



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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GRADUATE ATTRIBUTES

Graduates with solid academic knowledge, discipline-specific and broad skills complemented with social responsibility are the highest strength of the country. The curriculum frame work for Biochemistry graduates aims to build the following attributes;

1. Disciplinary Knowledge:

- Ability to realize fundamental concepts of biology, chemistry and apply basic principles of chemistry to biological systems.
- Ability to relay various interrelated physiological and metabolic events.
- Good experimental and quantitative skills and awareness of laboratory safety.
- A general awareness of current developments at the forefront in biochemistry and allied subjects.
- Awareness of resources, and their conservation.

2. Communication Skills:

- Ability to speak and write clearly in English and local language.
- Ability to listen to and follow scientific viewpoints and engage with them.

3. Problem Solving:

- Capability to make careful observation of the situation, and apply lateral thinking and analytical skills.

4. Analytical Reasoning:

- Ability to use scientific evidences and experimental approach to substantiate one's argument in one's reading of scientific texts.

5. Teamwork and Time Management:

- Readiness to participate constructively in class room discussions and contribute to group work.
- Ability to meet a deadline.

6. Scientific Reasoning:

- Aptitude to examine theories and beliefs, evaluate ideas and scientific strategies.

7. Digital Literacy:

- Ability to use digital resources, and apply various platforms to convey and explain concepts of biochemistry.

8. Moral and Ethical Values:

- Ability to interrogate one's own ethical values, and to be aware of ethical and environmental issues.

9. Life-long Learning:

- Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day-to-day practices.



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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Main objective of the curriculum is to

PEO 1	equip the students with a detailed understanding the molecular events that control growth and development of all living things and thereby enhancing the technical skills to compete and excel in the challenging career aspects.
PEO 2	demonstrate a coherent and systematic approach to the experimental and theoretical aspects of biochemistry. This would also include the student's ability to understand and engage with critical concepts, theories and dogmas.
PEO 3	demonstrate the ability to understand the role of scientific developments, particularly, biological sciences in a changing world from the disciplinary perspective as well as in relation to its professional and everyday use.
PEO 4	communicate ideas, opinions and values both scientific themes and values of life in all shades and shapes in order to expand the knowledge of the subject as it moves from the classroom/laboratory to industry and society.
PEO 5	demonstrate the ability to share the results of academic and disciplinary learning through different forms of communication such as essays, dissertations, reports, findings, notes, seminars etc., on different platforms of communication such as the classroom, the media and the internet.
PEO 6	recognize the scope of biochemistry in terms of career opportunities, employment and lifelong engagement in teaching, publishing, communication, media, soft skills and other allied fields.

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.



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PROGRAMME SPECIFIC OUTCOMES (PSOs)

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 – II YEAR COURSE STRUCTURE – III SEMESTER

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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COURSE STRUCTURE – III SEMESTER

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

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
21UBCC31	ENZYMOLGY AND ENZYME TECHNOLOGY	CORE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	III	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:

This course covers purification and separation of enzymes, categorization of enzymes and cofactors, enzyme kinetics and their applications in industry, medicine, and diagnostics.

COURSE OBJECTIVES:

- To provide the students a theory base and knowledge relevant to the enzymology principles including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics.
- To make the students acquire insight about the production, extraction, purification, characterisation and application of enzymes.
- To help the students understand the kinetics of enzyme–catalysed reactions as well as enzyme inhibitory and regulatory processes
- To help them execute enzyme immobilisation.
- To enable the students become acquainted with enzymes utilised in industrial and medicinal applications.

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	comprehend the fundamental knowledge on enzymes and their importance in biological reactions.	Upto K3
CO 2	understand the difference between a chemical catalyst and biocatalyst and understand activation energy.	Upto K3
CO 3	characterize the enzymes in each enzymatic class, examples of such enzymes and their application in practice	Upto K3
CO 4	demonstrate the mechanism involved in the production of biosensors and immobilized enzyme systems.	Upto K3
CO 5	identify the clinical, industrial and biomedical applications of enzymes.	Upto K3

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



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ENZYMOLGY AND ENZYME TECHNOLOGY

UNIT- I:

Historical background – Nomenclature and Classification of enzymes, Active site – salient features – unit of enzyme activity– Isoenzymes – Multienzymes – Zymogens.

UNIT- II:

Enzyme Kinetics – Enzyme substrate complex, Michaelis – Menten kinetics – Determination of K_m and V_{max} – Line weaver – Burk plot, Hanes Woolf equation, Eadie – Hofstee equation, Factors affecting enzyme activity – Enzyme specificity – Stereo specificity, Structural specificity and functional specificity.

UNIT- III:

Enzyme inhibition – Reversible inhibition – Competitive, non – competitive, Uncompetitive inhibition, Irreversible inhibition, Allosteric inhibition.

UNIT- IV:

Mechanism of Enzyme action – Activation energy, Enzyme – substrate complex formation – Theories of Enzyme– substrate complex formation – Lock and Key model – Induced fit theory – Substrate strain theory – Multienzyme complex – Role of Co–enzymes in Enzyme reactions – Co enzyme A, NAD, FAD, Pyridoxal phosphate, Zymogens – Activation of Digestive Enzymes – chymotrypsinogen, Trypsinogen.

