS

1. Sharma, D. S. (2017). *Nutritional Biochemistry.*CBS Publishers and distributors - ISBN 10: 8123925271 / ISBN 13: 9788123925271

2. Srilakshmi, B. (2019). *Dietetics* - (Multi Colour Edition ed.). New Age International Publishers - ISBN 10: 9386649209 / ISBN 13: 9789386649201

3. B.Srilakshmi, B. (2017). *Food Science* (Multi Colour Edition ed.). New Age International Publishers - ISBN 10: 8122438091 / ISBN 13: 9788122438093

REFERENCE BOOKS

1. Sathyanarayana. (2017). *Biochemistry.* Elsevier - ISBN: 9788131236017

2. Swaminathan. (2005). *Advanced Textbooks of food and Nutrition.* BAPP CO PRESS.

3. Krause's. (2013). *Food, Nutrition, & Diet Therapy* (11th ed.). W.B. Saunders - ISBN-10 : 0721697844, ISBN-13 : 978-0721697840

FIRST SEMESTER

Course Title: ALLIED CHEMISTRY-I

Course code: 2411102	**Credits :03**
L:T:P:S : 3:0:0:0	**CIA : 50marks**
Examhours: 03	**ESE: 50Marks**

On the successful completion of the course, student will be able to:

Course Number	CO statement
CO 1	Know the discovery of electron, proton and neutron To have a basic idea about nuclear Chemistry and its applications, nuclear reactions and radioactivity and their medical importance(isotopes).
CO2	Apply the fundamental principles of measurement, matter. To study theories of chemical kinetics, and to describe a reaction rateintermsofachangeinconcentrationdividedbyachangeintime(atconstantvolume) and a general form of a(differential) rate law
CO3	To make students capable of understanding and studying organic reactions and electron displacements. Able to predict the geometry of coordination compounds and type of hybridization.
CO4	Recognize the basic terms of thermodynamic terms. Able topredicttheenergychange inheatcapacitiesatconstantvolume andpressure and their relationship. Understand theories of electrochemical cell reactions,and also learn about chemical and physical equilibrium of the electrolytes. To study the various types of cells and functionalities.
CO5	To have basic idea about type of solutions and its fundamental concentration units. To have basic idea about type colloids and different types dispersed phase dispersed medium.

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	1	2	1	3	3
CO2	3	2	3	1	2	2	3
CO3	3	3	1	2	1	3	3
CO4	3	3	3	1	2	1	3
CO5	3	2	3	3	1	2	3

Correlations : 3 Strong 2 Medium 1 Low

S.No	Content of Module	Hrs	Cos
MO1	Fundamental particles of nucleus, isobars, isotopes, isotones, Differences between chemical and nuclear reactions. Artificial radioactivity (definition only) Application of radio isotopes–Radioactive tracers carbon dating and medical applications. Atom-fundamental particles present in atom-electron , proton and neutron-Arrangement of electrons in an atom-Bohr-Bury rule	**14**	**CO1**
MO2	Matter characteristics-Mass, volume, (definitions only). States of matter solid, liquid and gases(only).Inter molecular forces-definition of Vanderwaal's force, dispersion forces, Hydrogen bonding ,dipole-dipole, dipole induced dipole forces. Rate of chemical reaction–average and instantaneous rate(definitions only), factors affecting rate of reactions order and molecularity (definitions only)–integrated rate expression for first, second and Zero order reactions(no derivation)Half-life period– Activation energy. Arrhenius equation. Arrhenius theory	**15**	**CO2**
MO3	Electronic displacement effects: Inductive, resonance and steric effects (Definitions only). Nucleophiles, Electrophiles. Homolytic and Heterolytic bond dissociations (Definitions only).Werner Theory of co-ordination compounds terminologies-,Complex, Ligand and its types, coordination sphere, charge of the complex, chelation, Nomenclature, Homoleptic and heteroleptic complex. Applications of co-ordination of compounds	**16**	**CO3**
MO4	Introduction-System and its types, surrounding, Basic concepts- Work, energy, heat, Intensive and extensive properties. Exothermic and endothermic process. First law of Thermodynamics (definition only)-internal energy, Enthalpy, Entropy, heat capacity and specific heat (definition only).	**17**	**CO4**
MO5	Conductor of electricity-Electrolytic, metallic and mixed conductors. Electrochemical cells-Electrolytic cells(definitions only).Galvanic cells – emf–standard electrode potential,half cell reactions,(definitions and examples only)electrochemical series and its applications. Nernst equation, Standard solutions- Normality, molarity, molality-pH, pOH-Henderson Hasselbach equation-Buffers-definition and examples (Acid base buffers). Solutions, suspensions, colloids-definitions only. colloids- types with examplesdispersedphase,dispersionmedium-properties-tyndalleffect , brownian movement, electroosmosis.	**13**	**CO5**

RECOMMENDED BOOKS:

1. Puri, S. P. (2016). *Principles of physical chemistry.* Manav Book Distributers -

2.Puri,S.a.(2017).*PrinciplesofInorganicchemistry*(33rded.).MilestonePublishersand distributors - ISBN-10 :8192143333 / ISBN-13 :978-8192143330

3.JamesE.Huheey,E.A.(2014).*Inorganic chemistry ,principles of structure and reactivity* (14thed.).DorlingKinersleyindiapvtLtd-ISBN-10:006042995X/ISBN-13:978-0060429959

4.ClausBorgnakke(Author),R.E.(2008).*Mentals of Thermodynamics* (7thed.).Wiley India Edition- ISBN-10 : 9788126521524 /ISBN-13 : 978-8126521524

REFERENCE BOOKS

1. Soni, P. L. (2013). *Fundamentals of Organic Chemistry.* Sultan Chand and sons-

2.Bahl,A.a.(2018).*A Textbook of Organic chemistry*(22nded.).Sultan Chand and sons-ISBN : 9789352837304

FIRST SEMESTER

Course Title: BASICS OF MEDICAL TERMINOLOGIESNON MAJOR ELECTIVE -1

Course code	**2411103**	**Credits**	**02**
L:T:P:S	**2:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO Statement
CO1	Define Medical Terminologies
CO2	Compare Different Human Diseases
CO3	Apply Medical Terms in Health Sectors or Medical Reports
CO4	Analyze The Functions of Different Parts of Human body
CO5	Interpret Normal Values of Metabolic Parameters

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2	1	1	2
CO2	3	3	3	2	1	1	2
CO3	3	3	3	2	1	1	2
CO4	3	3	3	2	1	1	2
CO5	3	3	3	2	1	1	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No.	Content of Module	Hrs	Cos
MO1	Parts of the human body- Head, neck, thorax, abdomen, pelvis, upper limbs and lower limbs. Important internal organs, glands, bones, nerves and muscles present in part. Head-eyes, ears, nose, mouth, sinuses, brain, cranial bones.	**15**	**CO1**
MO2	Human diseases- definition of terms, sings, symptoms, autopsy, biopsy,- artery, vein, nerve, muscle- medial, lateral, superior, inferior , dorsal, ventral, anterior, posterior-tissue, organ, ulcer, cirrhosis, necrosis, cancer , ischemia, angina pectoris, coma, anemia, edemia pus,, lymph, lymphoma, acidity, pyrexia, myopia, hypermetropia, hypoxia, cyanosis.	**15** ,	**CO2**
MO3	Medical terms- (Definition only) Metabolic diseases- diabetes mellitus, Diabetes insipidus, Kernicterus, Hypertension. Endocrine disorders- hyper and hypo secretions of thyroid, pituitary, reproductive hormones. Neurological disorders- Alzhemiers disease, schizophrenia, Parkinsons, paralysis, migraine, Respiratory disorders-asthma, wheezing, tuberculosis- problems due to smoking, pneumonia. Skin –Leucoderma, psoriasis, spontaneous burning syndrome, complications in pregnancy, abortion, miscarriage.	**15**	**CO3,CO5**
MO4	Medical reports- definitions of normality, molarity, molality, osmoles, equivalents, milliequivalents, concept of positive and negative tests, examples for g/mol, mEq/mol, mg/dL, mg/mol –normal range for selected blood parameters- glucose, bilirubin, creatinine, cholesterol, triglycerides, hemoglobin, CRP, urea. Types of samples- whole blood, plasma, serum, urine, CSF, lymph, sweat, gastric juice, sputum, stools (faeces).Route of administration of drugs – oral, intravenous,subcutaneous, intraperitoneal, nasal, intramuscular.	**15**	**CO4, CO5**
MO5	Areas of application of medical terminologies- basic knowledge of medical coding, medical transcription, medical billing, insurance sectors, lab technicians, diagnostic labs.	**15**	**CO5**

RECOMMENDED BOOKS:

1.ChatterjeeRanashinde. (2012). *Medical Biochemistry.* Jaypee - ISBN : 9789350254844
2.Jayaraman, J. (2011). *Laboratory Manual in Biochemistry.* New Age International Pvt Ltd Publishers - ISBN-10 : 812243049X, ISBN-13 : 978-8122430493
3.Kaplan. (2010). *Clinical Biochemistry* (6th ed.). Mosby - ISBN-10 : 1464137846, ISBN-13 : 978-1464137846

REFERENCE BOOKS

1.ChatterjeeRanashinde. (2012). *Medical Biochemistry.* Jaypee - ISBN : 9789350254844
2.V.H., T. (2019). *Handbook Medical Laboratory Technology* (2nd ed.). CBS publishers and distribution - ISBN-10 : 8123906773 / ISBN-13 : 978-8123906775
3.Tietz. (2018). *Clinical Biochemistry* (8th ed.). Saunders.

FIRST SEMESTER

Course Title: CORE PRACTICAL-1NUTRITIONAL BIOCHEMISTRY

Course code	**2411104**	**Credits**	**03**
L:T:P:S	**0:0:3:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Quantify glycine by Sorenson formal titration
CO2	Quantify glucose in jaggery by Benedicts method
CO3	Quantify ascorbic acid in lemon by Dichlorophenol Indo phenol dye method, Know the methodology of extraction of lipids from seeds
CO4	Understand the principle of colorimeter and estimate the amount of carbohydrate and phosphorus by Colorimetery
CO5	Understand the importance of minerals and estimate the amount of minerals like calcium and chlorine

MAPPING OF CO vs PSO

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	**2**	2	2	2	1	1	1
CO2	**2**	2	2	2	1	1	1
CO3	**2**	2	3	2	1	1	1
CO4	**2**	2	2	2	1	1	2
CO5	**2**	2	2	2	1	1	2

S.No.	Content of Module	Hrs	Cos
MO1	Estimation of Glycine by Sorenson formal titration.	45	CO1
MO2	Determination of reducing sugars, total sugars in jaggery/honey by Benedicts method.		CO2
MO3	Estimation of ascorbic acid using 2, 6 – dichlorophenol indophenol as link solution, present in lemon		CO3
MO4	Extraction of lipids from oil seeds		
MO5	Colorimetric estimation of carbohydrate by anthrone method in food sample		
MO6	Colorimetric estimation of inorganic Phosphorus by Fiske Subbarow method in water sample.		CO4
MO7	Estimation of Calcium in milk		
MO8	Estimation of Chloride by Mohr's method		
	DEMONSTRATION EXPERIMENT		
MO9	Determination of ash and moisture content in food sample		CO5

RECOMMENDED BOOKS:

1.Jayaraman, J. (2011). *Laboratory Manual in Biochemistry.* New Age International Pvt Ltd Publishers - ISBN-10 : 812243049X, ISBN-13 : 978-8122430493

2.H.Saegal, I. (1991). *Biochemical calculations.* Liss, Newyork -

3.Singh, S. K. (2005). *Introductory Practical Biochemistry* (2nd ed.). Alpha Science International, Ltd - ISBN 10: 8173193029 / ISBN 13: 9788173193026

SEMESTER – I

Course Title: ALLIED PRACTICAL-1 (CHEMISTRY)

Course code	2411105	Credits	02
L:T:P:S	0:0:3:0	CIA Marks	50
Exam Hours	03	ESE Marks	50

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals.
CO2	Identify the glassware commonly used in the Chemistry laboratory and know how to properly utilize the glassware (K1)
CO3	Perform qualitative analysis unknown samples and semi micro qualitative analysis of organic compounds functional group identification.
CO4	Recognize the colors and adulterants present in foods and beverages Differentiate the chemical substances as acid, base, oxidizing and reducing agents.
CO5	Classify the food additives and discuss their functions ,Explain the reactions involving the organic compounds and analyse the food products and identify the adulterants.

