



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. BIOCHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

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UNDERGRADUATE (UG) PROGRAMME OUTCOMES (POs)

Undergraduate (B.A., B.Sc., B.Com., B.C.A., B.B.A., etc.) is 3-year degree programme with 6 semesters consisting the following Programme Outcomes (POs) under various criteria including critical thinking, problem solving, effective communication, societal/ citizenship/ ethical credibility, sustainable growth and employable abilities.

PO 1	Critical Thinking: Intellectual exploration of knowledge towards actions in clear and rational manner by understanding the logical connections between ideas and decisions.
PO 2	Problem Solving: Understanding the task/ problem followed by planning and narrow execution strategy that effectively provides the solution.
PO 3	Effective Communication: Knowledge dissemination by oral and verbal mechanisms to the various components of our society.
PO 4	Societal/ Citizenship/ Ethical Credibility: Realization of various value systems/ moral dimensions and demonstrate the empathetic social concern as well as equity in all the decisions, executions and actions.
PO 5	Environmental Concern and Sustainable Growth: Understanding the emerging environmental challenges and provide the possible contribution in sustainable development that integrates environment, economy and employment.
PO 6	Skill Development and Employable Abilities: Adequate training in relevant skill sector and creating employable abilities among the under graduates.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of **B.Sc. Biochemistry** programme, the students are expected to

PSO 1	realize the essential concepts in modern biology to meet the promising trends and inculcating the aptitude to evaluate the various biological mechanisms through diagnostic tools in living cells.
PSO 2	develop practical laboratory skills and strong exploratory foundation in the cross over discipline of Chemistry, Microbiology, Molecular Biology and Bioinformatics by handling microbial, cellular, molecular and biochemical systems.
PSO 3	comprehend the applications of Biochemistry in various fields such as Clinical Biochemistry, Medical Diagnostics, Genetic Engineering, Molecular biology & Biotechnology.
PSO 4	build and instigate innovations effectively and communicate efficiently with the scientific community and society at large to link the gap between scientific industry and academia.
PSO 5	contribute to the betterment of the society by inculcating expertise in healthcare sector by developing the work efficacy as a part of a team and engage effectively in research and development.
PSO 6	develop the ability and willingness to embark on new ventures and initiatives with critical thinking and desire for more continuous learning focusing on technical skills.



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B.Sc. BIOCHEMISTRY – COURSE STRUCTURE

SEMESTER – I

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT11	Part – I: Tamil – கவிதையும் சிறுகதையும்	6	3	25	75	100	3
	21UACH11	Hindi – Hindi – I						
	21UACS11	Sanskrit – Sanskrit – I						
2.	21UACE11	Part – II: English – English For Enrichment – I	6	3	25	75	100	3
3.	21UBCC11	Part – III: Core – 1: Biomolecules	5	3	25	75	100	4
4.	21UBCCP1	Part – III: Core LAB – I	2	–	–	–	–	0
5.	21UBCS11	Part – IV: SBS – 1: Nutritional Biochemistry	2	3	25	75	100	2
6.	21UBCA11	Part – III: Allied Chemistry for Life Sciences – I	4	3	25	75	100	4
7.	21UBCAP1	Part – III: Allied Chemistry Lab – Titrimetric Analysis	2	–	–	–	–	–
8.	21UACVE1	Part – IV: Value Education	2	3	25	75	100	2
		TOTAL	30					18

Practical examination conducted at the end of the even semester

SEMESTER – II

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT21	Part – I: Tamil – செய்யுளும் புதினமும்	6	3	25	75	100	3
	21UACH21	Hindi – Hindi – II						
	21UACS21	Sanskrit – Sanskrit – II						
2.	21UACE21	Part – II: English – English For Enrichment – II	6	3	25	75	100	3
3.	21UBCC21	Part – III: Core – 2: Biochemical Techniques	5	3	25	75	100	4
4.	21UBCCP1	Part – III: Core LAB – I	2	3	40	60	100	2
5.	21UBCS21	Part – IV: SBS – 2: Pharmacology	2	3	25	75	100	2
6.	21UBCA21	Part – III: Allied Chemistry for Life Sciences – II	4	3	25	75	100	4
7.	21UBCAP1	Part – III: Allied Chemistry Lab – Titrimetric Analysis	2	3	40	60	100	2
8.	21UACES2	Part – IV: Environmental Studies	2	3	25	75	100	2
		TOTAL	30					22



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SEMESTER – III

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT31	Part – I: Tamil – காப்பியமும் நாடகமும்	6	3	25	75	100	3
	21UACH31	Hindi – Hindi – III						
	21UACS31	Sanskrit – Sanskrit – III						
2.	21UACE31	Part – II: English – English For Enrichment – III	6	3	25	75	100	3
3.	21UBCC31	Part – III: Core – 3: Enzymology and Enzyme Technology	5	3	25	75	100	5
4.	21UBCCP2	Part – III: Core : Practical – II:* Lab in Biochemical Analysis	3	–	–	–	–	–
5.	21UBCA31	Part – III: Allied – 4: Theory: Cell Biology and Genetics	4	3	25	75	100	4
6.	21UBCAP2	Part – III: Allied – 5: Practical:* Cell Biology and Genetics & Biodiversity And Conservation	2	–	–	–	–	–
7.	21UBCS31	Part – IV: SBS – 3: Medical Lab Technology	2	3	25	75	100	2
8.	21UBCN31	Part – IV: NME – 1: Health and Human Diseases	2	3	25	75	100	2
		TOTAL	30				600	19

*Practical examinations at the end of the IV semester



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SEMESTER – IV

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT41	Part – I: Tamil – சங்க இலக்கியமும் அற இலக்கியமும்	6	3	25	75	100	3
	21UACH41	Hindi – Hindi – IV						
	21UACS41	Sanskrit – Sanskrit – IV						
2.	21UACE41	Part – II: English – English For Enrichment – IV	6	3	25	75	100	3
3.	21UBCC41	Part – III: Core – 4: Metabolism	5	3	25	75	100	5
4.	21UBCCP2	Part – III: Core : Practical – II:* Lab in Biochemical Analysis	3	3	40	60	100	2
5.	21UBCA41	Part – III: Allied – 6: Theory: Biodiversity and Conservation	4	3	25	75	100	4
6.	21UBCAP2	Part – III: Allied – 5: Practical: * Cell Biology and Genetics & Biodiversity And Conservation	2	3	40	60	100	2
7.	21UBCS41	Part – IV: SBS – 4: Biostatistics	2	3	25	75	100	2
8.	21UBCN41	Part – IV: NME – 2: Herbal Medicine	2	3	25	75	100	2
9.		Part – V: Extension Activities	–	–	–	–	100	1
		TOTAL	30				900	24



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SEMESTER – V

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UBCC51	Part – III: Core – 5: Molecular Biology	5	3	25	75	100	5
2.	21UBCC52	Part – III: Core – 6: Microbiology	4	3	25	75	100	4
3.	21UBCC53	Part – III: Core – 7: Immunology and Immunotechnology	4	3	25	75	100	4
4.	21UBCCP3	Part – III Core : Practical – III: Lab in Microbiology and Immunology	5	3	40	60	100	4
5.	Part – III : Elective – 1:		5	3	25	75	100	5
	21UBCE51	Human Physiology						
	21UBCE52	Bioethics, Biosafety and Intellectual Property Rights						
	21UBCE53	Ecology and Environmental Toxicology						
6.	Part – III: Elective – 2:		5	3	25	75	100	5
	21UBCE54	Bioinformatics						
	21UBCE55	Hospital Management						
	21UBCE56	Pharmaceutical Biochemistry						
7.	21UBCS51	Part – IV: SBS – 5: Food Processing Technology	2	3	25	75	100	2
8.	21USSY51	Soft Skills (Self-Study)	–	–	–	–	100	–
		TOTAL	30				800	29

*One elective course to be chosen from **THREE** courses



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SEMESTER – VI

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UBCC61	Part – III: Core – 8: Biotechnology & Genetic Engineering	5	3	25	75	100	5
2.	21UBCC62	Part – III: Core – 9: Plant Biochemistry	5	3	25	75	100	4
3.	21UBCC63	Part – III: Core – 10: Clinical Biochemistry	4	3	25	75	100	4
4.	21UBCC64	Part – III: Core – 11: Medical Diagnostics	4	3	25	75	100	4
5.	21UBCCP4	Part – III: Core : Practical – IV: Lab in Clinical Biochemistry	5	3	40	60	100	4
6..	Part – III: Elective – 3:		5	3	25	75	100	5
	21UBCE61	Endocrinology and Hormonal Regulations						
	21UBCE62	Industrial Biochemistry						
	21UBCE63	Therapeutic Nutrition						
7.	21UBCS61	Part – IV: SBS – 6: Bio entrepreneurship	2	3	25	75	100	2
8.	21UGKY61	General Knowledge (Self-Study)	–	–	–	–	100	–
		TOTAL	30				800	28

*One elective course to be chosen from THREE courses



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B.Sc. BIOCHEMISTRY– III YEAR COURSE STRUCTURE – V – SEMESTER

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UBCC51	Part – III: Core – 5: Molecular Biology	5	3	25	75	100	5
2.	21UBCC52	Part – III: Core – 6: Microbiology	4	3	25	75	100	4
3.	21UBCC53	Part – III: Core – 7: Immunology and Immunotechnology	4	3	25	75	100	4
4.	21UBCCP3	Part – III Core: Practical – III: Lab in Microbiology and Immunology	5	3	40	60	100	4
5.	Part – III : Elective – 1:		5	3	25	75	100	5
	21UBCE51	Human Physiology						
	21UBCE52	Bioethics, Biosafety and Intellectual Property Rights						
	21UBCE53	Ecology and Environmental Toxicology						
6.	Part – III: Elective – 2:		5	3	25	75	100	5
	21UBCE54	Bioinformatics						
	21UBCE55	Hospital Management						
	21UBCE56	Pharmaceutical Biochemistry						
7.	21UBCS51	Part – IV: SBS – 5: Food Processing Technology	2	3	25	75	100	2
8.	21USSY51	Soft Skills (Self-Study)	–	–	–	–	100	–
TOTAL			30				800	29

*One elective course to be chosen from THREE courses

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

T – Theory

P – Practical



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC51	MOLECULAR BIOLOGY	CORE – 5	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Molecular Biology course imparts candidates the basic understanding of biological aspects of DNA, RNA and Protein and their mechanisms.