UNIT- V:

Isolation, Purification – Size based – Dialysis, Gel filtration chromatography, size exclusion chromatography – Polarity based – Ion exchange chromatography – Ligand based– Affinity chromatography– Solubility based precipitation. Enzyme immobilization – methods – Adsorption, Covalent bonding, Cross linking, Entrapment, Encapsulation, Clinical and Industrial applications of enzymes, Biosensors and their applications.

TEXT BOOKS:

1. Renuka Harikrishnan., (2007) *An Introduction to Biomolecules and Enzymes*, 5th edition, Indrajai Pathipagam, Madurai.
2. Palmer, T., Bonner, P. L. (2007). *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry*. United Kingdom: Elsevier Science.

REFERENCE BOOKS:

1. Fersht, A. (1977). *Enzyme Structure and Mechanism*. United Kingdom: W. H. Freeman.
2. Voet, D., Voet, J. G., Pratt, C. W. (2002). *Fundamentals of Biochemistry 2002 Update*. United Kingdom: Wiley.
3. Jain, J. L. (2022). *Fundamentals of Biochemistry*. India: S. Chand Limited.
4. Cox, M. M., Nelson, D. L., Lehninger, A. L. (2013). *Lehninger Principles of Biochemistry*: 6th Edition. United Kingdom: Macmillan Learning.



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DIGITAL TOOLS:

1. <https://old.amu.ac.in/emp/studym/3464.pdf>
2. <https://mgcub.ac.in/pdf/material/20200413025103dafdce701b.pdf>
3. https://www.inf.ed.ac.uk/teaching/courses/csb/CSB_lecture_enzyme_kinetics.pdf
4. <https://www.onlinebiologynotes.com/enzymes-properties-and-mechanism-of-enzyme-action/>
5. <https://www.easybiologyclass.com/enzyme-cell-immobilization-techniques/>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	3	2	2	3	3	1
CO3	2	2	2	2	1	2
CO4	2	1	3	1	3	2
CO5	1	3	3	2	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
21UBCCP2	LAB IN BIOCHEMICAL ANALYSIS	CORE PRACTICAL	–	3	–

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	III	–	–	–

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

COURSE DESCRIPTION:

The student should be able to execute experiments with various laboratory procedures and be comfortable with the usage of the necessary laboratory equipment at the end of the course.

COURSE OBJECTIVES:

To make the students

- discover about the fundamental approaches for experimentally investigating biochemical problems
- acquire hands-on experience with fundamental separation techniques in biochemistry.
- learn the theoretical foundations and understand the applicability of the biochemical methods to realistic situations.
- estimate biomolecules quantitatively and qualitatively.
- detect adulterants

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 awareness about basic reactions of biomolecules.	Upto K3
CO 2	describe various types of biochemical reaction.	Upto K3
CO 3	estimate the biomolecules in the various samples	Upto K3
CO 4	know the utility of biomolecules in identification of adulterants.	Upto K3
CO 5	determine the role of Biomolecules estimation in quantitative and qualitative analysis	Upto K3

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



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LAB IN BIOCHEMICAL ANALYSIS

Analysis of Lipids:

- Determination of Iodine number.
- Determination of Saponification number.

Analysis of Carbohydrates:

- Estimation of glucose by Anthrone method.
- Estimation of pentose by Bial's method.
- Estimation of fructose by Seliwanoff method.
- Estimation of Lactose in milk – by Benedict's method.
- Estimation of Maltose by DNS method.

Analysis of Proteins:

- Estimation of protein by Biuret's method.

Analysis of Vitamins:

- Estimation of Ascorbic acid by Dye method.

TEXT BOOKS:

1. Wilson, K., Wilson, K., & Walker, J. (2005). *Practical Biochemistry: Principles and Techniques*. Press Syndicate of the University of Cambridge.
2. Burtis, C. A., Bruns, D. E., Ashwood, E. R. (2012). *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics – E-Book*. United Kingdom: Elsevier Health Sciences.

REFERENCE BOOKS:

1. Harold Varley, (1991). *Practical Clinical Biochemistry*, 5th edition, CBS Publishers.
2. Ochei, J. and Kolkhtar, A. (2000). *Bacteriology: Medical Laboratory Science, Theory and Practice*. McGraw Hill Education.

DIGITAL TOOLS:

1. <https://vlab.amrita.edu/?sub=3&brch=63>
2. <https://vlab.amrita.edu/?sub=3&brch=63&sim=631&cnt=1>
3. <https://vlab.amrita.edu/?sub=3&brch=63&sim=1094&cnt=1>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	2	3	3
CO2	3	3	2	1	3	2
CO3	2	3	2	2	2	2
CO4	2	3	3	1	1	3
CO5	1	2	3	2	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 CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCA31	CELL BIOLOGY & GENETICS	ALLIED – 4	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	III	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:

This course covers basic cell biology topics with an emphasis on cell structure and function, biological molecules, genetic code, and inheritance theories.

