A.D.M COLLEGE FOR WOMEN (AUTONOMOUS), NAGAPATTINAM

(Nationally Accredited with "A" Grade by NAAC - 4th Cycle)
(Affiliated to Bharathidasan University, Thiruchirappalli)
Nagapattinam – 611 001

DEPARTMENT OF BIOCHEMISTRY

SYLLABUS

B.Sc., BIOCHEMISTRY

2024-2027

B.Sc., BIOCHEMISTRY

(For the candidate admitted from the Academic year 2024-25 onwards)

Programme Educational Objectives (PEO)

PEO1	To get insights of multiple important technical areas of Biochemistry.
PEO2	Demonstrate knowledge and understanding of the principles and basic mechanism of metabolic control and molecular signaling.
PEO3	Analyse, interpret, and participate in reporting to their peers on the results of their laboratory experiments.
PEO4	To prepare students for career options in hospital, clinical laboratory and related fields.
PEO5	To prepare students to pursue professional programmes like Biochemistry, Bioinformatics, Nutrition and dietics etc...

PROGRAM OUTCOMES (PO)

PO1	Acquire knowledge in Biochemistry and apply the knowledge in their day to day life for betterment of self and society
PO2	Develop critical ,analytical thinking and problem solving skills
PO3	Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret and draw conclusion from data
PO4	Address and develop solutions for societal and environmental needs of local, regional and national development
PO5	Work independently and engage in lifelong learning and enduring proficient progress

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1	Comprehend the knowledge in the biochemical, analytical, bio statistical and computational areas
PSO2	Ability to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by human kind
PSO3	Acquiring analytical and hands on skills to perform research in multidisciplinary environments
PSO4	Use library search tools and online databases and sources to locate and retrieve scientific information about a topic and techniques related to biochemistry
PSO5	Provoke employability and entrepreneurship among students along with ethics and communication skills

CURRICULUM STRUCTURE – UG (SCIENCE) – I Year 2024 Batch Onwards

Part	Category of Courses	No. of Courses	Hrs	Total Credits
Part I	Language Courses (Tamil/Hindi/French/Arabic/ Sanskrit)	4	24	12
Part II	English Language Courses	4	24	12
Part III	Core Courses (CC) (T – 10, P – 4)	14	70	60
	Minor Course (T – 4 / 5 , P – 2/1)	6	24	16
	Discipline Specific Courses (DSC)	3	10	9
	Project	1	3	3
Part IV	Skill Enhancement Courses (SEC)	4	8	8
	Ability Enhancement Courses (AEC)	3	6	6
	Multi Disciplinary Courses (NME)	2	4	4
	Environmental Studies	1	2	2
	Value Education	1	2	2
	Soft Skill Development	1	2	2
	Summer Internship/Industrial Activity	0	0	2
Part V	Gender Studies	1	1	1
	Extension Activity (NCC/NSS/Sports/Any Other Activities)	0	0	1
	Total	**45**	**180**	**140**

EXTRA CREDIT SCHEME STRUCTURE – 2024 - 2027

Courses	Credits	Semester	Marks
Extra Credit Courses I(Professional English) ECPEA - ECC I - PROFESSIONAL ENGLISH FOR ARTS AND SOCIAL SCIENCES **(Tamil, English, History, Economics, Mathematics, CS, IT, BCA)** ECPEB - ECC I - PROFESSIONAL ENGLISH FOR COMMERCE AND MANAGEMENT **(Commerce & BBA)** ECPEC - ECC I - PROFESSIONAL ENGLISH FOR LIFE SCIENCES **(Zoology, Botany, Biochemistry & Marine)** ECPED - ECC I - PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES **(Physics, Chemistry & Geology)**	2	I	100
Extra Credit Courses II (Skill Course I – Add on)	2	II	100
Extra Credit Courses III(Skill Course II- Add on)	2	III	100
Extra Credit Courses IV(Skill Course III- Add on)	2	IV	100
Value added course I (Multidisciplinary)	2	V	100
Value added Course II (Same disciplinary)	2	VI	100
Total	**12**		

SCHEME OF EXAMINATIONS – 2024 Batch

SEMESTER – I							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	Language Course I	TAMIL PAPER – I	6	3	3	25	75
Part II	English Course I	ENGLISH PAPER - I	6	3	3	25	75
Part III	Core Course I	BIOMOLECULES	5	4	3	25	75
	Core Practical I	BIOMOLECULES PRACTICAL	3	-	-	-	-
	First Minor Course I	CHEMISTRY – I	4	3	3	25	75
	First Minor Practical I	CHEMISTRY PRACTICAL – I	2	-	-	-	-
Part IV	Skill Enhancement Course I	MICROBIAL TECHNIQUES	2	2	3	25	75
	VE	VALUE EDUCATION	2	2	3	25	75
*Extra Credit 1	Extra Credit I	PROFESSIONAL ENGLISH FOR LIFE SCIENCE		2	-	25	75
		No. of Courses –	**30**	**17+2**			

SEMESTER – II							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	Language Course II	TAMIL PAPER – II	6	3	3	25	75
Part II	English Course II	ENGLISH PAPER - II	6	3	3	25	75
Part III	Core Course II	CELL BIOLOGY	6	5	3	25	75
	Core Practical I	BIOMOLECULES PRACTICAL	2	3	3	40	60
	First Minor Practical I	CHEMISTRY PRACTICAL – I	2	2	3	40	60
	First Minor Course II	CHEMISTRY – III	4	3	3	25	75
Part IV	Skill Enhancement Course II	HERBAL MEDICNE	2	2	3	25	75
	EVS	ENVIRONMENTAL STUDIES	**2**	2	3	25	75
*Extra Credit II	Extra Credit II	SKILL COURSE I – ADD ON		2	-	0	100
		No. of Courses –	**30**	**23+2**			

SEMESTER – III							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	Language Course III	TAMIL PAPER – III	6	3	3	25	75
Part II	English Course III	ENGLISH PAPER - III	6	3	3	25	75
Part III	Core Course III	BIOCHEMICAL TECHNIQUES	6	6	3	25	75
	Core Practical II	BIOCHEMICAL TECHNIQUES PRACTICAL	2	-	-	-	-
	Second Minor Course I	MICROBIOLOGY – I	4	3	3	25	75
	Second Minor Practical I	MICROBIOLOGY PRACTICAL	2	-	-	-	-
Part IV	Multi Disciplinary Course I	NME-I WOMEN AND HEALTH	2	2	3	25	75
	Skill Enhancement Course III	HERBAL MEDICINE PRACTICAL	2	2	3	40	60
*Extra Credit III	Extra Credit III (Skill Course II- Add on)	MEDICAL LAB TECHNIQUES (THEORY & PRACTICAL)		2	-	0	100
		No. of Courses –	**30**	**19+2**			

SEMESTER – IV							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	Language Course IV	TAMIL PAPER – IV	6	3	3	25	75
Part II	English Course IV	ENGLISH PAPER - IV	6	3	3	25	75
Part III	Core Course IV	HUMAN PHYSIOLOGY	5	5	3	25	75
	Core Practical II	BIOCHEMICAL TECHNIQUES PRACTICAL	3	3	3	40	60
	Second Minor Practical I	MICROBIOLOGY PRACTICAL	2	2	3	40	60
	Second Minor Course II	MICROBIOLOGY – II	4	3	3	25	75
Part IV	Multi Disciplinary Course II	NME II - PERSONAL HEALTH AND HYGIENE	2	2	3	25	75
	Ability Enhancement Course I	BASICS OF FORENSIC SCIENCE	2	2	3	25	75
*Extra Credit IV	Extra Credit IV (Skill Course III- Add on)	QUANTIDATIVE APTITUDE		2	-	0	100
		No. of Courses –	**30**	**23+2**			

SEMESTER – V							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part III	Core Course V	ENZYMES	5	5	3	25	75
	Core Course VI	INTERMEDIARY METABOLISM	5	5	3	25	75
	Core Course VII	NUTRITIONAL BIOCHEMISTRY	5	4	3	25	75
	Core Course VIII	PLANT BIOCHEMISTRY & PLANT THERAPEUTICS	5	4	3	25	75
	Core Practical III	NUTRITIONAL BIOCHEMISTRY PRACTICAL	3	3	3	40	60
	Discipline Specific Elective I	IMMUNOLOGY / BIOCHEMICAL PHARMACOLOGY	3	3	3	25	75
Part IV	Ability Enhancement Course II	BIOMEDICAL INSTRUMENTATION	2	2	3	25	75
	SSD	SOFT SKILL DEVELOPMENT	2	2	3	25	75
	Summer Internship/ Ind. Training	INTERNSHIP	-	2			
*Extra Credit V	Extra Credit Courses V (Multidisciplinary)	VAC-I - TOOLS AND TECHNIQUES IN BIOSCIENCE		2	-	0	100
		No. of Courses –	**30**	**30+2**			

SEMESTER – VI							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part III	Core Course IX	CLINICAL BIOCHEMISTRY	6	5	3	25	75
	Core Course X	MOLECULAR BIOLOGY	6	5	3	25	75
	Core Practical IV	CLINICAL BIOCHEMISTRY & MOLECULAR TECHNIQUES PRACTCAL	3	3	3	40	60
	Core Course XI	CC XI - Project	3	3	3	25	75
	Discipline Specific Elective II	BIOTECHNOLOGY / BIO ENTREPRENEURSHIP	3	3	3	25	75
	Discipline Specific Elective III	BIOINFORMATICS / GENETIC ENGINEERING	4	3	3	25	75
Part IV	Ability Enhancement Course III	FOOD AND NUTRITION	2	2	3	25	75
	Skill Enhancement Course IV	TISSUE CULTURE	2	2	3	25	75
Part V	GS	GENDER STUDIES	1	1	3	25	75
	Extension Activities	(NCC/NSS/Sports/Any Other Activities)	-	1	-	-	-
*Extra Credit VI	Extra Credit Courses VI (Same disciplinary)	VAC-I - LABORATORY SAFETY MANAGEMENT		2	-	0	100
		No. of Courses –	**30**	**28+2**			

Grand Total – Credit 140 & Extra Credit 12

Semester-I / Core Course - I	BIOMOLECULES	Course Code:
Instruction Hours: 5	Credits: 4	Exam Hours: 3
Internal Marks :25	External Marks :75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	**Learning objectives** The main objectives of this course are to: • Introduce the structure, properties and biological significance of carbohydrates • Comprehend the classification, functions and acid base properties of amino acids • Elucidate the various levels of organization of Proteins. • Impart knowledge on the classification, properties and characterization of lipids. • Acquaint with the classification, structure, properties and functions of nucleic acids	
UNIT	**CONTENT**	**HOURS**
UNIT I	**CARBOHYDRATES:** Carbohydrates: Occurrence, Chemical properties, Classification and elucidation. Configuration of Glucose, Fructose. Inter Concersion of sugars, Structure and biological functions of Mono (Triose to xedose), Di, Oligo (Tri, tetra, penta) and polysaccharides. Homo and Heteroglycans. Reaction based on functional groups: Aldehyde &Ketone.	**15 Hrs**

UNIT II	**AMINO ACIDS & PROTEINS :** Amino acids - Structure. Classification essential and non essential amino acids & physical, chemical, biological properties Zwitter ions isoelectricpoint. Proteins- Classification, Primary, Secondary, tertiary and Quaternary structure (Haemoglobin and Myoglobin only). Protein in biological properties Denaturation & Renaturation with agents.	**15 Hrs**
UNIT III	**FATTY ACIDS & LIPIDS** Fatty acids: Definition, classification (saturated & unsaturated & PUFA). Essential and non essential fatty acids- general properties. Lipids: Definition, classification, structure, properties- physical, chemical, biological properties of lipids. Example (cholesterol & lecithin structure)	**15 Hrs**
UNIT IV	**NUCLEIC ACIDS** Purine and pyrimidine bases, nucleosides, nucleotides. Classification, Structure and Functions of nucleic acids. Types of DNA and RNA (Watson & crick model of DNA), RNA(t RNA, r RNA, mRNA).	**15 Hrs**
UNIT V	**VITAMINS & MINERALS** Vitamins – Definition, occurrence, Classification, Structure, Nutritional Requirements & deficiency Diseases of fat soluble (A,D,E,K) and water soluble (Vitamin C & Folic acids, cyanocobalamine). Minerals and its biological importance, sources, types and nutritional requirements of Macro minerals and Micro minerals (sodium, potassium, calcium, phosphorous, magnesium, zinc, iron, cobalt)	**15 Hrs**

Text Book:

1. Biochemistry, U.Sathyanarayana &U.Chakrapani,2013,5th edition Elsevier India Pvt.Ltd.,Books & Allied Pvt.Ltd.
2. Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, 2013, 7thedition S.Chand & Company Ltd.
3. Textbook of Medical Biochemistry, MN Chatterjea, Rana Shinde, 2002,8th edition,Jaypee Brothers.

