

Ist B. Sc (2023-2024)

Biochemistry

SEMESTER I

Title of the Course : BIOMOLECULES**Category of the Course : CORE COURSE****Semester****I****Course Code : U1R3ECCC1****Nature of the Skill : EMPLOYABILITY****Marks : CIA:25+ Ext: 75 = 100 Hrs/Week 5****Credits : 5 Total Inst. Hrs 75****Course objectives:**

The objectives of this course are to

1. Introduce the structure, properties and biological significance of carbohydrates
2. Comprehend the classification, functions and acid base properties of amino acids
3. Elucidate the various levels of organization of Proteins.
4. Impart knowledge on the classification, properties and characterization of lipids.
5. Acquaint with the classification, structure, properties and functions of nucleic acids

Unit I**14 Hours****Molecules in Life:**

Definition, scope and significance of Biochemistry. Important discoveries in Biochemistry. Basic principles of organic chemistry, role of carbon, types of functional groups, chemical nature of water, pH and biological buffers. An overview of biomolecules, trace elements, minerals & vitamins.

Unit II**17 Hours****Carbohydrates:**

Definition, empirical formulae, classification, biological importance. Monosaccharides: Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers, and diastereo isomers (ICT). Disaccharides: Establishment of structures of sucrose and lactose, biological importance and structure of isomaltose, trehalose and maltose. Polysaccharides: Partial structure, occurrence and importance of starch, glycogen, inulin, cellulose, chitin, pectin and heparin, hyaluronic acid, teichoic acid and chondroitin sulphate (ASSIGNMENT). Bacterial cell wall polysaccharide, peptidoglycans.

Unit III**15 Hours****Amino acids and Proteins:**

Structure and classification of amino acids. Peptides: Peptide bond, structure and biological importance (ASSIGNMENT) Primary Structure of proteins, methods of determining N- and C- terminal

amino acids, amino acid composition. Sequencing by Edman's degradation method. Secondary Structure – α Helix. β -sheet, β -bend (ICT). Tertiary structure of myoglobin and quaternary structure of hemoglobin, denaturation and renaturation of proteins.

Unit IV

17 Hours

Lipids:

Classification and biological role. Fatty acids – Nomenclature of saturated and unsaturated fatty acids. Physiological properties of fatty acids. Acylglycerols: Mono, di and triglycerols. Saponification value, iodine value, acid value (Assignment) and their significance. Phosphoglycerides: Structure of lecithin, cephalins, phosphatidylinositol, plasmalogens, and cardiolipin. Biological role of phosphoglycerides. Sphingolipids: Structure and importance of sphingomyelin. Glycosphingolipids: Structure and importance of gangliosides and cerebroside. Eicosanoids: Structure of PGE₂, and PGF₂ α importance of prostaglandins (ICT).

Unit V

12 Hours

Nucleic acids:

Composition of DNA. Nucleosides and nucleotides. Chargaff's rule. Watson and Crick model of DNA. Melting of DNA (T_m) (ICT). RNA: Composition, types (mRNA, tRNA and rRNA), secondary structures of tRNA – clover leaf model.

Course Outcomes:

Course Name – BIOMOLECULES		Course Code - U1R3BCCC1	Knowledge Level
After completion of this course, students would be able to			
CO1	Classify, illustrate the structure and explain the physical and chemical properties of carbohydrates.		K1
CO2	Indicate the classification, structure, properties and biological functions of amino acids.		K1
CO3	Explain the classification and elucidate the different levels of structural organization of proteins.		K1
CO4	Elaborate on classification, structure, properties, functions and characterization of lipids		K1, K4

CO5	Describe the structure, properties and functions of different types of nucleic acids	K1
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Text Books:

1. Textbook of Medical Biochemistry – MN Chatterjee & Rana Shindee, 7th Edition, Jaypee Publishers, 2007.
2. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, 1st Edition, Cengage Learning, 2009.

Reference Books:

1. Lehninger Principles of Biochemistry- `David L. Nelson & Michael M. Cox, 4th Edition, W. H. Freeman Publication, 2004.
2. Biochemistry-Donald Voet & Judith G. Voet ,3rd Edition, John Wiley and Sons Publication, 2004
3. Biochemistry- Jeremy M Berg, John L Tymoczko, and Lubert Stryer,6th Edition, Freeman Publications, 2006.

e-Learning Resources:

1. <https://youtu.be/iuW3nk5EADg>
2. <https://youtu.be/Fp1wKo72b2A>
3. <https://youtu.be/6AfRX6oh9-E>

Relationship Matrix for CO, PO & PSO

Title of the Course: BIOMOLECULES							Course Code: U1R3BCCC1			
Course Outcomes (COs)	PO						PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	3	-	-	3
CO2	3	-	-	-	-	-	3	-	-	3
CO3	3	-	-	-	-	-	3	-	-	3
CO4	3	-	-	2	-	-	3	2	-	3
CO5	3	-	-	-	-	-	3	-	-	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course : Practical - I Biomolecules

Category of the Course : Core Course

Semester

I

Course Code

: UIR3BCCC2P

Nature of the Skill

: EMPLOYABILITY

Marks

: CIA:40+ Ext: 60 = 100

Hrs/Week

4

Credits

: 5

Total Inst. Hrs

60

Course objectives:

The main objectives of this course is to

1. Identify the biomolecules carbohydrates by qualitative test.
2. Identify the biomolecules and amino acids by qualitative test.
3. Determine the quality of Lipids by titrimetric methods.
4. Isolate nucleic acids from plant source.
5. Isolate nucleic acids from animal source.

I Qualitative test for

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

II Titrimetric methods

1) Determination of Saponification value of an edible oil

2) Determination of Iodine number of an edible oil

3) Determination of Acid number of an edible oil

III Group Experiments

1) Isolation of DNA from plant/animal source.

2) Isolation of RNA from rich source.

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	K1, K2, K3
CO2	Qualitatively analyze amino acids and report the type of amino acids based on specific tests	K1, K2, K3
CO3	Determine the Saponification, Iodine and acid number of edible oil	K1, K3, K4
CO4	Isolate the nucleic acid from biological sources	K1, K3
CO5	Qualitatively Analyze the Proteins.	K1, K2, K3

Text books

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. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees a Practical book on Biochemistry Everest publishing house 1st 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 Neha Garg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.
4. Harold Varley, Practical Clinical Biochemistry, CBS. 6 editions, 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>

Relationship Matrix for CO, PO & PSO

Title of the Course: Major Practical – I							Course Code: U1R2BCCC2P			
Course Outcomes (COs)	PO						PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	-	-	-	3	3	3	3
CO2	2	3	3	-	-	-	3	3	3	3
CO3	2	-	3	2	-	-	3	3	3	3
CO4	2	-	3	-	-	-	3	3	3	3
CO5	2	-	3	-	-	-	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course : Foundation Course

Category of the Course : Foundation Course

Semester I

Course Code : U1R3BCFC

Nature of the Skill : Entrepreneurship

Marks : CIA:25+ Ext: 75 = 100

Hrs/Week 2

Credits : 2

Total Inst. Hrs 30

Course objectives:

The objectives of this course are to

1. Understand the basic concepts in chemistry.
2. Understand the fundamental concepts in organic chemistry.
3. Explain the theories of origin of life on earth.
4. Illustrate the structure, composition and functions of cell and its organelles.
5. Familiarize with genetics.

Unit I

06 Hours

Some Basic Concepts of Chemistry

General Introduction- Importance and scope of Chemistry. Nature of matter, laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules. Atomic and molecular masses, mole concept and molar mass, percentage composition, empirical and molecular formula.

UNIT II

08 Hours

Cell biology

Cell as basic unit of life, prokaryotic and eukaryotic cells and their similarities and differences. Structure and functions of cell wall, plasma membrane, endoplasmic reticulum (rough endoplasmic reticulum and smooth endoplasmic reticulum), golgi apparatus, lysosomes, micro bodies (peroxysomes and glyoxysomes), vacuoles, ribosomes, centriole and basal bodies, Mitochondria, chloroplasts, nucleus, nucleolus, nuclear membrane and organization of chromosomes

UNIT III

05 Hours

Genetics

Chromosomes – structure and types – genes and genomes – linkage and crossing over – gene mapping – recombination of chromosomes – mutation – chromosomal aberrations – DNA as genetic material – structure of DNA – replication of DNA – structure of RNA and its types

UNIT IV

05 Hours

Biotechnology

Recombinant DNA technology – transgenic plants and microbes – plant tissue culture and its application – protoplasmic fusion – single

UNIT V**06 Hours****Plant physiology**

Photosynthesis – significance – site of photosynthesis – photochemical and biosynthetic phases – electron transport system – cyclic and non - cyclic and C photophosphorylation – C pathways – photorespiration – factors – saprophytic –parasitic and insectivorous plants – chemosynthesis – respiration.

Course Outcomes

Course Name - Foundation Course		Course Code – U1R3BCFC	Knowledge Level
After completion of this course, students would be able to			
CO1	Understand the basic concepts in chemistry		K2
CO2	Understand the fundamental concepts in organic chemistry		K3
CO3	Explain the theories of origin of life on earth		K3
CO4	Illustrate the structure, composition and functions of cell and its organelles		K4
CO5	Familiarize with genetics		K1

Text Books:

1. Textbook of Medical Biochemistry – MN Chatterjee & Rana Shindee, 7th Edition, Jaypee Publishers, 2007.
2. Introduction to Biochemistry – Mary K. Campbell & Shawn O. Farrell, 1st Edition, Cengage Learning, 2009.

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1. Lehninger Principles of Biochemistry- `David L. Nelson & Michael M. Cox, 4th Edition, W. H. Freeman Publication, 2004.
2. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.
3. Biochemical Tests – Principles and Protocols. Anil Kumar, SarikaGarg and NehaGarg. Vinod Vasishta Viva Books Pvt Ltd, 2012.

e-Learning Resources:

1. <https://youtu.be/iuW3nk5EADg>
2. <https://youtu.be/Fp1wKo72b2A>
3. <https://youtu.be/6AfRX6oh9-E>

Relationship Matrix for CO, PO & PSO

Title of the Course: Foundation Course							Course Code: U1R3BCFC			
Course Outcomes (COs)	PO						PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	-	3	-	-	2	3	3	3	3
CO2	3	-	3	-	-	-	3	-	-	3
CO3	2	-	-	-	-	-	-	3	3	3
CO4	2	-	-	-	-	3	3	3	3	3
CO5	2	-	-	-	-	-	-	3	3	3

S - Strong (3) M - Medium (2) L –Low (1)

Title of the Course : MEDICINAL DIET

Category of the Course : Non Major Elective

Nature of the Skill : Entrepreneurship

Marks : CIA:25+ Ext: 75 = 100 Hrs/Week : 2

Credits : 2 **Total Inst. Hrs :** 30

Course objectives:

The main objectives of this course are to

1. Provide basic knowledge about diet
2. Understand of diet modification for GI diseases
3. Plan a diet for liver diseases
4. Prepare diet chart for Infectious diseases
5. Plan a diet for Diabetes, Renal and Cardio-vascular diseases

Unit I

06 Hours

Principles of Therapeutic Diet: Definitions of Normal diet, Therapeutic diet, soft Diet and Liquid diet. Objectives of Diet Therapy. Advantages of using normal diet as the basis for Therapeutic diet. Normal Diet-therapeutic modification of normal diet.

Unit II

06 Hours

Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Malabsorption syndrome.

Unit III

06 Hours

Diet Modification in liver and gall bladder in diseases: Etiology, symptoms and dietary treatment in jaundice, hepatitis, cirrhosis of liver and hepatic coma.

Unit IV

06 Hours

Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis.

Unit V

06 Hours

Diet Modification in Diabetes, Renal and Cardio-vascular Diseases-Diabetes, acute & chronic glomerulonephritis, nephrosis, renal failure, kidney stone and Hypertension.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Possess basic knowledge about diet	K1
CO2	Sketch diet plan for GI diseases	K1, K4, K5, K6
CO3	Sketch diet plan for liver diseases	K1, K4, K5, K6
CO4	Sketch a diet plan for Infectious diseases	K1, K4, K5, K6
CO5	Prepare diet chart for Diabetes Renal and Cardio-vascular diseases	K1, K4, K5, K6

Text Books

1. M. Raheena Begum, A Text Book of Foods, Nutrition and Dietetics, Sterling Publishers Pvt. Ltd.
2. M.V. Raja Gopal, Sumati.R., Mudambi, Fundamentals of foods and Nutrition, Wiley Eastern Limited, Year-1990.
3. William S.R Nutrition and Diet Therapy, 1985, 5th edition, Mosly Co. St. Louis.

Reference books

1. Rodwell Williams Nutrition and Diet Therapy, 1985, the C.V Mosly St. Louis.
2. M.V. Krause & M. A. Mohan, Food Nutrition and Diet Therapy, 1992 by W.B Saunders Company, Philadelphia, London.
3. Davidson and Pass more, Human Methods and Diabetics, 1976 the English Language Book Society and Churchill.

Relationship Matrix for CO, PO & PSO

Title of the Course: MEDICINAL DIET										
Course Outcomes (COs)	PO						PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	3	3	-	3
CO2	2	-	-	2	3	2	3	3	-	3
CO3	2	-	-	2	3	2	3	3	-	3
CO4	2	-	-	2	3	2	3	3	-	3
CO5	2	-	-	2	3	2	3	3	-	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course : LIFE STYLE DISEASES

Category of the Course : Non Major Elective

Nature of the Skill : Entrepreneurship

Marks : CIA:25+ Ext: 75 = 100 Hrs/Week : 2

Credits : 2 Total Inst. Hrs : 30

Course objectives:

The main objectives of this course are to

1. Create awareness on life style diseases among adolescents.
2. List out the lifestyle diseases.
3. Explain the common lifestyle diseases and their prevention.
4. Acquaint the disorders associated with women's health.
5. Impart life skills so as to prevent life style diseases.

Unit I

06 Hours

Lifestyle diseases: Definition, Factors contributing to lifestyle diseases – Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation.

Unit II

06 Hours

Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country.

Unit III

06 Hours

Causes, symptoms, types, preventive measures and treatment of Obesity, cardiovascular diseases, diabetes and cancer.

Unit IV

06 Hours

Women's lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis.

Unit V

06 Hours

Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation.