COURSE OBJECTIVES:

To make the students

- understand the structure and function of prokaryotic and eukaryotic cell components.
- understand the ultrastructure of cellular organs and their activities
- understand cell division in multicellular organisms
- infer the principle and application of genetics.
- learn Mendelian Genetics and Inheritance

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	outline the cell structure – prokaryotic and eukaryotic – plant and animal cells. and basic concepts of microscopy	Upto K3
CO 2	infer the cellular organs and their activities of function	Upto K3
CO 3	make use of the process of cell division in Chromatin	Upto K3
CO 4	compare the concepts of Mendelian Genetics– Mendel's experiments, Mendel's laws of inheritance	Upto K3
CO 5	analyse the linkage Principle, crossing over in Drosophila and Sex–linked inheritance	Upto K3

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



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CELL BIOLOGY AND GENETICS

UNIT– I:

Cell Structure – prokaryotic and eukaryotic (comparison) – plant and animal cells. Microscopy: Principles of Light and Electron microscopy. Plasma membrane – Chemistry and ultra-structure – Fluid Mosaic model– functions. Protoplasm – Chemistry and organization – microtubules and microfilaments (a brief account). Endoplasmic reticulum and Golgi complex – structure and functions.

UNIT– II:

Lysosomes – ultra structure and functions, types. Ribosomes – ultra structure and functions. Chloroplast – ultra structure and chemistry, function – mechanism of photosynthesis and generation of ATP to be explained briefly. Mitochondria – ultra structure and functions (a brief account).

UNIT– III:

Nucleus – Nuclear envelop –nucleolus–structure and function. Chromatin – structure – nucleosomes. Cell Cycle – G1, S & G2 phases (a brief account). Cell division: Mitosis and Meiosis – stages and their significance.

UNIT– IV:

Mendelian Genetics – Mendel's experiments, Mendel's laws of inheritance, Test cross and Back cross. Allelic gene interaction – complementary genes (Flower colour in Sweet Pea), epistasis– dominant (Fruit colour in Cucurbita) and recessive (Coat colour in Mice). Non-allelic gene interaction–Incomplete dominance (Flower colour in Mirabilis) and multiple gene interaction (ABO Blood Group inheritance in Human).

UNIT– V:

Linkage – Principles – linkage in Drosophila. Crossing over in Drosophila– mechanism and significance of crossing over (theories of crossing over are not necessary). Sex linked inheritance (Hemophilia and colour blindness).

TEXT BOOKS:

1. Arumugam. N (2010). *Cell and Molecular Biology*. Saras Publications ISBN : 9789386519627
2. Rastogi, S. C. (2006). *Cell And Molecular Biology*. India: New Age International (P) Limited.
3. Agarwal, V.K. *Cell Biology*. (2022). India: S Chand & Company Limited.
4. Meyyan, R.P. (2012). *Genetics*. Saras Publications



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REFERENCE BOOKS:

1. Lodish, H. (2007). *Molecular Cell Biology*. India: W. H. Freeman.
2. Wilson, J., Hunt, T. (2014). *Molecular Biology of the Cell 6E* – United States: W.W. Norton.
3. Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. United Kingdom: Wiley.
4. Simmons, M. J., Snustad, D. P. (2015). *Principles of Genetics*. India: Wiley.

DIGITAL TOOLS:

1. [https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_A_Introductory_Biology_\(CK-12\)/02%3A_Cell_Biology_/2.03%3A_Prokaryotic_and_Eukaryotic_Cells](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_A_Introductory_Biology_(CK-12)/02%3A_Cell_Biology_/2.03%3A_Prokaryotic_and_Eukaryotic_Cells)
2. <https://microbenotes.com/lysosomes-structure-enzymes-types-functions/>
3. <https://www.khanacademy.org/science/biology/structure-of-a-cell/prokaryotic-and-eukaryotic-cells/a/nucleus-and-ribosomes>
4. <https://www.toppr.com/guides/biology/principles-of-inheritance-and-variations/laws-of-inheritance/>
5. <http://eagri.org/eagri50/GBPR111/lec19.pdf>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	3	2	1
CO2	3	3	3	3	3	2
CO3	2	3	2	1	2	1
CO4	2	3	1	2	3	2
CO5	1	3	3	2	3	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
21UBCAP2	CELL BIOLOGY AND GENETICS & BIODIVERSITY AND CONSERVATION	ALLIED – 5 PRACTICAL	–	2	–

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	III	–	–	–

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

This course covers experiments in basic cell biology, genetics and biodiversity.

COURSE OBJECTIVES:

To make the students

- identify the structure of cell
- understand the cell division process
- learn classical genetic concepts through experiments.
- acquire knowledge about how to conservation of biological diversity
- interpret biodiversity among species by measuring index method

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 part of microscope and theirs function.	Upto K3
CO 2	interpret cell inclusions, cell organelles and cell stages.	Upto K3
CO 3	articulate to study of mendelian trait in man and genetic disorders.	Upto K3
CO 4	correlate Measuring Biodiversity – Species diversity index.	Upto K3
CO 5	appraise Indian map mark important Biodiversity regions	Upto K3

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



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LAB IN BIOLOGY– GENETICS AND CELL BIOLOGY & BIODIVERSITY AND CONSERVATION