COURSE OBJECTIVES:

- To introduce the type of DNA sequences and chromosome structure to the students
- To emphasize the molecular mechanisms of DNA replication, mutation, repair and gene regulation in different organisms.
- To introduce the type of DNA sequences and chromosome structure.
- To make the students understand the molecular basis of RNA synthesis and different types of RNA.
- To discuss the genetic code, molecular basis of protein synthesis & modification.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	acquire knowledge related to discovery of DNA as genetic material, DNA replication, transcription, DNA repair and translation.	Upto K3
CO 2	have a basic knowledge related to processes of transcription and translation in prokaryotes and eukaryotes.	Upto K3
CO 3	understand the Coding and non-coding regions of eukaryotic genome and their importance.	Upto K3
CO 4	develop understanding of the molecular basis of RNA processing and RNA splicing.	Upto K3
CO 5	comprehend the ways in which the biological processes are regulated and the significance of regulation in maintaining different life forms.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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MOLECULAR BIOLOGY

UNIT– I:

Origin of Molecular biology and chemical basis of heredity: Prebiotic origin of Biomolecules, self-replicating Biomolecules, chromatin structure and composition, structure of DNA and different forms of DNA, RNA and its types.

UNIT– II:

Nucleic acid as the genetic material: classical experiments – Griffith experiment, Mc Avery and Claud, Hershey and chase, Exchange of genetic material – Transformation, Transduction – types and mechanism, conjugation.

UNIT– III:

Replication: initiation, elongation and termination of DNA Replication– Enzymology of DNA replication, models of replication – Sigma replication, (σ) Theta replication, Inhibitors of DNA replication – DNA damage, DNA repair mechanism – Photo reactivation, Mismatch repair, Excision repair – Base excision, Nucleotide Excision.

UNIT– IV:

Transcription: initiation, elongation and termination of transcription, post transcriptional modification, Inhibitors of Transcription– Regulation of transcription: concepts of operon – Lac operon – Inducers and repressors.

UNIT– V:

Introduction to Genetic code – Wobble Hypothesis, Translation – role of mRNA, rRNA, tRNA, initiation, elongation and termination of Protein synthesis, Inhibitors of Protein synthesis– Post translational modification.

TEXT BOOKS:

1. David friefielder (1990). *Molecular Biology*, 2nd edition, Narosa Publishers.
2. Gardener EJ, Simmons MJ, Snustad DP (2006). *Principles of Genetics*, 8th edition, John Wiley and Sons Pvt. Ltd.
3. Becker, Wayne, Kleinsmith, Lewis, Hardin, Jeff, Bertoni ,Gregory Paul (2009) *The World of Cell* , 7th Edition, Pearson Education Inc.

REFERENCE BOOKS:

1. Benjamin Lewin (2003). *Gene VIII*, Benjamin Cummins Publishers, United States edition.
2. Geoffrey M. Cooper, (2000). *The Cell: A Molecular Approach*, 4th edition, ASM Press.
3. Lodish *et al.*, (2003). *Molecular Cell Biology*, Scientific American press
4. Watson JD *et al.* (2004) *Molecular Biology of the Gene*, 5th edition, Pearson Education.
5. Gerald Karp, (1996). *Cell and Molecular Biology*, 1st edition, John Wiley & sons.

DIGITAL TOOLS:

1. <https://microbenotes.com/category/molecular-biology/>
2. <https://www.studocu.com/en-gb/document/university-college-london/biochemistry-and-molecular-biology/cell-molecular-biology-notes/10045497>
3. <https://www.fmed.uniba.sk/uploads/media/Introduction to Medical and Molecular Biology.pdf>
4. <https://thebiologynotes.com/category/molecular-biology/>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC52	MICROBIOLOGY	CORE – 6	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Microbiology course helps to understand the basic principles of microbiology and its applications.

COURSE OBJECTIVES:

- To define the basic concepts of microbiology.
- To explain the basic structure of bacteria and able to identify the gram positive and negative organisms.
- To define the soil microbiology and their application in bio-fertilizer formation.
- To help the students acquire skills to handle the microscope, staining procedures.
- To make the students understand the application of the microorganisms in food and other industries.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	define the fundamentals of basic microbiology.	Upto K3
CO 2	outline the bacterial growth curve.	Upto K3
CO 3	explain the principles of microscopy technique.	Upto K3
CO 4	utilize microorganism in food industries.	Upto K3
CO 5	relate the role of microbes in agriculture.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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MICROBIOLOGY

UNIT– I: Classification and Organization

Introduction – History of Microbiology, Importance and applications of Microbiology. Outline classification of living organisms: Haeckel's, Whittaker and Carl Woese systems. Prokaryotes – General characteristics of bacteria, archaebacteria, rickettsias, mycoplasmas, cyanobacteria and actinomycetes. Ultrastructure of a bacterial cell: cell wall, cell membrane, ribosomes, nucleoid, Capsule, flagella, fimbriae, endospore and storage granules.

UNIT– II: Nutrition, Growth and Reproduction

Microbial nutrition – nutritional requirements and uptake of nutrients by cells. Nutritional groups of microorganisms – autotrophs, heterotrophs. Bacterial growth – Growth curve, Factors influencing microbial growth. Reproduction – modes of reproduction – Binary fission, fragmentation, budding, conjugation, transformation, transduction and sporulation.

UNIT– III: Microscopy

Principles and applications, resolving power, numerical aperture, types – dark field, bright field microscopy, phase contrast microscopy, fluorescent microscopy, electron microscopy, TEM and SEM– Staining techniques– Simple and differential staining– Sterilization techniques (Brief account only).

UNIT– IV: Applied Microbiology

Food microbiology – spoilage, poisoning, food borne infections. Industrial microbiology – fermentation, use of microbes in industries, productions – organic acids (lactic acid and citric acid), antibiotics (penicillin and streptomycin). beer, wine. Microorganisms and milk – milk souring, alkali production, sweet curding. Fermented milk products – cheese, yoghurt, sauerkraut.

UNIT– V: Agricultural and Medical Microbiology

Plant growth – promoting microorganisms – mycorrhizae, rhizobia, Biofertilizers – Rhizobium. Plant diseases bacteria and viruses. Pathogenesis and prevention of air and water borne diseases – Typhoid, cholera, dysentery, Diarrhoea, hepatitis, amoebiosis, tuberculosis, pox diseases, diphtheria, poliomyelitis.

TEXT BOOKS:

1. Prescott, (2003) *Microbiology*, 6th edition, McGraw – Hill international.
2. Stainer, et al, (1993) *General Microbiology*, 5th edition, The Mac Milan press Ltd.

REFERENCE BOOKS:

1. Davis et al, (1990) *Microbiology*, 4th edition J.B.Lippincott Company.
2. Michael J. Pelczar I.R., C. E. (2004). *Microbiology*. 5th ed Tata McGRAW–Hill, New Delhi



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DIGITAL TOOLS:

1. https://faculty.ksu.edu.sa/sites/default/files/140_mbio-final_notes.pdf
2. <https://www.studocu.com/en-au/document/university-of-technology-sydney/general-microbiology/general-microbiology-lecture-notes-1-21/291249>
3. http://www.dspmuranchi.ac.in/pdf/Blog/General_MicrobiologyCSP_Proof012417.PDF
4. <https://www.hccfl.edu/media/572066/microscopy.pdf>
5. <https://microbiologynotes.org/category/general-microbiology/>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC53	IMMUNOLOGY AND IMMUNOTECHNOLOGY	CORE – 7	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Immunology course introduces students to a wide range of topics in immunology starting from cells of immune system, innate and adaptive immune systems, humoral immunity, antibody structure and function, basic immunological techniques, autoimmunity, hypersensitivity and vaccine production.

COURSE OBJECTIVES:

- To impart knowledge about the types and the various determinants of immunity.
- To expose the students to different types of lymphoid organs and to the cellular basis of immunity.
- To enable them appreciate clonal selection theory, mechanism of cell mediated and humoral mediated immune responses.
- To make the students understand the diagnostic methods of immunology.
- To teach the disorders associated with immunological processes.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand the overview of immune system including cells, organs and receptors.	Upto K3
CO 2	learn structure and functions of different classes of immunoglobulins, the genetic basis of antibody diversity and the importance of humoral, cell-mediated and innate immune responses in combating pathogens.	Upto K3
CO 3	understand mechanisms involved in different types of hypersensitivity and the importance of conventional vs. recombinant vaccines.	Upto K3
CO 4	get acquainted with the importance of antigen-antibody interaction in disease diagnosis.	Upto K3
CO 5	understand the principles of tolerance, autoimmunity and the role of immunity in protection against pathogens.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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IMMUNOLOGY AND IMMUNOTECHNOLOGY

UNIT– I:

Historical background – contributions of Edward Jenner, Louis Pasteur, *Rodney Porter*– Definition: Immunity, host resistance, antigen, antibody, leucocytes, lymphocytes etc., principles of Innate and acquired immunity, memory specificity – self / non self–diversity – introduction to cells – [lymphocytes, monocytes, macrophages and granulocytes] and organs of the immune system – [bone marrow, thymus, spleen, lymph nodes, MALT, GALT.