MAPPING OF CO vs PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	3	2	2	2	2
CO2	3	2	3	2	1	2	2
CO3	3	1	2	1	1	3	3
CO4	2	2	3	3	1	3	3
CO5	3	2	3	3	2	3	3

CORRELATION:3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
	LIST OF EXPERIMENTS. **Organic** Qualitative **Analysis:** a)Identification of acidic, phenolic, basic and neutral organic substances b) Detection of N and S c) Test for aliphatic and aromatic nature of substances. d) Test for saturation and unsaturation. e) Identification of functional groups i) Carboxylic acid (Mono and Dicarboxylic acid) ii) Phenols iii) Aromatic Aldehyde (Benzaldehyde) iv) Ketones v) Carbohydrates (Monosaccharides) vi) Aromatic amines (Aniline) vii) Diamide (Urea) viii) thiourea **ADULTERATION** Exercise 1 : Detection of Metanil Yellow in a Given Food Sample Exercise 2 : Check the Presence of Rhodamine B in the Given Food Sample Exercise 3 : Test the Presence of Sugar in Honey Exercise 4 : Detection of NaHCO3 (Chalk) in Flour Exercise 5 : Check for the Presence of Vanaspati and Rancidity in the Ghee Exercise 6 : Check the Milk for Presence of Proteins, Urea, Sugar and Starch	**45**	**CO1 - CO5**

RECOMMENDED BOOKS:

1.Giri, D. O. (2016). *PRACTICAL CHEMISTRY.* S Chand - ISBN: 9788121908122, 9788121908122

2.Clarke, H. T. (2007). *A hand book of Oraganic: Qualitative and quantitative Analysis - ISBN : 9780713124606, 0713124601*

3.Ramamurthy, N. G. (1998). *Organic chemistry Lab manual* .S.Viswanathan Co. Pvt. Ltd -

SECOND SEMESTER

Course Title: CELL BIOLOGY(CORE PAPER II)

Course code	**2411206**	**Credits**	**04**
L:T:P:S	**4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Identify and explain the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially the organelles
CO2	Demonstrate familiarity with various elements of cytoskeleton
CO3	State the structure, function and composition of cell membrane and communicate the types and mechanism of membrane transport
CO4	Illustrate the phases of cell cycle; in particular mitosis and describe the significance of meiosis in genetic diversity
CO5	Relate the structure and biological role of extracellular matrix and cell - cell junction with physiological processes

Mapping of Course Outcomes to Program SpecificOutcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	1	3	3	3
CO2	3	3	2	1	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	2	2	3	3
CO5	3	3	3	1	3	3	3

Correlations : 3 Strong 2 Medium 1 Low

SNo.	Content of Module	Hrs	Cos
MO1	Architecture of cells- Structural organization of prokaryotic and eukaryotic cells – microbial, plant and animal cells. The ultra structure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions.	**15**	**CO1**
MO2	Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions.	**15**	**CO2**
MO3	Bio membranes- Structural organization of bilipid layer model and basic functions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.	**15**	**CO3**
MO4	Cell cycle- Cell division- mitosis and its significance, meiosis (definitions and overview) ,basic characteristics of cancer cells.	**15**	**CO4**
MO5	Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, gap junction and tight junction.	**15**	**CO5**

RECOMMENDED BOOKS:

1.Arumugam.N. (2019). *Cell biology.* Saras publication (10ed, paperback) -

2.Devasena.T. (2012). *Cell Biology.* Oxford University Press India - ISBN: 9780198075516, 0198075510

3.S.C, R. .. (2008). *Cell Biology.* Newage Publishers - ISBN-10 : 8122416888 / ISBN-13 : 978-8122416886

REFERENCE BOOKS

1.Cooper, G. a. (2013). *The Cell: A Molecular Approach.* Sinauer Associates, Inc - ISBN 10: 0878931066 / ISBN 13: 9780878931064

2.E.M.F., D. R. (2006). *Cell and Molecular Biology.* Lippincott Williams & Wilkins Philadelphia - ISBN : 0781734932 9780781734936

SECOND SEMESTER

Course Title: ALLIED CHEMISTRY-II

Course code:2411207	**Credits :03**
L:T:P:S : 3:0:0:0	**CIA : 50marks**
Exam hours:3	**ESE: 50 Marks**

On the successful completion of the course, student will be able to:

Course outcome	Course outcome statement
CO1	To make students capable of understanding about the organic reaction and hybridization of organic compounds.
CO2	Apply the fundamental principles of water analysis. To study the various types of water purification techniques.
CO3	To understand the industrial application of fuels, fertilizers
CO4	To understand the basic concepts of Photochemistry
CO5	To understand the basic concepts of Plastics and polymers

Mapping of course Outcomes to Program Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	1	2	3	2
CO2	3	3	1	1	1	2	1
CO3	3	3	1	2	2	2	2
CO4	3	1	1	1	1	3	3
CO5	3	3	2	2	1	3	3

S.No	Contents of module	Hrs	CO
MO1	**Fundamentals of organic chemistry** Classification of organic compounds-Hybridization in methane, ethane ethylene, acetylene, benzene-Classification of reagents-electrophiles, nucleophiles and Free radicals- Classification of reactions-addition, substitution, elimination, condensation and polymerization.	**12**	CO1
MO2	**Water Technology** Water quality parameters-Contamination of water by arsenic, lead, fluoride, mercury and their removal. Hardness: Types-Expression-Units. Estimation of hardness of water by EDTA method (calcium and magnesium). Water softening: Zeolite process Demineralization process. Desalination: Reverse osmosis- Electrodialysis.	**18**	C02
MO3	**Industrial Chemistry** Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil as(manufacturing details not required).Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium, nitrate, NPK, fertilizer, superphosphate, triple superphosphate	**16**	**CO3, CO5**
MO4	**Photochemistry** Grothus- Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).	**17**	**CO4**
MO5	Plastics, Polythene, PVC, Bakelite, Polyesters, Resins and their Applications-Natural Rubber-Synthetic rubbers-Vulcanization-Preparation and its Applications- Antipyretics, Analgesics, Anesthetics, Sedatives- *Definition*- Examples and Uses	**12**	**C05**

Recommended Books

1.V.Veeraiyan,TextbookofAncillaryChemistry;Highmountpublishinghouse,Chennai, firstedition,2009.

2.S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications,Karur,2006.

3.Arun Bahl, B.S.Bahl, Advanced Organic Chemistry ;S.Chand and Company, New Delhi, twenty thirdedition,2012.

4. Chakrabarty B.N., Industrial Chemistry, Oxford& IBH Publishing Co.,NewDelhi, 1981.

5. SinghP.P. ,JosephT.M and DhavaleR.G.,CollegeIndustrialChemistry,4thEdition, Himalaya Publishing House, Bombay, 1983.

Reference Books

1.FundamentalConceptsofAppliedChemistry- Jayashree Ghosh,S.Chand & Co Ltd., New Delhi-2010.

2.Applied chemistry - K. Bagavathi Sundari- MJP Publishers (2006).

3.B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenth edition,2014.

4.Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

SEMESTER- II

Course Title: PREVENTION AND MANAGEMENT OF LIFESTYLE DISORDERS(NME)

Course code	**2411208**	**Credits**	**02**
L:T:P:S	**2:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO Statement
CO1	Define Lifestyle and Balanced Diet
CO2	Identify Lifestyle Prone Disorders
CO3	Categorize Communicable and Non-Communicable Disease
CO4	Prioritize Improved Lifestyle
CO5	Develop Healthy Habits. Illustrate the Importance of Nutrition In Prevention and Management of Life Style Prone Disorders

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	3	3	1	1	2
CO2	3	1	3	3	1	1	2
CO3	3	1	3	3	1	1	2
CO4	3	1	3	3	1	1	2
CO5	3	1	3	3	1	1	2

CORRELATION: 3-STRONG 2-MEDIUM 1-LOW

S.No.	Content of Module	Hrs	Cos
MO1	**Lifestyle and balanced diet:** Definition-Biological clock-Routine-Dress, Personal hygiene Food, Exercise, Drink, technology, Balanced diet, Macro and micronutrients, carbohydrates, proteins, fats.Vitamins and minerals, RDA, Sources. Role of non energy yielding foods, water and Importance of Fibre intake.	**15**	**CO1**
MO2	**Lifestyle disorders:** Lack of Physical activity, Incompatible food, irregular food habits, Substance abuse-Alcohol, cigarette smoking, drugs, technology-Computer vision syndrome, mobile vision syndrome.	**15**	**CO2**
MO3	**Physiological psychological and social disorders** **Physiological disorders:** Food poisoning-Signs and symptoms, Vomiting, diarrhea, head ache, stomach ache, dizziness, lethargy, hormonal imbalance, premenstrual syndrome, kidney stones and gall stones. **Psychological disorder**- Memory dysfunction, stress. Depression, mood swings, bipolar disorder, Lack of motivation Accidents, Drowning, suicides, Self medications. **Social disorders:** Avoiding family and friends, Violence, physical assault of weaker section, Hyper tension in Early pregnancy in adolescent girls/ Abortion- Definition-signs, symptoms-preventions. Basic life support- Deaddiction.	**15**	**CO3,CO5**
MO4	**Risk factors Non-communicable diseases and communicable diseases. Non-communicable diseases**- Etiology, Metabolic risk factors, modifiable risk factors, type 2 diabetes, cancer, Heart diseases, Strokes, PCOD, Infertility, Obesity. **Communicable diseases**- AIDS, Tuberculosis, Cholera, typhoid, Jaundice.	**15**	**CO4, CO5**
MO5	**Control and Prevention Treatment** Improved lifestyle, Food habits, Proper sleep, Exercise-Yoga, Swimming,Walking, Outdoor games, Stress management-Meditation, Music, Painting, Propermedication, Nutrigenomics.	**15**	**CO5**

RECOMMENDED BOOKS

1. Sharma, D. S. (2017). *Nutritional Biochemistry.*CBS Publishers and distributors - ISBN 10: 8123925271 / ISBN 13: 9788123925271
2. Srilakshmi, B. (2017). *Dietetics* (Multi Colour Edition ed.). New Age International Publishers - ISBN 10: 8122438091 / ISBN 13: 9788122438093
3. Srilakshmi, B. (2019). *Dietetics* - (Multi Colour Edition ed.). New Age International Publishers - ISBN 10: 9386649209 / ISBN 13: 9789386649201

REFERENCE BOOKS

1. Sathyanarayana. (2017). *Biochemistry.* Elsevier - ISBN: 9788131236017
2. Swaminathan. (2005). *Advanced Textbooks of food and Nutrition.* BAPP CO PRESS.
3. B. Kumar, M. K. (2004). *Guide to prevention of lifestyle diseases b. kumar.* Deep and Deep Publications, --ISBN 10: 8176295183 ISBN 13: 9788176295185

SEMESTER – II
Course Title: CORE PRACTICAL II-CELL BIOLOGY

Course code	**2411209**	**Credits**	**03**
L:T:P:S	**0:1:3:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	Description
CO1	Identify the parts of microscope
CO2	Preparation of Slides &determine the animal and plant cell
CO3	Identify the stages of mitosis & meiosis
CO4	Visualize nucleus and mitochondria by staining methods
CO5	Identify the spotters of cells, organelles stages of cell division

Mapping of COs TO PSOs

CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO6	PSO7
CO1	3	3	3	2	3	2	2
CO2	2	1	2	3	3	1	1
CO3	3	3	3	3	3	1	2
CO4	3	**2**	3	3	3	2	2
CO5	3	3	3	3	3	2	1