1. Study of Parts and functions of compound microscope
2. Study of Cell inclusions: Starch grains – smear of potato, banana or rice., Cystolith– Sections of *Ficus* leaves
3. Study of cell organelles using photomicrographs
4. Study of various stages of mitosis and meiosis using *Allium cepa* roots and *Rheo* flower buds.
5. Study of Survey of mendelian traits in man.
6. To work out simple genetic problems in monohybrid and dihybrid crosses.
7. Measuring Biodiversity – Species diversity index (Simpson's Index) of vegetation.
8. Analysis of the vegetation for frequency, density and abundance using quadrat method.
9. By using world and Indian map mark important Biodiversity regions.
10. Collection of endemic plants and animals photos with information by using websites, Journals, Newspapers

TEXT BOOKS:

1. Witherow, D. S., Miller, H. B., Carson, S. (2011). *Molecular Biology Techniques: A Classroom Laboratory Manual*. Netherlands: Elsevier Science.
2. Schleif, R. F. (1993). *Genetics and Molecular Biology*. United Kingdom: Johns Hopkins University Press.

REFERENCE BOOKS:

1. B. Albert, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson (1983) *Molecular Biology of the Cell*, New York, Garland.
2. *CPR Manual of Biodiversity* (2003) – Environmental Education Centre, Chennai.
3. Krishnamurthy, K. V. (2018). *An Advanced Textbook on Biodiversity: Principles and Practice*. India: CBS Publishers & Distributors.

DIGITAL TOOLS:

1. <https://microscopeinternational.com/compound-microscope-parts/>
2. <https://askabiologist.asu.edu/mendelian-traits-humans>
3. <https://www.youtube.com/watch?v=xTOMgXeGizU>
4. https://entnemdept.ufl.edu/hodges/protectus/lp_webfolder/9_12_grade/student_handout_1a.pdf
5. <https://www.pmfias.com/biodiversity-hotspots-india/>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	3	3	2	1
CO2	2	3	2	2	1	3
CO3	1	2	3	3	2	3
CO4	3	1	1	2	2	2
CO5	3	2	1	3	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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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCS31	MEDICAL LAB TECHNOLOGY	SBS – 3	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	III	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:

Medical Laboratory Technology (MLT) is focused with the use of clinical laboratory tests in the diagnosis, treatment, and prevention of diseases. This course is related to medical lab technology and it contents of Haematology, Blood bank, Microbiology, serology, Clinical pathology.

COURSE OBJECTIVES:

To help the students

- learn of biological fluids such as urine, blood and their estimation.
- understand the blood disorders, its lab diagnosis and various type of laboratory test
- learn of Haematology – Rh factors and blood cell counting techniques.
- learn the basic techniques with clotting mechanism, blood banking techniques and automation.

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 good laboratory practices in a chemistry/biochemistry laboratory.	Upto K3
CO 2	learn qualitative and quantitative analysis of constituents of biological fluids such as urine, blood and their estimation using standard methods	Upto K3
CO 3	get trained in performing routine microbiological practices such as sterilization, media preparation, maintenance of microbial culture, staining etc	Upto K3
CO 4	learn techniques and to learn the principles of blood typing.	Upto K3
CO 5	learn about the normal constituents of urine, blood and their significance in maintaining good health	Upto K3

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



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MEDICAL LAB TECHNOLOGY

UNIT– I:

Blood Banking Blood grouping – ABO System, ABO Grouping, Rh typing, Coomb's test, Blood transfusion – Blood donors, donor screening, drawing of blood, compatibility testing, cross matching, blood transfusion complications.

UNIT– II:

CSF and Other body fluids Cerebrospinal fluid and the body fluids. Semen analysis, sputum examination, pregnancy test – Interpretation.

UNIT– III:

Haematology: Haematology, Estimation of Haemoglobin – Shali's method, RBC count, PCV, ESR, Total and differential WBC count, Platelet count, Clotting time, Bleeding time Serology – VDRL, CRP, RA, HIV, HBs Ag, Pregnancy test.

UNIT– IV:

Medical microbiology Culturing of organisms from various specimens. Culture media and antibiotic sensitivity test (pus, urine, Stool, sputum, throat swab, gram staining, Ziehl –Neilson staining (TB, Leptra bacilli). Safety procedure in microbiological laboratory technique.

UNIT– V:

Urine and faeces analysis Collection of urine and faecal samples; Faecal analysis to detect fats, undigested food and blood; Qualitative analysis of urine for normal and pathological conditions.

TEXT BOOKS:

1. K. N. Sulochana, S. Ramakrishnan (2012) *Manual of Medical Laboratory Techniques*. India: Jaypee Brothers Medical Publishers.
2. Talib, V. H. (2019). Handbook *Medical Laboratory Technology*. India: CBS Publishers & Distributors.

REFERENCE BOOKS:

1. Gowenlock, A. H., Varley, H., Bell, M. (1976). *Practical Clinical Biochemistry*. Serbia and Montenegro: Heinemann Medical.
2. Kanai L. Mukherjee. (2010). *Medical Laboratory Technology*, Tata McGraw Hill Publication and co. Ltd., Vol, I, II, III.
3. Chawla, R. (2014). *Practical Clinical Biochemistry: Methods and Interpretations*. India: Jaypee Brothers Medical Publishers Pvt. Limited.
4. Manickam, A., Sadasivam, S. (2007). *Biochemical Methods*. India: New Age International (P) Limited.
5. Plummer, D. T. (1987). *An Introduction to Practical Biochemistry*. India: McGraw–Hill.