UNIT– II:

Types of immunoglobulins – IgM, IgG, IgA, IgD and IgE – structure of antibody molecule – IgG only. Nature of antigens – immunogen and hapten – T dependent and T independent antigens. Complement Components: Definition, explanation and functions of complement components.

UNIT– III:

Antigen – antibody interaction – agglutination – precipitation – immunodiffusion – immuno electrophoresis – radioimmunoassay – immunofluorescence – complement fixation – ELISA – production of antisera.

UNIT– IV:

Blood group antigen – Rhesus – incompatibility – major histocompatibility complex – [type I & II and functions] autoimmune diseases (Graves, RA, Myasthenia gravis, SLE) – Vaccination – vaccines and their preparations, primary and secondary immune response, active and passive immunization, types of vaccines.

UNIT– V:

Hypersensitivity – types – mechanism – transplantation – graft rejection, tissue typing, immunosuppression, Production of monoclonal antibodies and its applications. Immunological disorder: AIDS, *Severe combined immunodeficiency (SCID)*.

TEXT BOOKS:

1. Eli Benjamini., Richard. C., and Geoffrey S., (2003) ***Immunology***, V Ed. John Wiley & Sons, Inc., Hoboken, New Jersey.
2. Kuby, J. (2004) ***Immunology***, V Edition. W.H. Freeman and Company, NY.
3. Roitt, I M, (2005) ***Essentials of Immunology***, ELBS, Blackwell Scientific Publication.

REFERENCE BOOKS:

1. Ian R. Tizard, (1995) ***Immunology***, 4th edition, Saunders College Publication.
2. Richard M.Hyde (1997) ***Immunology***, 3rd edition, B.I. Waverly Pvt. Ltd.
3. Abul K.Abbas (1998) ***Cellular and Molecular Immunology***, 3rd edition, Harcourt Brace & Company.



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DIGITAL TOOLS:

1. <https://microbenotes.com/category/immunology/>
2. <https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/>
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_la_b_tech_students/In_imm_serology_final.pdf
4. https://www.researchgate.net/publication/320623534_Immunology_and_Immunotechnology

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCCP3	LAB IN MICROBIOLOGY & IMMUNOLOGY	CORE PRACTICAL	–	5	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Lab in Microbiology & Immunology course introduces the theoretical and practical elements of microbiology and immunology, with an emphasis on microbiological methods and interactions at the interface between antigen and antibodies for the immune system.

COURSE OBJECTIVES:

To enable the students

- understand the basic concepts of microbiology with an emphasis on sterile technique, microscopy, isolation and cultivation of microorganisms.
- learn and understand the identification and characterization of microbes.
- learn and understand the separation techniques.
- receive an introduction to experimental design and basic techniques commonly used in immunology research laboratories.
- take up jobs in Diagnostic laboratories.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	isolate microbes from provided samples and to perform bacterial cultures in different media.	Upto K3
CO 2	get trained in performing routine microbiological practices such as sterilization, media preparation, maintenance of microbial culture, staining etc.	Upto K3
CO 3	acquire expertise to culture and screen microbes for antibiotic resistance.	Upto K3
CO 4	get acquainted with the importance of antigen–antibody interaction in disease diagnosis.	Upto K3
CO 5	obtain hands–on training in basic separation techniques in biochemistry like chromatography.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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LAB IN MICROBIOLOGY & IMMUNOLOGY

1. Sterilization techniques and cleaning of glass wares.
2. Preparation of simple culture media.
3. Selection of suitable culture medium.
4. Gram's staining, motility – Hanging drop method.
5. Isolation of microbes from soil – serial dilution, plating techniques
6. Enumeration of *E.coli* in milk and ice cream.
7. Water quality analysis – presence of Coliform test.
8. RBC, WBC count.
9. Blood grouping.
10. Immunodiffusion
11. ESR – Erythrocyte sedimentation rate.
12. Hemagglutination
13. Identification of nucleic acids by Agarose Gel Electrophoresis.
14. Separation of amino acids by Paper Chromatography, TLC

TEXT BOOKS:

1. Hudson, L., Hay, F. C., & Hudson, L. (1989). *Practical Immunology* (Vol. 3). Oxford: Blackwell scientific publications.
2. Cappuccino, J. G., & Welsh, C. T. (2017). *Microbiology: A Laboratory Manual*. Pearson Education.

REFERENCE BOOKS:

1. Gunasekaran.P,(2009) *Lab Manual in Microbiology*. New age International Pvt Ltd Publishers, U.S.A .
2. Benson, H.J. (2002) *Microbiological Applications: Laboratory Manual in General Microbiology*. 8th Edition, McGraw Hill, New York.
3. Palanivelu, P. (2019). *Analytical Biochemistry and Separation Techniques*. 6th Ed., 21st Century Publications.

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=ujzSmsmg7ok>
2. <https://www.youtube.com/watch?v=y1CHEytZr0>
3. <https://www.youtube.com/watch?v=w2WAYViQBXM>
4. <https://www.medicofem.com/index.php/microbiology/microbiology-practical-aspects/culture-media/>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level
COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE51	HUMAN PHYSIOLOGY	ELECTIVE – 1	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Human physiology course introduces students to the physiology of the human body.

COURSE OBJECTIVES:

- To impart knowledge about Blood composition and function and mechanism of respiration
- To make the students study about the circulatory system.
- To enable the students appreciate about the components of excretory system and mechanism of Urine formation.
- To help the students understand the structure and function and different components of Digestive system.
- To introduce the organization of Nervous system.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain a complete knowledge in the physiology of life Gaining a complete knowledge in the physiology of life.	Upto K3
CO 2	be aware of the functional relationships between various organ systems of the body.	Upto K3
CO 3	classify blood groups so as to identify the blood groups of patients and donors for the purpose of safe blood transfusion.	Upto K3
CO 4	understand various systems of the body which support life viz. Circulatory, digestive, respiratory, nervous and excretory systems.	Upto K3
CO 5	explain the structure and functions of neuron, transmission of nerve impulse and understand neuromuscular coordination.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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HUMAN PHYSIOLOGY

UNIT– I:

Blood composition and function, types of blood cells, morphology and function. Blood groups – ABO and Rhesus system . Composition and function of lymph and lymphatic System. Respiratory system– structure & function of different components of respiratory units. mechanism of respiration – Acid base balance in lungs.

UNIT– II:

Circulatory System – heart – structure, properties of cardiac muscle. overview of systemic and pulmonary circulation, conducting system of the heart, heart rate, cardiac cycle, cardiac output, Systolic and Diastolic pressure.

UNIT– III:

Digestive systems: Structure of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salt in digestion of lipids, Gastric secretion in stomach, role of various enzymes and hormones involved in digestive process.

UNIT– IV:

Excretory system–Structural components of urinary system: Kidney structure and its function – Structure of Nephron. Mechanism of urine formation– Glomerular filtration rate (GFR), Tubular Secretion and reabsorption – Acid base balance in kidneys.

UNIT– V:

Brief outline of nervous system–brain (parts and ventricles), spinal cord, nerve fibres, synapses, chemical and electrical synapses, Transmission of nerve impulses, action potential and neurotransmitters–Cholinergic and Adrenergic Neurotransmitters. Muscles–Types of muscles and their functions: myofibrillation and contraction and relaxation of skeletal muscles.

TEXT BOOKS:

1. Sembulingam, K. S. (2019). *Essentials of Medical Physiology*. Jaypee Brothers Medical Publishers.
2. Derrickson, G. J. (2017). *Principles of Anatomy and Physiology*. John Wiley & Sons, Inc., Hoboken, New Jersey.
3. Hall, G. A. (2019). *Text book of Medical Physiology*. Elsevier india.

REFERENCE BOOKS:

1. D. Venkatesh, H. H. (2018). *Textbook of Medical Physiology*. Wolters Kluwer India Pvt. Ltd.
2. H. S. Ravi Kumar Patil, H. K. (2009). *A Textbook of Human Physiology*. I K International Publishing House Pvt. Ltd .

DIGITAL TOOLS:

1. https://laney.edu/rebecca_bailey/wp-content/uploads/sites/10/2017/07/Human-Physiology-Lecture-Notes-update-2017.pdf
2. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/nursing_students/ln_human_anat_final.pdf
3. <https://drnaitiktrivedi.com/index.php/notes/anatomy-physiology-notes/>
4. <https://www.docsity.com/en/subjects/human-physiology/>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level
COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE52	BIOETHICS, BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS	ELECTIVE – 1	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Bioethics, Biosafety and Intellectual Property Rights Course introduces basic concepts of ethics and safety that are essential for different disciplines of science and procedures involved and protection of intellectual property and related rights.

COURSE OBJECTIVES:

- To instil bioethical values in students
- To create awareness on our rights and to respect others rights
- To impart standard and safety practices in biomedical field
- To sensitize the students to ethical issues in research
- To inculcate knowledge on intellectual property rights

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand the ethics, realize rights and responsibilities in society.	Upto K3
CO 2	be ethical in biomedical research.	Upto K3
CO 3	follow standard guidelines in laboratory and clinical trials	Upto K3
CO 4	follow ethical practices in biomedicine.	Upto K3
CO 5	identify intellectual property in research and apply for patents.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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BIOETHICS, BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS

UNIT– I:

Ethics – Introduction; Types – Meta ethics, Applied ethics, Moral ethics, Descriptive ethics, Normative ethics; Principles – Beneficence, Non – Maleficence, Respect to Autonomy, Justice.

UNIT– II:

Ethical issues in Biotechnology and Biomedical Research: ICMR guidelines for Biomedical Research; Consent – Types, consent from minors; Cloning; stem cells, Gene Therapy, GMO.

UNIT– III:

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

UNIT– IV:

Ethical issues concerning birth, life and death: Reproductive technologies – Gamete donation, In Vitro Fertilisation, Embryo transfer, surrogacy, prenatal diagnosis, sex–selection; withholding and withdrawing medical treatment; abortion, euthanasia.