Reference Books:

1. DavidL.Nelson, MichaelM.Cox, 2005, Principles of Biochemistry, 4th edition W.H.Freeman and Company.
2. Voet.D,Voet.J.G.and Pratt,C.W,2004, Principles of Biochemistry, 4th editionJ ohn Wiley & Sons,Inc.
3. ZubayG.L,*et.al*., 1995, Principles of Biochemistry,1st edition,W.M.C.Brown Publishers.

Web-Resources:

1. https://www.britannica.com/science/biomoleculehttps://en.wikipedia.org/wiki/Biomoleculehttps://www.khanacademy.org/science/biology/macromolecules.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Classify, illustrate the structure and explain the physical and chemical properties of carbohydrates.	PO1
CO2	Indicate the classification, structure, properties and biological functions of amino acids.	PO1
CO3	Elaborate on classification, structure, properties, functions and characterization of Fatty acid and lipids	PO1
CO4	Describe the structure, properties and functions of different types of nucleic acids	PO1,PO4
CO5	It helps the students in understanding the classification functions and application aspects of Vitamins and Minerals	PO1

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	S	**S**	**S**
CO 4	**S**	**S**	**S**	M	**S**	**S**	**S**	M	**S**	**S**
CO5	**S**	S	**S**	S		**S**	**S**	S	**S**	**S**

S-Strong M-Medium L-Low

Semester-I & II / Core Practical - I	BIOMOLECULES PRACTICAL	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks : 40	External Marks: 60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives	The main objectives of this course are to • Identify the bio molecules carbohydrates and amino acids by qualitative test • Determine the quality of Lipids by titri-metric methods Isolate nucleic acids from plant and animal source
	CONTENT
	I) Qualitative test 1) Carbohydrates a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g)Starch 2) Amino acids a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine 3) Lipids Libermann-Burchard 's Test, Aromatic test **II Quantitative test** 1. Estimation of amino protein by calorimetric method 2. Estimation of Ascorbic acid by titrametric method using 2,6 dichlorophenol indophenols dye 3. Estimation of reducing sugar Benedict'squantitative method 4. Estimation of calcium by titrimetric method 5. Determination of Saponification value of an edible oil

	6. Determination of Iodine number of an edible oil 7. Determination of Acid number of an edible oil

Text Book:

1. David T Plummer ,An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Edition
2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015
3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher's third edition

Reference Books:

1. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees A Practical book on BiochemistryEverest publishing house1st Edition, 2019
2. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.
3. Biochemical Tests – Principles and Protocols. Anil Kumar, Sarika Garg and NehaGarg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.
4. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4th edition, Cambridge University press, Britain.1995.

Web-Resources:

1. https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html 14.
2. https://www.pdfdrive.com/analytical-biochemistry-e46164604.html.
3. https://www.pdfdrive.com/biochemistry-books.html.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Qualitatively analyze the carbohydrates and report the type of carbohydrate based on specific tests	PO1,PO2, PO3
CO2	Qualitatively analyze amino acids and report the type of amino acids based on specific tests	PO1,PO2 ,PO3
CO3	Determine the Saponification, Iodine and acid number of edible oil	PO1, PO3,PO4
CO4	Isolate the nucleic acid from biological sources	PO1,PO3
CO5	Students acquire skill to perform the experiment in the real lab.	PO1,PO2 ,PO3

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	M	**S**	**S**	M	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester I / Skill Enhancement Course - II	MICROBIAL TECHNIQUES	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks :25	External Marks :75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objective of this course are to • Study the growth of bacteria • Know the parts & uses of microscope • Learn staining methods to identify microbes • Learn different types of culture methods • Study food preservation methods	
UNIT	**CONTENT**	**HOURS**
UNIT I	Growth of bacteria- Definition, growth phases, factors affecting growth (pH, temperature, and oxygen), cell count (hemocytometer, Bacterial cell- Bacillus subtilis), fungal cell (Saccharomyces) and human blood cell.	6 Hrs
UNIT II	Microscopy- Principle, types - Compound microscope, electron microscope- TEM, SEM, use of oil immersion objective.	6 Hrs
UNIT III	Stains and staining- Principles of staining, simple staining, negative staining, Differential staining, Gram and acid-fast staining, flagella staining, capsule and endosperm Staining. Staining of yeast (methylene blue), lactophenol cotton blue, staining of mold (Penicillium, Aspergillus), Agaricus.	6 Hrs

UNIT IV	Cultivation of bacteria– Types of growth media (natural, synthetic, complex, enriched, selective- definition with example), culture methods (streak plate, spread plate, pour plate, stab culture, slant culture, liquid shake culture, anaerobiosis) - aerobic and Anaerobic bacteria.	6 Hrs
UNIT V	Food microbiology- Microbiological examination of food: microscopic examination and culture, phosphatase test of Pasteurized milk. Preservation of food- High temperature (boiling, pasteurization, appreciation), low temperature (freezing), dehydration, osmotic pressure, chemical preservations, radiation. Microorganisms as food SCP.	6 Hrs

Text books

1. Sherris Medical Microbiology, 7th Edition byAuthors: Kenneth Ryan, C. George Ray, Nafees Ahmad, W. Lawrence Drew, Michael Lagunoff, Paul Pottinger, L. Barth Reller and Charles R. Sterling
2. Food Microbiology: Fundamentals And Frontiers, 5th Edition by Editor(s):Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill

   3.Text book of microbiology by Ananthanarayan and Panicker's
4. Textbook of microbiology by P.C. Trivedi Sonali Pandey Seema Bhadauria5. 5.Prescott's Microbiology, 10th Edition by Authors: Joanne Willey, Linda Sherwood and Christopher J. Woolverton

Reference books

1. Bailey & Scott's Diagnostic Microbiology, 14th Edition by Author: Patricia Title
2. Medical Microbiology, 7th Edition Authors: Patrick R. Murray, Ken S. Rosenthal andMichael A. Pfaller
3. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J.Leboffe and Burton E. Pierce

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Understand the growth of bacteria and to perform cell count	PO1,PO2
CO2	Acquire knowledge of microscope and its uses	PO1,PO2
CO3	Identify the microbes by staining methods	PO1,PO2, PO6
CO4	Culture microbes by various methods	PO1,PO2, PO6
CO5	Preserve foods at high and low temperature	PO,PO2,

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S - Strong M - Medium L -Low

Semester-II / Core Course - II	CELL BIOLOGY	Course Code:
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Provide basic understanding of architecture of cells and its organelles. • Understand the organization of prokaryotic and eukaryotic genome. • Educate on the structural organization of bio membrane and transport mechanism • Impart knowledge on cell cycle, cell division and basics of cells Familiarize the concept of mechanism of cell-cell interactions.	
UNIT	**CONTENT**	**HOURS**
UNIT I	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, per oxisome and their functions.	18Hrs
UNIT II	Cytoskeleton- microfilament, microtubules and intermediary filament-structure, composition and functions. Organization of Genome - prokaryotic, and eukaryotic genome. Organization of chromatin – his tones, nucleosome concept, formation of chromatin structure. Special types of chromosomes – lamp brush chromosomes, polytene chromosomes.	18 Hrs

UNIT III	Bio membranes-Structural organization of lipid bi layer model and basic functions- transport across cell membranes- Unipart, Symport and Antiport. Passive and active transport.	18 Hrs
UNIT IV	Cell cycle-Definition and Phases of Cell cycle – Cell division- Mitosis and Meiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells.	18 Hrs
UNIT V	Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans-structure and biological role. Structure and role of cadherin, selectins, integrins, Cell - cell interactions – Types - gap junctions, tight junctions and Desmosomes.	18 Hrs

Text Book:

1. Arumugam.N,Cellbiology.Saraspublication(10ed, paperback), 2019
2. Devasena.T.CellBiology.OxfordUniversityPressIndia-ISBN:9780198075516, 0198075510, 2012
3. Bruce Al berts and Dennis Bray. 2013, Essential Cell Biology. (4”ed). Garland Science.

Reference Books:

1. S.C,R. Cell Biology. New age Publishers -ISBN-10: 8122416888/ISBN-13: 978- 8122416886, 2008
2. Cooper,G.A.TheCell:AMolecularApproach.SinauerAssociates,Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013
3. E.M.F.,D.R,CellandMolecularBiology.LippincottWilliams&WilkinsPhiladelphia - ISBN: 0781734932 9780781734936, 2006
4. LodishH.A ,Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.

Web-Resources:

1. https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf
2. https://www.medicalnewstoday.com/article/320878.php
3. https://biologydictionary.net /cell

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Ex plain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.	PO1
CO2	Familiarize the cytoskeleton and chromatin	PO1,PO2
CO3	Illustrate the structure, composition and functions of cell membranerelated to membrane transport	PO1,PO2
CO4	Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells.	PO1, PO2
CO5	Relate the structure and biological role of extracellular matrix in cellular interactions	PO1,PO2

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S - Strong M - Medium L -Low

Semester-II / Skill Enhancement Course -II	HERBAL MEDICINE	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1-Acquire / Remember** **K2-Understanding** **K3-Apply** **K4-Analyze** **K5-Evaluate** **K6-Create**	
Course Objectives	**The objectives of this course are** • To learn the history of herbal medicine. • To understand the source of herbal materials. • To learn the drug yielding. • To understand the physical and chemical constants. • To learn the plant morphology.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Definition, Brief history, scope and application of herbal medicine. Study of various systems of drugs of plant origin in Allopathy, Ayurveda, Unani, Siddha, Homeopathy and Aromapathy.	**6 Hrs**
UNIT II	Source of herbal raw materials, identification, collection and processing of herbal drugs and authentication.	**6 Hrs**
UNIT III	Organoleptic study of the following medicinal plants: Fruit – Amla, Bulb – Garlic, Rhizome – Ginger, seed – castor, Bark – Cinchona, Leaves – Neem, Flower – Clove.	**6 Hrs**
UNIT IV	Determination of physical and chemical constants such as extractive values, moisture content, volatile oil content, ash values and bitterness value and its Significances.	**6 Hrs**
UNIT V	Biological importance of various phytochemicals in plants: Alkaloids, Saponins, Flavonoids, Glycosides, Steroids, Terpenoids and Phenolic compound.	**6 Hrs**

	Plant morphology –Botanical description of various plants parts used as drugs such as root, Rhizome, stolon, bulb, bark, leaf, flower, fruits, and seed. biological importance of phytochemicals.	

Text Book:

1. V. Kumaresan, "Herbal Biotechnology and Pharmacognosy" Saraspublications.
2. Joseph E. Pizzorno and Michael T. Murray "Textbook of Natural Medicine"Fifth Edition 2020

Reference Books:

1. India medical plants by orientLongman-1996
2. Ayuruvedic materials media for domestic use by ThohomasJ.Graham-2006
3. Herbal medicines by Dr.M.D .ZulfeequarAlam-2008.
4. Medicinal Plants,A.K.shrivastava,2010.
5. Pharmacognosy,C.KKokate, A.P.Purohit andS.B.Gokhale-2007

Web Resources:

1. https://www.kobo.com/us/en/ebook/fundamentals-of-herbal-medicine-3.

2. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine- natural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu.

Course Outcomes

On completion of the course the learner will be able

CO1: To ensure the students scope and application of herbal medicine.

CO2: To understand the raw materials of herbal medicine.

CO3: To study about the drug yielding in fungi and algae.

CO4: To understand the determination of physical and chemical constants.

CO5: To study about the botanical description of various plants.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO 2	PSO3	PSO4	PSO1
CO 1	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	S	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-III/ Core Course - III	BIOCHEMICAL TECHNIQUES	Course Code:
Instruction Hours:6	Credits:6	ExamHours:3
InternalMarks:25	ExternalMarks:75	TotalMarks:100

Cognitive Level	**K1–Recalling** **K2-Understanding** **K3-Applying** **K4-Analyzing** **K5-Evaluating** **K6–Creating**	
Course Objectives	The objectivesofthis course are • Introduce the basic principles, types and applications of various sedimentation techniques. • Provide an understanding of the underlying principles of chromatographic techniques • Demonstrate experimental skills in various electrophoretic techniques. • Appraise the use of colorimetric and spectroscopic techniques in biology • Impart knowledge about the measurement of radio activity and safety aspect of radioactive isotopes.	
UNIT	**CONTENT**	**HOURS**
UNITI	Centrifugation-Basic principles, RCF**,** Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation-differential and density gradient centrifugation, Ratezonal and Isopycnic techniques, construction, working and applications of analytical ultracentrifuge. Determination of molecular weight (Derivation excluded)	18 Hrs
UNITII	Chromatography - adsorption, partition. Principle, instrumentation and applications of paper chromatography, Thin layer chromatography, Colum Chromatography, ion- exchange chromatography, gel permeation chromatography and affinity chromatography, HPLC, Western Blotting .	18 Hrs

UNIT III	Electrophoresis –General principles, factors affecting electrophoretic mobility. Tiseliu smoving boundary electrophoresis. Electrophoresis with paper and starch. Principle, instrumentation and applications of agarose gel electrophoresis and SDS-PAGE.	18 Hrs
UNIT IV	Basics of Electromagnetic radiations- Energy, wavelength, wave number and frequency. Absorption and emission spectra, Lambert–Beer Law, Light absorption and transmittance. Colorimetry - Principle, instrumentation and applications. Visible and UV spectrophotometry – Principle, instrumentation.	18 Hrs
UNIT V	Radio activity –Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity-Methods based upon ionization-Geiger Muller Counter. Methods based upon excitation- Solid & Liquid scintillation counters. Autoradiography. Biological applications and safety aspects of radio isotopes.	18 Hrs

Text books

1. Avinash Upadhyay, Kakoli Upadhyay & NirmalenduNath, 2002, Biophysical Chemistry, Principles and Techniques, 3rdedition, Himalaya Publishing House.
2. L.Veerakumari, 2009,Bio instrumentation,1stedition, MJP Publishers.
3. Keith Wilson &John Walker, 2000, Practical Biochemistry-Principles and techniques, Cambridge University Press, 4thedition.