DIGITAL TOOLS:

1. <https://scert.kerala.gov.in/wp-content/uploads/2020/06/16-mlt.pdf>
2. <https://www.slideshare.net/AvinandanJana/physiology-of-blood-134110013>
3. https://stacks.cdc.gov/view/cdc/7590/cdc_7590_DS1.pdf
4. <https://www.in.gov/health/files/l61.pdf>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	3	3	2	3	1
CO2	3	3	3	3	3	2
CO3	3	3	3	2	3	2
CO4	1	2	2	3	3	3
CO5	3	1	3	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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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCN31	HEALTH AND HUMAN DISEASES	NME – 1	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	III	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:

This course covers topics in human health function and diseases.

COURSE OBJECTIVES:

To enable the students

- comprehend the structure and function of the human body in health; signs and symptoms of disease; the molecular basis of disease; current treatment of disease and cutting-edge therapeutics.
- understand the causes of various diseases commonly affecting human beings
- know the clinical aspects of various metabolic disorders
- describe emergency procedures and techniques of basic life support for adult, child, or infant victims of airway obstruction, respiratory arrest and/or cardiac arrest.
- understand the causes of emergency procedures and techniques

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 about health and importance of yoga in human system	Upto K3
CO 2	comprehend the fundamental knowledge of diseases and its causes with treatment	Upto K3
CO 3	know about the importance of Vaccination and prevention of diseases.	Upto K3
CO 4	know the importance of healthy habits and disease prevention.	Upto K3
CO 5	understand the emergency procedures and techniques.	Upto K3

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



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HEALTH AND HUMAN DISEASES

UNIT– I:

Health and its significance – Physical and Mental Health – yoga – nutrition, exercise, causes of disease – environment – Longevity– living conditions – Life style – Obesity – BMI.

UNIT– II:

Human Diseases – (heart diseases, jaundice, cancer) – Causative agent, symptoms, diagnosis and treatment (Brief).

UNIT– III:

Communicable diseases - AIDS–Nosocomial diseases– traveling diseases– children and old age diseases – T.B – leprosy–Dengue–Bird flu.

UNIT– IV:

Diseases prevention – healthy habits, disease prevention awareness – vaccination – immunization schedule.

UNIT– V:

First aid measures – Accident care – Bleeding and Wound care – Fractures and dislocations – electrical shock – burns – breathing emergency – Allergies– pregnancy care.

TEXT BOOKS:

1. M.N. Chatterjee & Ranashinde (2006). *Text Book of Medical Biochemistry*. 6th edition Jaypee Brothers Medical Publisher (P) Ltd.
2. Fears, J. W. (2011). *The pocket outdoor survival guide: The ultimate guide for short-term survival*. Skyhorse Publishing Inc.

REFERENCE BOOKS:

1. Goering, R. V. (2020). *Mims' medical microbiology and immunology*, Elsevier.
2. Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K. (2019). *Textbook of biochemistry for medical students*. Jaypee brothers Medical publishers.
3. Handal, K. A. (1992). *The American Red Cross first aid & safety handbook*. Little, Brown, & Company.

DIGITAL TOOLS:

1. https://www.physio-pedia.com/Physical_Activity_and_Mental_Health
2. <http://kmbiology.weebly.com/human-health-and-disease---notes.html>
3. <http://download.nos.org/srsec314newE/PDFBIO.EL28.pdf>
4. <http://www.immunize.org/catg.d/p2011.pdf>
5. <http://gputtawar.edu.in/downloads/first-aid.pdf>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	2	3	2	3
CO2	3	1	3	3	1	3
CO3	3	3	3	2	3	1
CO4	2	1	1	2	3	1
CO5	1	2	1	1	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 STRUCTURE – IV SEMESTER

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

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
21UBCC41	METABOLISM	CORE – 4	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	IV	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:

This course covers the metabolic pathways and their interactions, functions of enzymes and hormones.

COURSE OBJECTIVES:

To make the students

- study about over view of metabolism have an understanding about energetics about carbohydrate and lipid metabolism have an understanding of enzymes and metabolism of fatty acids a nucleic acid
- understand the concepts of Metabolism and its importance in the proper functioning of each cell
- understand anabolic and catabolic pathways of carbohydrates, lipids.
- understand catabolic pathways of amino acids and nucleic acids and comprehend how any defect in a pathway could lead to diseases
- understand how metabolism is regulated by enzymes and hormones

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 concepts of metabolism.	Upto K3
CO 2	study about over view of metabolism – have an understanding about energetics	Upto K3
CO 3	describe the Metabolism of carbohydrates, lipids and its regulation	Upto K3
CO 4	describe the metabolism of amino acids, nucleic acids and its regulation.	Upto K3
CO 5	understand how metabolism is regulated by enzymes and hormones	Upto K3

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



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METABOLISM

UNIT– I:

Bioenergetics: High energy and low energy compounds (ATP, Phosphocreatinine, Phosphoenol pyruvate, Glucose – 6 – phosphate) – Exergonic and Endergonic reactions – Electron transport chain and Oxidative phosphorylation. Uncouplers of Oxidative phosphorylation.