Course outcomes

CO	On completion of the course the students will be able to	Program Outcomes
CO1	Define Life style diseases and describe the contributing factors	K1
CO2	Enumerate the top life style diseases and its impact on life.	K1, K4, K5
CO3	Elaborate the treatment and prevention measures of common lifestyle diseases.	K1, K4, K5
CO4	Highlight the life style diseases that affects the women's health	K1, K4, K5
CO5	Illustrate the various measures for prevention of life style diseases	K1, K4, K5

Text books

1. James M R, Life style Medicine, 2nd Edition, CRC Press, 2013
2. Akira Miyazaki, New Frontiers in Life style -Related Disease, Springer,2008

Reference books

1. Steyn K, Life style and related risk factors for chronic diseases
2. Willett WC, Prevention of chronic disease by means of diet and lifestyle.
3. Kumar M & R. Kumar, Guide to prevention of life style diseases. Deep & Deep publications

Web resources

1. <https://youtu.be/jDdL2bMQXfE>
2. <https://youtu.be/7WnpSB14nDM>
3. <https://youtu.be/ollz9MqtW-U>

Relationship Matrix for CO, PO & PSO

Title of the Course: Life Style Diseases										
Course Outcomes (COs)	PO						PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	3	3	-	3
CO2	2	-	-	2	3	-	3	3	-	3
CO3	2	-	-	2	3	-	3	3	-	3
CO4	2	-	-	2	3	-	3	3	-	3
CO5	2	-	-	-	-	-	3	3	-	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course : HEALTH AND NUTRITION

Category of the Course : Non Major Elective

Nature of the Skill : Entrepreneurship

Marks : CIA:25+ Ext: 75 = 100 Hrs/Week : 2

Credits : 2 Total Inst. Hrs : 30

Course objectives

The main objectives of this course is to

1. Gain basic knowledge about health.
2. Understand about vitamins.
3. Learn about functions of fat on health.
4. Understand the types of minerals and its functions
5. Know about the importance of carbohydrates and proteins on health

Unit I

06 Hours

Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value.

Unit II

06 Hours

Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances.

Unit III

06 Hours

Sources and functions of dietary fats, role of fats in health and diseases.

Unit IV

06 Hours

Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc.

Unit V

06 Hours

Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications.

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Understand about the importance of health and diet	K1
CO2	Discuss about the classification properties and deficiencies of vitamins	K1
CO3	Understand about sources and functions of fats and lipids on health	K1, K4
CO4	Detail about the different typed of minerals and its role in health	K1, K4
CO5	Relate the role of proteins and carbohydrates on health	K1, K4

Text books

1. S. Davidson and J. R. Passmore (1986) Human Nutrition and Dietetics, (8th ed), Churchill Livingstone
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10th ed), Churchill Livingstone
3. M. Swami Nathan (1995) Principles of Nutrition and Dietetics, Bappco

Reference Books

1. Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall

Web Resources

1. <https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages>.
2. [nhp.gov.in/healthy living/healthy diet](http://nhp.gov.in/healthy_living/healthy_diet)
3. www.anme.com.mx/libros/PrinciplesofNutrition.pdf

Relationship Matrix for CO, PO & PSO

Title of the Course: Health and Nutrition										
Course Outcomes (COs)	PO						PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	3	3	-	3
CO2	3	-	-		-	-	3	3	-	3
CO3	3	-	-	2	-	-	3	3	-	3
CO4	3	-	-	2	-	-	3	3	-	3
CO5	3	-	-	2	-	-	3	3	-	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course	: CELL BIOLOGY	Semester	II
Category of the Course:	CORE COURSE	Nature of the Skill :	EMPLOYABILITY
Course Code	: U2R3BCCC3	Hrs/Week	: 5
Marks	: CIA:25+ Ext: 75 = 100	Total Inst. Hrs	: 75
Credits	: 5		

Learning Objectives

The objectives of this course are to

1. Provide basic understanding of architecture of cells and its organelles.
2. Understand the organization of prokaryotic and eukaryotic genome.
3. Educate on the structural organization of bio membrane and transport mechanism
4. Impart knowledge on cell cycle, cell division and basics of cells
5. Familiarize the concept of mechanism of cell-cell interactions.

Unit I

15 Hrs

Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultrastructure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions

Unit II

15 Hrs

Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome -prokaryotic, and eukaryotic genome. Organization of chromatin – histones, nucleosome concept, formation of chromatin structure. Special types of chromosomes – lamp brush chromosomes, polytene chromosomes.

Unit III

15 Hrs

Biomembranes-Structural organization of lipid layer model and basic functions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.

Unit IV

15 Hrs

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.

Unit V

15 Hrs

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

Course Outcomes

Course Name-Cell Biology		Course Code U2R3BCCC3	Knowledge Level
After completion of this course, students would be able to			
CO1	Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.		K1
CO2	Familiarize the cytoskeleton and chromatin		K1,K2
CO3	Illustrate the structure, composition and functions of cell membrane related to membrane transport		K1,K2
CO4	Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells.		K1,K2
CO5	Relate the structure and biological role of extra cellular matrix in cellular interactions		K1,K2

Text books:

- 1.Arumugam.N, Cell biology. Saras publication (10ed, paperback), 2019
2. Devasena.T. CellBiology.OxfordUniversityPressIndia-ISBN:9780198075516, 0198075510, 2012
- 3.Bruce Alberts 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.

e-Learning Resources:

<https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf>

<https://www.medicalnewstoday.com/article/320878.php>

<https://biologydictionary.net /cell>

Relationship Matrix for CO, PO and PSO

Title of the Course: Cell Biology							Course Code: U2R3BCCC3			
Course Outcomes(COs)	PO						PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	-	-	-	-	-	3	-	-	3
CO 2	3	3	-	-	-	-	3	-	-	3
CO 3	3	3	-	-	-	-	3	-	-	3
CO 4	3	3	-	-	-	-	3	3	-	3
CO5	3	3	-	-	-	-	3	-	-	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course	: MAJOR PRACTICAL II		
Category of the Course:	CORE COURSE	Semester	II
Course Code	: U2R3BCCC4P	Nature of the Skill :	EMPLOYABILITY
Marks	: CIA:40+ Ext: 60 = 100	Hrs/Week	: 5
Credits	: 5	Total Inst. Hrs	: 75

Learning Objectives

The objectives of this course are to

1. Learn the parts of microscope
2. Investigate the cells under microscope.
3. Image the cells using different stains
4. Identify the cells, organelles and stages of cell division
5. Identify the spotters

I MICROSCOPY AND STAINING TECHNIQUES

1. Study the parts of light and compound microscope
2. Preparation of Slides and Micrometry
3. Examination of prokaryotic and eukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by aceto carmine stain
6. Staining and visualization of mitochondria by Janus green stain

II GROUP EXPERIMENT

7. Identification of different stages of mitosis in onion root tip
8. Identification of different stages of meiosis in onion bulb

III SPOTTERS

9. a) **Cells:** Nerve, plant and Animal cell
- b) **Organelles:** Mitochondria, Chloroplast, Endoplasmic reticulum,
- c) **Mitosis stages**—Prophase, Anaphase, Metaphase, Telophase

Course Outcomes

Course Name- MAJOR PRACTICAL II		Course Code: U2R3BCCC4P	Knowledge Level
After completion of this course, students would be able to			
CO1	Identify the parts of microscope.		K1,K2
CO2	Preparation of Slides		K1,K2
CO3	Identify the stages of mitosis & meiosis		K1,K2
CO4	Visualize nucleus and mitochondria by staining methods		K1,K2
CO5	Identify the spotters of cells, organelles and stages of cell division		K1,K2

Text books

1. Rickwood, D and J. R. Harris cell Biology: Essential Techniques, Johnwikey1996.
2. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.
3. Ganesh M.K. and Shiva shankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2ndEdn.

Reference books

- 1) Essential practical handbook of Cell biology, Genetics and Microbiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017
- 2) Cell biology Practical, Dr. Venugupta ISBN8193651219, Prestige publisher, 1st Jan 2018.
- 3) Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987

Web resources

- 1) <http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1>
- 2) <https://www.microscopemaster.com/organelles.html>
- 3) <https://www.pdfdrive.com/biochemistry-books.htm>
- 4) http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%20microscope%20is%20necessary,and%20small%20granules%20and%20vesicles.
- 5) <http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1>
- 6) <https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and-geneticdiversity/a/phases-of-meiosis>.
- 7) <https://www.microscopemaster.com/organelles.html>
- 8) <https://www.pdfdrive.com/biochemistry-books.html>

Relationship Matrix for CO, PO and PSO

Title of the Course: Major Practical II							Course Code: U2R3BCCC4P			
Course Outcomes(COs)	PO						PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	-	-	-	-	3	3	3	3
CO 2	2	3	-	-	-	-	3	3	3	3
CO 3	2	3	-	-	-	-	3	3	3	3
CO 4	2	3	-	-	-	-	3	3	3	3

Title of the Course	: BIOMEDICAL INSTRUMENTATION		
Category of the Course:	SKILL ENHANCEMENT COURSE	Semester : II	
Course Code	: U2R3BCSEC3:1	Nature of the Skill :	EMPLOYABILITY
Marks	: CIA:25+ Ext: 75 = 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs	: 30

Learning Objectives

The objectives of this course are to

1. Provide insights about the blood pressure and its measurement.
2. Elaborate the mechanism of instruments related to respiration.
3. Highlight the importance of imaging techniques.
4. Acquaint students about the basics of medical assisting devices.
5. Familiarize about the life saving therapeutic equipments.

Unit 1 6 Hrs

Measurement of blood pressure – sphygmomanometer. Cardiac output – Cardiac rate – Heart sound – Stethoscope, ECG – EEG – EMG – ERG.

Unit II 6 Hrs

Monitoring of inspired/expired anaesthetic gases, capnograph, inhalators, nebulizers, aspirators, infant respirator, Plethysmography.

Unit III 6 Hrs

Medical imaging: X-ray machine - Radio graphic and fluoroscopic techniques – Computed tomography – MRI – PET, Ultrasonography – Endoscopy – Thermography.

Unit IV 6 Hrs

Assisting equipments: Pacemakers – Defibrillators – Ventilators

Unit V 6 Hrs

Therapeutic equipment: Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers.

Course Outcomes

Course Name- BIOMEDICAL INSTRUMENTATION		Course Code: U2R3BCSEC3:1	Knowledge Level
After completion of this course, students would be able to			
CO1	Illustrate the functions of instruments used for measuring blood pressure.		K1,K2,K5
CO2	Elaborate the devices required for monitoring of respiratory gases.		K1,K2,K5
CO3	Understand the operation of the imaging and sonographic instruments.		K1,K2,K5
CO4	Differentiate between the action of pacemakers , defibrillators and ventilators.		K1,K2,K5
CO5	Demonstrate the function of therapeutic equipments		K1,K2,K5

Text books

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons.
4. C.Rajarao and S.K.Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', 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.,

WebResources

<https://youtu.be/GkUCmb0cKwo?list=PLCZ9KmODEcu138IIVeHClJ4nskArYr1Dg>

Relationship Matrix for CO, PO and PSO

Title of the Course: Biomedical Instrumentation							Course Code: U2R3BCSEC3:1			
Course Outcomes(COs)	PO						PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	-	-	3	-	3	3	3	3
CO 2	2	3	-	-	3	-	3	3	3	3
CO 3	2	3	-	-	3	-	3	3	3	3
CO 4	2	3	-	-	3	-	3	3	3	3
CO5	2	3	-	-	3	-	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course	: FIRST AID		
Category of the Course:	SKILL ENHANCEMENT COURSE	Semester : II	
Course Code	: U2R3BCSEC3:2	Nature of the Skill : EMPLOYABILITY	
Marks	: CIA:40+ Ext: 60 = 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs	: 30

Learning Objectives

The objectives of this course are to

1. Provide knowledge on the basics of first aid.
2. Perform first aid during various respiratory issues.
3. Demonstrate the first aid to treat injuries.
4. Learn the first aid techniques to be given during emergency.
5. Familiarize the first aid during poisoning.

Unit I

6 Hrs

Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.

Unit II

6 Hrs

Basics of Respiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma.

Unit III

6 Hrs

Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones.

Unit IV

6 Hrs

First aid related to unconsciousness, stroke, fits, convulsions- seizures, epilepsy

Unit V

6 Hrs

First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning.

Course Outcomes

Course Name- First Aid		Course Code: U2R3BCSEC3:2	Knowledge Level
On completion of this course, students will be able to			
CO1	Discuss on the rules of first aid, dealing during emergency and first aid techniques		K1,K4,K5
CO2	Understand the first aid techniques to be given during different types respiratory problems		K1,K4,K5
CO3	Provide first aid for injuries, shocks and bone injury		K1,K4,K5
CO4	Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions		K1,K4,K5
CO5	Gain expertise in giving first aid for insect bites and chemical poisoning		K1,K4,K5

Text books

- 1) First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr.ManjulMungali
1ISBN-978-93-92208-19-5
- 2) Indian First Aid Mannual-<https://www.indianredcross.org/publications/FA-manual.pdf>
- 3) Red Cross First Aid/CPR/AED Instructor Manual

Reference books

Web resources

- 1) <https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online>
- 2) <https://www.firstaidforfree.com/>

Relationship Matrix for CO, PO and PSO

Title of the Course: First Aid							Course Code: U2R3BCSEC3:2			
Course Outcomes(COs)	PO						PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	-	-	-		-	3	3	3	3
CO 2	2	-	-	3	3	-	3	3	3	3
CO 3	2	-	-	3	3	-	3	3	3	3
CO 4	2	-	-	3	3	-	3	3	3	3
CO5	2	-	-	3	3	-	3	3	3	3

S-Strong (3) M-Medium (2)

L-Low (1)

BIOCHEMICAL TECHNIQUES

U3R3BCCC5

Employability

Course Objectives:

CO1: To Learn the tools of Biochemistry used in industries and clinical lab

CO2: To study the biochemical applications of analytical methods

CO3: To acquire the knowledge about radiation and its applications.

CO4: To understand the principles of chromatography and its applications.

CO5: To gain the knowledge about the principle of spectrophotometer

Unit I (14 Hours)

Biophysics:

Acids and bases, Hydrogen ion concentration (pH), Henderson-Hassel batch equation. pH meter. Buffers Bicarbonate buffer, Phosphate buffer and Proteins as buffer. Solutions- Parts per million, Molarity, Molality and Normality. Osmosis and osmotic pressure, (ICT) Gibbs - Donnan membrane equilibrium, Viscosity, Diffusion and Surface tension.

Unit II (16 Hours)

Chromatography

Principle and classification of chromatography. Partition chromatography- Paper chromatography, Thin layer chromatography and Gas-liquid chromatography. Adsorption chromatography- Column chromatography. Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, High-performance liquid chromatography (Assignment).

Unit III (15 Hours)

Electrophoresis and Centrifugation

Principle and types. Factors affecting electrophoretic mobility. Paper electrophoresis. SDS-PAGE electrophoresis, (ICT) Isoelectric focusing, Agarose gel electrophoresis, pulsed-field gel electrophoresis. Immuno electrophoresis. Centrifugation: Types of centrifuges, rotors. Differential centrifugation, Density-gradient centrifugation. Analytical centrifugation- Applications in the determination of molecular weight of macromolecules.

Unit IV (16 Hours)

Spectroscopy

Absorption spectrum, visible spectrum, wave length and wave number. Molar-extinction coefficient. Beer-Lambert's Law. Instrumentation and applications of Colorimeter, UV-Visible Spectrophotometer. Spectrofluorimetry, Flame Photometry-Atomic emission and absorption flame photometry. Nuclear magnetic resonance spectrometry (NMR), (ICT)Electron spin resonance spectrometry (ESR), Mass spectrometry.