Reference books

1. Terrance G. Cooper The tools of Biochemistry ,. 1977, , John Wiley &Sons,Singapore.
2. Gurumani, Research Methodology for Biological Sciences, 2011,1stedition, MJP Publishers.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1stedition, Narosa Publishing house.

Web-Resources:

1. https://www.britannica.com/science/chromagraphy

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Describe types of rotors and identify the centrifugation technique for the separation of biomolecules.	PO1,PO2
CO2	Demonstrate the principles, operational procedure and applications of planar and column chromatography.	PO1,PO2
CO3	Specify the factors and explain the separation of DNA and protein using electro phoretic technique.	PO1,PO2
CO4	State Beer's Law and illustrates the instrumentation and uses of colorimeter and spectrophotometer.	PO1,PO2
CO5	Enumerate various methods of measurement of radioactivity and safety aspects of radioactive isotopes.	PO1,PO2

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-III & IV / Core Practical - II	BIOCHEMICAL TECHNIQUES PRACTICAL	Course Code:
Instruction Hours: 3	Credits:3	ExamHours:3
InternalMarks:40	ExternalMarks:60	TotalMarks:100

Cognitive Level	**K1–Recalling** **K2 Understanding** **K3-Applying** **K4 –Analyzing** **K5-Evaluating** **K6–Creating**
Course Objectives	The objectives of this course are • Acquaint the students with colorimetric estimations of biomolecules. • Equip skills on various separation techniques. • Impart knowledge about the estimation of minerals and vitamins
	CONTENT
	I Colorimetry 1. Estimation of amino acid by Ninhydrin method. 2. Estimation of protein by Biuret method. 3. Estimation of DNA by Diphenylamine method. 4. Estimation of RNA by Orcinol method. 5. Estimation of Phosphorus by Fiske and Subbarow method. **II Chromatography** 1. Separation and identification of sugars and amino acids by paper chromatography. 2. Separation and identification of amino acids and lipids by thin layer chromatography 3. Extraction and separation of leaf pigment by TLC. 4. Separation of Plant Pigments by the column chromatography. **III Demonstration** 1. Separation of serum and plasma from blood by centrifugation. 2. Separation of serum proteins by SDS-PAGE.

Text books

1. J.Jayaraman, Laboratory Manualin Biochemistry New Age International(P) Limited Fifth edition 2015.
2. S.Sadasivam.A. Manickam Biochemical Methods Newage International Pvt Ltd publishers third edition 2018.
3. Keith Wilson and John Walker Principles and techniques of Practical Biochemistry Cambridge University Press 2010, Seventh edition.

Reference books

1. S.K.Sawhney and Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd 2nd edition, 2005.
2. David T. Plummer,2001, An Introduction to Practical Biochemistry,3rd edition,Tata McGraw-Hill publishing company limited.
3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition,1988.

Webresources

1. https://www.pdfdrive.com/biochemistry-books.html

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcome**
CO1	Estimate the amount of biomolecules by Colorimetric method.	PO1,PO3
CO2	Quantify the amount of minerals by Colorimetric Method	PO1,PO3
CO3	Separate and identify sugars, lipids and amino acids by Chromatography	PO1,PO3
CO4	Operate centrifuge for these parathion of serum and plasma	PO1,PO3
CO5	Demonstrate the separation of proteins electrophoretically	PO1,PO3

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	S	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-III / Second Minor Course - I	MICROBIOLOGY - I	Course Code:
Instruction Hours:4	Credits:3	Exam Hours:3
Internal Marks:25	External Marks:75	Total Marks:100

Cognitive Level	**K1–Recalling** **K2-Understanding** **K3-Applying** **K4 –Analyzing** **K5-Evaluating** **K6–Creating**	
Course Objectives	The objectives of this course are • To gain knowledge on history of microbiology and various types of microscopes. • To learn about cell structure and staining methods. • To understand Microbial Classification and genome organization. • To gain knowledge on culturing microorganisms and microbial growth. • To learn about antimicrobials and various groups of microorganisms.	
UNIT	**CONTENT**	**HOURS**
UNIT-I	Definition and scope of Microbiology, History and Recent Developments, Spontaneous generation, Biogenesis, Contribution of Louis Pasteur, Leewen Holk, Lazzarn - Spallanzani, John Tyndall, Joseph Lister, Robert Koch, Microscopy - Simple, Compound, Light Microscopy Dark ground, Phase contrast, Flurescence and Election microscopy.	12 Hrs
UNIT-II	Five Kingdom concept cell Theory, Binomial Nomenclature of microbes, species concept, classical approach with examples, Anatomy of Prokaryotes and Eukaryotes, ultra structure and function of cell wall and cell organelles.	12 Hrs

UNIT-III	Culture Techniques, Media preparation, Preservation of cultures, Aerobic and Anaerobic culture techniques, Microbial morphology - wet mount, Hanging drop staining methods, Dyes, Simple - Differential and Special staining techniques Acid fast staining spore stain, Capsule stain, staining for met achromatic Granules, Development of Laboratory Techniques for pure and Mixed culture.	12 Hrs
UNIT-IV	Antimicrobial chemotheraphy - Antibiotics - source, classification mode of action - Antimicrobial resistance - Tests for Sensitivity to Antimicrobial agents and its Quality control classical techniques of Microbial identification - Morphological, Physiological and Biochemical properties.	12 Hrs
UNIT-V	Measurement of microbial growth Batch and continuous culture, Growth Determination - Growth curve. Structural characteristics of algae - Cholrella, Fungi - Mucor and Protozoa - Entamoeba.	12 Hrs

Text Book:

1. Prescott's Microbiology. 10th Edition, 2016. Willey J., Sherwood L., Woolverton C.J. McGraw Education, New York.

Reference Books:

1. Principles of Microbiology. 2nd Edition, 1997. Atlas R.M. William C Brown Publishers, New York.
2. Microbiology. 5th Edition, 2006. Pelczar T.R., Chan E.C.S. and Krieg N.R. Tata McGraw-Hill, New Delhi.
3. Foundations in Microbiology. 8th Edition, 2001. Talaro K.P. and Chess B. McGraw Hill Companies, New York.
4. Microbiology: Principles and Explorations. 8th Edition, 2012. Black J.G. 2012. John Wiley & Sons, Inc., Hoboken, New Jersey.
5. Microbiology: An Introduction. 10th Edition, 2010. Tortora G.J., Funk B.R. and Case C.L. Benjamin Cummings, San Francisc

Web-Resources:

1. https://www.britannica.com/science/biomolecule
2. https://en.wikipedia.org/wiki/Biomoleculehttps://www.khanacademy.org/science/biology/macromolecules

Course Outcomes

CO	On completion of this course, students will be able to
CO1	Understand the historical Developments in Microbiology
CO2	Understand the usage of microscopes to know the size and shape of microorganisms.
CO3	Understand Eubacteria, Archaebacteria and Actinomycetes.
CO4	Understand systemic classification of microorganisms.
CO5	Understand the concept of microbial growth, culture media and the process of controlling microbial growth.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-III/ Second Minor Practical - I	MICROBIOLOGY PRACTICAL	Course Code:
Instruction Hours: 2	Credits:2	ExamHours:3
InternalMarks:40	ExternalMarks:60	TotalMarks:100

Cognitive Level	**K1–Recalling** **K2 –Understanding** **K3-Applying** **K4 – Analyzing** **K5-Evaluating** **K6–Creating**	
Course Objectives	The objectives of this course are • To operation of all laboratory equipments, • To isolation techniques of microorganisms • To staining of microbial cells • To enumeration methods of microorganisms • To understand basic structure of microbes.	
UNIT	**CONTENT**	
	LIST OF EXPERIMENTS : 1. Cleaning of glasswares, sterilization techniques 2. Gram staining 3. Motility (Hanging drop) 4. Lactophenol cotton blue mounting of fungi – *Mucor, Rhizopus, Penicillium, Aspergillus* 5. Observation of wet mount for algae 6. Serial dilution techniques 7. Pure Culture Techniques: Pour plate, Steak plate method and spread plate method 8. Preparation of culture media 9. Slant preparation 10. Assessment of milk quality by MBRT test 11. Microscopic observation of curd 12. Cross sectioning of Root nodules for *Rhizobium* 13.Assessment of air quality by open plate method 14. Bacteriological Examination of water (MPN) 15. Antibiotic Sensitivity Testing.	

Text Book:

1. David T Plummer ,An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Edition
2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015
3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher's third edition 2018.

Reference Books:

1. Experimental Procedures in Life Sciences. Rajan. S and Selvi Christy. 2015. Anjanaa Book House Publishers, Chennai.
2. Microbiology: A Laboratory Manual. Cappuccino and Sherman. 7th edition, 2004. Benjamin Cummings Publications, US

Web Resource:

1. https://www.freebookcentre.net/medical_text_books_journals/microbiology_ebooks_online_texts_download.html

Course Outcomes:

CO	**On completion of this course, students will be able to**
CO1	• To operation of all laboratory equipments,
CO2	• To isolation techniques of microorganisms
CO3	• To staining of microbial cells
CO4	• To enumeration methods of microorganisms
CO5	• To understand basic structure of microbes.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	S	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-III / Multi Disciplinary Course I (Non Major Elective-I)	WOMEN AND HEALTH	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1-Acquire / Remember** **K2-Understanding** **K3-Apply** **K4-Analyze** **K5-Evaluate** **K6-Create**	
Course Objectives	The objectives of this course are • To learn the female reproductive system and diseases. • To understand the vaccines for during pregnancy. • To study of different types of parturition. • To learn the health problem in women. • To enable the students can get knowledge about balanced diet for women.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Balanced diet for women –carbohydrate, lipids, proteins vitamins and minerals - sources and deficiency disorders . Physicals activity – calorie expenditure for various activities, aerobics and yoga. Nutrition during adolescence	**6 Hrs**
UNIT II	.Study of the female reproductive system, female hormones, disorder of female sex hormones, menarche, menstrual cycle ,menopause, associated problems - premenstrual syndrome, amenorrhoea, dysmenorrhoea, polycystic ovarian diseases (PCOD) and fallopian tube obstruction,.	**6 Hrs**
UNIT III	Pregnancy, vaccines and diagnosis test during pregnancy, fetal testing – amniocentesis and other tests for genetic abnormalities, genetic counselling complications associated with pregnancy –gestational	**6 Hrs**

	diabetes, ectopic pregnancy ,miscarriage ,nutrition during pregnancy	
UNIT IV	Parturition –different types, significance of breast feeding, nutrition during lactation, vaccination for infants, contraceptive methods, sexually transmitted diseases.	**6 Hrs**
UNIT V	Health problems in women, cancer –breast cancer, cervical cancer ovarian cancer, diagnosis and treatment. Menopause associated problems- osteoporosis. Infertility- Causes and Treatments. Hormones replacement therapy.	**6 Hrs**

Text Book:

1.Text Book of Womens, Health Lila A.Wallis, 1997

2. Nutrition Science, B.Sri Lakshmi,2008

Reference Books:

1.Essential of food and nutrition,Vol.I and II,Swaminathan.M,2006

2.Food chemistry,L.G.Meyor

3.Food Science,Polter

4.Nutrition Science,B.Sri Lakshmi,2008

5.A text book of Health Worker (ANM),Vol I and II ,A.M .Chacklay.