UNIT– II:

Carbohydrate Metabolism: Acetyl – CoA synthesis, Glycolysis – aerobic and anaerobic– Energetics of glycolysis , TCA cycle – Amphibolic nature of TCA cycle – Energetics of TCA cycle, Glyoxalate cycle – HMP Shunt and Gluconeogenesis, Glycogen metabolism – Glycogenesis, Glycogenolysis (Brief account only). Conversion of simple sugars (Sucrose, Maltose, Lactose) into Glucose

UNIT– III:

Lipid Metabolism: Biosynthesis of Fatty acids, β – Oxidation of Fatty acids, Energetics of Fatty acid Oxidation, Ketone bodies metabolism, Metabolism of Triacyl glycerol's, phospholipids, Cholesterol metabolism (Structure is not needed).

UNIT– IV:

Amino acid Metabolism : Transamination, Deamination – Oxidative and non– oxidative A brief account of Amino acid metabolism – Glucogenic amino acids (Glycine, Cysteine, Proline) – Ketogenic amino acids (Leucine, Lysine) – Aromatic amino acids (Phenylalanine, Tyrosine, Tryptophan).

UNIT– V:

Nucleic acid Metabolism: Purine and Pyrimidine bases – Biosynthesis of Purines and Pyrimidines – Salvage pathway – Inhibitors of Nucleic acid metabolism.

TEXT BOOKS:

1. Chatterjee, (2005). *Text Book of Medical Biochemistry*, 6th edition, Jaypee brother's publication.
2. Satyanarayana, U. (2017). *Biochemistry*. India: Elsevier Health Sciences.
3. Devlin (1997). *Text book of Biochemistry*, 4th edition, John Wiley & sons, INC Publications.

REFERENCE BOOKS:

1. Donald Voet & Judith Voet (2004) *Fundamentals of Biochemistry*, 3rd edition, Wiley International.
2. Cox, M. M., Lehninger, A. L., Nelson, D. L. (2013). *Lehninger Principles of Biochemistry*: 6th Edition. United Kingdom: Macmillan Learning.
3. Rodwell, V. W., Bender, D. A., Weil, P. A., Kennelly, P. J., Botham, K. M. (2018). *Harper's Illustrated Biochemistry* 31e. United Kingdom: McGraw–Hill Education.



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DIGITAL TOOLS:

1. https://asutoshcollege.in/new-eb/Study_Material/Semester_4_Introduction_07042020.pdf
2. https://www.osmosis.org/notes/Carbohydrate_Metabolism
3. <https://aklectures.com/lecture/fatty-acid-metabolism-introduction/introduction-to-fatty-acid-metabolism>
4. <https://ocw.mit.edu/courses/7-05-general-biochemistry-spring-2020/resources/lecture-31-amino-acid-metabolism-ii/>
5. https://www.uobabylon.edu.iq/eprints/publication_4_19662_533.pdf
6. <http://www.news-medical.net/life-sciences/What-is-Metabolism.aspx>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	1	2	2
CO2	2	1	3	2	2	1
CO3	3	1	3	2	1	2
CO4	2	1	3	3	3	3
CO5	3	1	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
21UBCCP2	LAB IN BIOCHEMICAL ANALYSIS	CORE PRACTICAL	–	3	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	IV	40	60	100

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

COURSE DESCRIPTION:

The student should be able to execute experiments with various laboratory procedures and be comfortable with the usage of the necessary laboratory equipment at the end of the course.

COURSE OBJECTIVES:

To make the students

- discover about the fundamental approaches for experimentally investigating biochemical problems
- acquire hands-on experience with fundamental separation techniques in biochemistry.
- learn the theoretical foundations and understand the applicability of the biochemical methods to realistic situations.
- estimate biomolecules quantitatively and qualitatively.
- understand the use of biomolecules in the detection of adulterants

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 awareness about basic reactions of biomolecules.	Upto K3
CO 2	describe various types of biochemical reaction.	Upto K3
CO 3	estimate the biomolecules in the various samples	Upto K3
CO 4	know the utility of biomolecules in identification of adulterants.	Upto K3
CO 5	determine the role of Biomolecules estimation in quantitative and qualitative analysis	Upto K3

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



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LAB IN BIOCHEMICAL ANALYSIS

Analysis of Lipids:

- Determination of Iodine number.
- Determination of Saponification number.

Analysis of Carbohydrates:

- Estimation of glucose by Anthrone method.
- Estimation of pentose by Bial's method.
- Estimation of fructose by Seliwanoff method.
- Estimation of Lactose in milk – by Benedict's method.
- Estimation of Maltose by DNS method.

Analysis of Proteins:

- Estimation of protein by Biuret's method.

Analysis of Vitamins:

- Estimation of Ascorbic acid by Dye method.