Radioactivity

Radioactive decay, Half-life of radioactive elements, Units of Radioactivity, types of radiation. Isotopes-stable and radioactive isotopes. Measurement of Radioactivity - GM counter, liquid and solid Scintillation counter, Scintillation cocktails. Radioactive tracer technique and its applications. Applications of Radio isotopes in biological and medical sciences. (Assignment) Safety aspects of radioisotopes. Auto radiography.

Text Books:

1. Keith Wilson, Kenneth H. Goulding, 3rd Edition 1992, A Biologists guide to principles and Techniques of practical Biochemistry. Cambridge University Press.
2. Upadhyay, Upadhyay and Nath. Biophysical Chemistry - Principles and Techniques., 3rd Edition, 2002. Himalaya Publishing House.
3. Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
4. Chromatography – G. Abbott.

Reference Books:

1. Sharma B.K. (1981) 11 th Edition. Instrumental method of chemical analysis. Goel Publishers
2. David T. Plummer, 3rd Edition (1998), An Introduction to practical Biochemistry. Tata McGraw- Hill publishing company limited, New Delhi.
3. Jessica Carol, Analytical Biochemistry, 2016, Syrawood Publishing House.

e-Learning Resources:

1. Analytical Biochemistry 1998 by David Holme & Hazel Peck
2. Physical Chemistry Third Edition, 2008 by Robert G. Mortimer

Course Out Comes

After the successful completion of the course the students shall be able to

CO No.	CO Statement	Knowledge level
CO1	Demonstrate the measurement of pH by glass electrode	K4
CO2	To Utilize the Chromatographic Techniques	K3
CO3	Use appropriate Electrophoresis Methods and Techniques	K3
CO4	Acquire knowledge about centrifugations, types and its applications.	K4
CO5	Appreciate the principle and Applications of Radio isotopes	K3

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	2	3	2	2	2.3
CO2	3	3	2	2	3	2	2	2	3	3	2.5
CO3	3	3	2	1	3	3	2	3	2	2	2.4
CO4	3	3	3	2	3	3	2	3	3	2	2.7
CO5	2	3	3	2	2	3	2	3	2	3	2.5
											2.48

Mean Overall Relationship is **2.48** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 : Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

Practical - III

U3R3BCCC6P

Skill Development

Course Objectives:

CO1: To Understand the practical aspects of analytical techniques in Biochemistry

CO2: To prepare of molarity and normality solution

CO3: To Measure the pH using pH Meter.

CO4: To understand the Molarity and Molality solution prepare calculations

CO5: To gain the knowledge on chromatography

I. Buffer and pH

1. Preparation of Buffer – citrate buffer, bicarbonate buffer and phosphate buffer
2. pH Measurements Using pH Meter.
3. Normality solution preparation
4. Molarity solution preparation
5. Molality solution preparation

II. Analytical methods

1. Calculation of R_f for given amino acids and unknown sample by TLC
2. Separation of Amino acids and Sugars by Thin layer chromatography
3. Separation of Amino acids and Sugars by Paper Chromatography (plant pigments, secondary metabolites tannin, alkodi)
4. Separation of plant pigments by Column Chromatography
5. Separation of Serum Proteins by Electrophoresis
6. Separation of cellular organelles by differential centrifugation
7. Titration Curve of Amino acids
8. Verification of Beer – Lambert's Law

Reference Books:

1. Manuals in Biochemistry, DrJ.Jeyaraman

2. Practical Biochemistry, Warley

3. Practical Biochemistry, Plummer
4. Practical clinical Biochemistry, Herald varley

Course Outcomes

After the successful completion of the course the students shall be able to

CO No.	CO Statement	Knowledge level
CO1	Demonstrate the working Principles of pH meter	K4
CO2	To Understand the working principles of pH indicator and estimation of macromolecules	K2
CO3	Use appropriate Methods for Determination of molecular weight of macro molecules	K4
CO4	Acquire knowledge about the principles of colorimetry and spectroscopy	K3
CO5	To understand the the principles and instrumentation of chromatography methods	K2

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	3	2	3	2.6
CO2	3	3	3	3	3	2	3	2	3	3	2.8
CO3	3	3	2	2	3	3	2	3	3	3	2.7
CO4	3	3	2	3	3	3	2	3	2	2	2.6
CO5	3	3	3	3	2	3	3	3	3	3	2.9
											2.72

Mean Overall Relationship is 2.72 which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

FUNDAMENTALS OF BIOLOGY

U3R3BCDSE3:1

Skill Development

Credits

: 03

Total Inst. Hrs

: 60

Course Objectives:

CO1: To understand the Taxonomical Principles and their Rules and Regulations.

CO2: To study about the Primitive Groups of Plants and Animals.

CO3: To acquire the knowledge about the Plant and Animal Cell Structure and Cellular organelles functions.

CO4: To understand the Embryological Development and their various Stages.

CO5: To gain the knowledge about the Commercial Values of Plants and animals.

UNIT I

(10 Hours)

Biological Classification and Taxonomy (Linnaeus)

Introduction to principles of Taxonomy (**Linnaeus**) – Concepts of species of hierarchical taxa, Biological nomenclature, Classical and quantitative methods of Taxonomy, (Eukaryotic System) Taxonomic Position of Plant and Animal and Two Kingdom- Five Kingdom Systems Concept (ICT).

UNIT II

(14 Hours)

Plant and Animal Groups

Classification of Plants, Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. (**Assignment**) Animal groups: Major Phyla - General characters with appropriate examples - Protozoa - Porifera – Coelenterata - Platyhelminthes - Aschelminthes - Annelida - Arthropoda - Mollusca - Echinodermata and Chordates

UNIT III

(12 Hours)

Cell Biology (Eukaryotic System)

Cell Biology- Structure of plasma membrane, Fluid Mosaic Model and Functions. (ICT) Structure and function of cellular organelles – Cell wall, Nucleus, Endoplasmic Reticulum, Golgi bodies, lysosomes, Mitochondria and Ribosomes. Mitosis and Meiosis-Cell cycle.

UNIT IV

(13Hours)

Developmental Biology

Developmental Biology in Animal – Gametogenesis, Zygote formation, Cleavage, blastula, gastrula, Embryogenesis. (Assignment) Developmental Stages. Developmental Stages in Plants – Introduction to Plant Embryology.

Applied Biology

Plants for man: cereals, pulses, fibres, and Coconut oils, timber and fruit, Medicinal plants, ornamental plants and the parts used Sericulture: Silk producing organisms: Mulberry Silk worm. The Mulberry Silk worm - *Bombyx mori*: Commercial races of India. Vermiculture: Organic farming –Biology of Earthworm. (Assignment) Species and Advantages of using vermicomposting and their benefits to environment.

Text Books

1. General, organic and Biochemistry, 2nd edition, Ira blei & George Odian, W.H. Freeman Company, New York 2006.
2. Molecular Biology of the cell- 4rd ed. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. New York: Garland Science; 2002.
3. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, P.S.Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2004
4. Environmental Biology (Principles of Ecology) P.S. Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2012.
5. Cell Biology, C.B. Powar, Himalaya Publishing House, 2010.

Reference Books:

1. Plant Biochemistry, 4th ed, Hans-walter Heldt, Academic press, Elsevier Publications, 2010.
2. Plant Physiology 4th ed, SN Pandey, BK Sinha, Vikas Publishing House, New Delhi, 2009.
3. Introductory Modern Biology, S.Sundara Rajan, Anmol Publications Pvt. Ltd, New Delhi.
4. Text Book of Plant Physiology, V. Verma, Ane Books Pvt. Ltd, New Delhi, 2011.
5. Essentials of Modern Bology, R.C. Sobti, V.L. Sharma, Ane Books India, 2009.

e-Learning Resources:

1. In Developmental Biology by Scott F. Gilbert, published by 2010 by Susan R. Singer
2. Introduction to botany, 2016 by Alexey Shipunov

Course Out Comes

After the successful completion of the course the students shall be able to

CO No.	CO Statement	Knowledge level
CO1	To Understand the Systematic Position of Plants and Animals	K2
CO2	Use appropriate Classification methods for Plants	K3
CO3	To Understand the Cell organelles and functions	K2
CO4	Acquire knowledge about Developmental stages of Animals	K3
CO5	Apply Plants and Animals Products for Commercialization	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	3	2	3	3	2	3	2.6
CO2	3	3	2	2	3	2	3	2	3	3	2.4
CO3	3	3	2	3	3	3	3	3	2	2	2.7
CO4	3	2	3	2	3	3	2	3	3	2	2.6
CO5	3	3	3	2	3	3	3	3	2	3	2.8
											2.62

Mean Overall Relationship is **2.62** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

GENETICS

U3R3BCDSE3:2

EMPLOYABILITY

Course Objectives: -

- CO1: To inculcate the knowledge about Mendel's contribution to Genetics
- CO2: To learn about the genetic disorders, their ethology and diagnosis
- CO3: To provide an understanding of both classical and modern concepts in the areas in genetics
- CO4: To prove the knowledge of transmission, molecular and population Genetics.
- CO5: To create linkage and genetic maps

Unit 1: (12Hours)

Mendelian Genetics and its Extension

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis(ICT), Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance.

Unit 2: (11 Hours)

Linkage, Crossing Over and Chromosomal Mapping

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization(ICT).

Unit 3: (13 Hours)

Mutation

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens(ASSIGNMENT); Detection of mutations: CLB method, attached X method.

Unit 4: (10 Hours)

Sex Determination

Gametogenesis – structure of gametes – gamete binding and recognition – fusion and prevention of polyspermy – cleavage – patterns – gastrulation – stem cells. Embryogenesis – Axis specification in *Drosophila* – *Xenopus* – Mammalian- genetic control of pattern formation – ectoderm, endoderm and mesoderm. Chromosomal mechanisms of sex determination in *Drosophila* and Man.

Unit 5: (14 Hours)

Extra-chromosomal Inheritance

Criteria for extra-chromosomal inheritance Inborn errors of metabolism, Sickle cell, hemochromatosis, cystic fibrosis, hypogonadotropic, hypogonadism, Gaucher's disease, achondroplasia, (SEMINAR), Antibiotic resistance in *Chlamydomonas*, Mitochondrial mutations in *Saccharomyces*, Infective heredity in *Paramecium* and Maternal.

Reference Books:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings
4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.

e-Learning Resources:

1. <https://youtu.be/NWqgZUnJdAY>
2. <https://youtu.be/Tw9PV1GqdAE>
3. <https://youtu.be/fwxFmUnoNZw>

Course Outcomes

After the successful completion of the course the students shall be able to

Co. No	Co Statement	Knowledge Level
CO1	Understand the principles of Mendelian genetics, extensions and applications.	K2
CO2	Learn and appreciate the various factors that confer genotypic and phenotypic variability	K2
CO3	Use the concepts of bacterial and viral genetics to understand resistance patterns and to create linkage and genetic maps	K4
CO4	Use statistical tools to analyse biological data.	K4
CO5	Apply the principles of transmission and inheritance in real life situations.	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2	3	2	2.2
CO3	2	3	2	2	3	3	2	2	3	3	2.5
CO4	2	2	3	2	2	2	2	2	2	1	2
CO5	1	2	3	3	2	3	2	2	2	2	2.2
											2.18

Mean Overall Relationship is **2.18** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 : Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

: MEDICAL LABORATORY TECHNOLOGY

: U3R3BCSEC4:1

: EMPLOYABILITY

Learning Objectives

The main objectives of this course are to

CO1: Impart knowledge on specimen collection and disposal of waste.

CO2: Acquaint knowledge on collection, preservation and transfusion of blood.

CO3: Quantify the biomolecules in biological sample

CO4: Understand the significance of various tests and their interpretation in diseased conditions

CO5: Acquaint knowledge on enzymes, hormones and Immunoglobulins as markers for diagnosis.

UNIT I

(6 Hours)

Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste-Non-infectious waste, biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines

UNIT II

(6 Hours)

Determination of Blood group and Rh factor -Basic blood banking procedures- cross matching, screening test. Blood transfusion and hazards.6 Hrs

UNIT III

(6 Hours)

Estimation of blood sugar – Enzymatic method, HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral,vitamin and CSF analysis

UNIT IV

(6 Hours)

Immuno diagnostics - test – Montaux and Lepramin test.

UNIT V

(6 Hours)

Assay of clinically important enzymes- Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Collect&preserve of biological samples.	PO1,PO2
CO2	Estimate the various constituents in biological sample	PO1,PO2,PO6
CO3	Perform the routine procedures adopted in blood bank	PO1,PO2,PO6
CO4	Analyze and interpret the values for both normal and disease conditions.	PO1,PO2,PO6
CO5	Assay the enzymes and hormones &interpret clinical implications	PO1,PO2,PO6

Text Books

- 1 Kanai L Mukherjee and Anuradha Chakravarthy Medical Laboratory Technology IVth edition, Vol I, 2022
2. Ramnik Sood, Text Book of Medical Laboratory Technology, Jaypee Publishers, 2006
3. Tietz, N. (2018) Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th edition, W.B. Saunders Company

Reference books

Web Resources

- 1 <https://www.youtube.com/watch?v=QNYIX5Ne9lQ>
- 2 <https://www.slideshare.net/doctorrao/agglutination-tests-and-immunoassays>
- 3 <https://microbenotes.com/introduction-to-precipitation-reaction/>

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3					3	3	3	3
CO 2	2	3				2	3	3	3	3
CO 3	2	3				2	3	3	3	3
CO 4	2	3				2	3	3	3	3
CO5	2	3				2	3	3	3	3

S - Strong (3) M - Medium (2) L - Low (1)

MICROBIOLOGY

: U3R3BCSEC4:2

Employability

Course Objectives:

- CO1: Gain insights on how the subject area is developed over a period of time.
CO2: Impart knowledge on the working of different types of Microscopes.
CO3: Internalize the techniques used to observe microorganisms by different staining techniques.
CO4: Understand the concept of asepsis and modes of sterilization.
CO5: Identify the different types of medium and techniques used for the growth and cultivation of microorganisms.

UNIT I

(6 Hours)

History and Scope of Microbiology

History and Scope of Microbiology – Spontaneous generation theory (ICT), – conflict – Contribution of Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, Waksman, John Tyndall, Paul Ehrlich, Watson & Crick and Miescher (Seminar).

UNIT II

(6 Hours)

Microscopy

Microscopy – Principles and applications – Bright field, Dark field, Phase contrast, Fluorescence, Confocal, SEM & TEM – Specimen preparation for Electron microscopy (ICT),

UNIT – III

(6 Hours)

Morphology and its Growth Media

Bacteria, Structure and organization of bacterial cell wall: fine structure, Brief and general account: Archaeobacteria, Eubacteria, Algae, Fungi, Viruses, Protozoa, Mycoplasmas, Rickettsiae, Cyanobacteria, Chlamydia, Culture and Media preparation (ICT), – Solid and Liquid – Types of Media – Synthetic and Complex, Enriched, Enrichment, Selective and Differential media (Seminar).