CORRELATION: **3- STRONG** **2- MEDIUM** **1- LOW**

S.No	Contents of Modules	Hrs	Cos
MO1	Compound Microscope	45	CO1
MO2	Preparation of Slide		CO2
MO3	Visualization of animal and plant cell by methylene blue		
MO4	Identification of different stages of mitosis in onion root tip		CO3
MO5	Identification of different stages of meiosis in onion bulbs		
MO6	Visualization of nuclear fraction by acetocarmine stain		CO4
MO7	Staining and visualization of mitochondria by Janus green stain		
MO8	**Spotters** a)Nerve,plant & Animal cell b) Mitochondria, Chloroplast, Endoplasmic reticulum, c) Mitosis stages – Prophase, Anaphase, Metaphase, Telophase		CO5

Reference Books:

1.Essential practical handbook of Cell biology, Genetics and Microbiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition2017

2. Cell biology Practical, Dr.Venugupta ISBN 8193651219, Prestige publisher, 1st Jan 2018.

3. Cell and Molecular biology, DeRobertis, 8th edition,1st June, 1987

SEMESTER – II

Course Title: ALLIED PRACTICAL-II (CHEMISTRY)

Course code	2411210	Credits	02
L:T:P:S	0:0:3:0	CIA Marks	50
Exam Hours	03	ESE Marks	50

To impart basic knowledge in estimation of acid- base, various metal ions by volumetric analysis, preparation of simple inorganic compounds

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO STATEMENT
CO1	Estimate the amount of metal ions like Mg, Zinc, Ca present in the solution
CO2	Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals
CO3	Show the preparation of various concentrations of solutions from stock solution.
CO4	Differentiate the chemical substances as acid, base, oxidizing and reducing agents. Assess the choice of indicators according to the pH involved in the titrations
CO5	Explain the volumetric laws and concept of normality, molarity, molality, and equivalent mass. Know about the preparation of simple inorganic compounds

Mapping of COs TO PSOs

CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO6	PSO7
CO1	2	1	3	2	2	2	2
CO2	3	2	3	2	1	2	2
CO3	3	1	2	1	1	3	3
CO4	**2**	**2**	3	3	1	3	3
CO5	2	1	3	2	2	2	2

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No	Contents of Modules	Hrs	COs
	VOLUMETRIC ANALYSIS	45	CO1-CO5
1	Estimation of sodium hydroxide using standard Sodium carbonate.		
2	Estimation of borax using standard Sodium carbonate.		
3	Estimation of HCl using Standard Oxalic Acid		
4	Estimation of Oxalic acid using standard Ferrous ammonium sulphate.		
5	Estimation of total hardness of water*.		
	PERMANGANOMETRY		
6	Estimation of KMnO4 Using Standard NaOH.		
7	Estimation of Ferrous ion using standard Oxalic acid		
	COMPLEXOMETRY		
8	Estimation of Magnesium sulphate using EDTA as link and Zinc sulphate as standard		
	SALT PREPARATION		
9	Preparation of Potash Alum		
10	Preparation of Ferrous Ammonium Sulphate		
11	Preparation of Tetraamine copper(II) Sulfate Monohydrate		

Recommended books:

1.Giri, D. O. (2016). PRACTICAL CHEMISTRY. S Chand - ISBN: 9788121908122, 9788121908122

2.Clarke, H. T. (2007). A hand book of Oraganic: Qualitative and quantitative Analysis -ISBN : 9780713124606, 0713124601

3.Ramamurthy, N. G. (1998). Organic chemistry Lab manual . S.Viswanathan Co. Pvt. Ltd

II BSC BIOCHEMISTRY

THIRD SEMESTER

Course Title: CHEMISTRY OF BIOMOLECULES (CORE PAPER III)

Course code	**2411311**	**Credits**	**04**
L:T:P:S	**3: 0: 1:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the structure, biological importance and physico chemical properties of carbohydrates, from monosaccharides to polysaccharides
CO2	Identify the structure of amino acids, classify proteins and explain their properties
CO3	Relate the structural levels of organization of proteins and describe the forces stabilizing the structure of proteins
CO4	Illustrate the structure of nucleotides, distinguish DNA and RNA and describe the structure of DNA, types of RNA and their biological functions
CO5	Define and classify lipids with examples, explain the properties of fats and describe the structure and biological functions of phospholipids, glycolipids and sterols

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	2	3	3	3	1
CO2	3	3	2	3	3	2	3
CO3	3	3	2	1	3	3	3
CO4	3	3	3	1	3	1	3
CO5	3	3	3	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Carbohydrates: Classification of carbohydrates, stereoisomerism and optical isomerism of sugars, anomeric forms and mutarotation. Occurrence, structure and biological importance of mono, di (Lactose, maltose, sucrose) and polysaccharides (starch, cellulose, glycogen, dextrin, inulin). Physical and chemical properties of carbohydrates reactions (oxidation, reduction, reaction with phenylhydrazine, esterification, etherification).Heteropolysaccharides (Structure not needed).	**20**	**CO1**
MO2	Classification and structure of amino acids. Physical and chemical properties of amino acids. Protein- classification based on solubility and composition, shape, and function. Properties of proteins. Denaturation and renaturation of proteins	**15**	**CO2**
MO3	Determination of amino acid sequence of a polypeptide chain. Protein structure- primary, secondary, (α-helix and β-pleated sheet), tertiary and quaternary structures of proteins (basic concepts). Structure of peptide bonds. Forces stabilizing the secondary, tertiary and quaternary structure of proteins.	**10**	**CO3**
MO4	Structure of purine and pyrimidines, nucleosides and nucleotides. Differences between DNA and RNA, double helical structure of DNA, Types of RNA –m-RNA, t-RNA r- RNA and their biological functions.	**15**	**CO4**
MO5	Definition and classification of lipids- chemical properties of fats- iodine value, saponification value, acid number, rancidity, RM value. Structure and biological functions of Lecithin, Cephalin, Phosphatidyl inositol, Plasmalogen, Sphingomyelin, Cerebrosides Gangliosides. Sterols (Cholesterol only), bile acids and bile salts.	**15**	**CO5**

RECOMMENDED BOOKS

1.J. L. Jain, N. J. (7th ed 2016). *Fundamentals of Biochemistry 7th edition.* S. Chand @ Co.Ltd - ISBN: 9788121924535

2.Sathyanarayana. (2017). *Biochemistry.* Elsevier - ISBN: 9788131236017Company - ISBN 10: 1464126119 / ISBN 13: 9781464126116

REFERENCE BOOKS

1.Rodwell, V. (2018). *Harper's Illustrated Biochemistry.* McGrew. Hill -

2.David.L.Nelson, M. M. (7th ed 2017). *Lehninger principles of Biochemistry* . Freeman. W.H. and Company - ISBN 10: 1464126119 / ISBN 13: 9781464126116

THIRD SEMESTER

Course Title: ALLIED MICROBIOLOGY-1

Course code	**2411312**	**Credits**	**03**
L:T:P:S	**3: 0: 0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to explain the basic structure of bacteria and able to identify the gram positive and negative organisms. To relate the evolutionary relatedness of organisms by phylogenetic tree.
CO2	Graduates acquire skills to handle the microscope, staining procedures, isolate the pure cultures of bacteria by applying the various methods of sterilization
CO3	Able to understand bacterial growth, factors affecting growth, Nutritional requirements of bacteria.
CO4	Analyse and understand the types of microbes in Food microbiology and water microbiology, food spoilage and food preservation techniques used in microbiology
CO5	Predict the importance of microbial fermentation in the production of dairy products, organic acids, antibiotics and alcoholic beverages.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	2	1	2	3	1	1	1
CO2	1	1	1	1	1	1	1
CO3	1	2	2	2	1	1	1
CO4	2	1	1	2	1	1	1
CO5	2	2	1	1	1	2	1

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Microscope-principle , parts of light microscope, history-microbiology. Structural characteristics of Bacteria, fungi (molds and yeasts) and Protozoa- plasmodium, and virus-HIV Structure	**16**	**CO1**
MO2	Basic microbiological techniques-Cleaning of glassware. Sterilization of glassware and media. Streak plate, spread plate and pour plate, enrichment culture, single spore isolation, serial dilution, standard plate count. Staining techniques-simple and differential.	**16**	**CO2**
MO3	Cultivation of bacteria-Nutritional requirements and nutritional types of bacteria, Types of culture media. Physical conditions required for bacterial growth, bacterial growth curve	**15**	**CO3**
MO4	**Food Microbiology.** Food spoilage. Food preservation techniques-asepsis, canning, bottling, smoking, pasteurization, salting, dehydration (hot and cold).Water Microbiology-potable water, sewage water treatment-Primary, secondary and tertiary treatment.	**14**	**CO4**
MO5	**Industrial Microbiology.** Microbes in the production of dairy product-Cheese, Organic acid-citric acid, antibiotic-Penicillin and alcoholic beverages-Beer and wine.	**14**	**CO5**

Recommended books:

1.Michael J. Pelczar I.R.,C. E. (5th ed 2004). Microbiology. Tata McGRAW-Hill, New Delhi-ISBN 10:0070492409 /ISBN 13:9780070492400

2.RM, A. (2014). Principles of microbiology. McGraw Hill Education.

3.Parija. (2012). *Textbookof Microbiology and Immunology, 2/e* .ELSEVIER- ISBN 10: 813124461X /ISBN13:9788131244616

4.Prescott. (2017). *Microbiology* (8th ed.). Mc GrawHill, Boston- ISBN-10 : 1259281590 / ISBN-13 :978-1259281594

SEMESTER – III

Course Title : MAJOR PRACTICAL III- CHEMISTRY OF BIOMOLECULES

Course code	**2411313**	**Credits**	**03**
L:T:P:S	**0: 0: 3:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Qualitatively analyze the carbohydrates and report the type of carbohydrate based on specific tests
CO2	Qualitatively analyze amino acids and report the type of amino acids based on specific tests
CO3	Understand the preparation of starch from potatoes
CO4	Understand the preparation of casein, lactalbumin from milk, albumin from eggs
CO5	Determine the SAP, Iodine and acid number of edible oil

MAPPING OF CO vs PSO

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	**2**	2	2	2	1	1	1
CO2	**2**	2	2	2	1	1	1
CO3	**2**	2	2	2	1	1	1
CO4	**2**	2	2	2	1	1	1
CO5	**2**	2	2	2	1	1	1

CORRELATION:3- STRONG2- MEDIUM1- LOW

S.No	Module content	Hrs	Cos
	I Qualitative analysis of Carbohydrates	45	CO1-CO5
MO1	Qualitative analysis of Glucose		
MO2	Qualitative analysis of Fructose		
MO3	Qualitative analysis of Arabinose		
MO4	Qualitative analysis of Maltose		
MO5	Qualitative analysis of Sucrose		
MO6	Qualitative analysis of Starch		
	I Qualitative analysis of Aminoacids		
MO7	Qualitative analysis of Arginine		
MO8	Qualitative analysis of Cysteine		
MO9	Qualitative analysis of Tryptophan		
MO10	Qualitative analysis of Tyrosine		
MO11	Qualitative analysis of Histidine		
MO12	Qualitative analysis of Proline		
	III Biochemical preparation		
MO13	Preparation of starch from potatoes		
MO14	Preparation of casein from milk		
MO15	Preparation of albumin from eggs		
MO16	Preparation of Lactalbumin from milk		
	IV Demonstration Experiments(Any TWO)		
MO17	Determination of SAP number of an edible oil		
MO18	Determination of Iodine number of an edible oil		
MO19	Determination of Acid number of an edible oil		

REFERENCE BOOKS

1.Jones Evangeline, Manual of Practical Medical Biochemistry, Jaypee Publishers,2011

2.Damodaran Geetha KPractical Biochemistry, Ppaer back-Jaypee Brothers Medical Publishers 2016

3, DM Vasudevan Subir Kumar Doss, Practical textbook of Biochemistry for medical students,Jaypee Brothers Medical Publishers2020

4.Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees,A Practical book on Biochemistry,Everest publishing house,1st edition,2019