UNIT– V:

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.

TEXT BOOKS:

1. Shaleesha. A. Stanley, (2008) *Bioethics*, Wisdom Educational Service.
2. S. Ignacimuthu. (2009) *Bioethics*, Alpha Science International Ltd.
3. S V Satakar. (2002) *Intellectual Property Rights and Copyrights* – ESS Publication, New Delhi.

REFERENCE BOOKS:

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

DIGITAL TOOLS:

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

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE53	ECOLOGY AND ENVIRONMENTAL TOXICOLOGY	ELECTIVE – 1	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Ecology and Environmental Toxicology Course includes the principles of ecology and methods of biological testing for toxicity and health.

COURSE OBJECTIVES:

- To enable the students to understand ecosystem structures and functions.
- To provide deep understanding of incredible diversity of life, interactions between different ecosystem services and impacts of natural disturbances on ecosystem.
- To impart knowledge on harmful effects and disposal of radioactive wastes.
- To enable the students to understand inorganic and organic pollutants, their entry into the environment and transformation within the environment.
- To impart knowledge on various bioremediation methods.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	utilize the knowledge in understanding the ecosystem.	Upto K3
CO 2	discuss and explain the interaction between various ecosystem and impact of natural disturbances on ecosystem	Upto K3
CO 3	explicate the harmful effects of radioactive pollutants and their waste.	Upto K3
CO 4	apply the knowledge in executing preventive measures on understanding toxic metals, organic and inorganic pollutants into environment.	Upto K3
CO 5	apply the knowledge in the disposal of waste by various bioremediation methods.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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ECOLOGY AND ENVIRONMENTAL TOXICOLOGY

UNIT- I:

Introduction to Ecology–Definition, Branches and relation of ecology with other disciplines– Significance of ecology for man. Structure of Ecosystem–Abiotic and biotic components. Examples of ecosystem, Productivity of ecosystem, food chain in ecosystem, ecological pyramids.

UNIT- II:

Ecosystem–fresh water communities– physiochemical nature, Lentic–biotic communities, distribution of oxygen and dissolved nutrients. Estuaries –Types of estuaries, physiochemical aspects of estuaries. Marine – physiochemical stratification, currents, marine communities (biotic) coral reef as a specialized oceanic ecosystem. Terrestrial Ecosystems–Classification, biomes, tundra, alpine, forest, grassland, desert, wetland biomes and tropical savanna biomes.

UNIT- III:

Radioactive pollution– Radioactivity and kinds of radiation. Sources of radioactive pollution. Effect of radioactive pollution, protection and control from radiation, disposal of radioactive waste.

UNIT- IV:

Chemical toxicology–Toxic metals–toxic effects of Pb, Cd, Hg, Ar, Cr and Ni. Estimation of toxic metals. Toxicity of pesticides–toxic effects of organochlorines, halogenated hydrocarbons, heterocyclic compound, organophosphates and amides in urea.

UNIT- V:

Bioremediation – Insitu engineered bioremediation, intrinsic bioremediation and natural attenuation and bio barriers .Ex situ–Bioremediation, phytoremediation, microbial degradation of xenobiotics.

TEXT BOOKS:

1. Verma, P.S. and Agarwal, V.K. (2005) *Environmental Biology: Principles of Ecology*. S. Chand and Company Limited, New Delhi.
2. H. Sharma and B. K. Kaur (1995). *Environmental Chemistry*, Goel Publishing House, Meerut.

REFERENCE BOOKS:

1. Walker, C.H. et al. (1996). *Principles of Ecotoxicology*. Taylor & Francis. Inc. Shaw, I. and J. Chadwick. (1998). *Principles of Environmental Toxicology*. Taylor & Francis. Inc.
2. Sharma, P.D. (2003) *Ecology and Environment*. 7th Edition, Rastogi Publication, Meerut.
3. A. Wallace Hayes, Claire L. Kruger. Hayes (2014) *Principles and Methods of Toxicology*, 6th Edition, CRC Press, London.



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DIGITAL TOOLS:

1. [https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Science_\(Ha_and_Schleiger\)/04%3A_Humans_and_the_Environment/4.04%3A_Environmental_Health/4.4.04%3A_Environmental_Toxicology](https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Science_(Ha_and_Schleiger)/04%3A_Humans_and_the_Environment/4.04%3A_Environmental_Health/4.4.04%3A_Environmental_Toxicology) <https://www.ethics.org>
2. http://envirottox.hu/wp-content/uploads/2017/10/Environmental-toxicology_lecture-notes_part1.pdf <http://research-ethics.org>
3. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000035ZO/P000891/M020628/ET/1519034453M41AppliedEcologyEcotoxicologyQuad1.pdf
4. <https://www.conserve-energy-future.com › radioactive-pollution-causes-effects-solution>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE54	BIOINFORMATICS	ELECTIVE – 2	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Bioinformatics course provides an introduction to the application of computational methods to biological data analysis and for discovery.

COURSE OBJECTIVES:

- To impart knowledge about the basics of Internet communication
- To expose the students to the principles and applications of Bioinformatics & databases
- To enable the students understand the concept of Sequence alignment & gene prediction
- To enable the students understand protein structural organization and prediction
- To make the students understand the basics of Phylogenetics analysis

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	recall the basic concepts of internet.	Upto K3
CO 2	define bioinformatics and its applications.	Upto K3
CO 3	summarize the biological databases.	Upto K3
CO 4	compare sequence alignment methods.	Upto K3
CO 5	apply sequence alignment for phylogeny analysis.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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BIOINFORMATICS

UNIT– I:

Basics of internet, Computing and Information networks: Browsing, web, online journals – Pubmed. Brief account on database management system, HTTP, HTML and VRLS.

UNIT– II:

Introduction to Bioinformatics – Definitions and basic concepts, Genome projects, the role and applications of bioinformatics.

UNIT– III:

Biological databases: Sequence databases, sequence assembly, submission of sequence, Database browsers and search engines.

UNIT– IV:

Sequence Alignment: Pair wise Alignment – Dot matrix, dynamic programming algorithms, BLAST and FASTA, similarity searches, Multiple sequence Alignment.

UNIT– V:

Homology and diversity: Phylogeny – evolutionary basis of sequence alignment. Methods of Phylogeny analysis: Distance and character-based methods.

TEXT BOOKS:

1. David Mount. W, (2003) *Bioinformatics*, CBS Publishers & Distributors.
2. Attwood, T.K. and Parry – Smith .D.J, (2002) *Introduction to Bioinformatics*, Pearson Education private Ltd., Singapore.

REFERENCE BOOKS:

1. Arthur M. Lesk, (2008) *Introduction to Bioinformatics*, Oxford University Press.
2. Howard Parish J., Richard M. Twyman, (2002) *Instant Notes in Bioinformatics*, Bios Scientific publishers Ltd.

DIGITAL TOOLS:

1. https://bioboot.github.io/bioinf525_w16/class-material/lecture1-1_525_W16_large.pdf
2. <https://www.biologydiscussion.com/biodiversity/bioinformatics/notes-on-bioinformatics-genetics/38224>
3. <https://thebiologynotes.com/category/bioinformatics/>
4. <https://www.biotechnologynotes.com/bioinformatics/notes-on-bioinformatics/693>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

C COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE55	HOSPITAL MANAGEMENT	ELECTIVE – 2	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Hospital Management Course revolves around imparting knowledge about the managerial and administrative roles at a hospital or a healthcare institute.

COURSE OBJECTIVES:

To enable the students

- understand the role of administration in patient care, planning and management.
- understand the importance of information system in hospitals.
- understand the policy and procedures in clinical services.
- understand the legal and safety aspects in health care services.
- understand the aspects of counselling and its importance in hospital management.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	know and understand the importance and role of various departments, support services in hospitals.	Upto K3
CO 2	confer about information system in hospitals and Quality assurance.	Upto K3
CO 3	communicate about Ethics governing various clinical aspects like blood transfusion, transplantation.	Upto K3
CO 4	comprehend various legal and safety aspects in hospital administration.	Upto K3
CO 5	discuss counselling and recognize the role of counsellors in Hospital management.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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HOSPITAL MANAGEMENT

UNIT- I:

General features of a hospital, various departments –Outpatient department, Casualty and Emergency services, General surgery department ,ICU, Obstetrics department, Clinical laboratory. Supportive services– Admission department, Medical records department, Pharmacy, Food services, Housekeeping department, Volunteer department.

UNIT- II:

Information system in hospital: Communication, Delegation, Decision making, Monitoring, Evaluation, Meetings and Negotiations; Quality assurance.

UNIT- III:

Biomedical research: Ethics; Ethics pertaining to blood transfusion, transplantation; Bio-medical waste management.

UNIT- IV:

Hospital Administration, Hospital ethics, Challenges in hospital administration, Legal aspects, Environmental Safety, Health services, National Health Policy.

UNIT- V:

Counseling– Types, Techniques, Function, Development of counselling services, Duties of a counselor.

TEXT BOOKS:

1. K.J. Kundurs. (2008) *Hospitals–Facilities Planning and Management*, Tata McGraw Hill, New Delhi,
2. R.C. Goyal. (2005) *Hospital Administration and Human Resource Management*, 4th Edition, Prentice Hall of India Pvt Ltd.

REFERENCE BOOKS:

1. R. Kumar S.L. Goel, (2009) *Hospital Administration and Management: Theory and Practice*, Jaypee Brothers, Medical Publishers Pvt. Limited,
2. Joydeep Das Gupta, (2009) *Hospital Administration and Management: A Comprehensive Guide*, Jaypee Brothers, Medical Publishers Pvt. Limited.
3. K. V. Ramani , (2011) *Hospital Management*, Pearson Education India.