UNIT IV

(6 Hours)

Control of Microorganisms

Sterilization and Disinfection – Principles – Methods of Sterilization – Physical methods – Dry heat, Moist heat, Filtration (Membrane & HEPA), Radiation – Chemical Sterilization (ICT), – Chemical agents and their Mode of action – Phenol coefficient test – Sterility testing (Seminar).

UNIT – V

(6 Hours)

Applied Microbiology

Economic importance of viruses with reference to vaccine production, role in research, medicine and

diagnostics, as causal organisms of plant diseases (ICT). Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine) (Seminar),

Text Books:

- 1 Ananthanarayanan R and CK Jayaram Panicker, (2017). Textbook of microbiology, 10thEd. Orient Longman.
- 2 Dubey, R.C. & D.K. Maheshwari, (2010). A text Book of Microbiology. S. Chand & Co.

Reference Books:

1. Joanne Willey and Kathleen Sandman and Dorothy Wood, (2020). Prescott's Microbiology 11thEd. Mc Graw Hill Book.
2. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R.Krieg, (1993). Microbiology 5thEd. Mc Graw Hill Book Company.
3. Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R, (1986). The Microbial world, 5thEd. Eagle Works Cliffs N.J. Prentica Hall.
4. Tauro P., Kapoor, K.K. Yadav, K.S. An introduction to Microbiology 1stEd., New Age International Publishers.
5. Gerard J. Tortora, Berdell R. Funke & Christine L. Case, (2013). Microbiology – An Introduction 11th Ed.

e-Learning Resources:

1. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_\(Kaiser\)/Unit_1%2FIntroduction_to_Microbiology_and_Prokaryotic_Cell_Anatomy/1%3AFundamentals_of_Microbiology](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Kaiser)/Unit_1%2FIntroduction_to_Microbiology_and_Prokaryotic_Cell_Anatomy/1%3AFundamentals_of_Microbiology)
2. <http://www.wales.nhs.uk/sitesplus/888/agordogfen/149787>
3. <http://ecoursesonline.iasri.res.in/course/view.php?id=108>
4. <https://www.cliffsnotes.com/study-guides/biology/microbiology/microbial-cultivation-andgrowth/microbial-cultivation>
5. <https://www.swayam.gov.in>

Course Outcomes

After the successful completion of the course the students shall be able to

CO NO.	CO Statement	Knowledge level
CO1	Get acquainted with contributions of various scientists.	K1
CO2	Gain knowledge about microscopy.	K3
CO3	Acquainted the economic importance of microorganisms.	K4
CO4	Explore basic techniques of microbiology.	K4
CO5	Identify the shapes of microbes and cultivate microbes in the lab	K3

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	3	3	2	2	3	2	3	2.5
CO2	2	2	2	2	3	2	2	2	3	3	2.3
CO3	2	2	2	3	2	2	2	3	3	3	2.3
CO4	2	3	3	3	3	3	3	3	2	2	2.7
CO5	3	2	3	2	2	2	2	2	2	2	2.2
											2.4

Mean Overall Relationship is 2.4 which is **High**

Relationship of Outcomes:

Low Level Relation – 01 (If it is related less than 40 %)
Medium Level Relation – 02 (If it is related between 40 – 70 %) High
Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2	: Low
Greater than or equal to 1.2 and less than 2.2	: Medium
Greater than or Equal to 2.2	: High

Title	CLINICAL BIOCHEMISTRY
Reg. No.	190101010101
Course	B.Sc. in Biochemistry
Semester	IV
Code	U4R3B
Prerequisites	Skilled in laboratory
Mode	Practical =
Time	1 hour

COURSE OBJECTIVES:

- CO1: To enable students, understand the basics of biological specimen and haematological parameters in diagnosis.
- CO2: To impart knowledge on concepts of metabolic disorders of carbohydrate and amino acid in disease developments
- CO3: To educate students in understanding the metabolic defects of lipid and nucleic acid and possible complications
- CO4: To impart knowledge on diagnostic procedures for gastric and renal function.
- CO5: To emphasize on diagnostic application of enzyme biomarkers in identification of disease.

UNIT I

(15 Hours)

Urine

Normal composition of urine - volume, pH, colour, specific gravity. Constituents-urea, uric acid, creatinine, pigment. Abnormal constituents -glucose, albumin, ketone bodies, variations in urea, creatinine, pigments and their clinical significance in brief.

UNIT II

(15 Hours)

Blood

Normal constituents of blood and their variation in pathological conditions Lipid profile - cholesterol, triglycerides, lipoproteins - HDL and LDL. Blood Clotting Disturbances in blood clotting mechanisms - haemorrhagic disorders - haemophilia, Sickle cell anaemia, purpura, thrombotic thrombocytopenic purpura, acquired prothrombin complex disorders, circulating anticoagulants (ICT).

UNIT III

(15 Hours)

Inborn Errors of Metabolism

Disorders of carbohydrate metabolism - Glycogen storage diseases; Diabetes mellitus, GTT; Galactosemia and lactose intolerance. Disorders of lipid metabolism -Hyperlipidaemia, Hyper cholesterolemia; sphingolipidosis; Diseases associated with lipoprotein metabolism - Atherosclerosis and coronary artery Diseases; fatty liver, and lipotrophic factors (ICT). Disorders of protein metabolism: Phenylketonuria, hartnup's disease, alkaptonuria, albinism, maple syrup urine diseases (Assignment). Disorders of purine and pyrimidine metabolism: Gout, orotic aciduria. Disorders of porphyrin metabolism – porphyria's.

UNIT IV:

(15 Hours)

Diagnostic Enzymes

Enzymes in health and diseases (Seminar). Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, alkaline phosphatase, CPK, cholinesterase, LDH.

UNIT V

(15 Hours)

Diagnostic Tumor markers: Tumor markers-neuron specific enolase, prostate specific antigen, oncofetal antigen, AFP, CEA. Carbohydrate markers, genetic marker, p53 gene, Ras gene (ICT).

Text Books:

1. Chatterjee, M.N. and Rana Shinde. Text book of Medical Biochemistry, 8th ed. Jaypee Medical Publishers, 2012.
2. U.Sathyanarayana, U. Chakrapani. Reprint 2009. Biochemistry. Books and Allied Private Limited, Kolkata.

Reference Books:

1. Concise Medical Physiology -Choudhary- New Central Book Agency - Calcutta.
2. Text Book of Medical Physiology -Guyton – Prism Books Pvt. Ltd. - Bangalore.
3. Harper's Biochemistry - Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
4. Textbook of medical physiology: A. C. Guyton, and J. E Hall Saunders Elsevier

e-Learning Resources:

1. <https://www.easybiologyclass.com/topic-bioc>
2. <https://pdfs.semanticscholar.org>
3. www.metbio.net › docs › MetBio-TrainingDoc-DARE695483-01-09-
4. <https://www.ncbi.nlm.nih.gov> › books › NBK507821

Course Outcomes

After the successful completion of the course the students shall be able to

Co. No	Co Statement	Knowledge level
CO1	Enable the students skill to test the biological samples in the clinical lab.	K2
CO2	Students will learn about functional tests and enzymatic assays to diagnose the function of liver, kidney, thyroid, gastrointestinal and pancreas.	K4
CO3	Provide knowledge about carbohydrate, lipid and nucleic acid metabolic disorders	K3
CO4	Offer knowledge about haemoglobin metabolism and associated diseases	K3
CO5	To Understand about functional tests of organs and clinical diagnosis of diseases by enzymatic assays	K3, K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	2	3	2	3	3	2	3	3	2.4
CO2	3	2	2	2	3	2	3	3	3	2	2.5
CO3	2	3	2	2	3	3	2	2	3	3	2.5
CO4	2	3	3	2	2	3	3	3	2	3	2.6
CO5	3	2	3	2	2	3	3	3	3	3	2.7
											2.54

Mean Overall Relationship is 2.54 which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

Course objectives:

CO1: Explain the clinical significance of the laboratory tests

CO2: Diagnosis of clinical disorders by estimating biomarkers

CO3: Determine various substances including substrates, enzymes, hormones, etc and their use in Diagnosis and monitoring of disease are applied

CO4: Evaluate the abnormalities which commonly occur in the clinical field

CO5: Review the information from each category of tests and develop a protocol for Disease diagnosis

Course content:

1. Qualitative analysis of abnormal constituents in urine - glucose, albumin, bile pigments,
2. bile salts and ketone bodies.
3. Estimation of serum calcium by Clark and Collips method.
4. Determination of A/G ratio by Biuret method.
5. Analysis of SGOT-SGPT (AST, ALT) / creatine kinase / acid or alkaline phosphatase.
6. Qualitative analysis of Urine sample for normal and abnormal constituents.
7. Determination of titrable acidity of urine.
8. Estimation of uric acid in serum and urine by Caraway's method
9. Estimation of creatinine and creatine in serum and urine by Zaffe's method.
10. Estimation of urea in urine by Nesslerization method (Urease method).
11. Determination of urine Chloride by Volhard-Arnold method.
12. Estimation of 17-ketosteroid by Zimmerman's method.
13. Estimation of urine Bilirubin. Estimation of serum enzymes - Creatine phosphokinase (CPK), ALP, AST, SGPT and SGOT

Text Books:

1. Joshi SA. (2010). Nutrition and Dietetics. 3rd Ed. New Delhi: McGraw Hill Education
2. (India) Put Ltd.
3. Raut SK., Mitra K and Chowdhury P., AdhunikPustibigyan, Academic Publishers.

Reference Books:

1. Practical Biochemistry- Keith Wilson and John Walker, Cambridge University Press, 1997
2. R. Boyer, Modern Experimental Biochemistry, 3rd., Pearson Education (Singapore) Pvt. Ltd., 2001.
3. D.T. Plummer, Practical Biochemistry - TATA McGraw-Hill education; 3rd edition, 2006
4. Wilson and J. Walker, Practical Biochemistry, Principles and Techniques, Cambridge University Press, eighth edition 2018.

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Apply and practice the methods to improve blood typing	K1, K2
CO 2	Analyse the isolation of blood cells.	K2, K3
CO3	Helps the students to understand, evaluate and analysis the abnormal constitutes in various serum biological profile	K3, K4
CO4	Create awareness of different lifestyle diseases increasingly found in present day	K2, K3
CO5	Understand and familiarize in the modern clinical Laboratory techniques and its applications	K3, K4

Course Outcomes

After the successful completion of the course the students shall be able to

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	1	3	3	3	3	2	3	2.5
CO2	1	2	2	3	3	2	3	3	3	3	2.5
CO3	2	3	3	3	2	3	3	3	3	3	2.8
CO4	3	2	3	2	2	3	2	3	2	2	2.4
CO5	2	3	3	1	2	2	2	3	3	3	2.4
											2.52

Mean Overall Relationship is 2.52 which is **High**

Relationship of Outcomes:

Low Level Relation – 01 (If it is related less than 40 %)

Medium Level Relation – 02 (If it is related between 40 – 70

%) High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2 :Low

Greater than or equal to 1.2 and less than 2.2 Medium

m Greater than or Equal to 2.2 :High

IMMUNOLOGY

: U4R3BCDSE4: 1

Skill Development

COURSE OBJECTIVES:

CO1: To impart knowledge about the types and the various determinants of immunity.

CO2: To expose the students to different types of lymphoid organs and to the cellular basis of immunity.

CO3: To appreciate clonal selection theory, mechanism of cell mediated and humoral mediated immune responses

CO4: To understand the diagnostic methods of immunology.

CO5: To understand the disorders associated with immunological processes.

UNIT I

(12 Hours)

Infection – Types of infection, Immunity – Innate Immunity, Active, Passive, Natural and Artificial immunity, Factors affecting Innate immunity – Physical, Mechanical, Biochemical, Cellular and Genetic factors. Inflammation, Mechanism of Phagocytosis (ICT).

Unit II

(12 Hours)

Cells involved in Immune response – T, B and Null cells, Structure and functions of lymphoid organs- Thymus, Bone Marrow, Spleen, Lymph nodes, Mucous Associated Lymphoid Tissue, Gut Associated Lymphoid Tissue (ICT).

UNIT III

(12 Hours)

Antigen, Factors affecting Antigenicity, Epitope, Haptens, Adjuvants. Clonal Selection Theory, Antibody – Classes, Structure and Biological function. Humoral and Cell Mediated Immunity (ICT).

UNIT IV

(12 Hours)

Principles of Ag-Ab interactions – Affinity, Avidity, Precipitation – Precipitation curve, Agglutination, Principle – ELISA, RIA, Immune electrophoresis and Immunofluorescence (Seminar). Monoclonal Ab production- Hybridism technology (Assignment).

UNIT V

(12 Hours)

Hypersensitivity – Gel- Coomb's classification, Immediate Type – I (Allergic Asthma), II (Erythroblastosis Foetalis), III & Delayed Type – IV (Contact Dermatitis). Autoimmune Diseases – Hashimoto's Thyroiditis and Rheumatic Arthritis (ICT).

TEXT BOOKS:

1. Immunology- Peter, Alex and Micheal, 2nd edition, 2004
2. Fundamentals of Medical Immunology- Venugopal Jayapal, 2007
3. Text book of Microbiology- Ananthanarayanan and Panickar, 9th edition, 2013.

REFERENCE BOOKS:

1. Immunology - Kuby, 5th edition, 2003.
2. Essential Immunology – Roitt, 3rd edition

Course Outcomes

After the successful completion of the course the students shall be able to

CO. NO	Co Statement	Knowledge Level
CO 1	Apply and practice the methods to improve immunity	K2
CO 2	Appreciate and analyse the integration of immune cells and organs	K2
CO3	Apply the knowledge on the production of vaccines and immune kits.	K3
CO4	Analyse and diagnose the various immune disorders.	K4
CO5	Preventive measures for allergy and other hypersensitivity reactions	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	3	3	2	3	2	3	2.4
CO2	2	2	3	2	3	2	3	3	2	3	2.5
CO3	3	2	3	2	2	2	3	3	3	3	2.6
CO4	3	3	3	2	2	2	3	2	3	2	2.5
CO5	2	2	2	3	3	3	3	2	3	3	2.6
											2.52

Mean Overall Relationship is **2.52** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 : Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

Title of the Course :	LIFE STYLE DISORDERS		
Cate	Discipline Specific Elective	Semester	IV
Course Code :	U4R3BCDSE4:2	Nature of the Skill	Skill Development
Mark	C	Hours	4
Credit	03	T	

COURSE OBJECTIVES

- CO1: To impart knowledge on complications associated with lifestyle habits.
- CO2: To educate about the ailments of unhealthy food habits and emphasize on healthy eating.
- CO3: To create awareness on health hazards of costumes and chemical cosmetics.
- CO4: To develop knowledge on understanding free radicals, antioxidants, cancer, liver disease, and DM.
- CO5: To educate students about prevention and treatment for lifestyle diseases that affect heart, lungs and kidney.