SEMESTER III

Course Title: ALLIED PRACTICAL-III-MICROBIOLOGY

Outcomes: At the end of the Course, the Student will be able to:

Course Code : 2311314	**Credits : 02**
L:T:P:S : 0:0:2:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	By the end of this course, students will be able to demonstrate the practical skills in handling microscope and staining procedures.
CO2	Graduates acquire knowledge in sterilization techniques and be able to perform routine culture handling tasks safely and effectively.
CO3	Students will be able to know various Culture medias used in isolating Pure culture of bacteria, perform in pathological samples.
CO4	Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.
CO5	It provides the knowledge of antibiotic sensitivity and various biochemical characterizations of bacteria.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	2	1	2	3	1	1	1
CO2	1	1	1	1	1	1	1
CO3	1	2	2	2	1	1	1
CO4	2	1	1	2	1	1	1
CO5	2	2	1	1	1	2	1

Correlations : 3 Strong 2 Medium 1 low

S.No.	Content of Module	Hrs	Co
1.	Principles of Microscope-Light, compound microscope	3	CO1 CO2 CO3 CO4 CO5
2.	Preparation of Agar slants	3	
3.	Preparation of Bacterial smear.	3	
4.	Streak plate, Pour plate and Spread Plate Culture techniques	3	
5.	Staining Techniques: i) Simple Staining ii)Differential Staining	6	
6.	Hanging drop method for testing the motility of bacteria.	3	
7.	Determination of quality of milk by Methylene blue reductase Test (MBRT).	3	
8.	Biochemical Characterization- i)Test for Catalase ii) Test for Caseinase	3	
9.	Antibiotic sensitivity test	3	
10.	Enumeration of bacteria from water	3	
11.	SPOTTERS Inoculation loop Petriplate Incubator Autoclave Microscope Slant Spread plate Streak Plate L rod Spreader Petriplate carrier Penicillin Rhizopus Mucor Aspergillus	3	

REFERENCE BOOKS

1.Panicker.J, A. R. (1986). textbook of microbiology. Orient Longmans - ISBN 10: 9386235250 / ISBN 13: 9789386235251

2.pandey, v. k. (2019). Lab practical micro-biology Notion Press 2019. Notion Press

3.Dr.RC.Dubey. (2010). Practical Microbiology. S.Chand Publishers - ISBN : 9788121926201.

4. Parija, S. C. (2007). Textbook Of Practical Microbiology (2007 ed.). Ahuja Publishing House -

5. Welsh, J. G. (2017). Microbiology: A Laboratory Manual (11th ed.). Pearson Publishers - ISBN-13: 9780134298597

6. Green, E. G. (2015). Practical Handbook of Microbiology (3rd ed.). CRC Press Taylor & Francis Group - ISBN 10: 1466587393 / ISBN 13: 9781466587397

FOURTH SEMESTER
Course Title: BIOCHEMICAL TECHNIQUES (CORE PAPER IV)

Course code	**2411415**	**Credits**	**04**
L:T:P:S	**4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	A practical knowledge on the separation of biological sample by centrifugation Separation of subcellular organelles by differential centrifugation
CO2	To learn various techniques of product purification and design purification strategy based on product characterized and cost effectiveness Obtaining analytical skills to separate samples (amino acids) using paper chromatography. Detection of sugars using thin layer chromatography .Separation and purification of proteins using affinity chromatography
CO3	Know the structure of atoms and molecules. The larger the number of wavelengths emitted by these system makes it possible to investigate their structure in detail including electronic configuration of ground and various excited state and also biochemical assay of macromolecules Advanced knowled.ge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy Analyze and interpret spectroscopic data collected by the methods Assay of biomolecules using UV spectroscopy
CO4	The students will be able to demonstrate the methodology involved in separation of proteins, Nucleic acid by various electrophoretic techniques.
CO5	Acquire knowledge on atomic structure. Radiation, types of radioactive decay, Detection and measurement of radioactivity using GM counter and Scintillation counter. Biological hazards of radiation and safety measures in handling radio isotopes.

Mapping of Course Outcomes to Program Specific Outcomes:

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	2	2	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	1
CO4	3	3	3	3	3	2	2
CO5	3	2	2	2	3	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	COs
MO1	**CENTRIFUGATION** Basic principles of centrifugation, RCF, Types of Rotors, Principle, procedure and applications of differential and density gradient centrifugation, Preparative and analytical ultracentrifugation Determination of Molecular weight (Derivation excluded).	**15**	**CO1**
MO2	**CHROMATOGRAPHY:** Principles of chromatography, Paper chromatography, Thin layer chromatography, Ion exchange, Affinity chromatography Gel permeation chromatography, HPLC and GLC	**15**	**CO2**
MO3	**PRINCIPLES OF SPECTROSCOPY**, Basic principles of electromagnetic radiation energy, wavelength, wavenumber and frequency- absorption and emission spectra, - Beer- Lambert law, Light absorption and transmittance. UV and Visible spectrophotometry, Principle, Instrumentation, and applications on enzyme assays and kinetic assays, Protein structural studies. Applications of MALDI and NMR.	**15**	**CO3**
MO4	**ELECTROPHORETIC TECHNIQUES:** Definition, Factors affecting electrophoresis – Principle, procedure and applications of Paper, Cellulose acetate/Nitrate, Agarose gel electrophoresis, SDS PAGE and Its applications.	**15**	**CO4**
MO5	**RADIOACTIVITY** Atomic structure, radiation, types of radioactive decay, half-life, units of radio activity. Detection and measurement of radioactivity - methods based upon ionization (GM counter), methods based upon excitation (Scintillation counter). Autoradiography and isotope dilution techniques. Applications of radioisotopes in the elucidation of metabolic pathways, clinical scanning and radio dating. Biological hazards of radiation and safety measures in handling radio isotopes.	**15**	**CO5**

RECOMMENDED BOOKS:

1.Anand, C. (2014). *Instrumental methods of Analysis.* Himalaya Publishing house - ISBN : 978-93-5142-088-0

2.Wilson/Walker. (2018). *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology.* Cambridge University Press - ISBN: 9781316677056

3.Dr. AvinashUpadhyay, D. K. (2016). *Biophysical Chemistry.* Himalaya Publishing house - ISBN-10 : 8184888074 / ISBN-13 : 978-8184888072

REFERENCE BOOKS

1.Dua, S. (2010). *Biochemical Methods of Analysis: Theory and Applications.* Narosa - ISBN-10 : 1842655906 / ISBN-13 : 978-1842655900

2.Bernard J.White, J. F. (2015). *Biochemical Techniques - Theory And Practice.* CBS Publishers & Distributors.

3.Basha, M. (2020). *Analytical Techniques in Biochemistry.* Humana Press - ISBN : 978-1-0716-0134-1

FOURTH SEMESTER

Course Title: ALLIED IV- BIOSTATISTICS AND COMPUTER APPLICATIONS

Course code	**2411416**	**Credits**	**03**
L:T:P:S	**4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcome: At the end of the course, the student will be able to

CO number	**CO statement**
CO1	Recognize the definition of biostatistics and its scope and ascertain the methods of data collection and presentation
CO2	Examine the usage of statistical tools like measure of central tendency, measureof dispersion and infer the results of skewness, kurtosis,
CO3	Evaluate the concept of hypothesis testing and deduce test, and chi square test to make statistical decision
CO4	Enumerate the basics of computers architecture and storage devices
CO5	Explain the basics of working with MS-word, excel and power point

Mapping of Course Outcomes to Program Specific Outcomes:

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	1	1	3	2	3	3	3
CO2	1	1	3	2	3	3	3
CO3	1	1	3	2	3	3	3
CO4	1	1	3	2	3	2	3
CO5	1	1	2	2	2	2	2

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	COs
MO1	**Introduction to Biostatistics:** Function and scope. Statistical enquiry. Sampling Methods of collection of primary and secondary data. Classification and tabulation. Graphical representation-histogram and ogive. Diagrammatic representation-bar diagram and pie diagram.	**15**	**CO1**
MO2	**Statistical Measures**: Individual discrete and continuous series Measure of central tendency-mean median and mode. Measure of variation-range. Quartile deviation and standard deviation. Skewness and kurtosis.	**15**	**CO2**
MO3	Hypothesis testing for the mean: Steps involved. Null and alternate hypothesis. Level of significance Type l and Type ll errors. Student's t test, Chi square test.	**15**	**CO3**
MO4	Components of Computer-input devices. Output devices. CPU. Memory unit and operating system. Types of computer and its applications. List of low level and high level languages. Function and types of computer network.	**15**	**CO4**
MO5	MS office and Internet: Microsoft Word-features, creating, editing saving and printing a document, Microsoft Excel-features, components of an excel workbook data entry and saving a new workbook Mathematical and statistical functions Creating and working with basic charts. Microsoft PowerPoint-Adding slides. chart picture textbox to a presentation. Duplicating and deleting slides. Adding animation to a presentation and making slideshow. Internet ,search Engines, electronic mail.	**15**	**CO5**

Recommended Books

1. Mohammad AmjadManaullahAbid. (2019). Fundamentals of Computers. (1st Ed.)DreamtechPress,ISBN-978-93-89520-39-2

2.S.P.Gupta(2019),Biostatisticalmethods(1stEd.)SultanChandandSons,ISBN93-5161-112-7

3.VeerBalaRastogi(2018).Biostatistics.MedtechPublisher,ISBN:9789384007591, 9384007595

Reference Books

1. Jerrold H. Zar (2014), Biostatistical Analysis (5th Ed), New Delhi: Pearson Education

2.PritiSinhaPradeepK.Sinha(2018).ComputerFundamentals(6thEd.)BPBPublications; Reprint Edition, ISBN: 9788176567527

WEBLINKS:

1.https://testbook.com/learn/maths-mean-median-mode/

2.https://web.cortland.edu/andersmd/STATS/corr.html

II BSC Biochemistry
SEMESTER – IV

Course title: CORE PRACTICAL IV-BIOCHEMICAL TECHNIQUES

Course code	**2411417**	**Credits**	**03**
L:T:P:S	**0: 0: 3:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

Co number	**CO statement**
CO1	Assess the absorption spectrum of proteins and nucleic acids using UV Spectroscopy
CO2	Evaluate the pH of biological samples using glass electrode
CO3	Learn the estimation of phosphorus and amino acids using colorimetric method
CO4	Gain expertise in basic separation technique like paper chromatography, thin layer chromatography and column chromatography for detection of amino acids, sugars, lipids and plant pigments
CO5	Demonstrate the principle and working of SDS PAGE and Spectrofluorimetry

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	1	2	3	3	2	1	1
CO2	1	1	3	3	1	1	1
CO3	1	2	3	3	1	1	1
CO4	1	1	3	3	1	1	1
CO5	1	1	3	3	1	1	1

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	Course Statement	COs
1	Determination of ultraviolet absorption spectra of proteins and Nucleic acid	CO1-CO5
2	Determination of pH of biological samples (blood, plasma, urine, saliva) phosphate buffer by glass electrode.	
3	Colorimetric Estimation of protein by Biuret method.	
4	Colorimetric estimation of amino acids by ninhydrin method.	
5	Paper chromatographic separation and detection of amino acids	
6	Paper chromatographic separation and detection of simple sugars	
7	Separation of polar and non-polar lipids by thin layer chromatography	
8	Chromatographic separation of plant pigments using column Chromatography	
	Demonstration Experiments	
9.	Separation of serum proteins by SDS-PAGE.	
10	Determination of Thiamine /Riboflavin by Spectro fluorimetry	

TEXT BOOKS/ REFERENCE BOOKS:

1.J. Jayaraman, Laboratory Manual in Biochemistry, New Age International (P) Limited, Fifth edition 2015

2.S. Sadasivam A. Manickam, Biochemical Methods, New age International Pvt Ltd publishers, third edition 2018

3.K2010, Seventh edition, Wilson and John Walker, Principles and techniques of Practical Biochemistry, Cambridge University Press,2010, Seventh edition,

4.,S. K. Sawhney and Randhir Singh, Introductory Practical Biochemistry, Alpha Science International, Ltd,2nd edition, 2005

SEMESTER IV

Course Title: ALLIED PRACTICAL-IV BIOSTATISTICS AND COMPUTER APPLICATIONS

Course code	**2411418**	**Credits**	**02**
L:T:P:S	**0: 0: 2:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO number	**CO statement**
CO1	Learn statistical representation of data.
CO2	Understand the computation of various statistical tools.
CO3	Emphasize on various statistical tests and their significance
CO4	Learn about the operation and importance of computers and internet usage
CO5	Evaluate the importance of MS-Office in data manipulation and presentation

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	Contents	Hrs	COs
1	Construction of discrete and continuous frequency distribution based CO1 on a biological data. (manual method or using excel)	45	CO1-CO5
2	Representation of statistical data by histogram, bar chart, pie diagram and line graph. (manual method or using excel)		
3	Computation of statistical averages-arithmetic mean, median and mode for a biological data. (manual method or using excel)		
4	Determination of measures of dispersion-mean deviation, standard deviation and standard error for a biological data.(manual method or using excel		
5	Browsing internet using various search engine and downloading text, images and videos		
6	Creating an e- mail account and sending and receiving mails.		
7	Creating, editing saving and printing a word document. Paraphrasing using quillbot		
8	Designing a complex table based on a biological data using excel		
9	Creating a power point presentation based on biological data using auto content wizard		
10	Demonstration experiment-Conducting test of significance–chi Square test ort –test using excel.		