Web Resources:

1. **https://www.elsevier.com/books/women-and-health/goldman/978-0-12- 288145-9.**
2. **https://www.ebooks.com/en-us/subjects/health-fitness-women-s-health-ebooks/401/.**

Course Outcomes

CO	**On completion of this course, students will be able to**
CO1	Ensure the students to acquire knowledge on anatomy of female reproductive system and related diseases.
CO2	To understand the concepts of vaccines and genetic complication during the pregnancy.
CO3	To understand acquire knowledge on different types of parturition and vaccination for infants.
CO4	Ensure the students to understand acquire knowledge on diagnosis and treatment in health problem for women
CO5	Ensure the students to understand acquire knowledge on balanced diet and physical activity for women

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	M	M	S	S	S	S	S	M
CO5	S	S	S	S	S	S	S	M	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-III / Skill Enhancement Course -III	HERBAL MEDICINE PRACTICAL	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -40	External Marks-60	Total Marks: 100

Cognitive Level	K1-Acquire / Remember K2-Understanding K3-Apply K4-Analyze K5-Evaluate K6-Create	
Course Objectives	• To enable the students can get the practical knowledge about the analysis of various phytoconstituents present in materials. • Students to understand the soxhlet apparatus how to collect solvent extracts. • Preparing TLC fingerprints of various plants extracts. • To understand the column chromatography. • To understand the separation of plant pigments using column chromatography.	
UNIT	**CONTENT**	**HOURS**
	1. Qualitative Analysis of medicinal plants. 2. Preparation of alcoholic and other organic solvents extracts of medicinal plants by Soxhlet. 3. Preparing TLC fingerprint profile of various plants extracts. 4. Estimation of Ascorbic acid (Vitamin C) by 2,6 Dichloroindophenol dye method 5. Estimation of Alkaloids 6. Separation of plant pigment by column chromatography	

Text Book:

1. Phytochemical methods, Harbone J.B and Mabry T.J,1984.
2. Text book of pharmacogenosy - Handa S and Kapoor V.K,2003

Reference Books:

1. Quality control methods for medicinal plant materials, world health organization,2000
2. Plant drug analysis-Wagner H.andBladt,1996.
3. Text book of pharmacogenosy-Handa S and Kapoor V.K,2003
4. Phytochemical methods , Harbone J.B and Mabry T.J,1984.

Web Resources:

1. https://www.amazon.in/Practical-Herbal-Medicine-Handbook- Reference-ebook/dp/B00QR9QLRY.

Course Outcomes

On completion of the course the learner will be able

CO1: Demonstrating initiative by beginning work in a timely manner without being reminded

CO2: Exhibiting professional appearance by adhering to laboratory dress code

CO3: Organizing work flow and determining priorities

CO4: Producing accurate work within the allotted time

CO5: Demonstrating awareness of own limitations, and seeking help when needed.

Mapping with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**S**	S	S	S	**S**	**S**	**S**	S	S	**S**
CO 2	**S**	S	M	S	**S**	**S**	**S**	S	S	**S**
CO 3	**S**	S	S	M	**S**	**S**	**S**	**S**	S	**S**
CO 4	**S**	M	S	S	**S**	**S**	**S**	L	S	**S**
CO 5	**S**	S	S	S	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester- IV / Core Course - IV	HUMAN PHYSIOLOGY	Course Code: BSBF
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Aid in understanding the physiology of respiratory and circulatory systems • Explain the structure and physiology of the nervous and muscular system • Explicate the functions of digestive and excretory system of the body. • Impart knowledge about the process of reproduction. • Emphasize the importance of various endocrine factors that regulate metabolism, growth, homeostasis and reproduction.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Respiratory System-Overview of respiratory system, Types of respiration, Transport of respiratory gases, Exchange of respiratory gases in lungs and tissues –Chloride Shift & Bohr's effect, Lung surfactant. Circulatory System-Structure and functions of the Heart. Arterial and venous system, Cardiac cycle, Pace maker, Blood pressure and Factors affecting blood pressure.	18 Hrs
UNIT II	Nervous system- Structure of neuron, synaptic transmission, reflex action, neurotransmission- Resting membrane and Action potential. neuro transmitters- acetyl choline, Noradrenaline, Dopamine, Serotonin, Histamine, GABA, Substance. Muscular system-structure and types of muscles - skeletal, smooth and cardiac muscles, muscle proteins- types and functions, mechanism of muscle contraction	18 Hrs

UNIT III	Digestive system- composition, functions of saliva, gastric pancreatic intestine and bile secretions, structure of digestive system, Digestion, absorption of carbohydrates, lipids, proteins. Excretory system-Structure of nephron, mechanism of urine formation, Concentration and acidification of Urine. Role of kidneys in the maintenance of acid base balance.	18 Hrs
UNIT IV	Reproductive system:-Oogenesis, spermatogenesis, capacitation and transport of sperm- blood testis barrier. Fertilization, early development, Implantation, Placentation and Parturition.	18 Hrs
UNIT V	Endocrinology- Classification of hormones, endocrine glands and their secretions, structure and functions of Insulin, thyroxine. Steroid hormones- Corticosteroids, Sex hormones – testosterone and estrogen, menstrual cycle.	18 Hrs

Text Book:

1. K.Sembulingam&PremaSembulingam,2016,Essentials of Medical Physiology, 7thedition, Jaypee Brothers Medical Publishers (P)Ltd.
2. Chatterjee.C.C.,1988, Human Physiology-VolI&II,1st edition, Medical Allied Agency.
3. Animal Physiology-Mariakuttikan and Arumugam, Saras publication,2017.

Reference Books:

1. Text book of medical biochemistry physiology- MN. Chatterjee and Rana shinde, 7th edition, Jaypee brothers- medical publishers, 2007.
2. Meyer,Meyer&Meij,2002,HumanPhysiology,3rd edition,A.I.T.B.SPublishers.
3. Guyton and Hall, 2011,Textbook of Medical Physiology, 12thedition,W.B.SaundersCompany.
4. Test book of Medical Physiology –Guyton&Hall,12thedition,Saunders Publishers, 2010
5. Humananatomyandphysiology–ElaineN.Marieb,3rdedition, Benjamin/Cummings(a Pearson education company), 1995.

Web-Resources:

1. https://www.youtube.com/watch?v=6qnSsV2syUE
2. https://www.youtube.com/watch?v=9_h0ZXx1lFw
3. https://slideplayer.com/slide/9431799/

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the exchange of gases, design of blood vessels and cardiac cycle.	PO1
CO2	Summarize the events in transmission of nerve impulses mechanism of muscle contraction.	PO1
CO3	Elaborate the structure and functions of digestive system, structure of nephron and mechanism of urine formation and role of kidney in maintenance of pH.	PO1
CO4	Describe the process of Oogenesis, Spermatogenesis, Fertilization, and Parturition.	PO1,PO2

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 3	**S**	S	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**

S-Strong M-Medium L-Low

Semester-IV / Second Minor Course - II	MICROBIOLOGY – II	Course Code:
Instruction Hours: 4	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • To gain knowledge about the importance of microorganisms in soil and agriculture • To understand the role of microorganisms in air and water • To learn about food borne microorganisms • To gain knowledge on microbial production of industrially important compounds • To learn about various microorganisms causing diseases in humans	
UNIT	**CONTENT**	**HOURS**
UNIT I	Morphology, Classification, Characteristics Pathogenecity, Laboratory diagnosis andprevention of Infections caused by following organisms mycobacteria, dermatophytes, Hepatitis, Entamoeba histolytica, Antigens - Antibody reactions.	12 Hrs
UNIT II	Soil Microbiology - Soil structure, Soil formation, Characterization of Soil Typesand importance, Biofertilizers.	12 Hrs
UNIT III	. Aquatic Microbiology, Sewage Treatment - Physiological and Biological. Microbes in air, Distribution and Source of Airborne Organisms.	12 Hrs
UNIT IV	Food Microbiology, Microbial Spoilage of food, food preservation techniques, Microbes in Milk and their source, Pasteurisation techniques. Industrial Production - Pencillin	12 Hrs

UNIT V	Biotechnology - Definition of a Gene, structure, Cloning Techniques, Genome library. Nano technology - SCP production. Gene Theraphy methods.	12 Hrs

Text Book:

1. Prescott's Microbiology. 10th Edition, 2016. Willey J., Sherwood L., Woolverton C.J. McGraw Hill Education, New York.

Reference Books:

1. Modern food microbiology. 7th Edition, 2005. James M. Jay, Martin J. Loessner, David A.Golden. Springer Science & Business.
2. Environmental Aspects of Microbiology. 1996. Joseph C. Daniel. Brightsun Publications,Chennai.
3. Biotechnology. 2nd Edition, 2000. Crueger W. and A Crueger. Panima Publishing Corporation,New Delhi.
4. Text Book of Microbiology. 9|h Edition, 2013. Ananthanarayanan, R and C.K.J. Panicker. Orient Longman Private Ltd., Chennai.
5. Soil Microbiology - Soil microorganisms and Plant growth. 4th Edition, 2017. Subba Rao,N.S.Oxford & IBH publishing Co. Pvt. Ltd

Web-Resources:

1. https://www.freebookcentre.net/medical_text_books_journals/microbiology_ebooks_online_texts_download.html
2. http://www.microbeworld.org

Course Outcomes

CO	**On completion of this course, students will be able to**
CO 1	Understand the soil microbiology and types
CO 2	To estimate the various Sewage Treatment
CO 3	Students will be able to observe and identify the food Spoilage, food preservation techniques
CO 4	Understand the Morphology, Classification, Characteristics Pathogenecity, Laboratory diagnosis andprevention of Infections.
CO5	To estimate the gene structure and cloning Techniques.

Semester-IV / Multidisciplinary Course - II (Non Major Elective-II)	PERSONAL HEALTH AND HYGIENE	Course Code: ---
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 –Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• To learn about Personal Health and its importance • To exemplify the importance of personal health and Hygiene. • To gain knowledge on physical health and • To learn about mental health • To study the Environmental health	
UNIT	**CONTENT**	**HOURS**
UNIT I	**Introduction:** Scope of health and hygiene, Nutrition and health, Importance of the study; Diet control for diabetics, cholesterol etc, concept of energy, daily food intake as per occupation. Malnutrition and over nutrition – obesity and weight control; defects of modern food habits – fast food, soft drinks, ice-creams and broiler chick	**15**
UNIT II	**Personal health** – Factors contributing to relationship between health and disease – healthy habits, Oral Hygiene. **Personal Hygiene -** History of hygienic practices, Importance of Personal hygiene.	**15**
UNIT III	Physical health – Care of skin, ear, eyes, teeth, hands and feet, recreation and posture, menstrual hygiene, care of the sick and disabled, care of old people (geriatrics).	**15**

UNIT IV	Mental health – Definition –Causes and Types - Characteristics of a mentally healthy person – Factors contributing to mental health.	**15**
UNIT V	Environmental health – Relation of environment to health - health hazards – purification of water - efficient disposal (different methods like bore - hole latrine) - Solid waste disposal and control - food and milk sanitation – pest and rodent control	**15**

Text Book:

1. David morley and others:Practicing health for all

Reference Books:

1. J.H. Helberg :Community Health

2. Gill Watt :Health Policy

3. W.B. Saunders :Epidemology, Biostatistics and Preventive medicine, 1996

4. J.E.Park & K. Park:Preventive And Social MedicineBrown And Io.1978

Web Resources:

1. https://www.healthdirect.gov.au/personal-hygiene
2. https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/personal-hygiene

Course Outcomes

On completion of the Course, Students should be able to

CO 1 Learn health and hygiene with its principles and importance

CO 2 Acquire the knowledge on personal health and its factors

CO3 Know the physical health

CO 4 Explore concepts on Mental Health

CO5 Understand environmental health and its hazards

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 5	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-V / AEC - I	BASICS OF FORENSIC SCIENCE	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to 1. Gain knowledge on the basic practices of forensic analysis. 2. Perform investigation using fresh blood. 3. Carry out the analysis using body fluids 4. Investigate the presence of forms of drugs and poisons in body fluids. 5. Execute the identification test on multiple samples.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis.	6 Hrs
UNIT II	Blood – grouping and typing of fresh blood samples including enzyme .Cases of disputed paternity and maternity problems, DNA profiling.	6 Hrs
UNIT III	Analysis of body fluids- Analysis of illicit liquor including methyl and ethyl alcohol in body fluids and breathe. Chemical examination, physiology and pharmacology of Insecticides and pesticides.	6 Hrs
UNIT IV	Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids.	6 Hrs
UNIT V	Identification tests- Identification of hair, determination of species origin, sex, site and individual identification from hair. Classification and identification of fibers. Examination and identification of saliva, milk, urine and faecal matter.	6 Hrs

Text Book:

1. Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
2. Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
3. Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.
4. Grierson and Covey, S.N.1988. Plant Molecular biology. Blackie.
5. Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

Reference Books:

1. An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.
2. Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E.
3. Forensics by Embar-Seddon, Ayn and Pass. Allan D.
4. Forensic Medicine by Adelman, Howard C &Kobilinsky, Lawrence Page 24 of 63

Web-Resources:

1. https://www.youtube.com/watch?v=QNYlX5Ne9lQ

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Gain knowledge on basics of forensic science and method for collection and preservation of samples	PO1,PO2,PO6
6CO2	Assess the paternity ,maternity problems and DNA profiling	PO1,PO2
CO3	Identify the presence of alcohol ,insecticides and pesticides in body fluids	PO1,PO2
CO4	Detail on the test performed to identify the presence of drugs and poisons in body fluids	PO1,PO2
CO5	Identify species and sex from the available body fluids	PO1,PO2