DIGITAL TOOLS:

1. https://shodhganga.inflibnet.ac.in/bitstream/10603/43767/10/10_chapter%201.pdf
2. <https://www.asianhbm.com/facilities-operations/environmental-safety-hospitals>
3. <http://ncert.nic.in/vocational/pdf/keda101.pdf>
4. <https://www.scribd.com/document/332414371/BM-Sakharkar-Principles-of-Hospital-Administration-and-Planning-2nd-Edition-pdf>
5. <https://www.pdfdrive.com/hospital-administration-books.html>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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502

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE56	PHARMACEUTICAL BIOCHEMISTRY	ELECTIVE – 2	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Pharmaceutical Biochemistry Course introduces basis for understanding of the chemistry of pharmaceuticals and other pharmacologically active compounds, their mode of action, and their turnover in the human body, and how this contributes to health benefits.

COURSE OBJECTIVES:

- To provide an in–depth knowledge about sources of drugs, pharmacokinetics and pharmacodynamics.
- To give an outline on routes of drug administration.
- To give knowledge on drug receptor metabolism.
- To teach adequate scientific knowledge about pharmaceutical manufacturing process.
- To make the students gain a better understanding of drug discovery, design and its development.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand drug dosage, routes of administration and about bioavailability of drugs.	Upto K3
CO 2	understand about basic principles involved in pharmacokinetics.	Upto K3
CO 3	understand about the drug receptor interactions and gain knowledge on metabolism.	Upto K3
CO 4	describe the general principles of adverse drug reactions and acute poisoning.	Upto K3
CO 5	advance the knowledge on drug discovery process and ethical issues in drug discovery process and in preclinical toxicological studies.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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PHARMACEUTICAL BIOCHEMISTRY

UNIT-I:

Introduction – Sources of drugs, routes of drug administration, dosage forms, drug dosage. Bioavailability – Bioavailability of drugs, Factors affecting bioavailability, Bioequivalence. Combined effect of drugs – Synergism, antagonism.

UNIT-II:

Pharmacokinetics – Absorption, distribution of drugs, half-life, c_{max} , t_{max} , factors influencing drug absorption and distribution. Drug elimination – Renal excretion, fecal excretion, biliary excretion, pulmonary excretion and other routes of excretion.

UNIT-III:

Pharmacodynamics – Drug receptors – Concept and theory, Drug – receptor interactions, Receptor mediated and non – receptor mediated drug action, Mechanism of phase I and Phase II metabolic reactions, factors affecting drug metabolism, significance of drug metabolism. Placebo effects, Factors modifying drug action.

UNIT-IV:

Adverse Drug Reactions and Toxicology – Pharmacologic ADRs, Non – pharmacological ADRs, disease – related ADRs, multiple drug reactions. Acute poisoning – General principles and management. Drug dependence, drug tolerance and intolerance.

UNIT-V:

Drug Discovery and Development – Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing. Preclinical research, clinical research, overview of DCGI, NPPA, CDSCO, FDA, ICMR and FSSAI.

TEXT BOOKS:

1. R.S. Satoskar, S. B. (2017) *Pharmacology and Pharmacotherapy*. Elsevier.
2. Tripathi, K. (2018) *Essentials of Medical Pharmacology*. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
3. Katzung, B. G. (2015) *Basic and Clinical Pharmacology*. Tata McGraw Hill Education Private Limited, New Delhi.

REFERENCE BOOKS:

1. S C Metha and Ashutosh Kar (2011). *Pharmaceutical Pharmacology*, New age International publishers.
2. Padmaja Udayakumar (2009), *Text book of Medical Pharmacology* – 2nd Edition, CBS Publishers & Distributors, New Delhi.

DIGITAL TOOLS:

1. https://www.carewellpharma.in/B_Pharmacy/Notes/2nd_Sem/Biochemistry/Unit_2
2. <https://www.studocu.com/in/course/jawaharlal-nehru-technological-university-anantapur/pharmaceutical-biochemistry/3890078>
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_sciences_students/medicalbiochemistry.pdf

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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504

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCS51	FOOD PROCESSING TECHNOLOGY	SBS – 5	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Food Processing Technology Course covers the techniques and ideas involved in the processing and preservation of food.

COURSE OBJECTIVES:

- To impart knowledge about food processing and various unit operations – storing and preservation.
- To make the students understand the advanced principles of food processing and to choose a method of preservation in relation to food composition.
- To make the students understand about milk, milk processing methodologies.
- To create awareness about the processing of major cereals.
- To make the students know about processing technology of meat, fish and eggs.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	explain major food groups and bio-fortification.	Upto K3
CO 2	know about cereals and pulses milling techniques which To develop entrepreneurial skills.	Upto K3
CO 3	understand the processing of fruits and vegetables.	Upto K3
CO 4	understand the various milk processing methods.	Upto K3
CO 5	gain knowledge on the processing of meat, fish and eggs products and egg products.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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FOOD PROCESSING TECHNOLOGY

UNIT – I: Introduction

Definition – function of food – food groups – Bio-fortification – Nutraceuticals – low cost nutrient supplement – Food fortification

UNIT – II: Cereals and Pulses

Grain characteristics and plant products – Wheat milling process – products of wheat – Rice processing. Pulses – processing – Fermentation and Germination

UNIT – III: Fruits and Vegetables

Structure, composition, physiological and biochemical changes during ripening, handling and storage – processing of vegetables – citrus juice, grape juice and raisins, squashes, jam, ketchups

UNIT – IV: Milk and Milk Products

Milk processing – Pasteurization, homogenization, packing – fortified milk, skim milk – cream, butter, cheese, ice-cream, paneer, yogurt

UNIT – V: Meat, Fish and Eggs

Meat –Aging, tenderizing, freezing – storage. Fish preservation and processing. Egg – dehydrated egg powder, frozen egg – egg storage

TEXT BOOKS:

1. Sivasankar. B. (2000) *Food Processing and Preservation*, 1st edition, PHI Learning Pvt. Ltd.
2. Srilakshmi. B. (2011) *Food Science*, 5th edition, New Age International Pvt Ltd.

REFERENCE BOOKS:

1. Ramaswamy H and Marcott M, (2006). *Food Processing Principles and Applications*, CRC Press.
2. Swaminathan, M., (2010) *Advanced Text Book on Food and Nutrition*, Volume I & II, The Bangalore Printing and Publishing Co. Ltd.

DIGITAL TOOLS:

1. <https://unacademy.com/content/neet-ug/study-material/biology/biofortification/>
2. <http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=147681>
3. <https://microbiologynotes.org/milk-composition-processing-pasteurization-pathogens-and-spoilage/>
4. <https://microbenotes.com/preservation-of-meat-and-meat-products/>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level
COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE STRUCTURE – VI – SEMESTER

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UBCC61	Part – III: Core – 8: Biotechnology & Genetic Engineering	5	3	25	75	100	5
2.	21UBCC62	Part – III: Core – 9: Plant Biochemistry	5	3	25	75	100	4
3.	21UBCC63	Part – III: Core – 10: Clinical Biochemistry	4	3	25	75	100	4
4.	21UBCC64	Part – III; Core – 11: Medical Diagnostics	4	3	25	75	100	4
5.	21UBCCP4	Part – III: Core Practical–IV: Lab in Clinical Biochemistry	5	3	40	60	100	4
6.	Part – III: Elective – 3:		5	3	25	75	100	5
	21UBCE61	Endocrinology and Hormonal Regulations						
	21UBCE62	Industrial Biochemistry						
	21UBCE63	Therapeutic nutrition						
7.	21UBCS61	Part – IV: SBS – 6: Bio entrepreneurship	2	3	25	75	100	2
8.	21UGKY61	General Knowledge (Self-Study)	–	–	–	–	100	–
		TOTAL	30				800	28

*One elective course to be chosen from THREE courses

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

T – Theory

P – Practical



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC61	BIOTECHNOLOGY & GENETIC ENGINEERING	CORE – 8	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Biotechnology & Genetic engineering course provides the outline of biotechnological techniques and their applications for the development of recombinants.

COURSE OBJECTIVES:

- To introduce the tools of genetic engineering.
- To instil the knowledge about the strategies of gene cloning method.
- To enable students understand plant Biotechnology in crop improvement and disease resistance.
- To impart knowledge on types of cell cultures and their application in medical field.
- To utilize the knowledge in understanding the application of biotechnology in various industries.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	describe the fundamental steps in genetic engineering procedures and relate the different vectors used in genetic engineering.	Upto K3
CO 2	identify various natural and artificial ways to propagate plants to increase genetic variety and infer the use of transgenic plants.	Upto K3
CO 3	outline the fundamentals of various types of animal cell cultures and identify the suitable methods for producing transgenic animals.	Upto K3
CO 4	illustrate the biotechnology-based applications of microbes and their enzymes.	Upto K3
CO 5	discuss the role of biotechnology in industrial sectors.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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BIOTECHNOLOGY & GENETIC ENGINEERING

UNIT– I:

Genetic engineering: Introduction to Gene manipulation – restriction enzymes and DNA ligases, Introduction to gene cloning, Types of cloning vectors – plasmid, phagemid, cosmid, M13 phage, BAC, YAC.

UNIT– II:

Plant biotechnology: Tissue culture – Plant tissue culture, protoplast culture, Agrobacterium mediated gene transfer, transgenic plants and its applications, crop improvement.

UNIT– III:

Animal biotechnology: Introduction to cell culture and cell lines. Viral vector system – Baculo viral vector, Methods for producing transgenic animal – Microinjection, Electroporation, Gene gun method, Invitro – fertilization and embryo transfer, Application of transgenic animals.

UNIT– IV:

Microbial biotechnology: Basic principles of microbial growth, types, design and operation of fermentors, Microbial degradation of oil spills, Biodegradable plastics – PHB production.