Recommended text books

1.Pranab Kr. Banerjee.(2009).IntroductiontoBiostatistics,3rdedn,S.ChandandCompany Ltd.

2. N. Gurumani. (2009). An Introduction to Biostatistics, 2nd edn. MJPpublishers.3.
Peter Norton (2008). Introduction to Computer, 6th edn Tata Mac GrawHillPub.

Reference books

1.NormanT.J.Bailey(2004).StatisticalmethodsinBiology,3rdrevisededn.Cambridge university press.

2. Palanichamy S and Manoharan M (1994). Statistical methods for Biologists, 1st edn. Palani Paramount Publishers

III BSC Biochemistry

FIFTH SEMESTER

Course Title: ENZYMES (CORE PAPER V)

Course code	**2411519**	**Credits**	**04**
L:T:P:S	**3:0:1:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Understand about the structure, function, composition and classification of enzyme.
CO2	Analyse and interpret MM plot and LB plot based on kinetics data as well as gain knowledge on enzyme inhibition and its types.
CO3	Interpret the theories of mechanism of enzyme action and explain the principles behind enzyme catalysis.
CO4	Describe the structure and functions of various coenzymes and cofactors in the biological system
CO5	Comprehend the various methods for production, purification, characterization of immobilized enzymes and discuss the application of industrially important enzymes.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	2	3	3	2	3
CO5	3	3	3	3	1	3	3

CORRELATION: 3- Strong 2- Medium 1- Low

S.No.	Content of Module	Hrs	Cos
MO1	**Introduction:** Nomenclature, IUB system of enzyme classification, specificity, turn over number Enzyme units (IU and Katal), active site ,allosteric site.	**15**	**CO1**
MO2	**Enzyme Kinetics**: Rate and order of reactions, factors affecting the enzyme activity, derivation of Michaelis-Menton Equation, Significance of Km, Line-Weaver and Burk plot. Enzyme inhibition – Competitive, non-competitive and uncompetitive inhibitors (kinetic derivations excluded) with suitable examples.	**15**	**CO2**
MO3	**Mechanism of enzyme action:** Fischer's Lock and key model, Koshland's Induced fit hypothesis – Activation energy. Acid base catalysis, metal ion and covalent catalysis.	**15**	**CO3**
MO4	**Cofactors & coenzymes Prosthetic group:** Structure and functions of NAD, FAD, CoA, biotin, cobamide, TPP, PLP, THF	**15**	**CO4**
MO5	**Enzyme application:** Industrial uses of enzymes –Amylase, Protease and Lipase-Immobilized enzymes production and applications. Abzymes and ribozymes.	**15**	**CO5**

RECOMMENDED BOOKS

1.Trevor Palmer, P. B. (2007). *Enzymes.* Wood head Publishing - ISBN : 9780857099921, 0857099922

2.Meenakshi Meena, D. C. (2009). *Fundamental of Enzymology.* Aavinshankar Publisher 2009 - ISBN-10 : 8179102807 / ISBN-13 : 978-8179102800

3.David L. Nelson, M. M. (2017). *Principles of Biochemistry*(7th ed.). Macmillian Education -

REFERENCE BOOKS

1.Donald Voet, C. W. (2012). *Principles of Biochemistry.* Wiley - ISBN 10: 1118092449 / ISBN 13: 9781118092446

2.Sathyanarayana. (2017). *Biochemistry.* Elsevier - ISBN: 9788131236017

3.Rodwell, V. (2018). *Harper's Illustrated Biochemistry.* McGrew. Hill -

FIFTH SEMESTER

Course Title: INTERMEDIARY METABOLISM (CORE PAPER VI)

Course code	**2411520**	**Credits**	**04**
L:T:P:S	**3:1:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Define the terms Metabolism-Catabolism and Anabolism Write chemical reactions involved in biochemical pathways of carbohydrate metabolism that produce ATP such as glycolysis, TCA cycle, ETC
CO2	To describe ETC & explain how biochemical energy is generated in cells using principles of thermodynamics (free energy enthalpy) using coupled reactions to show how an endergonic reaction can occur by coupling with exergonic reaction
CO3	To explain the metabolic pathways of Protein – Transamination, deamination, decarboxylation and urea cycle.
CO4	Describe the metabolism of, lipids. Write chemical reactions for the individual steps in each pathway
CO5	Exemplify the role of ribose5phosphate and the steps involved in the synthesis of adenine and guanine Detailed information in the formation of uric acid upon purine catabolism. Recall the steps involved in the biosynthesis and degradation of pyrimidine.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	2	3	2	3
CO2	3	3	3	2	3	2	3
CO3	3	3	3	2	3	2	3
CO4	3	3	3	2	3	2	3
CO5	3	3	3	2	3	2	3

Correlations : 3- Strong2 - Medium 1- Low

S.No.	Content of Module	Hrs	Cos
MO1	Introduction to Intermediary metabolism. Metabolism- Catabolism and Anabolism. Carbohydrates metabolism: The glycolytic pathway – aerobic and anaerobic glycolysis, energetics, Pyruvate to acetyl CoA and its energetics, citric acid cycle and its energetics. Glycogenesis and glycogenolysis –Reactions and its regulation, Pentose phosphate pathway Reactions and its significance.	**15**	**CO1**
MO2	Electron transport chain - components and reactions of ETC. Oxidative phosphorylation – Chemiosmotic hypothesis, Uncouplers of Oxidative phosphorylation. Energetics. High energy compounds- Definition and examples ATP, SAM	**15**	**CO2**
MO3	Protein metabolism – Introduction- catabolism of amino acids- Phenyl alanine, Leucin Transamination, Oxidative and Non-oxidative Deamination, Decarboxylation – Urea cycle and its regulation. Biosynthesis of creatinine.	**15**	**CO3**
MO4	Lipid metabolism –Biosynthesis of saturated fatty acids. Oxidation of fatty acids – Beta oxidation-Role of carnitine, Energetics of Palmitic acid Oxidation, alpha oxidation and omega oxidation. Biosynthesis of cholesterol. Ketogenesis.	**15**	**CO4**
MO5	Nucleic acid metabolism- Bio synthesis of purine nucleotides – Denovo synthesis and salvage pathways, regulation of purine biosynthesis. biosynthesis of pyrimidine nucleotides - Denovo synthesis and salvage pathways, regulation of pyrimidine synthesis. Catabolism of purine nucleotides and pyrimidine nucleotides -regulation.	**15**	**CO5**

RECOMMENDED BOOKS

1.Sathyanarayana. (2017). *Biochemistry.* Elsevier - ISBN: 9788131236017

2.J. L. Jain, N. J. (7th ed 2016). *Fundamentals of Biochemistry 7th edition.* S. Chand @ Co.Ltd - ISBN: 9788121924535

3.Rodwell, V. (2018). *Harper's Illustrated Biochemistry.* McGrew. Hill .

REFERENCE BOOKS

1.Donald Voet, C. W. (2012). *Principles of Biochemistry.* Wiley - ISBN 10: 1118092449 / ISBN 13: 9781118092446

2.David.L.Nelson, M. M. (7th ed 2017). *Lehninger principles of Biochemistry* . Freeman. W.H. and Company - ISBN 10: 1464126119 / ISBN 13: 9781464126116

3.Robert K.Murray, D. A. (2018). *Harper's Illustrated Biochemistry* (28th ed.). The McGraw- Hill Companies - ISBN-10 : 0071625917 / ISBN-13 : 978-0071625913

FIFTH SEMESTER

Course Title: HUMAN PHYSIOLOGY (CORE PAPER VII)

Course code	**2411521**	**Credits**	**04**
L:T:P:S	**4:0:0 :0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Gaining a complete knowledge in the physiology of life
CO2	Be aware of the functional relationships between various organ systems of the body
CO3	Classify blood groups so as to identify the blood groups of patients and donors for the purpose of safe blood transfusion
CO4	Cognizance of various systems of the body which support life viz. Circulatory, digestive, respiratory, nervous and excretory systems
CO5	Explain the structure and functions of neuron, transmission of nerve impulse, Understand neuromuscular coordination

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	1	3	3	3	3
CO2	3	3	1	2	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	1	3	3	3	3
CO5	2	3	2	3	3	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Blood composition and function, types of blood cells, morphology and function. Blood groups- ABO and Rhesus system. Composition and function of lymph and lymphatic System. Respiratory system-structure & function of different components of respiratory units. mechanism of respiration. Gaseous Exchange, Bohr's effect.	**15**	**CO1**
MO2	Circulatory System- heart- ,structure, properties of cardiac muscle overview of systemic and pulmonary circulation, conducting system of the heart, heart rate, cardiac cycle, cardiac output, Systolic and Diastolic pressure.	. **15**	**CO2**
MO3	Digestive systems: Structure of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salt in digestion of lipids, Mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive process.	**15**	**CO3, CO5**
MO4	Excretory system-Structural components of urinary system: Kidney -structure and its organization. Mechanism of urine formation-Glomerular filtration rate (GFR), Tubular Secretion and reabsorption.	**15**	**CO4**
MO5	Brief outline of nervous system-brain (parts and ventricles), spinal cord, nerve fibres, synapses, chemical and electrical synapses, Transmission of nerve impulses, action potential and neurotransmitters-Cholinergic and Adrenergic Neurotransmitters. Muscles-Types of muscles and their functions: myo filamentation and contraction and relaxation of skeletal muscles.	**15**	**CO5**

RECOMMENDED BOOKS:

1.Sembulingam, K. S. (2019). *Essentials Of Medical Physiology*. Jaypee Brothers Medical Publishers, - ISBN 10: 9352706927 ISBN 13: 9789352706921

2.Derrickson, G. J. (2017). *Principles of Anatomy and Physiology - ISBN: 978-1-119-40006-6*

3. Hall, G. A. (2019). Text book of Medical physiology. Elsevier india - ISBN-10 : 8131257738 - ISBN-10 : 8131257738.

REFERENCE BOOKS

1.D. Venkatesh, H. H. (2018). *Textbook of Medical Physiology.*Wolters Kluwer India Pvt. Ltd - ISBN-10 : 9387963535 / ISBN-13 : 978-9387963535

2.D. Venkatesh, H. H. (2018). *Textbook of Medical Physiology.*Wolters Kluwer India Pvt. Ltd ISBN-10 : 9387963535 / ISBN-13 : 978-9387963535

3.H. S. Ravi Kumar Patil, H. K. (2009). A Textbook of Human Physiology. I K International Publishing House Pvt. Ltd - ISBN : 9789380026503

FIFTH SEMESTER

Course Title: MOLECULAR BIOLOGY-(CORE PAPER VIII-SEC)