UNIT I (12 Hours)

Introduction:

Definition of health, lifestyle disorders, types and contributory factors of lifestyle disorders, impact of lifestyle factors on physical & mental health of the people.

UNIT II (12 Hours)

Food habits and health:

Junk food- Facts and ill effects, Carbonated drinks, Ready to eat foods, Acidity, Obesity, Eating disorders- Anorexia, Bulimia nervosa, Amoebiasis (Assignment).

UNIT III (12 Hours)

Modern lifestyle for Health and Disease:

Sedentary lifestyle- Obesity and hypertension, Diabetics, cancer Alzheimer's disease, Causes, Complications and Management -Stress related disorders, Sleeping disorders. Smoking, Alcoholism, Drugs- Risk factors, Electronic gadgets- Radiation and Health. Heart disease – Atherosclerosis (ICT).

UNIT IV (12 Hours)

Life style diseases:

Causes, symptoms and treatment of Breast, Cervical and Prostate cancer (ICT), Liver cirrhosis, Hepatitis, Diabetes Mellitus, kidney diseases- Nephritis, Pulmonary diseases- COPD, Allergic sinusitis, Rhinitis, Free radicals and Antioxidants.

Strategies and approaches in lifestyle disorders:

Prevention of disease by means of diet and lifestyle changes; Lifestyle choices and personal wellness (Seminar).

Text Books:

1. Guide to Prevention of Lifestyle Diseases by M. Kumar and R. Kumar, 2003, DEER & DEEP publications, New Delhi.
2. Dietetics by B Sri lakshmi, 2014, 7th Edition, Publisher: New Age International Private Limited.

Reference books:

1. Assocham Study on Preventive Healthcare. 2009.
2. The effect of diet on risk of cancer by Key TJ, Allen NE, Spencer EA. Lancet. 2002; 360: 86- 8.
3. Metabolic Syndrome and Related Disorders by Anoop Misra, Lokesh Khurana.

e-Learning

1. www.livestrong.com
2. www.med-health.net/Lifestyle-Diseases.html
3. <https://www.mayoclinic.org>
4. <https://www.healthline.com>
5. <https://www.medicalnewstoday.co>

Course Outcomes

After the successful completion of the course the students shall be able to

CO. NO	CO Statement	KNOWLEDGE LEVEL
CO1	Can explain the concept of lifestyle disease can explain health conditions in Norway and how lifestyle diseases have developed can explain what contributes to lifestyle diseases	K3
CO2	can provide examples of how to diagnose and treat the most common lifestyle diseases	K4
CO3	To account for various health services that aim to prevent lifestyle diseases	K5
CO4	To explain the importance of user participation and individualisation in the treatment of lifestyle diseases from a user perspective	K3
CO5	To explain perspectives on mastering lifestyle diseases	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	3	3	3	2.5
CO2	3	2	2	2	3	2	3	2	2	3	2.4
CO3	2	3	2	2	3	3	2	2	3	3	2.5

CO4	2	3	3	2	2	3	3	2	3	3	2.6
CO5	1	2	3	3	2	3	2	3	3	3	2.6
											2.52

Mean Overall Relationship is **2.52** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

Title of the Course	: Bio Statistics		
Category of the Course	: S E Course	Semester	: II
Course Code	: U4R3BCSEC5:2	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75=100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

CO1:- To update and expand the basic knowledge of Biostatistics.

CO2 : To review the basic concepts and knowledge in collection of Data

CO3:- To develop the skills pertinent to practice Measures of central tendency and Measures of Dispersion.

CO4:- To gain the knowledge about the polygon

CO5:- To understand the basic concepts of coefficient of Correlation

Unit I: Introduction to Biostatistics

Biostatistics: Definition- Application of Biostatistics - Role of Statistics – Characteristics – Limitations of statistics.

Unit II: Diagrams and Graphical representations

Diagrams: Simple bar diagram – Multiple Bar diagram – Pie diagram.

Graphical Representation: Histogram – Frequency Curve – Polygon.

Unit III: Measures of Central Tendency

Arithmetic mean - Median - Mode - Geometric mean, Harmonic Mean (definition simple problems only)

Unit IV: Measures of Dispersion

Measures of Dispersion: Definition - Characteristics - Range – Quartile Deviation - Mean derivation - Standard deviation - Coefficient of variation (definition simple problems only)

Unit V: Correlation

Definition – Karl Pearson’s coefficient of correlation – Spearman Rank correlation.(definition simple problems only)

Text Books:

[1] “**Biostatistics**” - P.N. Arora, P.K.Malhan, Himalaya Publishing House.(2014).

[2] “**Business mathematics and statistics**”–PA. Navanitham, Jai Publishers..

Unit I : Chapter 1, Sec. 1.1 -1.5, 1.11 – 1.13[1]

Unit II: Chapter 6, Part II – Pg no. 98 – 118, 124 – 137 [2]

Unit III: Chapter 7, Part II Pg. no. 159 – 260 [2]

Unit IV: Chapter 8, Part II Pg. No. 305 – 368 [2]

Unit V : Chapter 12, Part II Pg. no. 503 - 522[2]

Reference Books:

1. “Introduction to Biostatistics”, Sokal and Rohlf, Toppan Co., Japan.
2. “Primer of Biostatistics”, Stanton A. Clantz, The McGraw Hill Inc., New York.

e- Resources:

1. <https://www.cuemath.com/data/measures-of-dispersion/>
2. <https://www.statisticshowto.com/probability-and-statistics/correlation-coefficient-formula/>

Outcomes:

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basic concept of statistics.	K2
CO2	Apply statistical measures which are used to analyze the data.	K3
CO3	Acquire knowledge on measures of central tendency and dispersion.	K5
CO4	Prepare reports to conclude the findings in Correlation.	K4
CO5	Develop computational skill and logical thinking in formulating industry oriented problems as a mathematical problem and finding solutions to these problems	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	2	3	2	3	3	3	2	3	2.5
CO2	3	2	2	3	3	3	2	3	2	2	2.5
CO3	1	3	3	2	3	3	2	3	3	3	2.6
CO4	2	3	1	2	2	3	3	3	2	3	2.4
CO5	3	2	2	3	2	3	2	3	3	3	2.6
											2.52

Mean Overall Relationship is **2.52** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2	: Low
Greater than or equal to 1.2 and less than 2.2	: Medium
Greater than or Equal to 2.2	: High

Title of the Course : **NUTRITION**

Category of the Course : **Skill Enhancement Course** **Semester** **IV**

Course Code : **U4R3BCSEC5:2** **Nature of the Skill** : **CLUSTER 1**

Marks : **CIA:25+ Ext: 75 = 100** **Hrs/Week** **2**

Credits : **2** **Total Inst. Hrs** **30**

Course Objectives:

CO1: To familiarize students about food chemistry and its nutritional importance.

CO2: To study the importance of Nutrition & balanced diet.

CO3: To acquire knowledge on modern food & Beverages.

CO4: To understand food adulteration & poisoning method.

CO5: To know the chemistry of food preservation method, processing & packing technology.

UNIT-I

(4 Hours)

Food:

Sources of food, functions of food, constitutions of food, food groups, usage of food, food in relation to health, advantages & disadvantages.

UNIT II

(8 Hours)

Nutrition & Balanced diet:

Nutrition – Calorific value of food stuff - RQ of food (Respiratory quotient of food) – basal metabolic rate – factors influencing BMR, specific dynamic action of food (SDA). Energy requirement of individual diet & its componenting, protein requirements- Nutritional value of carbohydrates – fibres in the diet, dietary sugars – nutritional aspects of lipids (ICT).

UNIT III

(6 Hours)

Modern food & Beverages:

Snack foods, production of bread, bun & biscuits, candy manufacturing, caromelisation, fast foods, instant food, dehydrated food, spicy foods, Beverages – soft drinks, fruit juices, soda & alcoholic beverages (Types& content of alcohol) (Assignment). Ex: carbonation, addition to alcohol, cirrhosis of liver and social problems.

UNIT IV

(6 Hours)

Food adulterations & food poisoning:

Food adulteration – intentional, unintentional– common adulteration in food items – milk, oil, ghee, butter, wheat, rice, coffee powder, tea powder, Chili & Turmeric powder(Seminar). Food poisoning – Diseases due to foodstuff- first aid to food poisoning – causes and remedies for acidity, gastritis, indigestion& constipation.

UNIT V

(6 Hours)

Quality control:

Food preservation & processing, food determination, methods of preservation, and food processing, Specifications & standards – PFA, FPO, FDA, AGMARK, DRUG LICENCE, WHO STANDARDS. ISI Specifications, packaging offoods, classification, material usage of packing(ICT).

Text Books:

1. Swaminathan. M., Advanced text book on Food and Nutrition, volume I and II printing and publishing CO., Ltd., Bangalore. 1993.
2. Owen R Fennema, Food chemistry, Marcel Decker Inc., New York. 1996.
3. Srilakshmi. B., Food Science, New age International Pvt. Ltd. Publisher, III ed. 2003.

Reference Books:

1. Sivasanker. B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., NewDelhi 2002.
2. Alex V. Ramani, “Food Chemistry”, MJP Publishers, Chennai, 2009.
3. Seema Yadav, Food chemistry, Anmol Publishing Ltd, New Delhi.

e- Learning Resources:

1. <https://youtu.be/jDdL2bMQXfE>
2. <https://youtu.be/7WnpSB14nDM>
3. <https://youtu.be/ollz9MqtW-U>

Course Outcomes : After the successful completion of the course the students shall be able to

Relationship Matrix for CO, PO and PSO:

CO. NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To learn energy content in foods. techniques involved in the measurement of energy expenditure, Dietary requirements of carbohydrates, dietary fibre and dietary lipids	K2
CO2	To learn essential and non-essential amino acids, protein reserves in human body, Protein malnutrition, techniques for the study of starvation, concepts for weight reduction diets.	K2
CO3	To know about nutritional requirement during pregnancy, lactation, infants and Childs, Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.	K4
CO4	To learn about role of diet and nutrition in the prevention and treatment of diseases, learn about inherited metabolic disorders	K2
CO5	To learn naturally occurring food borne toxicants, Allergy causing foods and management.	K2

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	2	3	2	3	3	3	2	3	2.5
CO2	3	2	2	3	3	3	2	3	2	2	2.5
CO3	1	3	3	2	3	3	2	3	3	3	2.6
CO4	2	3	1	2	2	3	3	3	2	3	2.4
CO5	3	2	2	3	2	3	2	3	3	3	2.6
											2.52

Mean Overall Relationship is **2.52** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 : Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

MEDICAL CODING

: U4R3BCSEC6:1

EMPLOYABILITY

Course objectives

The objectives of this course are to

CO1: Understand the basic concept of Medical coding

CO2: Familiarize the student about medical terminology

CO3: Understand about the classification of diseases based on WHO/AHA

CO4: Understand about the CPT code used for diseases as per American Medical Association (AMA)

UNIT I

(6 Hours)

Introduction to Medical coding, coding theory, Healthcare Common Procedure Coding, First Aid and CPR

UNIT II

(6 Hours)

Introduction to Medical Terminology, specialization I & II, Diagnostic coding, factors affecting diagnostic coding

UNIT III

(6 Hours)

Documenting medical records- Importance of Documentation, Types of dictation formats

UNIT IV

(6 Hours)

Introduction to Human Anatomy and Coding, ICD-10- CM classification system

UNIT V

(6 Hours)

Introduction to CPT coding, types of CPT coding Medical Law and Ethics 6hrs

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Explaining the basic concept of coding and its application. Possess the knowledge about the First aid and CPR	PO1, PO2, PO6
CO2	Possess the knowledge about medical terminology used in Medical coding industry	PO1, PO2, PO6
CO3	Possess the knowledge about the ICD-10 CM international classification of diseases based on WHO	PO1, PO2, PO6
CO4	Possess the knowledge about the CPT codes used for diseases as per American Medical Association (AMA)	PO1, PO2, PO6
CO5	Understand CPT coding and its types	PO1, PO2, PO6

Text books

- 1.Understanding Medical Coding,A comprehensive guideSandraLJohnsonRobin Linker
- 2.Buck's Step – by – step Medical CodingElsevier reference

Reference books

1. Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CMcoding guidelines made easy2017.
- 4.Besty J Shiland- Medical terminology and anatomy for ICD-10.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3				3	3		2	3
CO 2	2	3				3	3		2	3
CO 3	2	3				3	3		2	3
CO 4	2	3				3	3		2	3
CO5	2	2				2	3		2	3

S - Strong (3) M - Medium (2) L -Low(1)

Title of the Course : BIOPHYSICAL CHEMISTRY

Category of the Course	: Skill Enhancement Course	Semester	IV
Course Code	: U4R3BCSEC6:2	Nature of the Skill	: EMPLOYABILITY
Marks	: CIA:25+Ext:75=100	Hrs/Week	2
Credits	: 2	Total Inst. Hrs	30

Course Objectives:

CO1: To Learn the knowledge about the acids and bases

CO2: To study about the properties of colloids

CO3: To acquire the knowledge about physics in various biological processes.CO4:

To understand the applications of Biophysics

CO5: To gain the knowledge about Formation of stones in kidney

UNIT (5 Hours)**Acid and bases**

Lewis concept of acid and bases, titrable acidity. pH, pOH, buffer, pH of body fluids, buffers in the body fluids, RBCs and tissues. Measurement of pH by indicator and glass electrode. (Assignment)

UNIT II (7 Hours)**Colloidal state:**

Properties of colloids (surface tension, viscosity, surface absorption, detergent action, electrical, optical and kinetic properties). Phenomenon of osmosis and osmo regulation in the body. Electro osmosis, Donnan membrane equilibrium, its applications - artificial kidney (dialysis of blood). Biophysical and chemical composition of architecture of bio membrane (esp. Cell membrane) (ICT)

UNIT III (7 Hours)**Determination of molecular weight of macro molecules:**

By chemical composition, sedimentation, molecular sieving, light scattering and osmotic pressure methods (ICT). Units of measurement of solutes in solution. eg. Normality, molarity, molality, milli equivalents and milli osmol, ionic strength. Examples for these concepts.

UNIT IV (5 Hours)**Biophysical basis**

Gaseous exchange in lungs and tissues partial pressure of CO₂ (pCO₂) and O₂ (pO₂). Influence of O₂ and CO₂ in RBC and body fluids during respiration. Physiological curve of formation and dissociation of oxyhemoglobin (HbO₂) and carbondioxide hemoglobin (HbCO₂).

(Assignment) Various physiological factors in these curves.