TEXT BOOKS:

3. Wilson, K., Wilson, K., & Walker, J. (2005). *Practical Biochemistry: Principles and Techniques*. Press Syndicate of the University of Cambridge.
4. Burtis, C. A., Bruns, D. E., Ashwood, E. R. (2012). *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics – E-Book*. United Kingdom: Elsevier Health Sciences.

REFERENCE BOOKS:

3. Harold Varley, (1991). *Practical Clinical Biochemistry*, 5th edition, CBS Publishers.
4. Ochei, J. and Kolkhtar, A. (2000). *Bacteriology: Medical Laboratory Science, Theory and Practice*. McGraw Hill Education.

DIGITAL TOOLS:

4. <https://vlab.amrita.edu/?sub=3&brch=63>
5. <https://vlab.amrita.edu/?sub=3&brch=63&sim=631&cnt=1>
6. <https://vlab.amrita.edu/?sub=3&brch=63&sim=1094&cnt=1>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	2	3	3
CO2	3	3	2	1	3	2
CO3	2	3	2	2	2	2
CO4	2	3	3	1	1	3
CO5	1	2	3	2	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 CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCA41	BIODIVERSITY AND CONSERVATION	ALLIED – 6	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	IV	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:

This course helps to explore the biodiversity, study the variation index, understand the conventions available to save our biodiversity.

COURSE OBJECTIVES:

To help the students

- acquire knowledge about Biodiversity, Ecosystem and Biospheres
- identify new biodiversity species and measuring index methods
- learn about biodiversity management databases IUCN, UNEP, UNESCO and WWF.
- understand the role of CITES
- interpret the International Conventions on Conservation

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 part of Biodiversity, ecosystem and Biodiversity management organization	Upto K3
CO 2	interpret types of biodiversity and its index.	Upto K3
CO 3	articulate mega diversity hotspots and IUCN.	Upto K3
CO 4	correlate biodiversity conservation and biospheres.	Upto K3
CO 5	appraise Biological Diversity and Geographical Indications	Upto K3

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



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BIODIVERSITY AND CONSERVATION

UNIT– I:

Biodiversity – introduction, concept and scope of Biodiversity. Levels of Biodiversity – Genetic, species & Ecosystem diversity. Values of Biodiversity. Organizations associated with Biodiversity management – IUCN, UNEP, UNESCO and WWF.

UNIT– II:

Measures of Biodiversity – alpha, beta and gamma diversity; species richness and evenness; Species Diversity indices – Simpson Index and Shannon Index. Sampling Method–Quadrat method.

UNIT– III:

Megadiversity centres & Hotspots (a brief account). Threats to Biodiversity – IUCN categories of threat. Role of CITES.

UNIT– IV:

Conservation of Biodiversity – Need for conservation – Methods of conservation – *in situ* – conserved areas of India – National Parks, Sanctuaries, Biosphere reserves and Sacred Groves – *ex situ* conservation – Cryopreservation and Germplasm conservation.

UNIT– V:

International Conventions on Conservation – Convention on Biological Diversity, Ramsar convention, TRIPS – Copyright and Patent, Trademarks, Industrial Designs, Geographical Indications & Layout design of integrated circuits, UPOV, IUPGR (a brief introduction). People's movements to conserve Biodiversity – Chipko movement & Silent valley movement (a brief account)

TEXT BOOKS:

1. *CPR Manual of Biodiversity (2003)* – Environmental Education centre, Chennai
2. Krishnamurthy, K. V. (2018). *An Advanced Textbook on Biodiversity: Principles and Practice*. India: CBS Publishers & Distributors.

REFERENCE BOOKS:

1. Belsare, D.K. (2007). *Introduction to Biodiversity*. India: APH Publishing Corporation.
2. Joshi, N., Joshi, P. C. (2004). *Biodiversity and Conservation*. India: APH Publishing Corporation.

DIGITAL TOOLS:

1. <https://www.ugc.ac.in/oldpdf/modelcurriculum/Chapter4.pdf>
2. <https://www.easybiologyclass.com/biodiversity-introduction-definition-classification-importance-measurement-of-biodiversity/>
3. <http://bsienvi.nic.in/files/biodiversity%20hotspots%20in%20india.pdf>
4. <https://www.studocu.com/in/document/galgotias-university/biodiversity-protection/biodiversity-lecture-notes-1-6/17702151>
5. <http://study.com/academy/lesson/what-is-biodiversity-definition-and-relation-to-ecosystem-stability.html>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	1	2	2	3
CO2	3	2	2	3	3	3
CO3	3	2	2	3	3	3
CO4	2	1	2	1	2	1
CO5	1	2	2	1	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
21UBCAP2	CELL BIOLOGY AND GENETICS & BIODIVERSITY AND CONSERVATION	ALLIED – 5 PRACTICAL	–	2	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	IV	40	60	100

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

This course covers experiments in basic cell biology, genetics and biodiversity.