Course Code	**2411522**	**Credits**	**04**
L:T:P:S	**3:1: 0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Infer the central dogma of molecular biology, Show how DNA acts as vehicle of inheritance through experimental evidences
CO2	Outline the steps involved in replication and explain the events, enzymology, fidelity and inhibitors of replication in E.*coli*
CO3	Summarize the process of prokaryotic transcription
CO4	Define genetic code, list its basic features and show how it can be deciphered Relate genetic code to translation process and explain protein biosynthesis
CO5	Illustrate the regulation of gene expression in prokaryotes using *lac* and *trp* Operon

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	1	3	3	3	3
CO2	3	3	1	3	3	3	3
CO3	3	3	1	1	3	3	3
CO4	3	3	1	2	3	3	3
CO5	3	3	1	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Central Dogma of Molecular Biology. DNA as the vehicle of inheritance – experimental evidence – Griffith, McLeod, McCarty and Avery, Hershey – Chase experiments.	**10**	**CO1**
MO2	DNA replication -semi conservative mode of replication, replication fork, semi discontinuous replication-Okazaki fragments. Enzymes of replication – DNA polymerases I, II, III, topoisomerases, helicases binding proteins and ligases. Replication in E.coli – replisomes, events at OriC (initiation), events on the replication fork (elongation) and termination. Fidelity of replication, Inhibitors of replication.	**20**	**CO2**
MO3	Transcription – Structure and functions of prokaryotic RNA polymerases. Initiation, elongation and termination –Rho dependent and Rho independent termination-Hair Pin loop Formation. Inhibitors of Prokaryotic transcription.	**15**	**CO3**
MO4	Genetic code –Codons and anticodons. Basic features of genetic code. Deciphering of genetic code. Wobble hypothesis. Protein biosynthesis-Prokaryotic ribosomes-Shine dalgarno sequence, Aminoacyl tRNA synthetases. Stages involved in protein biosynthesis- Initiation, elongation and termination. Inhibitors of translation.	**20**	**CO4**
MO5	Regulation of gene expression in prokaryotes. Operon concept – Inducible operon, Positive and negative regulation of lac operon-role of cAMP and glucose and trp operon – attenuation.	**10**	**CO5**

RECOMMENDED BOOKS:

1.Watson, J. D. (2017). *Molecular Biology of the gene* . Pearson - ISBN-10 : 9332585474 / ISBN-13 : 978-9332585478

2.David.L.Nelson, M. M. (7th ed 2017). *Lehninger principles of Biochemistry* . Freeman. W.H. and Company - ISBN 10: 1464126119 / ISBN 13: 9781464126116

3.V.Malathi. (2012). *Essentials of Molecular Biology* (1st ed.). Pearson Education - ISBN-10 : 8131773213 / ISBN-13 : 978-8131773215

REFERENCE BOOKS

1.Albert, B. (2014). *Molecular Biology of the cell.* W.W. Norton and company - ISBN 10: 0815344643 / ISBN 13: 9780815344643

2.Donal Voet, j. G. (2016). *Fundamentals of Biochemistry: Life at molecular level* (5th ed.). john Wiley & sons - ISBN: 978-1-118-91840-1

3.Rastogi, V. B. (2016). *Principles of Molecular biology* (2nd ed.). Medtech - ISBN-10 : 9789384007478 / ISBN-13 : 978-9384007478

FIFTH SEMESTER

Course Title: THERAPEUTIC NUTRITION (Open Elective Paper)

Course Code	**2411523**	**Credits**	**05**
L:T:P:S	**4:1: 0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Provide comprehensive knowledge on principles and planning of therapeutic diets.
CO2	Apply the nutrition knowledge in weight management- obesity.
CO3	Classify hypertension and able to trace the root cause, suggest diet for hypertension
CO4	Critically discuss about gastrointestinal and liver disorders, and summarize the disease management.
CO5	Describe the nature of fever, nutritional requirements define diet during fever

Mapping of Course Outcomes to Program specifiOutcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	1	3	3	3	3
CO2	3	3	1	3	3	3	3
CO3	3	3	2	2	3	2	3
CO4	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2

CORRELATION : 3-STRONG 2- MEDIUM 3- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Diet Therapy-Definitions & principles of diet therapy, concepts & objectives of therapeutic diet, therapeutic adaptation of normal diet: Normal diet, routine hospital diet: -clear liquid diet, full fluid diet/ liquid diet, semi-solid diet, high & low-calorie diet, high &low protein diet, high & low fiber diet, low cholesterol diet.	**12**	**CO1**
MO2	Weight Imbalance-Obesity-prevalence-etiology, risk factors, assessment ,treatment, lifestyle and dietary management-Fat discrimination-SFA,MUFA,PUFAandomega-3and6-fattyacids. Dietary fibre and its significance.	**12**	**CO2**
MO3	Hypertension-classification, prevalence, morbidity and mortality. Diet related factors influencing development of hypertension. Management-lifestyle, weight, salt restriction and other dietary modifications. Diet to be followed during Atherosclerosis.	**12**	**CO3**
MO4	Dietary management and nutritional care in gastrointestinal disorders -indigestion, acute gastritis and duodenal ulcers and liver diseases-hepatitis, and alcoholic live disease (cirrhosis) .	**12**	**CO4**
MO5	Nutritional requirement and dietary modification during acute, chronic and convalescent stage of fevers. Typhoid, &Malaria fever-symptoms, diagnosis, treatment and dietary management.	**12**	**CO5**

Recommended books

1.Sharma, D. S. (2017). *Nutritional Biochemistry.* CBS Publishers and distributors-ISBN 10: 8123925271 /ISBN 13: 9788123925271

2.Srilakshmi, B. (2019). *Dietetics* - (Multi Colour Edition ed.). New Age International Publishers-ISBN 10: 9386649209 / ISBN 13: 9789386649201

3.B.Srilakshmi, B. (2017).*Food Science*(MultiColour Edition ed.). NewAge International Publishers-ISBN 10: 8122438091 / ISBN 13: 9788122438093

4.Krause's. (2013). *Food,Nutrition, & DietTherapy* (11th ed.).W.B. Saunders -ISBN-10 : 0721697844,ISBN-13 : 978-0721697840.

SEMESTER-V

Course Title: Core Practical V Enzymology, Molecular Biology & Physiology

Course Code	**2411524**	**Credits**	**03**
L:T:P:S	**0:0: 3:0**	**CIA Marks**	**50**
Exam Hours	**06**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO Statement
CO1	Understand enzyme kinetics through the determination of optimum pH, temperature and substrate concentration
CO2	Assay the activity and specific activity of Urease and to understand the difference between them
CO3	Examine blood samples and interpret the results in hematology
CO4	Use the stethoscope to determine the pulse and use the sphygmomanometer to measure blood pressure
CO5	Isolate nucleic acids from various sources and estimate the same

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2	3	1	1
CO2	3	3	3	2	3	2	1
CO3	3	2	2	1	2	1	1
CO4	2	2	2	2	3	1	1
CO5	2	2	2	2	3	1	1

CORRELATION : 3-STRONG 2- MEDIUM 3- LOW

MO	Contents of module	Hrs	CO's
MO1	Determination of optimum pH of urease/amylase	**60**	**CO1-CO5**
MO2	Determination of optimum temperature of urease/amylase		
MO3	Effect of substrate concentration on the activity of urease/amylase		
MO4	Assay of enzyme activity of Urease/amylase		
MO5	Assay of specific activity of Urease/amylase		
MO6	Estimation of DNA(unknown)		
MO7	Estimation of RNA(Unknown)		
MO8	RBC count , WBC count – TC, DC ,Determination of ESR and PCV, Determination of bleeding time		
	Demonstration Experiments		
MO9	Isolation of DNA from (Plant/animal/Microbial source) Isolation of RNA from Yeast		
MO10	Detection of heart sounds using stethoscope, Measurement of Blood Pressure using Sphygmomanometer		

RECOMMENDEDBOOKS

1.Jayaraman,J. (2011).*Laboratory Manual in Biochemistry.* NewAge International Pvt Ltd Publishers - ISBN-10: 812243049X, ISBN-13 : 978-8122430493

2.Singh,S.K.(2005).*Introductory Practical Biochemistry* (2nded.) . Alpha Science International, Ltd-ISBN10:8173193029/ISBN13: 9788173193026

3.Ashwood,B.a.(2001).*TietzFundamentalsofClinicalchemistry.*WBSaunders Company, Oxford Science Publications USA- ISBN 10:0721686346/ ISBN 13: 9780721686349

REFERENCE BOOKS

1.WORK,T.W.(2009).*Laboratory techniques in Biochemistry & Molecular Biology by Amsterdam.* North Holland Pub.Co.

2.Manickam,S.S.(2018).*Biochemical Methods*(3rded.).New age international Pvt Ltd publishers-ISBN10:8122421407/ISBN13: 9788122421408

3.Plummer,D. T.(n.d.). *An Introduction to Practical Biochemistry.* Tata McGraw Hill - ISBN:9780070841659

SEMESTER VI

Course Title: Core Paper IX- Research methodology

Course Code :2411626	**Credits : 04**
L:T:P:S :3:0:1:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO Statement
CO1	Understand the definition and characteristics of nutritional research.
CO2	Demonstrate knowledge of the research process & Literature review
CO3	Demonstrate familiarity with common research tools.
CO4	Understand the structure and components of a thesis or research paper
CO5	Identifying funding agencies and research institutes in India

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PSO7
CO1	**3**	3	3	3	3	3	3
CO2	**3**	3	3	3	3	3	3
CO3	**3**	3	3	3	3	3	3
CO4	**3**	3	3	2	3	3	3
CO5	**3**	3	3	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	**Research**- Definition, Characteristics, Objectives, scope of research in nutrition,Types of Research- Descriptive, Analytical Research, Applied, Fundamental Research, Quantitative , Qualitative Research, Conceptual vs. Empirical Research.	**15**	**CO1**
MO2	**Research Process**- Basic Overview, Formulating the Research Problem, Defining the Research Problem, Computer & Internet: Its Role in Research, Threats and Challenges to Good Research. Literature Review Process.	**15**	**CO2**
MO3	**Types of research tools** – Questionnaire- types, characteristics of good questionnaire, Use and Limitations of questionnaire, ,ratings scale- Numerical, graphic, standard, rating by cumulative points, uses and limitations of rating scales and attitude scale- types('equal-appearing intervals, Likert scale),uses and limitations.	**15**	**CO3**
MO4	**Thesis format** - structure and components of a thesis or research paper, including the title page, abstract, introduction, methods, results, discussion, conclusion, and references. Formatting- font, margins, spacing, and citation styles(APA, Chicago), reference citation tool- Mendeley. Plagiarism- Definition, consequences of plagiarism and ways of avoiding plagiarism.	**15**	**CO4**
MO5	**Funding sources in India** - government agencies (DBT, ICMR), non-profit organizations (Wellcome Trust /DBT India Alliance). Research institutes in India and its role in the society.	**15**	**CO5**

Recommended Books

1) Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar. Publisher: SAGE Publications Ltd; 5th edition 2019.
2) Research Methodology: Methods and Techniques. Kothari, C. RNew Age International (P) Limited, Publishers. 2013 2nd edition. ISBN-13: 978-8122415223
3) Research Methods: the concise knowledge base; Trochim W.M.K., 2005. Atomic Dog Publishing.

Reference books

1) Research Methodology ; Panneerselvam R., PHI, Learning Pvt. Ltd., New Delhi - 2009
2) An introduction to Research Methodology; Garg B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002., RBSA Publishers.
3) Research Methodology. Dr. S. Sachdeva Lakshmi Narain Agarwal publisher.2021 - ISBN: 9789389918496

SEMESTER VI

Course Title: CLINICAL BIOCHEMISTRY (CORE PAPER X)

Course Code	**2411627**	**Credits**	**04**
L:T:P:S	**4:0: 0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcome :At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Understand the pathophysiology and molecular basis of Diabetes mellitus and will be able to interpret the biochemical manifestation in galactosemia, fructosuria and glycogen storage disease.
CO2	Discuss the inherited disorders like cystinuria, phenylketonuria, albinism and gout.
CO3	Explain the pathophysiology and differential diagnosis of jaundice.
CO4	Relate the clinical significance of GFT's and KFT's in the assessment of gastric function.
CO5	Demonstrate the diagnostic importance of serum enzymes and Isozymes in assessment of liver damage, bone disorders and myocardial infarction.