UNIT– V:

Protein engineering (T4-lysozyme), Site – directed mutagenesis, yeast two hybrid systems, Production of recombinant pharmaceuticals such as insulin, human growth hormone, factor VIII. Recombinant vaccines.

TEXT BOOKS:

1. Dubey, (2005). *A Text Book of Biotechnology*, 1st edition, S .Chand& Company Ltd.
2. Das H.K., (2004). *A Text book of Biotechnology*, 1st edition, Wiley Dreamtech India Pvt. Ltd.
3. Santhya Mithra (2015). *Genetic Engineering*, McGraw–Hill Publications.

REFERENCE BOOKS:

1. Balasubramanian et.al., (2003) *Concepts in Biotechnology*, Revised edition, university Press.
2. Freifelder, D., (1982) *Physical Biochemistry: Applications to Biochemistry and Molecular Biology*, 2nd edition, Narosa Publications.
3. Old R.W. and Primrose S.B., (2005) *Principles of Gene Manipulation*, 5th edition Blackwell Science.

DIGITAL TOOLS:

1. [https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Biology_\(Fisher\)/08%3A_Food_Hunger/8.02%3A_Biotechnology_and_Genetic_Engineering](https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Biology_(Fisher)/08%3A_Food_Hunger/8.02%3A_Biotechnology_and_Genetic_Engineering)
2. <https://www.freeexamacademy.com/biotechnology-and-genetic-engineering/>
3. <https://www.nios.ac.in/media/documents/SrSec314NewE/Lesson-30.pdf>
4. <https://opentextbc.ca/biology/chapter/10-1-cloning-and-genetic-engineering/>
5. <https://www.biologydiscussion.com/genetic-engineering/notes-on-genetic-engineering/51794>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level
COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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509

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC62	PLANT BIOCHEMISTRY	CORE – 9	5	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Plant Biochemistry Course deals with plant pigments, photosynthesis, plant growth metabolisms and their mechanisms, plant growth hormones and plant physiology.

COURSE OBJECTIVES:

To make the students

- understand plant cell structure and specific biochemical functions to all compartments of the plant cell.
- learn the mechanism of photosynthesis and biosynthetic pathways in plants.
- gain knowledge about secondary metabolites and their role in medicine.
- understand the plant cell physiology.
- illustrate about the plant growth through seed germination and seed dormancy.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	acquire knowledge on plant pigments.	Upto K3
CO 2	comprehend the process of photosynthesis and photorespiration.	Upto K3
CO 3	receive knowledge on plant nutrition and the role of enzymes in nitrogen fixation.	Upto K3
CO 4	comprehend the role of plant growth regulators.	Upto K3
CO 5	understand the plant cell physiology & methodology and application of plant tissue culture.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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PLANT BIOCHEMISTRY

UNIT– I:

Introduction: Occurrence, Classification, Structure and function of naturally occurring pigments – chlorophylls, carotenoids, flavones and flavonals.

UNIT– II:

Photosynthesis: Photosynthetic apparatus and Photosynthetic pigments, light reaction – photophosphorylation – cyclic and non-cyclic Phosphorylation, dark reaction – Calvin cycle, C4 and CAM plants, Photorespiration, Factors affecting Photosynthesis.

UNIT– III:

Plant nutrition: essential mineral nutrients – function, effects of toxicity and deficiency, nitrogen cycle, nitrogen fixation – symbiotic and asymbiotic nitrogen fixation, nitrogen assimilation, sulphate assimilation.

UNIT– IV:

Plant growth regulators: Natural growth hormones – Auxin, GA, cytokinins, Ethylene and ABA, Synthetic growth hormones – IAA, IBA, 2, 4–D.

UNIT– V:

Plant physiology and Reproduction: Brief account on biological membrane transport mechanisms and physiology of Germination, Dormancy, Photoperiodism, Vernalization, Plant tissue culture – Brief account on methodology and application.

TEXT BOOKS:

1. Srivastava H.N., (2004) *Plant Physiology*, 1st New millennium edition, Pradeep Publications.
2. Hans – Walter Hedlt. (2005) *Plant Biochemistry*, third edition, Academic Press.

REFERENCE BOOKS:

1. William G.Hopkins, (1999) *Introduction to Plant Physiology*, 2nd edition John Wiley& Sons.
2. Frank. B. Salisbury, & Cleon, W. Ross (1995) *Plant Physiology*, 3rd edition, CBS Publishers & Distributors.
3. James Bonner & Joseph E. Varner, (1976) *Plant Biochemistry*, 3rd edition, AP Publishers.
4. Ray Noggle. G & George J. Eritz, (1991) *Introduction to Plant Physiology*, 2nd edition, Prenlee Hall of India Pvt Ltd.

DIGITAL TOOLS:

1. <https://agrifyan.in/bioch-311fundamentals-of-plant-biochemistry-sknau-notes/>
2. https://issuu.com/brainkart.com/docs/plant_biochemistry
3. https://agri-bsc.kkwagh.edu.in/uploads/department_course/biochemistry_notes.pdf
4. <https://syukur16tom.files.wordpress.com/2016/01/lect1f-intro-2016-ppt-color.pdf>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC63	CLINICAL BIOCHEMISTRY	CORE – 10	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Clinical Biochemistry Course provides a solid foundation in a field that deals with the clinical study of bodily fluids and other biological material to help in illness diagnosis, treatment, and monitoring.

COURSE OBJECTIVES:

To enable the students

- learn about the scope, development, and applications of Clinical biochemistry.
- acquire knowledge on various diagnostic procedures to diagnose haematological disorders, renal and liver transport
- learn about the disorders and the inborn errors of protein, amino acid and nucleic acid metabolism.
- learn about the disorders of carbohydrate, lipid metabolism and their diagnosis.
- get an awareness on the functions of various organs and the diseases associated with them.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	determine the normal constituents of urine, blood and their significance in maintaining good health.	Upto K3
CO 2	explain the metabolic disorders of carbohydrate.	Upto K3
CO 3	become aware with the variations in the levels of triglycerides and lipoproteins and their relationship with various diseases.	Upto K3
CO 4	learn about the disorders and the inborn errors of protein, amino acid and nucleic acid metabolism.	Upto K3
CO 5	gain knowledge about the disorders and the inborn errors of nucleic acid metabolism.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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CLINICAL BIOCHEMISTRY

UNIT– I:

Introduction: Scope, Development and Applications of Clinical Biochemistry, Laboratory investigation in Clinical Biochemistry – Evaluation of Laboratory test, Normal range, system of international units.

UNIT– II:

Disorders of Carbohydrates Metabolism: Glucose level in normal blood – Hypoglycemia, Hyperglycemia, glycosuria, Diabetes mellitus, obesity, galactocemia, glucose tolerance test, inborn errors of Carbohydrate metabolism – Lactose intolerance, Glycogen storage disease, Carbohydrates Metabolism in starvation.

UNIT– III:

Disorders of lipid metabolism: hypo and hyper Lipoproteinemias, Atherosclerosis, Coronary arterial disease, myocardial infarction, cardiachypertrophy, fatty liver, obesity. Inborn errors of lipid metabolism.

UNIT– IV:

Disorders of Amino acid and Protein Metabolism: Disorders of Plasma protein, urea – Uremia, Uric acid – Urecemia, Creatinine, Ammonia, Inborn errors of Amino acid metabolism – Phenylketonuria, alkaptonuria, Amino acid metabolism in starvation.

UNIT– V:

Disorders of Purine and pyrimidine metabolism – Gout – primary Gout and Secondary Gout, Lesch–Nyhan syndrome (LNS), Orotic aciduria, Xanthinuria.

TEXT BOOKS:

1. Chatterjee, (2005) *A Text Book of Medical Biochemistry*, 5th edition, JAYPEEE Brothers Publication.
2. Tietz (2003) *Fundamental of Clinical Biochemistry*, 5th edition, Saunders, An imprint of Elsevier.
3. Vasudevan (2007) *A Text Book of Biochemistry for Medical Students*, 5th Edition, Jaypee Publications.

REFERENCE BOOKS:

1. Guyton, (2008) *A Text book of Medical Physiology*, 11th edition, Elsevier Publications.
2. Harold Varley (1991) *Practical Clinical Biochemistry*, 5th edition. CBS Publications.
3. Robert K.Murray et al., (2003) *Harper's Biochemistry*, 26th edition, Mc Graw Hill company.
4. Fauci et al, (1998) *Horizon's Principles of Internal Medicine*, 14th edition, Mc Graw–Hill Health Professions Division.



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DIGITAL TOOLS:

1. https://www.academia.edu/41197490/Clinical_Biochemistry_Lecture_Notes
2. <https://www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-13.pdf>
3. <https://download.e-bookshelf.de/download/0003/9373/59/L-G-0003937359-0003185124.pdf>
4. <https://www.studocu.com/latam/document/universidad-de-el-salvador/bioquimica/lecture-notes-clinical-biochemistry-9th-ed-booksmedicos/11891840>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCC64	MEDICAL DIAGNOSTICS	CORE – 11	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Medical Diagnostics course provides a comprehensive knowledge of medical devices classification and introduces students to the principles and application of Medical Diagnostic Systems in medical/clinical environments.

COURSE OBJECTIVES:

- To foster a better understanding of how the clinical sciences are applicable to the diagnosing of disease.
- To enable the students acquire knowledge about the pathophysiology of diseases.
- To provide a solid theoretical foundation in the healthcare–related professions.
- To demonstrate proper handling of patients/specimens and evaluate situations that may cause adverse issues.
- To correlate abnormal laboratory test results with various disease states.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	develop an understanding of the scientific basis underpinning medical diagnostic assays and technologies.	Upto K3
CO 2	understand the pathophysiological processes responsible for common biochemical disorders.	Upto K3
CO 3	understand the enzyme patterns in diseases of various organs such as pancreas, liver, bones, heart and muscle.	Upto K3
CO 4	give an overview of normal and abnormal metabolic functions, how they impact metabolic processes.	Upto K3
CO 5	detail the Clinical application of enzymes in diagnosis, differentiation of functional and non–functional plasma enzymes.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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MEDICAL DIAGNOSTICS

UNIT– I: Liver Function Tests

Liver structure and functions. Metabolism of bilirubin. Jaundice – types, clinical features and tests based on bile pigments level in blood and urine. Differentiation of three types of jaundice. Prothrombin Time. Liver function tests.