UNIT V

(6 Hours)

Application of Biophysical chemistry in chemical equilibria:

Formation and dissociation of NH_3 , HI, CaCO_3 . Biological application of chemical equilibria - Acid formation in stomach (hyper acidity and ulcer in stomach and duodenum) while using medicines like aspirin, paracetamol and antibiotics, Formation of stones in kidney and gall bladder. (Assignment)

Text Books:

1. Dash U.N- Text book of Biophysical Chemistry, 2006.
2. Agarwal S.K -Advanced Biophysics, 2014.
3. Vatsala Parimal- Biophysics 1st edition 2006.
4. Bengt Nolting- Methods in Modern Biophysics 2005.
5. Satake M. Hayashi, Sethi M. S and Iqbal S. A- Biophysical Chemistry, 2003.

Reference Books:

1. Srivastava P. K -Elementary Biophysics – an introduction, 2005.
2. Subramanian M. A -Biophysics Principles and Techniques, 2005.
3. Upadhyay, Upadhyay and Nath -Biophysical Chemistry-Principles and Techniques, 2008.
4. Narayanan P-Essentials of Biophysics, 2nd edition, 2011.

Course Outcomes

After the successful completion of the course the students shall be able to

CO No.	CO Statement	Knowledge level
CO1	Demonstrate the measurement of pH by indicator and glass electrode	K4
CO2	To Understand the indicator and glass electrode	K2
CO3	Use appropriate Methods for Determination of molecular weight of macro molecules	K3
CO4	Acquire knowledge about Physiological curve of formation and dissociation of oxyhemoglobin	K3
CO5	To understand the hyper acidity in stomach	K2

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	2	2	3	2	3	2.5
CO2	3	3	2	3	3	2	2	2	3	3	2.6
CO3	3	3	2	2	3	3	2	3	3	3	2.7
CO4	3	3	2	2	3	3	2	3	2	2	2.5
CO5	2	3	3	3	2	3	2	3	3	3	2.7
											2.6

Relationship Matrix for CO, PO and PSO:

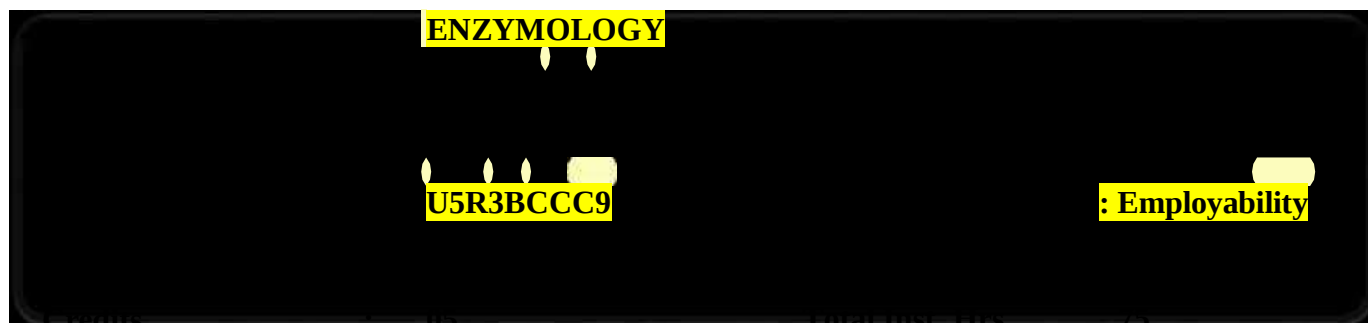
Mean Overall Relationship is **2.6** which is **High**

Relationship of Outcomes:

Low Level Relation – 01 (If it is related less than 40 %) Medium Level Relation – 02 (If it is related between 40 – 70 %) High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2 : Low
 Greater than or equal to 1.2 and less than 2.2 : Medium
 Greater than or Equal to 2.2 : High



Course Objectives:

CO1: To Impart Knowledge about properties of enzymes and the principles underlying them catalytic power.

CO2: To expose the students to various models of enzyme substrate complex and factors affecting catalytic activity.

CO3: To introduce enzyme kinetics that provides much of the framework for any discussion of enzymes.

CO4: To appreciate the various methods involved in enzyme extraction and isolation.

CO5: To understand the purification techniques of enzymes and designer enzymes

UNIT 1

(15 Hours)

Classification and units of enzymes:

Based on IUB with examples. Unit of enzyme activity –definition of IU, enzyme turn over number and nature of non-enzymatic and enzymatic catalysis. Specific activity. Enzyme specificity. Concept of active site, ES complex, specificity.

UNIT 2

(15 Hours)

Theories of enzyme catalysis:

Lock and key model, Koshland's induced fit theory. Acid- base catalysis, electrostatic catalysis, covalent catalysis. Mechanism of reaction catalyzed by enzymes (ICT) - lysozyme and chymotrypsin. Isoenzymes: Lactate dehydrogenase as an example(Seminar). Multienzyme complex – Pyruvate dehydrogenase complex. RNA as an enzyme. (Ribozymes).

UNIT 3

(15 Hours)

Enzyme Kinetics

Enzyme kinetics of single substrate reactions – Pre steady state and steady state kinetics, factors affecting enzyme activity, Michaleis - Menten plot, Lineweaver - Burk plot, Eadien - Hofstee plot and Hanes plot. Determination of Vmax & Km from L-B plot and their significance. Enzyme inhibition (ICT)-competitive, non-competitive and uncompetitive. Graphical representation by L-B

plot. Evaluation of K_m , K_i and V_{max} in presence of inhibitor. Factors affecting rate of enzyme catalyzed reactions (Assignment).

UNIT 4

(15 Hours)

Chemical modification:

Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin (ICT). Allosteric enzymes: Sigmoidal curve, positive and negative modulators, qualitative description of “concerted” & “sequential” models for allosteric enzymes. Half site reactivity, Flipflop mechanism, positive and negative co-operativity with special reference to aspartate transcarbamylase and phosphofructokinase.

UNIT 5

(15 Hours)

Applications of Enzymes:

Enzymes as reagents, Marker enzymes in diagnostics, Immobilized enzymes, Industrial and medical (SGOT, LDH, SGPT enzyme application) (seminar).

Text Books:

1. U. Sathyanarayana, U. Chakrapani. Reprint2009. Biochemistry. Books and Allied Private Limited, Kolkata.
2. Nelson and Cox, Lehninger’s Principles of Biochemistry, (2000), Kalyani Publishers, Ludhiana/Worth Publishers, Inc., New York.

Reference Books:

1. Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:019 850229X.
2. R. K. Murray, D.K. Granner, P.A. Mayes and V.W. Rod well, harper’s Biochemistry, 22nd edn. (1990), Prentice-Hall, International, USA.
3. P.K. Stumpf, OUTLINES OF BIOCHEMISTRY, 4th edn. (1994), Wiley Eastern, NewDelhi, (Chapters7 & 8).
4. L. Stryer BIOCHEMISTRY 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
5. G.L. Zubay BIOCHEMISTRY 4th Ed. (1998) W.C. Brown Publishers, USA.

e-Learning Resources:

1. <https://youtu.be/j00Ep0Byu0Y>
2. <https://youtu.be/uAi1LJUHUY>
3. <https://youtu.be/AusY2gGf0Ao>
4. <https://youtu.be/a-mYtHlrXR0>
5. <https://youtu.be/7h0XrF1BleM>

Course Out Comes

After the successful completion of the course the students shall be able to

Co. No	Co Statement	Knowledge Level
CO1	Discussing concepts of activation energy and cellular reactions to occur by a biocatalyst. Ever increasing number of newly discovered enzymes, a system for naming and classifying enzymes must be known and also the role of coenzymes in enzyme catalysed reaction.	K3
CO2	Comprehend the role of enzyme substrate complex formation and types of models and enzyme specificity.	K3
CO3	Apply the kinetics of enzyme such as MM equation, LB plot and Eadie Einstein mechanisms in various field of enzyme technology.	K4
CO4	Discuss techniques of enzyme extraction from various tissues and Isolation, intracellular localization of enzymes, marker enzymes an intensive research on the enzymes catalysing the reactions of cell metabolism.	K4
CO5	Apply purification techniques of enzymes, properties of multi enzyme complex and designer enzymes as an important practical tool in medicine, food processing, chemical industry and in agriculture.	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	2	3	3	3	2	3	3	3	2.5
CO2	3	2	2	2	2	2	3	3	2	3	2.4
CO3	2	3	1	2	3	3	3	2	3	3	2.5
CO4	2	3	3	2	2	3	3	2	3	3	2.6
CO5	3	2	3	3	2	2	3	2	3	3	2.5
											2.5

Mean Overall Relationship is 2.5 which is **High**

Relationship of Outcomes

Low Level Relation – 01 (If it is related less than 40 %)

Medium Level Relation – 02 (If it is related between 40 – 70 %)

High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2	:	Low
Greater than or equal to 1.2 and less than 2.2	:	Medium
Greater than or Equal to 2.2	:	High

INTERMEDIARY METABOLISM

U5R3BCCC10

EMPLOYABILITY

The objectives of this course are to

Course Outcome:

CO1: Understand the energy transformation in living organism.

CO2: Understand the metabolic pathways in living organism

CO3: Learn the fate of dietary carbohydrates, proteins and lipids.

CO4: Study the various catabolic and biosynthetic pathways of biomolecules and their significance.

CO5: Understand the interrelationship between carbohydrate, protein and fat metabolism.

Unit:1

(15 Hours)

Bioenergetics:

Free energy and Laws of Thermodynamics, High energy phosphates and their role in redox reaction. Role of high energy compounds as energy currency of the cell; free energy of hydrolysis of ATP and other organophosphates. The basic metabolic pathways, anabolic, catabolic and amphibolic pathways. Electron transport chain: - Role of respiratory chain in mitochondria; in energy capture; respiratory control. Oxidative phosphorylation: - Mechanism of oxidative phosphorylation; Chemiosmotic theory; uncouplers of oxidative phosphorylation (ICT).

Unit:2

(15 Hours)

Metabolism of Carbohydrates:

Glycolysis - aerobic and anaerobic, energetic of glycolysis pathways. TCA cycle - amphibolic nature, energetics of TCA cycle. Glucuronic Acid Cycle and Glyoxalate cycle (Entner-Duodoroff pathway). Pentose phosphate pathway (HMP Shunt). Gluconeogenesis; Glycogenesis. Glycogenosis. Gluconeogenesis and Cori cycle (in liver) (ICT).

Unit:3

(15 Hours)

Metabolism of Lipids:

Oxidation of fatty acid - Carnitine cycle; beta oxidation, energetic of β -oxidation. Alpha oxidation and omega oxidation (ICT). Biosynthesis of saturated fatty acids, degradation - lecithin, inositol, triacylglycerol and plasma lipoproteins. Cholesterol metabolism and Ketogenesis.

Unit:4**(15 Hours)****Metabolism of Amino acids:**

Amino acid metabolism: Glucogenic and ketogenic amino acids -Deamination, Transamination. Metabolism of glucogenic (glycine, cysteine, proline); ketogenic (leucine, lysine) and both glucogenic and ketogenic amino acids (phenylalanine). Catabolism of amino acid: Oxidative deamination, non-oxidative deamination, transamination, amino acid decarboxylation. Urea cycle (Assignment).

Unit:5**(15 Hours)****Metabolism of Nucleic Acids:**

Structures of purines and pyrimidine. Biosynthesis and catabolism of nucleotides. Biosynthesis (de novo and salvage pathway) of purines and pyrimidine DNA and RNA. Biosynthesis of nucleotide coenzymes – inhibitors of nucleotide biosynthesis (Seminar).

Text Books:

1. Deb, A.C. (2011), Fundamentals of Biochemistry, 10th ed., New Central Book Agency Pvt. Ltd., Kolkata 700 009.
2. Biochemistry by U. Satya Narayana, Allied Book Publishers, 3rd edition (2006)

Reference Books:

1. Vasudevan D.M., Sreekumari S. and Kannan Vaidyanathan (2011), Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical Publishers Pvt. Ltd., New Delhi.
2. Moran, Horton, Scrimgeour, Perry & Rawn (2013), Principles of Biochemistry, 5th edition. Pearson New International Edition, UK.
3. Understanding enzymes by Trevor Palmer, Prentice Hall Publishers, 4th edition (1997)
4. Enzymes by P. Asokan, Chinna publications, 2nd edition, (2005)
5. Biochemistry by Harper, Mc Graw Hill publishers, 25th edition (2003)

e-Learning Resources:

1. https://youtu.be/GNnng0IE_kc
2. <https://youtu.be/2oCxmVwvrI>
3. <https://youtu.be/sKhGSozFGw4>
4. https://youtu.be/c_-lwMgBsDE

Course Out Comes

After the successful completion of the course the students shall be able to

Co. No	Co statement	Knowledge level
CO1	Gain knowledge about various types of metabolism and pathways of carbohydrates by which nutrient molecules are degraded and hence energy production.	K3
CO2	Explain how cells survive and proliferate by synthesis and degradation of glycogen and serve as a buffer for glucose, HMP shunt for replenishing NADPH and ribose	K3
CO3	Outline the various types of amino acid degradation and its excretory product.	K4
CO4	Gain insights in to the importance of amino acid biosynthesis and degradation of specific glucogenic and ketogenic amino acids.	K2
CO5	Apply the Knowledge of energy concept in life	K3

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	3	2	3	3	3	2	3	2.6
CO2	3	2	1	2	3	2	3	3	2	2	2.3
CO3	2	2	2	2	3	3	2	2	3	3	2.4
CO4	2	3	3	2	2	3	3	3	3	3	2.7
CO5	3	1	3	3	2	1	3	3	1	3	2.3
											2.46

Mean Overall Relationship is **2.46** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
Medium Level Relation – 02 (If it is related between 40 – 70 %)
High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
Greater than or equal to 1.2 and less than 2.2 : Medium
Greater than or Equal to 2.2 : High

Title of the Course : HUMAN PHYSIOLOGY

Category of the Course : Core Course

Semester

V

Course Code : U5R3BCCC11

Nature of the Skill

: Skill Development

Marks : CIA:25+ Ext: 75 = 100

Hrs/Week

05

Credits : 04

Total Inst. Hrs

75

Course Objectives:

The objectives of this course are to

CO1: To describe the structure and function of different organs found in the body systems

CO2: To understand the basic physiological action of Muscle and Bone Remodelling

CO3: To Study about the circulatory system of the body

CO4: To Learn the secretions of digestive juices in the body and the Mechanism of Urine formation

CO5: To understand the Structure of neuron and Transmission of nerve impulse

Unit I

(15 Hours)

Respiratory system

Body fluids: Blood volume, composition and functions, RBC, WBC and platelets, their structure and functions. Lungs Structure and function, Mechanism of respiration, exchange and transport of respiratory gases (ICT), Regulation of respiration. Mechanism of blood coagulation. Biochemical events in transport of CO₂ and O₂ in blood.

Unit II

(15 Hours)

Circulatory system

Structure and Functions of the heart, cardiac tissue, Properties of the Cardiac muscles, divisions of circulation. cardiac cycle. (Assignment) Electrocardiogram (ECG). Cardiac output Measurement of Blood Pressure, coronary circulation.