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	2	1	1	3	3
CO2	3	3	2	1	1	3	3
CO3	3	3	2	1	1	3	3
CO4	3	3	2	1	1	3	3
CO5	3	3	2	1	1	3	3

CORRELATION:3-STRONG ,2-MEDIUM, 1-LOW

S.No.	Content of Module	Hrs	Cos
MO1	Blood glucose relation, hypo and hyperglycemia. Diabetes mellitus- types, clinical features and metabolic changes. Glycosuria, galactosemia and fructosuria. Glycogen storage diseases.	**15**	**CO1**
MO2	Etiology and clinical manifestation of phenylketonuria, Cystinuria, Albinism, Maple Syrup Urine diseases, Hypo and hyperuricemia, Gout. Clinical features of atherosclerosis.	**15**	**CO2**
MO3	Liver Function Tests-Jaundice-types-hemolytic, hepatic and obstructive. Differential diagnosis of Jaundice. Test based on excretory function (BSP), Test based on bile pigment metabolism.	**15**	**C O3**
MO4	Renal Function Tests- Clearance tests-Urea, Creatinine, Inulin, PAH test, Concentration and dilution tests. Gastric Function Tests Collection of gastric contents, examination of gastric residium, FTM, stimulation tests, Tubeless gastric analysis.	**15**	**C O4**
MO5	Clinical Enzymology- Definition of functional and non-functional plasma enzymes. Isozymes and diagnostic tests, enzyme patterns in liver damage, bone disorders, Myocardial infarction.	**15**	**CO5**

RECOMMENDED BOOKS

1.T.M.Devlin. (2006). *Textbook of Biochemistry with Clinical Correlations.* CBS Publishers and Distributers - ISBN 10: 0471513482 / ISBN 13: 9780471513483

2.Gupta, P. P. (2013). Textbook of Biochemistry with Biomedical significance (2nd ed.). CBS Publishers and distributors - ISBN 10: 8123922450 / ISBN 13: 9788123922454

3.U.Chakrapani, U. (2013). *Biochemistry (with Clinical Concepts and Case Approach)* (7th ed.). Elsevier Publishers - ISBN: 9788131237137 8131237133

REFERENCE BOOKS

1.M.N.Chatterjea. (2011). *Textbook of Medical Biochemistry* . Jaypee Brothers.Medical Publishers (P)Ltd - ISBN-13: 978-9350254844, ISBN-10: 9789350254844

2.T.M.Devlin. (2006). *Textbook of Biochemistry with Clinical Correlations.* CBS Publishers and Distributers - ISBN 10: 0471513482 / ISBN 13: 9780471513483

3.Ayling, M. &. (2014). *Clinical Biochemistry* (3rd ed.). Metabolic and Clinical Aspects - ISBN 10: 0702051403 / ISBN 13: 9780702051401

SEMESTER VI

Course Title: PRINCIPLES OF BIOTECHNOLOGY (Elective Paper IIA)

Course code	**2411628(A)**	**Credits**	**05**
L:T:P:S	**5:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	CO Statement
CO1	To Discuss the basic requirements and tools employed in genetic engineering process
CO2	Demonstrate the basic and recent techniques applied in the field of Recombinant DNA technology
CO3	Apply the basic rDNA technique to produce transgenic animal, discuss gene transfer methods, their application in pharmaceutical industry, cloning and its importance
CO4	Design experiments on plants using rDNA techniques
CO5	Handle the equipments employed in DNA amplification, describe about gene therapy and antisense RNA therapy

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	3	3	3	3	3	3
CO2	**3**	3	3	1	3	3	3
CO3	**3**	3	2	2	3	3	3
CO4	**2**	3	3	2	3	3	3
CO5	**2**	3	2	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Biotechnology – Introduction, Scope, definition, History and application–Brief history of recombinant technology- Restriction endonuclease- DNA cutting enzymes, DNA ligase- DNA joining enzyme, alkaline phosphatase, DNA modifying enzymes.	**15**	**CO1**
MO2	Vectors- the cloning vehicles – plasmids, bacteriophages, cosmids, artificial chromosome vectors, shuttle vectors, preparation of r-DNA, insertion of r-DNA into vector, methods of transfer, selection of recombinants and screening- genetic methods, chemical methods, South-Western screening, Nucleic acid hybridization methods, radio-active and non-radioactive labeling of probes.	**15**	**CO2**
MO3	Animal Biotechnology – animal call culture, tissue culture- gene transfer methods in animals- transfection microinjection, electroporation, cell viability, cell transformation- transgenic animals- applications.	**15**	**CO3,CO5**
MO4	Plant Biotechnology: Agrobacterium- mediated gene transfer to plant cells, microprojectiles, transgenic plant technology- for pest resistance, herbicide tolerance, delay of fruit ripening and use of plants to produce commercially important proteins.	**15**	**CO4, CO5**
MO5	PCR – types and applications. Gene therapy, antisense therapy- production of insulin in E.coli.	**15**	**CO5**

RECOMMENDED BOOKS:

1.U.Sathyanarayana. (n.d.). *Biotechnology* –ISBN-10 : 8187134909 / ISBN-13 : 978-8187134909

2.T.A, B. (2016). *Gene cloning and DNA analysis.*Wiley Blackwell - ISBN 10: 1119072573 / ISBN 13: 9781119072577

3.Primrose, O. a. (2003). *Principles of gene manipulation* . Business service 2003- *ISBN-10 : 1405135441 / ISBN-13 : 978-1405135443*

REFERENCE BOOKS

1.Dubey, R. (2014). *A Textbook of Biotechnology* .S. Chand - ISBN 10: 8121926084 / ISBN 13: 9788121926089

2.H.K.Das. (2010). Textbook of Biotechnology. Willey -ISBN: 9788126564040

3.Loroch, R. R. (2016). *Biotechnology for Beginners.* Academic Press - ISBN: 9780128012246

Semester VI

Course Title: IMMUNOLOGY (ELECTIVE PAPER II B)

Course code	**2422628(B)**	**Credits**	**05**
L:T:P:S	**5:0:0 :0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Associate structure and function of the organs involved in our body's natural Defense
CO2	Classification of antigens and antibodies on the basis of their properties
CO3	Explain the cooperation between the different lymphocytes in defending the Host
CO4	Examine the immunological tests and relate it to the immune status of an Individual
CO5	Understand the immune related diseases and mechanism of transplantation

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	1	1	3	3	3
CO2	3	3	2	1	3	3	3
CO3	3	3	1	2	3	3	3
CO4	3	3	1	3	3	3	3
CO5	3	3	3	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Structure and function of primary lymphoid organs (thymus , bone marrow), secondary lymphoid organs (spleen, lymph node),reticuloendothelial cells, phagocytosis	**15**	**CO1**
MO2	Antigens – Nature, immunogens, haptens. Immunoglobulin types structure and function. Cells involved in antibody formation, differentiation of T and B lymphocyte, Clonal selection theory, co- operation of T-cell with B-cell. Monoclonal antibody – Production and application in biology.	**-15**	**CO2**
MO3	Immunity and its types-Innate, Acquired, active and passive. Commonly used toxoid vaccines, killed vaccines, live attenuated vaccines, rDNA vaccines. Humoral and cell mediated immunity. Complement proteins-Definition, Classical pathway	**15**	**CO3, CO5**
MO4	Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immunodiffusion, Oudin Procedure, Oakley Fulthrope Procedure, Radio immunodiffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test-Wasserman's reaction, RIA, ELISA.	**15**	**CO4, CO5**
MO5	Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), Auto- immune diseases with examples. Organ specific and systemic autoimmunity. SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC, graft Vs host reaction, immunosuppressive Agents.	**15**	**CO5,**

RECOMMENDED BOOKS:

1.Kuby, J. (2018). *Immunology(5th ed).* W.H. Freeman - ISBN-10 : 1319114709 / ISBN-13 : 978-1319114701

2.Roitt, I. (2017). *Immunology(13th ed).* Wiley Black Well - ISBN-10 : 1118415779 / ISBN-13 : 978- 1118415771

3.AK, A. (2011). *Cellular and Molecular immunology.* Elsevier Health Sciences - ISBN 10: 0808921355 / ISBN 13: 9780808921356

REFERENCE BOOKS

1.Paniker. (2017). *Immunology* (10th ed.). University Press - ISBN 10: 1847558569 / ISBN 13: 9781847558565

2.Judy Owen, J. P. (2013). *Kuby Immunology.* International Edition W. H. Freeman - ISBN-10 : 1319114652, ISBN-13 : 978-1319114657

3.Rao, C. V. (2017). *Immunology* (3rd ed.). chennai: Alpha Science Int. Ltd - ISBN-10 : 1842652559 / ISBN-13 : 978-1842652558

SEMESTER VI

Course Title: BASICS IN MEDICAL LABORATORY TECHNOLOGY
(Elective Paper-II C)

Course code	**2411628(C)**	**Credits**	**05**
L:T:P:S	**5:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO Number	**CO statement**
CO1	Develop a good conduct in lab and prepare of laboratory reagents
CO2	Analyze the samples using various microscopes and Maintain lab wares
CO3	Identify the significance of normal and abnormal constituents of urine.
CO4	Examine the stool specimen
CO5	Estimate the hematological parameters

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	**PSO**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	3	3	3	3
CO 2	3	2	2	2	2	2	3
CO 3	3	3	3	3	3	3	3
CO4	3	2	2	3	3	3	3
CO 5	2	2	2	2	2	2	2

Correlation : 3 strong 2 medium 1 low

S.No.	Content of Module	Hrs	Cos
MO1	**Laboratory care:** Code of conduct for laboratory personnel - safety measures in handling laboratory chemical/Reagents, labelling, storage and usage.	**12**	**CO1**
MO2	**Laboratory equipments:** Working of microscope - Phase contrast, Fluorescence, Electron microscope. Centrifuge, analytical balance, colorimeter - Usage and care. Glass wares, water bath, incubator. Reporting laboratory tests and keeping records. Sterilization-Autoclave	**13**	**CO2**
MO3	**Urine Analysis**: Collection and preservation of urine sample. Composition of urine, Normal and abnormal constituents of urine. Urinalysis-Procedure. Examination of glucose, ketone bodies, bile pigments in urine. Hematuria.	**17**	**CO3, CO5**
MO4	**Stool**-Composition. Collection and examination of stools - inspection of feces-odour, pH, Interfering substance. Test for occult blood, fecal fat, microscopic examination of stool specimen.	**18**	**CO4, CO5**
MO5	**Hematology** - Collection and preservation of blood sample - Anticoagulant, Hematological parameters- Estimation of Hb, PCVWBC, RBC, Platelets, ESR. Clotting time, bleeding time - norma value, clinical interpretation.	**15**	**CO5**

RECOMMENDED BOOKS:

1.V.H., T. (2019). *Handbook Medical Laboratory Technology* (2nd ed.). CBS publishers and distribution - ISBN-10 : 8123906773 / ISBN-13 : 978-8123906775

2.V.H., T. (2014). *Practical Textbook of Laboratory Medicine.*CBS publishers and distribution - ISBN-10 : 8123918720 / ISBN-13 : 978-8123918723

3.Praful B. Godkar, D. P. (2014). *Textbook of Medical Laboratory Technology.* bhalani Publishing House - ISBN-10 : 9780074632239 / ISBN-13 : 978-0074632239

REFERENCE BOOKS

1.ChatterjeeRanashinde. (2012). *Medical Biochemistry.* Jaypee - ISBN : 9789350254844

2.Tietz. (2018). *Clinical Biochemistry* (8th ed.). Saunders -

3.Sood, R. (2009). *Medical Laboratory Technology Methods and Interpretations.* Jaypee - ISBN 10: 9351523330 / ISBN 13: 9789351523338