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-V / Core Course -V	ENZYMES	Course Code:
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Provide fundamental knowledge on enzymes and their properties. • Understand the mechanism of action of enzymes and the role of coenzymes in catalysis. • Introduce the kinetics of enzymes and determine the Km and V max. • Explain the effect of inhibitors on enzyme activity • Understand the role of enzymes in clinical diagnosis and industries.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**Introduction to enzymes :** Nomenclature and Classification based on IUB with examples, enzyme as catalyst-Activation energy, Enzyme specificity-absolute, Group, linkage and stereo specificities. Concept of Active site, Lock and key hypothesis and induced fit theory, Enzyme expression Units-IU, turnover number, katal and specific activity.	15 Hrs
UNIT II	**Mechanism of enzyme catalysis –** Acid Base catalysis, covalent catalysis, electrostatic catalysis, metal ion catalysis, proximity and orientation effect. Coenzymes -Definition, types, co-enzymatic forms of vitamins- NAD/NADP, FAD, FMN, Coenzyme A TPP,PLP, lipoic acid and biotin. Multi-enzyme complexes - Pyruvate dehydrogenase complex. Iso enzyme with reference to LDH and CK	15 Hrs

UNIT III	**Enzyme kinetics** --Definition of kinetics, Factors affecting enzyme activity - temperature, pH, substrate and enzyme concentration, activators-cofactors, Derivation of Michaelis-Menton equation for unisubstrate reactions , Line weaver - Burk plot, Eadie – Hof steep lot Significance of Km and V max and their determination using the plots	15 Hrs
UNIT IV	**Enzyme inhibition -** Reversible and irreversible inhibition-types of reversible inhibitors, competitive, non-competitive, un-competitive inhibitors. Graphical representation by L-B plot, (Kinetic derivations not required), Determination of Km and V max in the presence and absence of inhibitors. Allosteric enzymes - Sigmoidal curve, positive and negative modulators.	15 Hrs
UNIT V	**Applications of enzymes** -Immobilized enzymes - methods of immobilization-adsorption, covalent bonding, cross linking, encapsulation, entrapment and applications of immobilized enzymes. Biosensors-e.g. Glucose sensors. Clinical application of enzymes. Industrial applications of enzymes –Food, textile and pharmaceutical industries.	15 Hrs

Text Book:

1. U.Sathyanarayana&U.Chakrapani,2013,Biochemistry, 4thedition, Elsevier India Pvt. Ltd., Books &Allied Pvt.Ltd.
2. Dr.G.R Agarwal, Dr. Kiran Agarwal & O.P. Agarwal,2015, Textbook of Biochemistry(Physiologicalchemistry),18thedition,GoelPublishingHouse,
3. T.Devasena,2010,Enzymology,1stedition, Oxford university Press.

Reference Books:

1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, ClinicalChemistry,2ndedition,EastWestPressPvt.Ltd.
2. DavidL.Nelson,MichaelM.Cox,2005,PrinciplesofBiochemistry,4theditionW.H.FreemanandCompany,
3. .Voet.D,Voet.J.G.andPratt,C.W,2004,PrinciplesofBiochemistry,4theditionJohnWiley&Sons,Inc.
4. ZubayG.L,et.al.,1995,PrinciplesofBiochemistry,1stedition,WmC.BrownPublishers.

Web-Resources:

1. www.biologydiscussion.com/notes/enzymes-2.notes
2. https://www.britannica.com/science/protein/The-mechanism-of-enzymaticaction
3. https://www.youtube.com/watch?v=oVJ2LJxO6tU

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Identify the major classes of enzymes, differentiate between a chemical catalyst and a biocatalyst and define the units of enzymes.	PO1
CO2	Explain the mechanism of enzyme catalysis and the role of coenzymes in enzyme action.	PO1,PO2
CO3	Illustrate the steady state kinetics,, interpret MM plot and LB plot based on kinetics data, and determine Km and V max.	PO1,PO3
CO4	Distinguish the types of inhibition along with its importance biochemical reactions.	PO1,PO3
CO5	Comprehend the various methods for production of immobilized enzymes and discuss the application of enzymes in clinical diagnosis and various industries.	PO1,PO2,PO6

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 5	**S**	**S**	S	**S**	**S**	**M**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-V / Core Course -VI	INTERMEDIARY METABOLISM	Course Code:
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Review the basic concepts off energy transformation and describe biological oxidation. • Illustrate the pathways of carbohydrate metabolism. • Explain the pathways of oxidation and biosynthesis of lipids. • Detail the catabolism of amino acids and synthesis of specialized products from amino acids. • Acquaint the metabolism of nucleic acids and its regulation	
UNIT	**CONTENT**	**HOURS**
UNIT I	Bioenergetics-High energy compounds**:** Role of high energy compounds, free energy hydrolysis of ATP and other organophosphates, ATP-ADP cycle. Biological Oxidation: Electron transport chain -its organization and function. Inhibitors of ETC. Oxidative phosphorylation, P/Oratio, Peter Mitchell's chemi osmotic hypothesis. Mechanism of ATP synthesis, uncouplers of oxidative phosphorylation, substrate level phosphorylation withexamples.	15 Hrs
UNIT II	Metabolism of carbohydrates -Glycolysis, TCA Cycle, Amphibolic nature and integrating role of TCA cycle. Anaplerosis, Pentose Phosphate Pathway (HMP shunt), Gluconeogenesis, Glycogenesis, Glycogenolysis and its regulation, glyoxylate cycle, Entner- Duodoroff pathway and Coricycle.	15 Hrs

UNIT III	Metabolism of lipids -Oxidation of fatty acids - α, β and ω -oxidation of saturated fatty acids, Oxidation of fatty acids with odd number of carbon atoms and unsaturated fatty acids, Ketogenesis, Biosynthesis of saturated fatty acids and unsaturated fattyacids, Biosynthesis and degradation of triglycerides, phospholipids and cholesterol.	15 Hrs
UNIT IV	Metabolism of amino acid- Metabolic nitrogen pool, Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination and decarboxylation, Biogenic amines, Urea cycle and its regulation	15 Hrs
UNIT V	Metabolism of nucleotides-Biosynthesis of purines and pyrimidines, -denovo synthesis and salvage pathways, Degradation of purines and pyrimidines, Conversion of ribonucleotide to deoxyribonucleotide	15 Hrs

Text Book:

1. U.Sathyanarayana &U.Chakrapani,2015,Biochemistry,4th Elsevier IndiaPvt.Ltd.,
2. M.N. Chatterjea and RanaShinde,2002, Textbook of Medical Biochemistry, 5th edition Jaypee Brothers Medical Publishers Pvt. Ltd.

Reference Books:

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M.Cox, 2008,5th edition,W.H.Freeman and Company.
2. RobertK.Murray, DarylK.Granner, VictorW.Rodwell, 2006, Harper's Illustrated Biochemistry,27th edition,McGraw Hill Publishers.
3. Principles of Biochemistry Voet.D, Voet.J.G, and PrattC.W.,2010,,Fourth edition,JohnWiley & Sons,Inc,.
4. Principles of Biochemistry, GeoffreyL.Zubay, WilliamW.Parson, DennisE.Vance,1995, 2nd Edition,Wm.C. Brown Publishers.
5. Biochemistry, Garret,R.H.andGrisham,C.M.2005,3rdEdition. Thomson Learning INC.

Web-Resources:

1. https://nptel.ac.in/courses/104/105/104105102
2. http://www.nptelvideos.in/2012/11/bioche
3. https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	State the concepts of bioenergetics and illustrate the mechanism of flow of electrons and the production of ATP.	PO1,PO2
CO2	Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism.	PO1,
CO3	Sketch the oxidation and biosynthesis of fatty acids, phospholipids, triglyceride and cholesterol with suitable examples	PO1
CO4	Explain catabolism of amino acids, synthesis of nonessential amino acids and specialized products from amino acids.	PO1
CO5	Describe the metabolism of nucleic acids with necessary illustrations and its regulation.	PO1

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-VI / Core Course - VII	NUTRITIONAL BIOCHEMISTRY	Course Code:
Instruction Hours: 5	Credits: 4	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objectives of this course are to • Create awareness about the role of nutrients in maintaining proper health. • Understand the nutritional significance of carbohydrates, lipids and proteins. • Understand the importance of a balanced diet. • Study the effect of additives, emulsifiers, and flavour enhancing substances in food. Study the significance of nutraceuticals.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Concepts of food and nutrition. Basic food groups-energy yielding, body building and functional foods. Modules of energy. Calorific and nutritive value of foods. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI.	12 Hrs
UNIT II	Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method-Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.	12 Hrs

UNIT III	Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults, pregnant Women's and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects.	12 Hrs
UNIT IV	Food additives: Nature, Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.	12 Hrs
UNIT V	Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.	12 Hrs

Text Book:

1. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bred benner. 2013. Ward law's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
2. M.Swaminadhan (1995) Principles of Nutrition and Dietics. Bappco.
3. Tom Brody(1998). Nutritional Biochemistry (2nded), Academic press, USA
4. Garrow, JS, James WPT and Ralph A (2000). Human nutrition and dietetics(10thed)
5. Churchill Livingstone.

Reference Books:

1. Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. Advances in food biochemistry, FatihYildi z (Editor), CRC Press, Boca Raton, USA, 2010
4. Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.
5. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell ,UK.

Web-Resources:

1. http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf
2. https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-protein.html.
3. https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value	PO1,PO5
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.	PO1
CO3	Classify the food groups and its significance	PO1,PO2
CO4	Understand the effect of food additives	PO1,PO2
CO5	Describe the importance of nutraceuticals and pigments	PO1,PO5,PO6

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	M	**S**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	S	**S**
CO 3	**S**	M	**S**	**S**	**S**	**S**	**S**	L	S	**S**
CO 4	**S**	M	**S**	**S**	S	**S**	**S**	**S**	S	**S**
CO5	**S**	S	**S**	**S**	M	M	**S**	**S**	S	**S**

S-Strong M-Medium L-Low

Semester-V / Core Course - VIII	PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS	Course Code:
Instruction Hours: 5	Credits: 4	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Convey the knowledge of photosynthesis. • Detail the structure and types of secondary metabolites. • Impart the idea on various plant hormones. • Emphasize the effects of free radicals and the importance of antioxidants • Understand the role of medicinal plants in treating diseases.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Photosynthesis- Photosynthesis apparatus, pigments of photosynthesis, photo chemical reaction, photosynthetic electron transport chain, path of carbon in photosynthesis- Calvin cycle, Hatch – lack pathway (4 ways) CAM path way, significance of photosynthesis.	12 Hrs
UNIT II	Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and alkaloids. Medicinal properties of secondary metabolite.	12 Hrs
UNIT III	Plant hormones Structure and function of plant hormones such as ethylene, cytokinins, auxins, Absicic acid, Florigin and Gibberlins	12 Hrs
UNIT IV	Free radicals, types, production, free radical induced damages, lipid peroxidation, reactive oxygen species, antioxidant defense system, enzymatic and non-enzymatic antioxidants, role of antioxidants in prevention of disease, phyto-chemicals as antioxidants.	12 Hrs

UNIT V	Plant therapeutics: Bioactive principles in herbs, plants with anti-diabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	12 Hrs

Text Book:

1. SinghM.PandPanda.H2005.MedicinalHerbswiththeirformulations,Daya publishing house, Delhi
2. PlantPhysiology-DevlinN.RobertandFrancisH.Witham,CBSPublications
3. Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W.
4. Anderson and John Brardall, Black well Scientific Publications, 1994.

Reference Books:

1. Khan,I.AandKhanum.A2004.Roleofbiotechnologyinmedicinalandaromatic plants, Vol.1andVol.10,Ukka2publications,Hyderabad.
2. Plant Biochemistry and Molecular Biology – Hans Walter Heldt, Oxford University, 4th Edition, 2010
3. Plant biochemistry (2008), Caroline bowsher, Martin steer,Alyson Tobin, garlandscience.
4. Plant physiology and development (sixth edition) by Lincoln Taiz ,Eduardo Zeiger , Ian Max Moller and Angus Murphy publisher ; Oxford university press

Web-Resources:

1. https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/anintroductory-chapter-secondary-metabolites
2. https://www.toppr.com/guides/biology/plant-growth-and_development/plantgrowth

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Gain knowledge on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis	PO1
CO2	Learn in detail about the structure, types, sources, biosynthesis and functions secondary metabolites.	PO1,PO3
CO3	Understand the structure and functions of plant hormones.	PO1
CO4	Discuss about free radicals, types and its harmful effects. Role of enzymatic and non-enzymatic antioxidant in defence mechanism, prevention in disease.	PO1,PO2.PO3
CO5	Identify the plants with anti-diabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	PO1, PO2,PO3

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	S	S	**S**	**S**	**S**	**S**	S	**S**	**S**
CO 2	**S**	S	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	S	S	**S**	**S**	**S**	**S**	S	**S**	**S**
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-V / Core Practical - III	NUTRITIONAL BIOCHEMISTRY PRACTICAL	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks :40	External Marks:60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives	The objectives of this course are to • Impart hands-on training in the estimation of various constituents by titrimetric method • Prepare Biochemical preparations • Determine the ash content and extraction of lipid
	CONTENT
	I.TITRIMETRY 1. Estimation of ascorbic acid in a citrus fruit. 2. Estimation of calcium in milk. 3. Estimation of glucose by Benedict's method in honey. 4. Estimation of phosphorous (Plant source) **II.BIOCHEMICAL PREPARATIONS** Preparation of the following substances and its qualitative tests 5. Lecithin from egg yolk. 6. Starch from potato. 7. Casein and Lactalbumin from milk. **III.GROUP EXPERIMENT** 8.Determination of ash content and moisture content in food sample 9. Extraction of lipid by Soxhlet's method.