UNIT– II: Renal Function Tests

Formation of urine – Glomerular filtration and tubular reabsorption. Clearance tests–urea, creatinine, inulin, PAH test, concentration and dilution tests.

UNIT– III: Gastric Function Tests

Collection of gastric contents, Examination of gastric residuum, FTM. Stimulation tests. Tubeless gastric analysis.

UNIT– IV: Clinical Enzymology

Definition of functional and non – functional plasma enzymes. Isozymes and diagnostic tests, enzyme patterns in acute pancreatitis, liver damages, bone disorders, myocardial infarction and muscle wasting.

UNIT– V: Diagnosis of Tumours

Definition of tumor markers, Markers produced by various tissues, classification and clinical applications. Imaging techniques to diagnose cancer – CT, MRI, PET, SPECT.

TEXT BOOKS:

1. M.N. Chatterjee & Ranashinde (2006). *Text Book of Medical Biochemistry*. 6th edition Jaypee Brothers Medical Publisher (P) Ltd.
2. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), (2012). *Tietz Textbook of Clinical Chemistry and Molecular Diagnosis*. 5th edition, Elsevier, St. Louis, USA,

REFERENCE BOOKS:

1. Thomas M. Devlin. (2010) *Biochemistry with Clinical Correlation*. 7th Ed., John Wiley & Sons.
2. Marshall & Lapsle & Day & Ayling, (2014) *Clinical Biochemistry, Metabolic and Clinical Aspects*. 3rd Edition, Elsevier, St. Louis, USA,
3. Prakash, G. (2012) *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd.

DIGITAL TOOLS:

1. <https://www.ncbi.nlm.nih.gov/books/NBK338593/>
2. <https://www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html>
3. <https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-23.pdf>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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516

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCCP4	LAB IN CLINICAL BIOCHEMISTRY	CORE PRACTICAL	–	5	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Lab in Clinical Biochemistry Course provides advanced knowledge to students about the biochemical underpinnings of disease, specialised laboratory testing and associated analytical techniques, as well as the interpretation and communication of biochemical data as used in the modern clinical biochemistry laboratory.

COURSE OBJECTIVES:

- To help the students acquire knowledge associated with tests performed in a clinical biochemistry laboratory.
- To interpret common result patterns related to routine clinical biochemistry.
- To train students in isolation of Biomolecules from biological samples.
- To help the students comprehend the principles of the analytical instruments in use in the routine clinical laboratory.
- To help them determine the abnormal and normal constituents of urine.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain knowledge of about the normal constituents of urine, blood and their significance.	Upto K3
CO 2	learn qualitative analysis of constituents of biological fluids such as urine, blood.	Upto K3
CO 3	learn quantitative analysis of constituents of biological fluids such as urine, blood and their estimation.	Upto K3
CO 4	become aware with the variations in the levels of triglycerides and their relationship with various diseases.	Upto K3
CO 5	get acquainted with the role of enzymes in diagnosis of various diseases.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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LAB IN CLINICAL BIOCHEMISTRY

BLOOD ANALYSIS:

1. Estimation of Glucose by Phenol – Sulphuric acid method
2. Estimation of urea by Dam's method
3. Estimation of Cholesterol by Zak's method
4. Estimation of Uric acid by Caraway's method
5. Estimation of protein by Lowry's method
6. Estimation of Creatinine by Alkaline picrate method

URINE ANALYSIS:

7. Qualitative analysis of Normal urine and Abnormal urine.
 - Sugar
 - Urea
 - Creatinine
 - Uric acid
 - Ammonia
 - Protein

ESTIMATION OF ENZYMES:

8. Alkaline phosphatase

TEXT BOOKS:

1. SK Sawhney & Randhir Singh, (2014). *Introductory Practical Biochemistry*, 10th Edition, Narosa Publishers.
2. Keith Wilson & John Walker, (2000). *Practical Biochemistry*, Cambridge University press.

REFERENCE BOOKS:

1. Harold Varley, (1991) *Practical Clinical Biochemistry*, 5th edition, CBS Publications.
2. Carl A. Burtis & Co, Tietz (2006) *Text Book of Clinical Chemistry and Molecular Diagnostics*, 4th edition, Elsevier Publication.
3. Ochei J., and A. Kolhatkar, (2000) *Medical Laboratory Science*, Tata Mc Graw Hill publication.

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=VMmmQevIXk4>
2. <https://www.youtube.com/watch?v=yFUnu3gRNGQ>
3. <https://www.youtube.com/watch?v=y4mMP8rmp3M>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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518

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE61	ENDOCRINOLOGY AND HORMONAL REGULATIONS	ELECTIVE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Endocrinology and Hormonal Regulations Course will focus on the anatomy, physiology, biochemistry of the human endocrine system and hormone production, activities, regulatory mechanisms, physiological effects, and disease states.

COURSE OBJECTIVES:

- To explain the role of endocrine system in maintaining homeostasis, integrating growth and development.
- To make the students acquire knowledge related to the major hormones released from the hypothalamus.
- To discuss molecular, biochemical, and physiological effects of hormones on cells.
- To explain the consequences of under and overproduction of hormones
- To make the students identify the physiology, principle of measurement, reference ranges and clinical correlations of chemical constituents of the blood.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain knowledge about the classification and mechanism of action of hormones and to demonstrate various types of second messengers and their action.	Upto K3
CO 2	understand hypothalamic and pituitary hormones.	Upto K3
CO 3	learn various functions of thyroid, parathyroid hormones along with their mechanism of action.	Upto K3
CO 4	discuss the link between pancreatic and gastro-intestinal hormones with diseases.	Upto K3
CO 5	demonstrate the biological functions of adrenal gland hormones and reproductive hormones.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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ENDOCRINOLOGY AND HORMONAL REGULATIONS

UNIT– I: Endocrine Systems and Hormones

Hormone – Definition, classification, circulation in blood, modification and degradation; Hormone receptors – structure and regulation, Mechanism of Hormone action. Signal transduction – basic concepts of signals, ligand and receptors, endocrine, paracrine, autocrine functions; Signal transduction cytoplasmic, nuclear receptor and messengers cAMP, cGMP and Calcium ions

UNIT– II: Hypothalamus and Pituitary Hormones

Hypothalamic releasing factors vasopressin, oxytocin. Biosynthesis, secretion, transport, regulation and biological effects of growth hormones, FSH, LH, TSH, ACTH and prolactin

UNIT– III: Thyroid Hormones

Biosynthesis, secretion, transport, regulation and biological actions – Hypo and hyper thyroidism, antithyroid agent's role of parathyroid hormones, calcitriol, calcium and phosphorous homeostasis – Hypo and hyperparathyroidism

UNIT– IV: Pancreatic Hormones

Islets of Langerhans, cell types – Insulin and glucagon: biosynthesis, mechanism of action and biological effects – Hormonal action of somatostatin and pancreatic polypeptide

UNIT– V: Adrenal Hormones

Biosynthesis, secretion, transport, mechanism of action and excretion of glucocorticoids, mineralocorticoids, adrenal medullary hormones – epinephrine and nor epinephrine, steroid hormones – androgens and estrogens – Hormone antagonists

TEXT BOOKS:

1. Harold Varley (1991) *Practical Clinical Biochemistry*, 5th edition. CBS Publications.
2. Sembulingam K and Sembulingam P. (2012) *Essential of Medical Physiology*. 6th Edition, New Jaypee Brothers Medical Publishers, Delhi, India.
3. *Harper's Illustrated Biochemistry*, 26th edition, McGraw–Hill Book Company.

REFERENCE BOOKS:

1. White A, Handler P, Smith E, Stetten D. Jr. (1964). *Principles of Biochemistry*, 3rd edition, McGraw–Hill Book Company.
2. Frisell. W.R (1982). *Human Biochemistry*, 1st edition, Macmillan Publishing Company.
3. Guyton, (2008). *A Text book of Medical Physiology*, 11th edition, Elsevier Publications.

DIGITAL TOOLS:

1. <https://www.studocu.com/en-gb/document/university-college-london/mammalian-physiology/endocrinology-lecture-notes-12131415/972897>
2. <https://teachmeanphysiology.com/endocrine-system/>
3. https://profketandhatariya.com/wpcontent/uploads/2020/09/introduction_to_endocrinology.pdf
4. [https://www.cell.com/trends/endocrinology-metabolism/fulltext/S1043-2760\(01\)00415-5](https://www.cell.com/trends/endocrinology-metabolism/fulltext/S1043-2760(01)00415-5)

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI

Passed in the BOS Meeting held on 04/03/2023

Signature of the Chairman



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520

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE62	INDUSTRIAL BIOCHEMISTRY	ELECTIVE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Industrial Biochemistry Course aims to integrate the knowledge of biochemistry and molecular biology with those of microbiology and biochemical engineering, with emphasis on their application to the biotechnological processes.