SEMESTER VI

Course Title: Elective paper III (A):FOOD STANDARD AND QUALITY CONTROL

Course code	**2411629(A)**	**Credits**	**05**
L:T:P:S	**5:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, Student will be able to:

CO Number	**CO statement**
CO1	Understand the concepts of quality control and government regulations in quality control
CO2	Describe the Food additives and its types
CO3	Illustrate about Food packaging and labelling methods and Explain the enzymes involved in food processing and assess food standards
CO4	Explore food laws and methods of evaluation of food
CO5	Assess the food safety and food hazards

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	**2**	**2**	**2**	**2**	**2**	**2**	**1**
CO2	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**2**	**2**	**1**	**2**
CO5	**2**	**2**	**2**	**2**	**2**	**2**	**1**

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	Principles of quality control-Raw material process control and Product inspection. Food adulteration and hygiene-definition, Common adulterants in different foods, method of detecting adulterated foods. Managing quality in supply chain and marketing of food products Government Regulations In Quality Control: FAO/ WHO codex Alimentarius commission, PFA, AGMARK, BIS, FPO, fair average quality (FAQ) specification for food grains.	**15**	**CO1**
MO2	Food additives - Definitions, Types. Leavening agents- Definitions, Classifications. Colour of foods -Natural colours, certified artificial colours, Non-certified colors, Use and Optimum levels.	**15**	**CO2**
MO3	Food Packaging: Food packaging and labelling various methods. Recent trends in Packaging and labelling. Enzymes of importance in food processing-Carbohydrates, Proteases, lipases, oxidoreductases, hydrolases. Standards for foods-Milk and milk products, Fruits and Vegetables, Beverages and Fleshy foods	**15**	**CO3**
MO4	Food Laws, Consumerism- Definition, Consumer protection, Consumer Education, Legal modes of protection and Machinery for redressal of consumer grievance. Evaluation of food - Objective methods of evaluation of food. Improvised instruments used for Indian recipes.	**15**	**CO4**
MO5	Food safety: Meaning of food safety, Importance of food: Quality and safety for developing countries. Food Hazards: Physical, Chemical, Biological hazards associated with food types. Effect of processing and storage on microbial safety.	**15**	**CO5**

Recommended books

1. A.Y.Sathe, A first course in food analysis- New Age Publications, 1999.
2. Norman.N. Potter andJoseph. H. Hotchkiss, Food Science- CBS Publishers, 1996.
3. M.Swaminathan, Food Science, Chemistry and Experimental Foods- Bappco Publishers.
5. Desrosier and Desrosier, Technology of food preservation- CBS Publishers, Fourth edition, 1999.

Reference books

1. Sivasankar, B. (2013) Food Processing and preservation 2nd edition, prentice Hall, Pvt, Ltd.
2. Srilakshmi, N., Food Science, New Age International Private Ltd., New Delhi, 2002.
4. Chandrasekhar, U,Food Science and Applications in Indian Cookery, Phoenix Publishing House Private Ltd., New Delhi, 2002.
5. Adams, M.R. and Moss, M.O., Food Microbiology, New Age International (P) Ltd., New Delhi, 2005.

SEMESTER VI

Course title: PHYTOMEDICINE (Elective Paper III B)

Course code	**2411629(B)**	**Credits**	**05**
L:T:P:S	**5:0:0:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to

CO Number	**CO Statement**
CO1	Gain a wide knowledge on plants and the phytochemicals present in plants
CO2	Perform the qualitative phytochemical screening
CO3	Understand Indian systems of medicine
CO4	Acquire knowledge on the biomedical importance of plants in day to day life.
CO5	Categorize the herbal medicines for treating human ailments.

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	**2**	**2**	**2**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**	**3**

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	Cos
MO1	**Plant anatomy** Functions of variousparts of plants. Phytochemicals-Definition. Overview of primary and secondary metabolism. Types of Phytochemicals -Flavonoids (Flavones, isoflavones and flavonone), alkaloids, tannins, terpenoids and anthocynanins, phytosterols-their biological functions	**15**	**CO1**
MO2	**Phytochemical screening- Qualitative analysis** Steroids, Phenolics, flavonoids, saponins, anthraquinones, sugars, terpenoids, Alkaloids, tannins, cardiac glycosides	**15**	**CO2**
MO3	**Pharmacognosy** Introduction to medical practices in India: History–Outlines of Ayurvedha, Siddha, Unani and Homeopathic systems of traditional medicine – Role of AYUSH, NMPB,CIMAP and CDRI.	**15**	**CO3**
MO4	**Plants in our daily life** Organoleptic study of the following medicinal plants: Wholeplant - *Phyllanthus amarus, Bacopa monnieri*, Fruit – *Solanum nigrum, Solanum xanthocarpum*, Bulb– *Allium cepa, Allim sativum* , Rhizome – *Zingiber officinale, Curcuma longa*, seed – *Trigonella foenum graceum. Cuminum cyminum* , Bark – Cinchona, Leaves – *Aloe vera, Azadirachta indica* and Flower– Clove.	**15**	**CO4**
MO5	**Herbal medicines for treating human ailments** Drug for urinogenital disorders–roots of *Withania somnifera*– Memory stimulants–*Centella asiatica*–Drug for dissolving kidney stones–*Musa paradisica* (pseudostem)–Anti inflammatory drug– Cardiospermum– Anticancer drug–*Catharanthus roseus*– Antidiabetic drug-*Aegle marmelos*	**15**	**CO5**

Recommended books

1.Kumar,N.C.(1993).An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi.

2.Rao,A.P.(1999).Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi.

3.Verma.(2015). *Plant Physiology.* Athena Academic -ISBN:9781910390016, 1910390011

4.Joshi,S. G. (2000)Medicinal Plants. Oxford and IBH, New Delhi.

Reference books

1.Ajay Kumar Meena, P.B. (2009). *Plants-herbal wealth as a potential source of ayurvedic drugs.* Asian Journal of Traditional Medicines.

2.W. C. (2009).*Trease and Evans Pharmacognosy* (16thed.).Elsevier- ISBN 10: 0702029343/ISBN13:9780702029349

3.Williamson,M.H.-G.(2018).*Fundamentals of Pharmacognosy and Phytotherapy.* Elsevier.

SEMESTER VI

Course Title: BIOINFORMATICS (ELECTIVE PAPER III)

Course code	**2411629(C)**	**Credits**	**05**
L:T:P:S	**3:0:1:0**	**CIA Marks**	**50**
Exam Hours	**03**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO NUMBER	**CO Statement**
CO1	Introduce the fundamentals of Bioinformatics and its applications explain the components of Bioinformatics Genome, metabolome & Transcriptome.
CO2	Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes.
CO3	Develop algorithms for interpreting biological data.
CO4	Classify biological database and to correlate the different file formats used by nucleic acid, protein database, structural and metabolic database.
CO5	Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method.

Mapping of Course Outcomes to Programspecific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**
CO1	3	3	3	3	2	3	3
CO2	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

S.No.	Content of Module	Hrs	COs
MO1	Introduction to Bioinformatics – Bioinformatics and its applications. – Genome, Metabolome-Definition, and its applications. Metabolome-Metabolome database-E.Coli metabolome database, Human Metabolome database. Transcriptome-Definition and any three applications.	**15**	**CO1**
MO2	Biological Databases - definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Genebank, DDBJ) Protein sequence database- Swiss Prot, TrEMBL, Structural Database-PDB ,Metabolic database-KEGG	**15**	**CO2**
MO3	Sequence Alignment-Local and Global alignment-Dot matrix analysis, PAM, BLOSUM. Dynamic Programming, Needleman-Wunch algorithm, Smith waterman algorithm	**15**	**CO3**
MO4	Heuristic methods of sequence alignment-BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNA Microarray-Procedure and applications.	**15**	**CO4**
MO5	Structural genomics-Whole genome sequencing (Shotgun approach), Comparative genomics-tools for genome comparison, VISTA servers and precomputed tools. Molecular visualization tools. Rasmol, Swiss PDB viewer. Nutrigenomics- Definition.	**15**	**CO5**

RECOMMENDED BOOKS:

1. Mount, D. w. (2004). *Bioinformatics sequence and Genome Analysis.* Cold Spring - ISBN 10: 0879697121 / ISBN 13: 9780879697129

2. S. G. Rastogi, N. (2013). *BI Mtds and Applications.* PHI learnings -

3. Ignacimuthu, S. (2013). *Basic Bioinformatics.* Alpha Science Int. Ltd - ISBN-10 : 1842658042 / ISBN-13 : 978-1842658048

REFERENCE BOOKS

1. Lesk, A. (2014). *Introduction of Bioinformatics.* Oxford University Press - ISBN 10: 0198724675 / ISBN 13: 9780198724674

2. Ramsden, J. (2015). *Bioinformatics-An Introduction.* Springer - ISBN 978-1-4471-6702-0

3. Andreas D. Baxevanis, G. D. (2020). *Bioinformatics.* Wiley - ISBN 10: 0471478784 / ISBN 13: 9780471478782

SEMESTER-VI

Course Title: CORE PRACTICAL-VI-CLINICALBIOCHEMISTRY

Course code	**2411630**	**Credits**	**03**
L:T:P:S	**3:0:1:0**	**CIA Marks**	**50**
Exam Hours	**06**	**ESE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to

CO NUMBER	CO Statement
CO1	Demonstrate the collection and preservation of blood and urine sample
CO2	Demonstrate the collection and preservation of urine sample
CO3	Estimate biochemical parameters such as glucose, protein, creatinine urea and cholesterol in samples by standardized methods
CO4	Assay the activity clinically important enzymes such as AST (SGPT), ALT (SGOT) and ALP
CO5	Qualitatively analyze urine sample for normal and abnormal constituents

Mapping of Course Outcomes to Program specific Outcomes:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2	3	1	1
CO2	3	3	3	2	3	2	1
CO3	3	2	2	1	2	1	1
CO4	2	2	2	2	3	1	1
CO5	2	2	2	2	3	1	1

S.No	Contents of Modules	Hours	CO's
MO1	Collection and Preservation of Blood and urine sample	75	CO1, CO2 CO3, CO4, CO5
MO2	Estimation of Glucose by OT method (Unknown sample & Blood sample)		
MO3	Estimation of protein by Lowry's method (Unknown sample & (Serum or plasma) sample		
MO4	Estimation of creatinine by Jaffe's method(Unknown sample & Serum)		
MO5	Estimation of Urea by DAM TSC method(Unknown sample & Blood Sample)		
MO6	Estimation of cholesterol by zak's method (unknown sample and blood)		
MO7	Assay of Serum Glutamate Pyruvate/oxaloacetate Transaminase		
MO8	Assay of Serum Alkaline phosphatase		
MO9	**Qualitative analysis of urine for** Normal constituents (Chloride, sulphate, phosphate, Urea, Creatinine and Calcium) **Qualitative analysis of urine for** Abnormal constituents: Glucose, fructose, Protein, Ketone bodies, calcium(in excess) Amino acids (Tryptophan and cysteine)		

RECOMMENDEDBOOKS

1.Jayaraman,J.(2011). *Laboratory Manual inBiochemistry.*NewAgeInternationalPvtLtdPublishers-ISBN-10: 812243049X,ISBN-13:978-8122430493

2.Singh, S. K. (2005). *Introductory Practical Biochemistry* (2nd ed.). Alpha Science International, Ltd- ISBN 10:8173193029 / ISBN13:9788173193026

3.Ashwood, B. a. (2001). *Tietz Fundamentals of Clinical chemistry.* WB Saunders Company, Oxford Science PublicationsUSA-ISBN 10:0721686346/ ISBN 13:9780721686349

REFERENCEBOOKS

1.Work,T.W.(2009).*LaboratorytechniquesinBiochemistry&MolecularBiologybyAmsterdam.*North HollandPub.Co.

2. Manickam, S. S. (2018). *Biochemical Methods* (3rd ed.). New age International Pvt Ltd publishers - ISBN10:8122421407/ISBN13:9788122421408

3.Plummer,D.T.(n.d.). *An Introduction to Practical Biochemistry.* Tata McGrawHill - ISBN:9780070841659