Text Book:

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011,
2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw- Hill Publishing Company Limited, 2001.

Reference Books:

1. Biochemical Methods, S. Sadasivam and A. Manickam , 4h edition, New Age International Publishers, 2016
2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
3. Bowman and Robert M. 2006. Present Knowledge in Nutrition. 9th edition, International Life Sciences Publishers.
4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.
5. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition. 3rd edition. Chand ,Publishers.

Web-Resources:

1. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors
2. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf
3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y
4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value	PO1,PO5
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.	PO1
CO3	Classify the food groups and its significance	PO1,PO2
CO4	Understand the effect of food additives	PO1,PO2
CO5	Describe the importance of nutraceuticals and pigments	PO1,PO5,PO6

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	M	**S**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	M	**S**	**S**	**S**	**S**	**S**	M	**S**	**S**
CO 4	**S**	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	S	**S**	**S**	M	M	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-V / DSE - I	IMMUNOLOGY	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objective of this course are to • Introduce the structure and functions of lymphoid organs and cells of the immune system • Illustrate the structure and classification of antibodies and adaptive immune response • Impart knowledge on the types of immunity and uses of vaccines • Provide an understanding of immune related diseases and transplantation • Study the Ag-Ab interaction and immunological techniques to identify antigens and antibodies	
UNIT	**CONTENT**	**HOURS**
UNIT I	Structure and function of primary lymphoid organs (thymus ,bone marrow), secondary lymphoid organs (spleen, lymph node), Cells involved in immune system- Functions-Phagocytosis –Inflammation.	9 Hrs
UNIT II	Antigens - Nature, Immunogens, haptens, cross reactions- Immunoglobulin- types- structure and function. Cells involved in antibody formation, Clonal selection theory, Co-operation of T-cell with B-cell. Differentiation of T and B lymphocyte -Humoral and cell mediated immunity. Monoclonal antibody -Production and application in biology.	9 Hrs
UNIT III	Immunity and its types-Innate, Acquired, active and passive.- Natural and Artificial - Vaccines – Types, toxoid vaccines, killed vaccines, live attenuated vaccines, rDNA Vaccines, DNA and subunit vaccines.	9 Hrs

UNIT IV	Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), Auto-immune diseases with examples. Organ specific and systemic auto immunity. SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC, graft Vs host reaction, immunosuppressive Agents.	9 Hrs
UNIT V	Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immuno diffusion, SID and DID-Oudin Procedure, Oakley Fulthrope Procedure, Radio immune diffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test-Wasserman's reaction, RIA, ELISA.	9 Hrs

Text Book:

1. Kuby, J. (2018). Immunology(5th ed). W.H. Freeman - ISBN-10 : 1319114709 / ISBN-13 : 978-1319114701
2. Rao, C. V. (2017). Immunology (3rd ed.). Chennai: Alpha Science Int. Ltd - ISBN-10 : 1842652559/ ISBN 13:978-1842652558
3. Tizard(1995). An Introduction to Immunology. Harcourt Brace College Publications

Reference Books:

1. Kenneth M. Murphy, Paul Travers, Mark Walport - (2007), Janeway's Immunobiology, 7thedition, Garland Science.
2. Abul K. Abbas, Andrew H. Lichtman, Jordan S. Pober - (1994), Cellular and molecular immunology, 2ndedition, B. Saunders Company.
3. Basic Immunology Functions and Disorders of the Immune System, 6th Edition - January 25, 2019 Authors: Abul Abbas, Andrew Lichtman, Shiv Pillai, ISBN: 9780323549431eBook ISBN: 9780323639095
4. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - (2006),Roitt's Essential Immunology, 11th edition, Wiley-Blackwell

Web-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_bt40/preview
2. https://onlinecourses.swayam2.ac.in/cec20_bt05/preview
3. https://youtu.be/8uahFPl6ny8

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Associate structure and function of the organs involved in our body's natural Defence	PO1
CO2	Classify antigens and antibodies and the role of lymphocytes in defending the host	PO1,PO2
CO3	Describe the types of immunity and the uses of vaccines	PO1, PO4
CO4	Understand the immune related diseases and mechanism of transplantation	PO1,PO2
CO5	Examine the immunological tests and relate it to the immune status of an Individual	PO1,PO3

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	**S**	**S**	S	**S**	**S**	**S**	**S**	S	**S**	**S**
CO 2	**S**	**S**	M	**S**	**S**	**S**	**S**	S	**S**	**S**
CO 3	**S**	**S**	S	M	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	M	S	S	**S**	**S**	**S**	L	**S**	**S**
CO 5	**S**	S	S	S	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-V / DSE - I	BIOCHEMICAL PHARMACOLOGY	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	**The objectives of the course are to:** • Introduce the basic concepts of pharmacology. • Explain the metabolism of drugs and factors responsible for metabolism. • Acquaint the adverse response and side effects of drugs . • Familiarize important drugs used for common metabolic disorders. • Provide an understanding about the action of antibiotics Introduce the basic concepts of pharmacology. • Explain the metabolism of drugs and factors responsible for metabolism. • Acquaint the adverse response and side effects of drugs . • Familiarize important drugs used for common metabolic disorders.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Drugs – classification based on sources, routes of drug administration - Oral/Enteral, Parenteral and Local application. Absorption of drugs, factors influencing drug absorption, distribution and excretion of drugs	9 Hrs
UNIT II	Drug metabolism - Phase I and Phase II reactions, role of cytochrome P_{450} , non- microsomal reactions of drug metabolism. Factors influencing drug metabolism. Therapeutic index.	9 Hrs
UNIT III	Drug allergy, Drug tolerance - IC 50, LD50 of a drug, Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance - biochemical mechanism.	9 Hrs

UNIT IV	Therapeutic Drugs - Analgesics and Non-steroidal anti-inflammatory drugs (NSAIDs) – Aspirin and Acetaminophen. Insulin, Oral antidiabetic drugs - Sulfonylureas, Biguanides. Antihypertensive drugs - ACE inhibitors, Calcium channel blockers. Anti-cancer agents – Antimetabolites.	9 Hrs
UNIT V	Antibiotics - Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracyclines and chloramphenicol	9 Hrs

Text Books

1. N.Murugesh, A concise text book of Pharmacology –Sathya Publishers.
2. Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & CompanyLtd.
3. S C Metha, Ashutosh Kar, Pharmaceutical Pharmacology –New Age International (P)Limited, Publishers.

References Books

1. Lippincott's illustrated Reviews- Pharmacology by Mary J.Mycek, Richard A.Harvey,Pamela C. Champe, Lippincott – Raven publishers, New Delhi.
2. David . E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt.Ltd.
3. R.S. Satoskar, S. B. Elsevier Pharmacology and pharmacotherapy. - ISBN-10 : 9788131248867 / ISBN-13 : 978-8131248867 ,2017.
4. Tripathi, K.Essentials of Medical Pharmacology. Jaypee Publishers- ISBN-10 : 9350259370 / ISBN-13 : 978-9350259375.2018.

Web Resources

1.https://slideplayer.com/slide/3728296/64/video/What+is+bioremediation%3F.mp4

Course Outcome

CO	On completion of this course, students will be able to	Programme outcome
CO1	Classify the different routes of drug administration, describe the absorption, distribution, metabolism and excretion of drugs.	PO1,PO3
CO2	Illustrate the metabolism of drugs, classify the microsomal and non-microsomal reactions and explain the role of cytochromes.	PO1,PO3
CO3	List out the various adverse response and side effects of drugs.	PO1,PO2,PO3
CO4	Justify the use of synthetic drugs and elucidate its pharmacological actions and its adverse effects for different disease.	PO1,PO2,PO3
CO5	Highlight the importance and explain the mode of action of important antibiotics.	PO1,PO3,PO4

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	**S**	S	S	S	**S**	**S**	**S**	S	S	**S**
CO 2	**S**	S	M	S	**S**	**S**	**S**	S	S	**S**
CO 3	**S**	S	S	M	**S**	**S**	**S**	**S**	S	**S**
CO 4	**S**	M	S	S	**S**	**S**	**S**	L	S	**S**
CO 5	**S**	S	S	S	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Lo

Semester-V / AEC - II	BIOMEDICAL INSTRUMENTATION	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objectives of this course are to • Provide insights about the blood pressure and its measurement. • Elaborate the mechanism of instruments related to respiration. • Highlight the importance of imaging techniques. • Acquaint students about the basics of medical assisting devices. • Familiarize about the life saving therapeutic equipments.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Measurement of blood pressure – sphygmomanometer. Cardiac output – Cardiac rate – Heart sound – Stethoscope, ECG – EEG – EMG – ERG.	6 Hrs
UNIT II	Monitoring of inspired/expired anaesthetic gases, capnograph, inhalators, nebulizers, aspirators, infant respirator, Plethysmography.	6 Hrs
UNIT III	Medical imaging: X-ray machine - Radio graphic and fluoroscopic techniques – Computed tomography – MRI – PET, Ultra sonography – Endoscopy – Thermography.	6 Hrs
UNIT IV	Assisting equipments: Pacemakers – Defibrillators – Ventilators.	6 Hrs
UNIT V	Therapeutic equipments: Nerve and muscle stimulators –Diathermy – Heart – Lung machine – Audio meters – Dialyzers.	6 Hrs

Text Book:

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John
3. Wiley & Sons.
4. J.Webster, 'Medical Instrumentation', John Wiley & Sons.
5. C.Rajarao and S.K.Guha, 'Principles of Medical Electronics and Bio-medicalInstrumentation', Universities (India) Ltd, Orient Longman Ltd.

Reference Books:

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II Edition, Pearson Education, 2002.
2. R.S.Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd.,

Web-Resources:

1. https://youtu.be/GkUCmb0cKwo?list=PLCZ9KmODEcu138IlVeHClJ4nskArYr1Dg

Course Outcomes

CO	**On completion of this course, students will be able to**	**Programme outcome**
CO1	Illustrate the functions of instruments used for measuring blood pressure.	PO1,PO2, PO5
CO2	Elaborate the devices required for monitoring of respiratory gases.	PO1,PO2, PO5
CO3	Understand the operation of the imaging and sonographic instruments.	PO1,PO2, PO5
CO4	Differentiate between the action of pace makers, defibrillators and ventilators.	PO1,PO2, PO5
CO5	Demonstrate the function of therapeutic equipments	PO1,PO2, PO5

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	S	S	**S**	**S**	**S**	S	**S**	**S**
CO 2	**S**	**S**	M	S	**S**	**S**	**S**	S	**S**	**S**
CO 3	**S**	**S**	S	M	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	M	S	S	**S**	**S**	**S**	L	**S**	**S**
CO 5	**S**	S	S	S	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-VI / Core Course - IX	CLINICAL BIOCHEMSITRY	Course Code:
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Comprehend the basic concepts and disorders of Fluids. • Explain the disorders of carbohydrate metabolism • Comprehend the disorders of lipid metabolism. • Explain the disorders of Protein & Nucleic acid metabolism • Elucidate the disorders of Endocrine Systems.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**DISORDERS OF FLUIDS:** Disorder of fluids - electrolyte balance & disorders involving changes in H+ concentration-water toxicity, Dehydration. Renal function tests: normal and abnormal constituents of urine. Disturbances in blood clotting mechanism, haemophilia, anemia, porphyrias & anticoagulants.	18 Hrs
UNIT II	**DISORDERS OF CARBOHYDRATE METABOLISM:** Sugar level in normal blood - maintenance of blood sugar concentration - endocrine influence on carbohydrate metabolism, hypoglycemia, hyperglycemia, glycosuria, renal threshold value, diabetes mellitus - classification, complications, glucose tolerance test, diabetic coma, diabetic ketoacidosis, glycogen storage disease, fructosuria, galactosemia & hypoglycemic agent.	18 Hrs