COURSE OBJECTIVES:

- To make the students discover the wide use of fermentation technology and microbial production techniques.
- To help them achieve essential awareness on principles of fermentation and types of fermenters.
- To update the latest scientific developments on microbes and its industrial application.
- To enable the students gain adequate knowledge on use of microbes in the environment.
- To illustrate on the microbial fabrication of bioactive compounds.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	learn about the culture techniques for isolation of microbes from various sources and preserve the isolates.	Upto K3
CO 2	gain basic knowledge about principles of fermentation and types of fermenters.	Upto K3
CO 3	describe the microbial production of bioactive compounds such as organic acids, bacterial and fungal polysaccharides, antibiotics and vitamins.	Upto K3
CO 4	learn about industrial production of alcohol, alcoholic beverages, production of Single Cell Protein, bioethanol and biogas production.	Upto K3
CO 5	provide fundamental insights to exploit microbes for protecting environment.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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INDUSTRIAL BIOCHEMISTRY

UNIT– I:

Introduction to Fermentation Technology – Isolation and screening of industrially important microbes, Various methods of achieving isolation – Inoculum preparation, strain improvement for better yield; primary and secondary detection of microorganisms. Primary and secondary screening; Biological assay of fermentation products, limitations of Bioassay, Diffusion Assay, Turbidometric assay, metabolic Response Assay, Enzymatic Assay.

UNIT– II:

Fermentation– Principles of fermentation. Surface, Submerged and solid–state fermentation, Design and operation of Fermenter, Agitation and aeration, Downstream processing. Types of Fermenters–Air–Lift fermenter, Fluidized Bed Bioreactor, Packed bed Bioreactor, Continuous culture; fed batch culture, fixed volume bed fed–batch, variable volume fed – batch, advantages and disadvantages of the Fed–batch reactors, continuous – Flow stirred – tank reactor.

UNIT– III:

Microbial Production of Bioactive Compounds – Production of organic acids – Citric acid, lactic acid, acetic acid. Production of bacterial and fungal polysaccharides, Production of Antibiotics – Penicillin and streptomycin. Production of vitamins – B12 and B2.

UNIT– IV:

Industrial Applications of Microbes – Industrial production of alcohol, alcoholic beverages – Wine and Beer by yeast .Production of Single Cell Protein (SCP) – Production of Edible Mushrooms. Bioethanol production, production of biogas from agricultural waste.

UNIT– V:

Microbes and Environment: Microbes in mineral recovery – Bioleaching – mechanism, advantages and disadvantages of bioleaching, Biosorption – Biosorbent material, Biosorption mechanisms. Microbial recovery of petroleum – process and advantages. Microbial degradation of xenobiotics – Biodegradation and Bioremediation.

TEXT BOOKS:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) *Microbiology*. 5th Edition, Tata McGraw–Hill, New Delhi.
2. B. Tom Betsy, & Jim Keogh, (2005) *Microbiology Demystified*, Tata McGraw–Hill, New Delhi.

REFERENCE BOOKS:

1. R C Tilton, (2002) *Microbiology*, 10th ed, Tata McGraw Hill, New Delhi.
2. D. Stuart Hogg (2013) *Essential Microbiology*, John Wiley & Sons, Ltd.



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DIGITAL TOOLS:

1. https://www.academia.edu/13300896/introduction_to_industrial_biochemistry
2. <https://www.americanandimportautorepair.com/wp-content/uploads/formidable/41/industrial-biochemistry-lecture-notes.pdf>
3. https://aiimsrishikesh.edu.in/documents/introduction_to_biochemistry.pptx
4. https://www.researchgate.net/publication/276249481_Lecture_notes_on_Industrial_Biotechnology_1_Fundamentals_of_Microbial_cell_cultivation

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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523

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCE63	THERAPEUTIC NUTRITION	ELECTIVE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The Therapeutic nutrition course explores the role played by therapeutic diets in the treatment of chronic disease and other nutritional disorders.

COURSE OBJECTIVES:

To enable the students

- develop intellectual skills in the field of therapeutic nutrition.
- identify patients at risk for major nutrition – related health problems.
- categorize the principles and explain the objectives of diet therapy.
- recognize most common therapeutic diets used in clinical care.
- modify the diet plans to suit the disease condition.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	illustrate the nature of nutritional requirements during fever.	Upto K3
CO 2	relate the nutrition knowledge in weight management.	Upto K3
CO 3	classify hypertension and able to trace the root cause, suggest diet for hypertension.	Upto K3
CO 4	examine about gastrointestinal disorders and summarize the disease management.	Upto K3
CO 5	apply the knowledge of biochemistry in treating metabolic disorders.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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THERAPEUTIC NUTRITION

UNIT– I:

Metabolism, treatment, nutritional requirement and dietary modification during acute, chronic and convalescent stage of fevers. Liquid diets, elemental and synthetic diet.

UNIT– II:

Weight Imbalance – obesity – assessment, risk, etiology and management of dietary, behaviour, pharmaceutical, children, eating disorders. Dietary intake and management – focus on – fat discrimination – SFA, MUFA, PUFA and omega – 3 and 6 – fatty acids.

UNIT– III:

Hypertension – Classification, prevalence, morbidity and mortality. Diet related factors influencing development of hypertension. Management – lifestyle, weight, salt restriction and other dietary modifications.

UNIT– IV:

Gastro intestinal system – Disorders, Classification of disorders – indigestion, acute gastritis and duodenal ulcers. Liver disease – hepatitis and alcoholic liver disease (cirrhosis) – Dietary management and nutritional care. Gall bladder disease – cholelithiasis, cholecystitis, cholestasis – acute & chronic conditions – Dietary management and care. Pancreas – pancreatitis – acute & chronic – Dietary management and nutritional care.

UNIT– V:

Diabetes Mellitus – IDDM and NIDDM. Malnutrition Related Diabetes Mellitus. Diagnosis and Management. Gout – Nutritional care, purines, alcohol pharmacological therapy – Dietary modification. Phenyl Ketonuria – Diagnosis and outcome. Nutritional care and management – Ketogenic diet.

TEXT BOOKS:

1. Sharma, D. S. (2017). *Nutritional Biochemistry*. CBS Publishers and Distributors.
2. Srilakshmi, B. (2019). *Dietetics* – (Multi Colour Edition) ed. New Age International Publishers.
3. B.Srilakshmi, B. (2017). *Food Science* (Multi Colour Edition) ed. New Age International Publishers.
4. Krause's. (2013). *Food, Nutrition, & Diet Therapy* (11th edition) W.B. Saunders Publishers.

REFERENCE BOOKS:

1. Swaminathan. (2005). *Advanced Textbooks of Food and Nutrition*. BAPP CO PRESS.
2. M.N.Chatterjea. (2011). *Textbook of Medical Biochemistry*. Jaypee Brothers. Medical Publishers (P) Ltd, New Delhi.



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DIGITAL TOOLS:

1. <https://unacademy.com/content/kerala-psc/study-material/human-nutrition-and-dietetics/therapeutic-nutrition/>
2. <https://www.teachmint.com/tfile/studymaterial/class-1st/nutrition/therapeuticnutritionpdf/-7bb3-432b-af04-d861054e8887>
3. https://www.cdss.ca.gov/agedblinddisabled/res/VPTC2/9%20Food%20Nutrition%20and%20Preparation/Types_of_Therapeutic_Diets.pdf
4. <http://ecoursesonline.iasri.res.in/course/view.php?id=190>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. K. RAGHAVAN & Prof. A. R. SARANYADEVI



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCS61	BIO ENTREPRENEURSHIP	SBS – 6	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

The Bio entrepreneurship Course provides students with the necessary knowledge on how to bridge science and business and translate biotech concepts into commercial terms.

COURSE OBJECTIVES:

- To provide an introduction to the basics of product and service innovation in life science industry.
- To help the students examine the entrepreneurial process in life science industry.
- To provide an overview of the life science market and business development opportunities in the life science industry.
- To describe the processes of product and service development in the life science sector.
- To demonstrate a general understanding of the central role that business development plays for the biomedical industry.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand the concept and scope for bioentrepreneurship.	Upto K3
CO 2	identify various operations involved in a venture creation.	Upto K3
CO 3	be aware of gathering funds and launching a winning business.	Upto K3
CO 4	nurture the organization and harvest the rewards.	Upto K3
CO 5	utilize the schemes promoted through knowledge centers and various agencies.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. BIOCHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

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BIO ENTREPRENEURSHIP

UNIT- I:

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

UNIT- II:

Business plan, budgeting and funding idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start – up and make in India initiative.

UNIT- III:

Legal requirements for starting a company; Registration of company in India; Ministry of Corporate Affairs (MCA); difficulties of entrepreneurship in India.

UNIT- IV:

Basics of market forecast for the industry; distribution channels – franchising, policies, promotion, advertising, branding and market.

UNIT- V:

Role of knowledge centres such as universities, innovation centres, research institutions (public & private) and business incubators in Entrepreneurship development. Definition, role and importance of CDSCO, NBA, GLP, GCP, GMP. Introduction to Patents, Trademarks & Copyrights

TEXT BOOKS:

1. Adams, D. J. (2008). *Enterprise for Life Scientists: Developing Innovation and Entrepreneurship in the Biosciences*. Scion Publishing Ltd.
2. Shimasaki, C. (2014). *Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies*. Academic Press, London.

REFERENCE BOOKS:

1. Jordan, J. F. (2014). *Innovation, Commercialization, and Start – Ups in Life Sciences*. London: CRC Press.
2. Desai, V. (2009). *The Dynamics of Entrepreneurial Development and Management*. New Himalaya. New Himalaya House, Delhi.

DIGITAL TOOLS:

1. <https://www.studocu.com/in/document/jamia-millia-islamiah/bioethics-biosafety/bio-entrepreneur-and-its-characteristics/19386932>
2. <https://www.mhaonline.com/faq/what-is-bioenterprise>
3. <https://www.scribd.com/presentation/472476674/Promoting-BioEntrepreneurship>
4. <https://www.science-entrepreneur.com/blog-1/study-bioentrepreneurship>

Mapping of CO with PSO

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

3. Advanced Application 2. Intermediate Development 1. Introductory Level

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