Unit III

(15 Hours)

Muscular and Bone System

Muscle: Types of muscles and their structure. (ICT) Ultra structure of skeletal muscle. Contractile and regulatory proteins of muscle. Sliding filament model of skeletal muscle contraction. Bone: Composition and structure of long bone, growth and remodelling of long bone. Factors affecting its growth.

Unit IV

(15 Hours)

Digestive and Excretory System

Parts of the digestive system- secretion, properties, composition and functions of saliva, gastric juice, pancreatic juice, Bile and succus entericus. Structure and Functions of Kidney. (ICT), Structure of the Nephron- Mechanism of urine formation-glomerular filtration, tubular reabsorption and tubular secretion.

Unit V

(15 Hours)

Neurotransmission and Reproductive System

Structure of neuron, Types of neurons, generalized structure of multipolar neuron. Resting membrane potential, Action potential, Transmission of nerve impulse along an axon and across a synapse. (Assignment) Male and female reproductive system-structure and functions of ovary. menstrual cycle.

Text Books:

1. Chatterjee, C.C- Human Physiology
2. Saradha Subramaniam.Text book of human physiology.
3. Guyton,Text book of Medical physiology.
4. K. Sembulingum, Prema Sembulingum,Essentials of Medical Physiology,Second Edition

Reference Books:

1. Chatterjee. C. Text book Medicinal Chemistry
2. Agarwal G.R. & Agarwal B.P. Text book of Biochemistry
3. Murray.R.G. Harper `s Biochemistry 24 th Edition
4. Lecture notes on human physiology, M, M Muthiah Vol II, 1991.

e-Learning Resources:

1. Essentials Human Physiology, 2004 by Laurie J. Kelly
2. Essentials of Anatomy and Physiology 2007 by Valerie C. Scanlon

Course Outcomes

After the successful completion of the course the students shall be able to

CO No.	CO Statement	Knowledge level
CO1	Outline the Muscular and Bone system and their Compositions	K3
CO2	To understand the Respiratory Mechanism	K2

CO3	Demonstrate the measurement of Blood Pressure	K4
CO4	Acquire knowledge about the Mechanism of Urine Formation	K4
CO5	To Study the Transmission of nerve impulse and Reproductive System	K3

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome(PO)					Programme Specific Outcome (PSO)					Average
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	2	2	2	2	2	2	2	2	2	2	2.0
CO2	1	2	2	3	2	2	2	2	3	3	2.2
CO3	2	3	2	2	2	1	2	2	2	3	2.1
CO4	2	3	2	3	3	3	2	3	2	2	2.5
CO5	3	2	2	2	2	3	2	3	3	2	2.4
											2.24

Mean Overall Relationship is **2.24** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

PRACTICAL - V

UE R3BCCC12P

Employability

Course Objectives:

The objectives of this course are to

- CO1: Know the activities of Enzymes
- CO2: Follow the Enzymes estimations by DNP methods
- CO3: Follow the Enzyme Kinetics methods
- CO4: To determine the pH optimum, K_m and V_{max} of enzymes
- CO5: Isolation and purification of Enzymes

Practical Contents:

1. Isolation (Estimation) of urease and demonstration of its activity.
2. Isolation (Estimation) of acid phosphatase and demonstration of its activity.
3. Determination of specific activity of salivary amylase by DNS.
4. (Estimation or isolation) of urease (Soybean).
5. Time course of urease reaction.
6. Effect of pH on enzyme activity (Acid phosphatase/Alkaline phosphatase (any one)).
7. Influence of substrate concentration and pH on the rate of enzymatic reaction.
8. Determination of K_m and V_{max} of salivary amylase.
9. Determination of initial velocity [time kinetics] of salivary amylase.
10. Determination of optimum temperature of salivary amylase.
11. Isoenzyme analysis (LDH) from serum sample- Native PAGE.

Reference Books:

1. R. Boyer, Modern Experimental Biochemistry, 3rd., Pearson Education(Singapore) Pvt. Ltd., 2001.
2. J. Jayaraman, Laboratory Manual in Biochemistry - New age international pvt. Ltd,2011
3. D.T. Plummer, Practical Biochemistry - TATA McGraw-Hill education; 3rd edition,2006.
4. K. Wilson and J. Walker, Practical Biochemistry, Principles and Techniques, Cambridge University Press, eighth edition 2018.
5. Experimental Biochemistry – A Student Companion - B.S. Rao & V. Deshpande, I.K. International Pvt. Ltd. (N. Delhi, Mumbai, Bangalore) 2005.

Course Out Comes

After the successful completion of the course the students shall be able to

Co. No	Co statement	knowledge Level
CO1	To gain knowledge on enzymology in the aspects of isolation and purification, kinetics as well as native PAGE analysis.	K4
CO2	Analyze the kinetics of enzyme catalysis and learn the basics of isolation and purification of enzymes.	K3
CO3	Understand the concepts of isoenzyme analysis and inhibitory mechanisms of enzyme activity	K5
CO4	Prediction of enzyme activity by estimations	K3
CO5	Determination of optimum temperature, pH and km of various enzymes.	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	1	2	2	3	2	3	2	3	2	3	2.5
CO2	3	2	2	2	2	3	3	3	3	2	2.5
CO3	3	3	2	2	3	3	2	3	3	3	2.7
CO4	2	3	2	2	2	3	3	2	3	3	2.5
CO5	3	1	3	2	2	3	3	3	2	3	2.6
											2.56

Mean Overall Relationship is **2.56** which is **High**

Relationship of Outcomes:

Low Level Relation – 01 (If it is related less than 40 %)

Medium Level Relation – 02 (If it is related between 40 – 70 %)

High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2

:Low

Greater than or equal to 1.2 and less than 2.2

: Medium

Greater than or Equal to 2.2

: High

: Biochemical Pharmacology

U5R3BCDSE5:1

EMPLOYABILITY

Learning Objectives

The objectives of this 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 .

Unit I:

(15 Hours)

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.

Unit II:

(15 Hours)

Drug metabolism - Phase I and Phase II reactions, role of cytochrome P₄₅₀ , non- microsomal reactions of drug metabolism. Factors influencing drug metabolism. Therapeutic index.

Unit III:

(15 Hours)

Drug allergy, Drug tolerance - IC₅₀, LD₅₀ of a drug, Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance - biochemical mechanism.

Unit IV:

(15 Hours)

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.

Unit V:

(15 Hours)

Antibiotics - Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracyclines and chloramphenicol.

Course Outcomes

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

Text Books

1. N.Murugesh, A concise text book of Pharmacology –Sathya Publishers.
2. Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & Company Ltd.
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

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

Mapping with Program Outcomes

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

S-Strong(3) M-Medium (2) L-Low (1)

Title of the Course : BIOETHICS AND PATENTING

Cate of the Course : Discipline Specific Elective

Semester : 5

Course Code : U5R3BCDSE5:2

Nature of the Skill : Skill Development

Mode : C Ext:7

Hours : 5

Credit : 3

Total Inst. Hrs :

COURSE OBJECTIVES:

CO1: To instil ethical values in students

CO2: To create awareness on our rights and to respect others rights

CO3: To impart standard and safe practices in Biomedical field

CO4: To sensitise the students to ethical issues in research.

CO5: To inculcate knowledge on intellectual property rights

UNIT I

(15 Hours)

Ethics – Introduction:

Types - Meta ethics, Applied ethics, Moral ethics, Descriptive ethics, Normative ethics; Principles – Beneficence, Non-Malificence, Respect to Autonomy, Justice; Theories – Deontology, Utilitarianism, Rights, Causist, Virtue; Case-studies; Bioethics.

UNIT II

(15 Hours)

Ethical issues in Biotechnology and Biomedical Research:

ICMR guidelines for Biomedical Research; Consent – Types, consent from minors; Cloning; stem cells (ICT), Gene Therapy, GMO.

UNIT III

(15 Hours)

Biosafety:

Definition, Containment facilities, levels of Biosafety; Biomedical waste Management – segregation, collection, transportation, disposal; International guidelines-GLP (ASSIGNMENT), GCP.

UNIT IV

(15 Hours)

Ethical issues concerning birth, life and death:

Reproductive technologies - Gamete donation, In Vitro Fertilisation, Embryo transfer, surrogacy, prenatal diagnosis, sex-selection (ICT); Genetic Screening, organ transplantation, withholding and withdrawing medical treatment biological principles and modern approaches to the

study of stem cells, regenerative medicine, and developmental biology. Students will increase critical thinking skills in the context of the topics discussed in the course. t; abortion, euthanasia.

UNIT V

(15 Hours)

Intellectual property rights:

Basic concepts and need for Intellectual Property rights - Patents, Copyrights, Geographical Indications, Trademarks, designs; Plagiarism, Basis of patentability; Non patentable inventions, Methods for patent application; WTO, TRIPS

Reference Books:

1. Bioethics: Introduction to History, Methods, and Practice, Nancy S. Jecker, Second edition, Jones & Bartlett Publishers (2007)
2. Biotechnology and Intellectual Property Rights - Kshitij Kumar Singh, 2015 edition, Springer Nature

e-Learning Resources:

1. <https://www.onlineethics.org>
2. <https://www.ethics.org>
3. <http://ethics.iit.edu>
4. <http://research-ethics.org>

Course Outcomes

After the successful completion of the course the students shall be able to

Co. No	CO statement	knowledge level
CO1	Apply ethics, realise rights and responsibilities in society	K4
CO2	Be ethical in biomedical research	K3
CO3	Follow standard guidelines in laboratory and clinical trials	K3
CO4	Follow ethical practices in biomedicine	K4
CO5	Identify intellectual property in research and apply for patents	K5

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	1	3	2	3	2	2	2	2	2	3	2.2
CO2	3	2	1	2	3	2	3	3	3	2	2.4
CO3	2	3	2	2	3	2	2	2	2	3	2.3

CO4	2	3	2	2	2	2	3	3	2	3	2.4
CO5	3	2	2	3	2	2	3	3	3	3	2.6
											2.38

Mean Overall Relationship is **2.58** which is **High**

Relationship of Outcomes:

Low Level Relation – 01 (If it is related less than 40 %)

Medium Level Relation – 02 (If it is related between 40 – 70 %)

High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

Less than 1.2 :Low

Greater than or equal to 1.2 and less than 2.2 : Medium

Greater than or Equal to 2.2 : High

Bio-entrepreneurship

U5R3BCDSE6:1

EMPLOYABILITY

Learning Objectives

The objective of this course are to

CO1: Impart knowledge on bio entrepreneurship and the types of industries

CO2: Learn about business plan, proposal and funding agencies

CO3: Understand the market strategy and the role of information technology in expansion of business

CO4: Provide insights on legal requirement and accounting to establish as Bio entrepreneurship

CO5: Familiarize about business bio incubators centres

Unit I: (15 Hours)

Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO;

Introduction to Trademarks, Copyrights and patents

Unit II: (15 Hours)

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.

Unit III: (15 Hours)

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 Expansion15 Hrs

Unit IV: (15 Hours)

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.

Unit V:

(15 Hours)

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.15 Hrs

Course Outcomes

After completion of the course the students will be able to

CO	On completion of this course, students will be able to	Programoutcomes
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

Text books

1. Adams, D. J. (2008). Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion - ISBN 10: 1904842364 / ISBN 13: 9781904842361
2. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303
3. 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
4. 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 sources

1. <http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/>
2. <https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introductionto-entrepreneurship/>

Mapping with Program Outcomes:

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

S-Strong(3) M-Medium (2) L-Low (1)

PAIN RELIEF FORMULATION AND COSMETICS

U5R3B 3:2

Entrepreneurship

Course Objective:

CO1: Self assess knowledge and skill in pain management.

CO2: Identify areas for further study.

CO3: Understand and perform assessment of pain and function.

CO4: Understand and be able to select between various techniques.

They serve as cosmetics for the care of body and its parts and the botanical ingredients present therein influence biological functions of skin and provide nutrients necessary for the healthy skin or hair.

PREPARATION OF

1. Turpentine liniment
2. Soap liniment
3. Pain balm preparation.
4. Simple ointment & Sulphur ointment
5. Calamine lotion
6. Calamine Benzoate Lotion
7. Cold cream
8. Vanishing cream
9. Hair cream
10. Liquid tincture of liquorices
11. Compound Tincture of Benzoin
12. Tincture of Orange
13. Shampoo

14. Nail bleach

15. Cuticle remover

16. Compound syrup of ferrous phosphate

17. Commercial cough syrup

18. Talcum powder

19. Baby powder

20. Tooth powder

Reference Book:

1. Arthur J. Winfield, R. Michael and E. Richard, Pharmaceutical Practice (2000), 3rd edition, Elsevier Publication

Course Outcomes

After the successful completion of the course the students shall be able to

CO. NO	CO Statement	Knowledge Level
CO 1	Know to prepare the natural cosmetics products and their usage	K2
CO 2	Know to apply the knowledge of preparing conventional dosage formulations	K3
CO3	Apply the knowledge on the preparation of pain relief ointments	K3
CO4	Analyse and diagnose the various drug formulation	K4
CO5	Guideline for Medical marketing	K4

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	3	2	2	1	3	3	2	3	2	3	2.4
CO2	2	3	1	3	3	2	2	3	3	3	2.5
CO3	2	2	3	3	2	2	3	3	3	3	2.6
CO4	3	2	1	2	3	3	3	3	3	2	2.5
CO5	3	2	3	2	3	3	2	3	3	3	2.7
											2.54

Mean Overall Relationship is 2.54 which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

MOLECULAR BIOLOGY

U6R3BCCC13

Employability

Course objectives:

CO1: To discuss the knowledge of the molecular basis of DNA synthesis

CO2: To know about the gene and its function

CO3: To understand the molecule basis of RNA synthesis and modified into different types of RNA

CO4: To discuss about the genetic code, molecular basis of protein synthesis & modification.

CO5: To inculcate about to link the concept with mutation and repair system.

Unit I

(18 Hours)

Genes, Genomes and DNA

DNA as the genetic material–Organization of prokaryotic and eukaryotic genomes, supercoiling, repetitive DNA–Levels of DNA packaging in Eukaryotes– Histone and its types (ICT).

Unit II

(18 Hours)

Replication

Replication of DNA- replication in prokaryotes and eukaryotes(ICT). enzymes involved in replication. types of replication-semiconservative, conservative and dispersive. evidence of mode of replication- Meselson and stahls experiment.

Unit III

(18 Hours)

Transcription

Overview and requirements of Transcription. Transcription in prokaryotes and eukaryotes. phases of transcription. Types of RNA transcripts. post transcriptional modifications of RNA in prokaryotes. Processing of RNA transcripts. Reverse transcription. Inhibitors of transcription (Seminar).

Unit IV

(18 Hours)

Translation

Genetic code: Characteristics, types and role. Protein biosynthesis in prokaryotes and eukaryotes. wobble hypothesis, Inhibitors of protein biosynthesis. Chaperones and protein folding. Protein targeting and degradation. Post translational modifications of proteins (Assignment).