UNIT III	**DISORDERS OF LIPID METABOLISM:** Lipid metabolism in liver and adipose tissue, plasma lipoproteins, cholesterol in health and diseases, fatty liver, atherosclerosis, lipid storage disease, hypolipoproteinemia and hyperlipoproteinemia.	18 Hrs
UNIT IV	**DISORDERS OF PROTEIN & NUCLEICACID METABOLISM:** Plasma proteins, their origin significance & variation in diseases, nitrogen balance, proteinuria, multiple myeloma, Wilson's disease. Liver function test, jaundice – Haemolytic, hepatic & obstructive jaundice. Phenyl ketonuria, alkaptanuria, tyrosinemia, albinism, gout - complications, Leschnyhan syndrome, oroticaciduria. COVID-19 - causes, Symptoms, diagnosis prevention and Treatment.	18 Hrs
UNIT V	**DISORDERS OF ENDOCRINE SYSTEMS:** Disorder associated with thyroid, pituitary, adrenal medulla & sex hormones	18 Hrs

Text Book:

1. MNChatterjeeandRanaShinde,TextBookofMedicalBiochemistry,JaypeeBrothers Medical Publishers (P) LTD, New Delhi, 8th Edition,2012

2. Ambika Shanmugam's Biochemistry for medical students, 8th edition, Published by Wolters Kluwer India Pvt. Ltd.

Reference Books:

1. Philip.D.Mayne,ClinicalChemistryindiagnosisandtreatment.ELBSPublication,6th edition, 1994.

2. Thomas M. Devlin (2014) Text book of Biochemistry with clinical correlations (7th ed). John Wiley and sons.

3. Tietz Fundamentals of clinical chemistry and molecular Diagnostics (2014) (7th ed) Saunders.

Web-Resources:

1. https://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate- metabolism
2. https://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests
3. https://onlinecourses.nptel.ac.in/noc20_ge13/preview

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment.	PO1,PO3,PO6
CO2	Analyze the lipid profile and different deficiency state.	PO1,PO3,PO6
CO3	Describe the liver and kidney functions and specific diagnostic methods used for biological sample.	PO1,PO3,PO6
CO4	Detail about the composition of gastric juice and special test for diagnosis.	PO1,PO3,PO6
CO5	Elaborate the enzyme markers used for diagnostic studies.	PO1,PO3,PO6

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	S	**S**
CO 3	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**M**	**S**
O 4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**M**	**S**
CO 5	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**M**	**S**

S-Strong M-Medium L-Low

Semester-VI / Core Course - X	MOLECULAR BIOLOGY	Course Code:
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objectives of this course are to • Provide insights into the central dogma of molecular biology and explain the mechanism of DNA replication. • Elaborate the mechanism of transcription and reverse transcription. • Highlight the characteristics of genetic code and describe the process of protein synthesis. • Introduce the concept of regulation of gene expression in prokaryotes • Familiarize the different types of mutations and explain the mechanism of DNA repair.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimental evidence by Griffith's transforming principle, Avery, McLeod and McCarthy's experiment and Hershey and Chase Experiment. Replication in prokaryotes: Model of replication, Meselson and Stahl's experimental proof for semi conservative replication. Mechanism of Replication – Initiation, events at ori C, Elongation-replication fork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitors of replication. Models of replication-theta, rolling circle and D loop model.	18 Hrs

UNIT II	Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Prib now box, elongation and termination. Post-transcriptional modifications ;inhibitors of transcription. RNAs plicing and processing of mRNA, tRNA and rRNA. Reverse transcription.	18 Hrs
UNIT III	Genetic Code and its characteristics, Wobble hypothesis. Translation: (Protein Synthesis) Adaptor role of tRNA, Activation of amino acids, Initiation, elongation and termination of protein synthesis, post-translational modifications and inhibitors of protein synthesis	18 Hrs
UNIT IV	Regulation of Gene Expression in Prokaryotes & Eukaryotes – Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, regulation of lac operon and trp operon.	18 Hrs
UNIT V	Mutation:Types-Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations.DNA repair: Direct repair, Photo reactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair.	18 Hrs

Text Book:

1. Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition, AnebooksIndia.
2. David Friefelder,1987, Molecular Biology, 2nd edition, Narosa Publishing House.
3. Dr.P.S.VermaandDr.V.K.Agarwal,2013,Cell biology, Genetics, Molecular Biology, Evolution and Ecology,1stedition,S.Chand&CompanyPvt.Ltd.

Reference Books:

1. Karp,G.,2010,Cell and Molecular Biology: Concepts and Experiments,6thedition, John Wiley & Sons. Inc.
2. DeRobertis, E.D.P. and DeRobertis, E.M.F.,2010,Cell and Molecular Biology, 8thedition, Lippincott Williams and Wilkins, Philadelphia.
3. James.D.Watson,2013, MolecularBiologyoftheGene7thedition,BenjaminCummings.
4. GeorgeM.Malacinski,1992,Freifelder's Essentials of Molecular Biology, 4thedition, Narosa publishing House.

Web-Resources:

1. www.mednotes.net/notes/biology
2. https://www.onlinebiologynotes.com/repair-mechanism-of mutation/
3. https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and model of replication.	PO1
CO2	Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA.	PO1
CO3	Decipher the genetic code and summarize the process of translation.	PO1
CO4	Comprehend the principles of gene expression and explain the concept of operon in prokaryotes.	PO1,PO2
CO5	Distinguish the types of mutations and explain the various mechanisms of DNA repair.	PO1,PO2

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	M	S	S	S	S	S	S	S	S
CO 5	S	M	S	S	S	S	S	L	S	S

S-Strong M-Medium L-Low

Semester-VI / Core Practical – IV	CLINICAL BIOCHEMISTRY AND MOLECULAR TECHNIQUES PRACTICAL	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks :40	External Marks: 60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives	The objectives of this course are to • Introduce the methods of sample collection (blood & urine) for analytical purpose. • Impart practical knowledge on the assay of activity of various diagnostically important enzymes • Understand the estimation procedure for various important biomolecules. • Help students learn the routine qualitative analysis of urine sample for diagnostic purpose. • Train students on various hematological tests and its significance.
UNIT	**CONTENT**
	1. Collection and preservation of blood and urine samples. 2. Estimation of creatinine by Jaffe's method (serum &urine) 3. Estimation of urea by diacetyl monoxime method (serum & urine) 4. Estimation of uric acid (serum & urine) 5. Estimation of cholesterol by Zak's method 6. Estimation of Glucose by Ortho Toluidine method 7. Estimation of Protein by Lowry's method 8. Estimation of Hemoglobin by Shali's/ Drabkins method 9. Assay of SGPT and SGOT 10. Qualitative analysis of normal constituents of urine a) Urea b) Creatinine

	c) Phosphorus d) Calcium 11. Qualitative analysis of Abnormal constituents a) Calcium b) Sugar(Glucose, fructose, pentose) c) Protein d) Aminoacids(Tyrosine, Histidine,Tryptophan) e) Ketone bodies f) Bile pigments with clinical significance. **DEMONSTRATION EXPERIMENTS** **HEMATOLOGY** **a)** RBC Counting **b)** Total and differential count of white blood cells **c)** Packed cell volume **d)** Erythrocyte sedimentation rate **e)** Blood clotting time **f)** Blood grouping **MOLECULAR TECHNIQUES:** 1. Isolation of genomic DNA from plant cells, 2. Extraction and separation of DNA samples on an Agarose gel electrophoresis, 3. Isolation of plasmid DNA, 4. RNA Isolation

Text Book:

1. Manickam,S.S.(2018).Biochemical Methods(3rded.).New age International Pvt Ltd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408

2. Plummer,D.T.(n.d.).AnIntroduction to Practical Biochemistry.Tata McGraw Hill-ISBN: 97800708416

3. Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.

4. B. Godkar. 2020. Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.

5. Kanai L Mukerjee. 1996. Medical Lab Technology, Vol I& II, 1st edition, Tata Mcgraw Hill, Pennsylvania.

6. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58 (Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.

Reference Books:

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

2. Ashwood, B. a. (2001). Tietz Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346 / ISBN 13: 978072168634

Web-Resources:

1. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors
2. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf
3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y
4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

Course Outcomes

CO	**On completion of this course, students will be able to**	**Programme outcome**
CO1	Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose.	PO1,PO2
CO2	Assay the activity of various clinically important enzymes and relate their clinical importance.	PO1,PO2
CO3	Estimate the important biomolecules in biological samples and relate their clinical significance	PO1,PO2,PO3,PO6
CO4	Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results	PO1,PO2,PO3
CO5	Perform the routine haematological tests.	PO1,PO2,PO3,PO6

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	M	S	S		S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S	S

S-Strong M-Medium L-Low

Semester-V / DSE - II	BIOTECHNOLOGY	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The main objectives of this course are to • Impart knowledge on gene manipulation and gene transfer technologies • Make the students understand the procedures involved in plant tissue culture. • Acquire knowledge on animal cell culture and stem cell technology. • Improve the employability skills of students by providing knowledge in recent techniques such as PCR, blotting, ELISA etc. • Understand the application of fermentation technology.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**Recombinant DNA Technology** Recombinant DNA technology - Principles of gene cloning: restriction endo nucleases and other enzymes used in manipulating DNA molecules. Ligation of DNA molecules, DNA ligase, linkers and adapters, homo polymer tailing. end labeling and construction maps of PBR322, λ bacteriophage.	9 Hrs
UNIT II	**Plant Biotechnology** Plant tissue culture- basic requirements for culture, M S medium, callus culture, protoplast culture. Vectors – Ti plasmid (cointegration vector and binary vector), Viral vectors- TMV, CaMV and their applications. Transgenic plants – pest resistant, herbicide resistant and stress tolerant plants	9 Hrs

UNIT III	**Animal Biotechnology** Animal cell lines and organ culture - culture methods and applications. Transgenic animals: transgenic mice- Production and its applications. Stem cell technology: definition, types, and applications.	9 Hrs
UNIT IV	**Molecular Techniques** PCR –Principle, types and its application in clinical diagnosis and forensic science. Southern blotting, Northern blotting and DNA finger printing Technique-principle and their applications.	9 Hrs
UNIT V	**Fermentation technology** Fermentation technology-Fermentors - general design, fermentation processes - Media used, downstream processing. Production and applications of ethanol, Streptomycin and Proteases. Production of edible vaccines.	9 Hrs

Text Book:

1.James D. Watson , Amy A. Caudy , Richard M. Myers , Jan Witkowski (2006) Recombinant DNA: Genes and Genomes - a Short Course (3rd ed),W.H.Freeman & Co

2. Satyanarayana U (2008), Biotechnology, Books & Allied (P) Ltd.

3. Cassida L (2007) Industrial Microbiology , New Age International

Reference Books:

1. Reed G (2004) Prescott and Dunn's Industrial Microbiology, CBS Publishers & Distributors

2.Biotechnology: applying the genetic revolution- David P. clark , Pazdernik N. J, Elsevier (2009).

3.Click B.R. and Pasternark J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology

Web-Resources:

1. https://nptel.ac.in/courses/102/103/102103041/
2. https://futureoflife.org/background/benefits-risks-biotechnology/
3. https://www.sciencedirect.com/topics/neuroscience/genetic-engineering
4. http://www.biologydiscussion.cm/biotechnology/techniquesbiotechnology/important-techniques-of-biotechnology-3-techniques/15683
5. https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1
6. https://www.slideshare.net/zeal_eagle/fermentation-technology
7. https://www.slideshare.net/zeal_eagle/fermentation-technology
8. https://www.slideshare.net/Chepkitwai/blotting-techniques-6129300

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonucleases	PO1,PO3
CO2	Get acquainted with the use of cloning and vectors in plant tissue culture.	PO1,PO2,PO3
CO3	Understand the methods for production of proteins using recombinant DNA technology and their applications, basics of tissue culture, transgenesis, stem cell technology, risks, and safety aspects and patenting in biotechnology	PO1,PO3
CO4	Gain knowledge about the importance of gene and gene manipulation technologies	PO1,PO3
CO5	Know the concept fermentation technology and its applications.	PO1,PO3

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S-Strong M-Medium L-Low

Semester-VI/ DSE - II	BIOENTREPRENEURSHIP	Course Code:
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objective of this course are to • Impart knowledge on bio entrepreneurship and the types of industries • Learn about business plan, proposal and funding agencies • Understand the market strategy and the role of information technology in expansion of business • Provide insights on legal requirement and accounting to establish as Bio entrepreneurship • Familiarize about business bio incubators centres	
UNIT	**CONTENT**	**HOURS**
UNIT I	Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; Introduction to Trademarks , Copyrights and patents	9 Hrs
UNIT II	Business Plan, Budgeting and Funding Idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start-up and make in India Initiative; dispute resolution skills; external environment changes; avoiding/managing crisis; Decision making ability	9 Hrs
UNIT III	Market Strategy- Basics of market forecast for the industry; distribution channels – franchising, policies, promotion, advertising, branding and market; Introduction to information technology for business administration and Expansion	9 Hrs