Unit V

(18 Hours)

Regulation of gene expression

Principles of gene regulation. Gene expression in eukaryotes. Regulation of gene action in prokaryotes-transcriptional, translational and post translational control. Regulation of gene action in eukaryotes-regulation at the level of genome, transcription, post-transcriptional and translational control. Hormonal control of gene expression. Mutation-point and frame shift mutation. DNA damage repair. Oncogenes Cancer cells (ICT).

Text Books:

1. Sundara Rajan- Cell and Molecular Biology, Anmol publication PVT., LTD., 2003.
2. Rastogi S.C- Cell and Molecular Biology, New age International publisher, 3rd edition, 2011.
3. Dr.P. Asokan-Molecular Biology, Chinnaa publications, 1st edition, 2005.

Reference Books:

1. Lewis J. Kleinsmith, Valerie M.Kish - Principles of Cell and Molecular Biology, Harpercollins College Publishers, 2nd edition, 1995.
2. Lodish et-al., Molecular Cell Biology, W.H. Freeman and company, 3rd edition, 1995. 3 David Freifelder-Molecular Biology, Narosa publishing house, 2nd edition, 2008.
3. 4 Gerald Karp - Cell and Molecular Biology, John Wiley and Sons, Inc., 5th edition, 2008.

e-Learning Resources:

1. Molecular Cell Biology 2003 by Lodish
2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology 2011 by PS Verma

Course Outcomes:

At the end of the course the student will be able to:

CO. NO	Co Statement	Knowledge Level
CO 1	Gain knowledge about the organization of genes to chromosomes in prokaryotes and eukaryotes, types of DNA sequences, complexity of DNA sequences determined by renaturation kinetics.	K2
CO 2	Apply the concept gained in mechanism of replication in the field of molecular biology.	K4
CO3	Gain knowledge about different types of RNA and its synthesis leads to understanding protein synthesis and development.	K4
CO4	Become familiarized and able to link the concept with mutation and repair system.	K4
CO5	Understand coding and non-coding regions of eukaryotic genome and their importance will be analyzed	K3

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	2	2	1	3	3	3	3	3	3	3	2.6
CO2	3	3	3	2	3	2	2	3	2	3	2.6
CO3	3	2	1	3	2	3	3	2	3	3	2.5
CO4	3	2	2	3	3	2	3	2	3	2	2.3
CO5	3	3	2	1	3	3	3	3	2	3	2.6
											2.52

Mean Overall Relationship is **2.52** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

: Plant Biochemistry and Plant Therapeutics

U6R3BCC14

Learning Objectives

CO1: Convey the knowledge of photosynthesis.

CO1: Detail the structure and types of secondary metabolites.

CO1: Impart the idea on various plant hormones.

CO1: Emphasize the effects of free radicals and the importance of antioxidants

CO1: Understand the role of medicinal plants in treating diseases.

Unit I:

(15 Hours)

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.

Unit II:

(15 Hours)

Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and alkaloids. Medicinal properties of secondary metabolite.

Unit III:

(15 Hours)

Plant hormones Structure and function of plant hormones such as ethylene, cytokinins, auxins, Abscicic acid, Florigin and Gibberlins.

Unit IV:

(15 Hours)

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, phytochemicals as antioxidants.

Unit V:**(15 Hours)**

Plant therapeutics: Bioactive principles in herbs, plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.

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 function of 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 antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	PO1, PO2,PO3

Text books

1. Singh M. Pand Panda. H2005. Medicinal Herbs with their formulations, Daya publishing house, Delhi
2. Plant Physiology - Devlin N. Robert and Francis H. Witham, CBS Publications
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. A. and Khanum. A. 2004. Role of biotechnology in medicinal and aromatic plants, Vol. 1 and Vol. 10, Ukka 2 publications, 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, Garland science.
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>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3		2				3	3		3
CO 3	3						3			3
CO 4	3	3	3				3	3		3
CO5	3	3	3				3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

Bioinformatics

U6R3BCDSE7:1

EMPLOYABILITY

The objective of this course are to

CO1: Impart knowledge on bioinformatics and applications

CO2: Learn about biological databases

CO3: Understand the local and global sequence alignment

CO4: Provide insights on BLAST and Microarray

CO5: Familiarize about structural genomics and visualization tools

Unit I: (15 Hours)

Introduction to Bioinformatics – Bioinformatics and its applications. –Genome, Metabolome- Definition and its applications.

Unit II: (15 Hours)

Biological Databases - definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Genbank, DDBJ) Protein sequence database- SwissProt, TrEMBL, Structural Database- PDB, Metabolic database-KEGG.

Unit III: (15 Hours)

Sequence Alignment-Local and Global alignment-Dot matrix analysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment.

Unit IV: (15 Hours)

BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format DNA

Microarray-Procedure and applications.15 Hrs

Unit V:**(15 Hours)**

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.

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, metabolome& 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

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>

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3		2	3
CO 2	3	3	3				3		3	
CO 3	3	3					3		3	
CO 4	3	3	3				3		3	
CO5	3	3					3		3	

S-Strong (3) M-Medium (2) L-Low (1)

Tissue Culture

U6R3BCDSE7:2

EMPLOYABILITY

Learning Objectives

The objectives of this course are to

CO1: Introduce the tools and techniques used in tissue culture technique.

CO2: Acquire knowledge on preparation of growth medium for culture techniques.

CO3: Impart knowledge on procedures involved gene transfer.

CO4: Acquaint with the process of tissue culture technique.

CO5: Understand the importance of plant and animal tissue culture for the production and evaluation of bioactive compounds

Unit I: (15 Hours)

Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques

Unit II: (15 Hours)

Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.

Unit III: (15 Hours)

Methods of gene transfer in plants and animals - direct and indirect gene transfer methods. 6 Hrs

Unit IV: (15 Hours)

Cell culture technique - **Explants selection, sterilization and inoculation.**

Unit V: (15 Hours)

Transgenic plants for crop improvement. **Transgenic plants for molecular farming. Animal Cloning - an overview-Applications of animal cell culture** 6 Hrs

Course outcomes

CO	On completion of this course, students will be able to	Programoutcomes
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 on plant and animal cell culture techniques	PO1,PO2,PO3
CO5	Study of applications of genetically modified plants and animals.	PO1,PO2,PO3

Text books

- 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. 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-Interscience, 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.
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

<https://www.britannica.com/science/tissue-culture>

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

<https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3				3	3	3	3
CO 2	2	3					3	3	3	3
CO 3	2	3	3				3	3	3	3
CO 4	2	3	3				3	3	3	3
CO5	2	3	3				3	3	3	3

S - Strong (3) M - Medium (2) L -Low(1)

Title of the Course		: Biotechnology		
Cate	the Course	Discipline Specific Elective	Semester	: VI
Course Code	: U6R3BCDSE8:1		Nature of the Skill	: EMPLOYABILITY
Mode	: C	Ext:	Hours	: 5
Credit	3	Total In. Hr.		:

Learning objectives

The main objectives of this course are to

CO1: Impart knowledge on gene manipulation and gene transfer technologies

CO2: Make the students understand the procedures involved in plant tissue culture.

CO3: Acquire knowledge on animal cell culture and stem cell technology.

CO4: Improve the employability skills of students by providing knowledge in recent techniques such as PCR, blotting, ELISA etc.

CO5: Understand the application of fermentation technology.

Unit I

(15Hours)

Recombinant DNA technology

Recombinant DNA technology - Principles of gene cloning: restriction endonucleases and other enzymes used in manipulating DNA molecules. Ligation of DNA molecules, DNA ligase, linkers and adapters, homopolymer tailing. end labeling and construction maps of PBR322, λ bacteriophage.

Unit II

(15 Hours)

Plant Tissue culture

Plant tissue culture- basic requirements for culture, MS 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.

Unit III

(15 Hours)

Animal Tissue culture

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.

Unit IV

(15Hours)

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. 15 Hrs

Unit V

(15 Hours)

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.

Course Outcomes

CO	On completion of this course, students will be able to	Programoutcomes
CO1	Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonuclease	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

Text Books

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 Pasternak J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology

Web Sources

NPTEL Certification course - Gene Therapy by Sachin Kumar
<https://nptel.ac.in/courses/102/103/102103041/>

Coursera Certification course –Vaccines

<https://futureoflife.org/background/benefits-risks-biotechnology/>

<https://www.sciencedirect.com/topics/neuroscience/genetic-engineering>

<http://www.biologydiscussion.com/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683>

<https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1>

https://www.slideshare.net/zeal_eagle/fermentation-technology

https://www.slideshare.net/zeal_eagle/fermentation-technology

<https://www.slideshare.net/Chepkitwai/blotting-techniques-6129300>

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3		3	3	3	3	3	3
CO 2	3		3		3	3	3	3	3	3
CO 3	3		3		3	3	3	3	3	3
CO 4	3		3		3	3	3	3	3	3
CO5	3		3		3	3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

RESEARCH METHODOLOGY

U6R3BCDSE8:2

Skill development

Course Objectives:

CO1: Gain insights on how the subject area developed over a period of time.

CO2: Identify appropriate research topics

CO3: Select and define appropriate research problem and parameters

CO4: Prepare a project proposal (to undertake a project)

CO5: Organize and conduct research (advanced project) in a more appropriate manner

Unit I

(15 Hours)

Foundations of Research

Meaning, Objectives, Motivation: Research Methods Vs Methodology, Types of Research: Analytical vs Descriptive (**Seminar**), Quantitative vs Qualitative, Basic vs Applied (**ICT**),

Unit II

(15 Hours)

Research Design Need for research design

Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models(**Seminar**). Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs (**ICT**),

Unit III

(15 Hours)

Data Collection, Analysis and Report Writing

Observation and Collection of Data-Methods of data collection- Sampling Methods, (**ICT**), Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology (**Seminar**)

Unit IV

(15 Hours)

Ethical Issues

Intellectual property Rights, Commercialization, Copy Right, Royalty (**Seminar**), Patent law, Plagiarism, Citation, Acknowledgement (**ICT**),

Unit V

(15 Hours)

Educational Tour

Note: -The students should be taken for the visit to scientific institutions, pharma/biotech industries in the country relevant to Biochemistry and a report to be submitted. Madras: IIT, Central Leather Research Institute, Cancer Institute, Adyar.

Text Books:

1. Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry,
2. Allyn and Bacon. Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.

Reference Books

1. Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
2. C.R.Kothari: Research Methodology, New Age International, 2009
3. Coley, S.M. and Scheinberg, C.A. 1990, "Proposal writing". Stage Publications.

e Learning Resources:

1. <https://www.coursera.org/browse/physical-science-and-engineering/research-methods>
2. <https://www.telegraphindia.com/edugraph/career/how-to-study-biomedical-science-ug-and-pg-courses-institutes-and-job-roles/cid/1858579>

Course Outcomes

After the successful completion of the course the students shall be able to

CO No.	CO Statement	Knowledge level
CO-1	Students will acquire the knowledge as how to write research plan proposal on a particular topic.	K1
CO-2	They will understand and gain knowledge of making power point/oral presentations.	K3
CO-3	Writing reviews will help the students in writing research reports	K4
CO-4	Overall, the students will have a concise and definite view of proceeding to execute a scientific research project.	K4
CO-5	Plan to write a research proposal (grants)	K3

Relationship Matrix for CO, PO and PSO:

Course Outcome (CO)	Programme Outcome (PO)					Programme Specific Outcome (PSO)					Average
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	3	3	2	3	2	3	2.5
CO2	2	3	2	3	2	2	3	2	2	2	2.3
CO3	3	3	2	3	3	2	3	3	3	2	2.7
CO4	2	3	2	2	2	2	2	2	2	2	2.1
CO5	3	2	2	2	2	2	2	3	2	2	2.2
											2.36

Mean Overall Relationship is **2.36** which is **High**

Relationship of Outcomes:

- Low Level Relation – 01 (If it is related less than 40 %)
- Medium Level Relation – 02 (If it is related between 40 – 70 %)
- High Level Relation – 03 (If it is related greater than 70 %)

Mean overall Score Range

- Less than 1.2 :Low
- Greater than or equal to 1.2 and less than 2.2 : Medium
- Greater than or Equal to 2.2 : High

: Basics of Forensic Science

: U6R3BCSEC7:1

EMPLOYABILITY

Learning Objectives

CO1: The main objectives of this course are to

CO2: Gain knowledge on the basic practices of forensic analysis.

CO3: Perform investigation using fresh blood.

CO4: Carry out the analysis using body fluids

CO5: Investigate the presence of forms of drugs and poisons in body fluids.

CO6: Execute the identification test on multiple samples.

Unit I

(6 Hours)

Forensic Science:

Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis.

Unit II

(6 Hours)

Blood:

Blood grouping and typing of fresh blood samples including enzyme. Cases of disputed paternity and maternity problems, DNA profiling. 6Hrs

Unit III

(6 Hours)

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.

Unit IV

(6 Hours)

Psychotropic drugs:

Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids.

Unit V**(6 Hours)****Identification tests:**

Identification of hair, determination of species origin, sex, site and individual identification from hair. Classification and identification of fibres. Examination and identification of saliva, milk, urine and faecal matter

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

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.
4. Forensics by Embar-Seddon, Ayn and Pass. Allan D.
5. Forensic Medicine by Adelman, Howard C &Kobilinsky, Lawrence Page 24 of 63

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3					3		3	3
CO 2	2	3					3		3	3
CO 3	2	3					3		3	3
CO 4	2	3					3		3	3
CO5	2	3					3		3	3

S-Strong (3) M-Medium (2)**L-Low (1)**

Microbial Techniques

U6R3BCSEC7:2

: EMPLOYABILITY

Learning objectives

The objectives of this course are to

CO1: Study the growth of bacteria

CO2: Know the parts & uses of microscope

CO3: Learn staining methods to identify microbes

CO4: Learn different types of culture methods

CO5: Study food preservation methods

Unit I

(6 Hours)

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.

Unit II

(6 Hours)

Microscopy:

Principle, types - Compound microscope, electron microscope- TEM, SEM, use of oil immersion objective.

Unit III

(6 Hours)

Stains and staining:

Principles of staining, simple staining, negative staining, Differential staining, Gram and acid-fast staining, flagella staining, capsule and endospore Staining. Staining of yeast (methylene blue), lactophenol cotton blue, staining of mold (*Penicillium*, *Aspergillus*), *Agaricus*.

Unit IV

(6 Hours)

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.

Unit V

(6 Hours)

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.

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, PO6

Text books

1. Sherris Medical Microbiology, 7th Edition by Authors: 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 Bhaduria
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 and Michael A. Pfaller
3. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierce

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3					3	3	3	3
CO 2	2	3					3	3	3	3
CO 3	2	3				2	3	3	3	3
CO 4	2	3				2	3	3	3	3
CO5	2	3				2	3	3	3	3

S - Strong (3) M - Medium (2) L -Low(1)