UNIT IV	Legal Requirements, Finance and Accounting; Registration of company in India; Ministry of Corporate Affairs (MCA); basics in accounting: introduction to concepts of balance sheet, profit and loss statement, double entry, bookkeeping; finance and break-even analysis; difficulties of entrepreneurship in India.	9 Hrs
UNIT V	Role of knowledge centres such as universities, innovation centres, research institutions (public & private) and business incubators in Entrepreneurship development; quality control and quality assurance; Definition, role and importance of CDSCO, NBA, GLP, GCP, GMP	9 Hrs

Text Book:

4. Adams, D. J. (2008). Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion - ISBN 10: 1904842364 / ISBN 13: 9781904842361

5. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303

6. Onetti, A. &. (2015). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge - ISBN 10: 1138616907 / ISBN 13: 9781138616905

7. Kapeleris, D. H. (2006). Innovation and entrepreneurship in biotechnology: Concepts, theories & cases - ISBN-13: 978-1482210125, ISBN-10: 1482210126

Reference Books:

1. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management New Himalaya. New Himalaya House Delhi:pub - ISBN : 9789350440810 9350440814
2. Ono, R. D. (1991). The Business of Biotechnology, From the Bench of the Street. Butterworth-Heinemann - ISBN 10: 1138616907 / ISBN 13: 9781138616905
3. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences.London: CRC Press - ISBN-10 : 812243049X ,ISBN-13 : 978-8122430493

Web-Resources:

1. http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/

2. https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introductionto-entrepreneurship/

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand the concept and scope for entrepreneurship	PO1
CO2	Identify various operations involved in a venture creation	PO1.PO5,PO6
CO3	Gather funding and launching a winning business	PO1.PO5,PO6
CO4	Nurture the organization and harvest the rewards	PO1.PO5,PO6
CO5	Illustrate about the Business incubator centres and Bio entrepreneurship	PO1.PO5,PO6

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-VI / Discipline Specific Elective –III	BIOINFORMATICS	Course Code:
Instruction Hours: 4	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	**The objective of this course are to** • Impart knowledge on bioinformatics and applications • Learn about biological databases • Understand the local and global sequence alignment • Provide insights on BLAST and Microarray • Familiarize about structural genomics and visualization tools	
UNIT	**CONTENT**	**HOURS**
UNIT I	Introduction to Bioinformatics – Bioinformatics and its applications. – Genome, Metabolome-Definition and its applications. Metabolome-Metabolome database-E.coli metabolome database, Human Metabolome database.Transcriptomics-Definition and applications	12 Hrs
UNIT II	Biological Databases - definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Genebank, DDBJ) Protein sequence database-SwissProt, TrEMBL, Structural Database-PDB,Metabolic database-KEGG	12 Hrs
UNIT III	Sequence Alignment-Local and Global alignment-Dot matrixanalysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment	12 Hrs
UNIT IV	BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, Result format. DNA Microarray-Procedure and applications	12 Hrs

UNIT V	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 and applications	12 Hrs

Text books

1.Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang Editors

2.Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools By: SupratimChoudhuri(Author)

3.Bioinformatics by Saras publication

4.Introduction to Bioinformatics by Arthur Lesk

Reference books

1. Computation in BioInformatics Multidisciplinary Applications S Balamurugan, Anand T. Krishnan, Dinesh Goyal, Balakumar Chandrasekaran

2. Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences
Navneet Sharma PhD Pharmaceutics, Himanshu Ojha, Pawan Raghav, Ramesh K. Goyal

Web resources

1.https://nptel.ac.in/courses/102/106/102106065/

2 http://www.digimat.in/nptel/courses/video/102106065/L65.html

3 https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Introduce the fundamentals of Bioinformatics and its applications Genome, metabalome& Transcriptome.	PO1
CO2	Classify biological database and to correlate the different file formats by nucleic acid, protein database, structural and metabolic database..	PO1,PO2. PO3
CO3	Develop algorithms for interpreting biological data.	PO1,PO2
CO4	Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes	PO1.PO2, PO3
CO5	Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method.	PO1.PO2

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**S**	S	S	**S**	**S**	**S**	**S**	**S**	M	**S**
CO 2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**		**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**		**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

Semester-VI / Discipline Specific Elective –III	GENETIC ENGINEERING	Course Code: ---
Instruction Hours: 4	Credits: 3	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 –Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• Understand the importance of plasmids and viruses to genetic engineering. • Understand the principles of the techniques of selection and screening of clones. • Analyze the methods of screening for clones that contain a desired gene fragment. • Evaluate the various techniques used to characterize DNA. • Analyze and evaluate the different applications of gene technology.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**TOOLS OF GENETIC ENGINEERING** Restriction enzymes: discovery, nomenclature, types and uses. Linking of DNA- ligases, linkers, adaptors and Homopolymer tails. Gene libraries: Genomic and cDNA libraries. Cloning vectors: Plasmids (pBR322), Bacteriophage (λ, M13) and Cosmids. Ti plasmid, Retrovirus, phagemid, YACs.	**15**
UNIT II	**GENE TRANSFER TECHNIQUES** Gene transfer techniques – calcium phosphate coprecipitation, transduction, protoplast fusion, electroporation, Microinjection and lipofection. Selection and Screening: Insertional inactivation Immunological screening, DNA Hybridization. Northern, Southern, Western Blotting and PCR- Principle, technique and applications.	**15**

UNIT III	**PLANT TISSUE CULTURE** Biotechnology: Definition, Scope, Biotechnology as an interdisciplinary pursuit.Plant tissue culture methods-callus culture, micropropagation, protoplast culture. Cloning of disease resistant plants, cloning of Bacillus thuringiensis, Application of plant tissue Culture. SCP and its applications.	**15**
UNIT IV	**ANIMAL CELL CULTURE** Animal cell culture – culture media, primary and continuous culture, cell lines and its applications. Stem cells and its applications. Fish Biotechnology: Transgenic fish, IVF. Transgenic live stock production and application, Knockout mice. Rules in Biotechnology – Patent (IPR), copyright safety, bioethics and hazards.	**15**
UNIT V	**APPLICATIONS OF BIOTECHNOLOGY** Recombinant hormones: concept, applications (Insulin and GrowthHormone)Vaccines: Subunit vaccines, Recombinant vaccines, edible vaccines. Monoclonal Antibodies: Methods of production (Hybridoma, vectors) and its application.	**15**

Text Book:

1. Dubey, P.C. (2007) Text Book of Biotechnology, Chand and Co New Delhi.

Reference Books:

1. Kumar, H.D. (1994) Mol. Bio., and Biotech. Vikas publishing House (P) Ltd., New Delhi.
2. Smith John, E. (1988) Biotech Edward Arnold London.
3. Trehan, K. (1990) Biotechnology, Wiley Eastern Ltd., New Delhi.
4. Old R.W and primrose, S.B (1989). Principles of Gene manipulation. Blackwell Scientific publications, Newyork.

Web Resources:

1. **http://freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html.**
2. **https://www.genengnews.com/category/resources/ebooks/.**

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Provide examples of current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic.

CO 2: Understand the concept of recombinant DNA technology or genetic engineering

CO 3: Describe DNA fingerprinting, and restriction fragment length polymorphism (RFLP) analysis and their applications.

CO 4:Explain the concept and applications of monoclonal antibody technology.

CO 5: Explain the general principles of generating transgenic plants, animals and microbes.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Ability Enhancement Course -III	FOOD AND NUTRITION	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1-Acquire / Remember** **K2-Understanding** **K3-Apply** **K4-Analyze** **K5-Evaluate** **K6-Create**
Course Objectives	**The objectives of the course are to:** • To enable the students can get knowledge about Food Composition, classification of food and food Preservation. • To provide students with the knowledge of basic terminology and several aspects of nutrition and the functions of food in healthy life sustenance; • To Learn about the Micro and macro mineral nutrients • To equip students with knowledge Nutrition in different stages • To enable the students can get knowledge about Diet Therapy.

UNIT	CONTENT	HOURS
UNIT I	Source food composition, properties and storage of common foods, functions of food in relation to health – classification of food based on nutrients, food preservation–food addictives. Types of food - body building foods and protective foods – Bomb colorimeter.	**6 Hrs**
UNIT II	Essential nutrients: fats, carbohydrates and proteins, Energy needs. Definition of unit of energy – Kcal, RQ, SDA, NPU, Basal metabolism – BMR – factors influencing BMR. Role of fiber in diet.	**6 Hrs**
UNIT III	Micro and macro mineral nutrients: Distribution, sources, metabolic functions and deficiency manifestion vitamins – classification, source functions and Deficiency disorder – hyper and hypo vitaminosis. Water and electrolyte balance.	**6 Hrs**

UNIT IV	Nutrition in different stages – Infants, children, adolescents, pregnant, lactating women and old persons.	**6 Hrs**
UNIT V	Principles of diet therapy. Diet during stressed conditions, labourer and patients, therapeutic diets for anemia, malnutrition, obesity, diabetes mellitus and allergy.	**6 Hrs**

Text Book:

1. Food Chemistry, L.GMeyers, CBS, 2004, Puiblishers & Distributors.
2. Food science, Polter 2001, CBSpublishers & Distributers

`Reference Books:

1. Food Chemistry, L.GMeyers, CBS, 2004, Puiblishers & Distributors.
2. Food science, Polter 2001, CB Spublishers & Distributers
3. Essential of food nutritions, Vol I&II ,Swaminathan. M.S, Bangaloreprinting
4. A Test book of food and nutrition, Annie Fredrick 2006 lotus press.

Web-Resources:

1. http://www.fao.org/publications/e-book-collection/nutrition/en/.
2. https://www.pdfdrive.com/nutrition-and-dietetics-text-books-online-e6071568.html
3. https://rushu.libguides.com/nutrition/ebooks.

Course Outcomes

CO	**On completion of this course, students will be able to**	**Programme outcome**
CO1	Locate and interpret government regulations regarding the manufacture and sale of food products.	PO1,PO3
CO2	Discuss the major chemical reactions that occur during food preparation and storage.	PO1,PO3
CO3	Discuss the important pathogens and spoilage microorganisms in foods.	PO1,PO2,PO3
CO4	Explain the effects of common food preparation methods and food storage conditions on survival and growth of microbial contaminants. Obtain food protection manager certification	PO1,PO2,PO3
CO5	Discuss basic principles of common food preservation methods.	PO1,PO3,PO4

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 5	M	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-L

Semester- VI / SEC - IV	TISSUE CULTURE	Course Code:
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	The objectives of this course are to • Introduce the tools and techniques used in tissue culture technique. • Acquire knowledge on preparation of growth medium for culture techniques. • Impart knowledge on procedures involved gene transfer. • Acquaint with the process of tissue culture technique. • Understand the importance of plant and animal tissue culture for the production and evaluation of bioactive compounds.	
UNIT	**CONTENT**	**HOURS**
UNIT I	Introduction to Tissue culture, Micro propagation, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques.	6Hrs
UNIT II	Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.	6 Hrs
UNIT III	Methods of gene transfer in plants and animals - direct and indirect gene transfer methods. Transgenic plants for crop improvement. Transgenic plants for molecular farming.	6 Hrs
UNIT IV	Cell culture technique - Explants selection, sterilization and inoculation and Culture Establishment.	6 Hrs

UNIT V	Animal Cloning - an overview-Application of animal cell culture. Animal Cell Culture: HeLa Cells.	6Hrs

Text Book:

1. Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
2. Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
3. Lycett, G.W. and Grier son, D. (e d). 1990. Genetic Engineering of crop plants.
4. Grier son and Covey, S.N.1988. Plant Molecular biology. Blackie.
5. Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

Reference Books:

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias Publications. 1995.
2. Stewart Jr., C.N., "Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley-Inter science, 2008.
3. Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010. 6th Edition.
4. Davis, J. M. (2008). Basic Cell Culture. Oxford University Press. New Delhi.
5. Davis, J. M. (2011). Animal Cell Culture. John Willy and Sons Ltd. USA.6Freshmen R. I. (2005). Culture of AnimalCells. John Willy and Sons Ltd. USA.
6. Butler, M. (2004). Animal Cell Culture and Technology. Taylor and Francis. Keywork USA.
7. Verma, A. S. and Singh, A. (2014). Animal Biotechnology. Academic Press, ELSEVIER, USA.

Web-Resources:

1. https://www.britannica.com/science/tissue-culture
2. https://en.wikipedia.org/wiki/Plant_tissue_culture
3. https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/

Course outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Introduction to plant tissue culture	PO1,PO2.PO3
CO2	Brief knowledge on preparation of tissue culture media	PO1,PO2
CO3	Understanding on different methods of gene transfer	PO1,PO2.PO3
CO4	Gain knowledge eon plant and animal cell culture techniques	PO1,PO2,PO3
CO5	Study of applications of genetically modified plants and animals.	PO1,PO2,PO3

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 2	**M**	**S**		**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 3	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low