COURSE OBJECTIVES:

To make the students

- identify the structure of cell
- understand the cell division process
- learn classical genetic concepts through experiments.
- acquire knowledge about how to conservation of biological diversity
- interpret biodiversity among species by measuring index method

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 parts of microscope and their function.	Upto K3
CO 2	interpret cell inclusions, cell organelles and cell stages.	Upto K3
CO 3	articulate mendelian trait in man and genetic disorders.	Upto K3
CO 4	correlate measuring Biodiversity – Species diversity index.	Upto K3
CO 5	appraise Indian map mark important Biodiversity regions	Upto K3

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



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BIOLOGY– GENETICS AND CELL BIOLOGY & BIODIVERSITY AND CONSERVATION

1. Study of Parts and functions of compound microscope
2. Study of Cell inclusions: Starch grains – smear of potato, banana or rice., Cystolith– Sections of *Ficus* leaves
3. Study of cell organelles using photomicrographs
4. Study of various stages of mitosis and meiosis using *Allium cepa* roots and *Rheo* flower buds.
5. Study of Survey of mendelian traits in man.
6. To work out simple genetic problems in monohybrid and dihybrid crosses.
7. Measuring Biodiversity – Species diversity index (Simpson's Index) of vegetation.
8. Analysis of the vegetation for frequency, density and abundance using quadrat method.
9. By using world and Indian map mark important Biodiversity regions.
10. Collection of endemic plants and animals photos with information by using websites, Journals, Newspapers

TEXT BOOKS:

1. Witherow, D. S., Miller, H. B., Carson, S. (2011). *Molecular Biology Techniques: A Classroom Laboratory Manual*. Netherlands: Elsevier Science.
2. Schleif, R. F. (1993). *Genetics and Molecular Biology*. United Kingdom: Johns Hopkins University Press.

REFERENCE BOOKS:

1. B. Albert, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson (1983) *Molecular Biology of the Cell*, New York, Garland.
2. *CPR Manual of Biodiversity* (2003) – Environmental Education Centre, Chennai.
3. Krishnamurthy, K. V. (2018). *An Advanced Textbook on Biodiversity: Principles and Practice*. India: CBS Publishers & Distributors.

DIGITAL TOOLS:

- <https://microscopeinternational.com/compound-microscope-parts/>
- <https://askabiologist.asu.edu/mendelian-traits-humans>
- <https://www.youtube.com/watch?v=xTOMgXeGizU>
- https://entnemdept.ufl.edu/hodges/protectus/lp_webfolder/9_12_grade/student_handout_1a.pdf
- <https://www.pmfias.com/biodiversity-hotspots-india/>

Mapping of CO with PSO

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

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



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

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UBCS41	BIOSTATISTICS	SBS – 4	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	IV	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:

This course helps to understand and apply the use of statistical methods and their importance in biological data analysis.

COURSE OBJECTIVES:

To enable the students

- list the various statistical methods and their applications
- infer the importance of statistics in biology
- measure dispersion
- study probability
- understand correlation and regression

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 basis of statistics	Upto K3
CO 2	list the different methods of representation of data	Upto K3
CO 3	classify central tendency	Upto K3
CO 4	summarize probability	Upto K3
CO 5	apply correlation and regression analysis	Upto K3

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



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BIostatistics

UNIT– I:

Introduction: Basis of Statistics – Definition – statistical methods – kinds of Biological Data Collection, organization and Representation of Data:

- Collection of Data – Types of data: primary data, secondary data – methods of collecting data.
- Sampling and sampling designs – Meaning and definitions – Random and Non-random sampling
- Editing the data: Definition for editing, objectives of editing, problems of Accuracy, problems of approximation and errors.
- Classification of data: Meaning, Definition, Objectives of Classification of data.

UNIT– II:

Tabulation: Meaning and definition – of parts of tables – advantages.

Representation of data: Diagrammatic: simple bar diagram, rectangles, squares, circles or pie diagram – Graphic representation: Histogram, frequency – polygon frequency curve, cumulative frequency curve or O give curve.

UNIT– III:

Measures of central Tendency: Explanation, Types of averages: 1. Arithmetic mean 2. Median 3. Mode. Explanation Problems related to: ungrouped data, Simple grouped data: continuous, discrete series.

Measures of dispersion: Explanation, Types of dispersion: 1. Range 2. Mean deviation 3. Standard deviation and Variance. Problems related to the above-mentioned dispersion taking ungrouped data.

UNIT– IV:

Probability: Definition and Explanation:

1. Theorem and probability: addition theorem and multiplication theorem.
2. Types of theoretical distribution: Binomial distribution (simple problems), Poisson distribution and Normal distribution (explanation problems not necessary).

UNIT– V:

Correlation and Regression:

Correlation Explanation

1. Types of correlation: Positive and negative correlation– Simple partial and multiple correlation– linear and non-linear correlation.
2. A method of studying correlation using Karl Pearson's co-efficient of correlation (simple problems related to correlation).

Regression analysis:

Explanation: Regression line– Regression equation: regression equation of X on Y, regression equation of Y on X.



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TEXT BOOKS:

1. Gupta, S. P. (2011). *Statistical Methods*. India: Sultan Chand & Sons.
2. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. India: New Age International (P) Limited.

REFERENCE BOOKS:

1. Banerjee, P. K. (2007). *Introduction to Biostatistics* (A Textbook of Biometry). India: S. Chand Limited.
2. Le, C. T., Eberly, L. E. (2016). *Introductory Biostatistics*. United Kingdom: Wiley.

DIGITAL TOOLS:

1. <https://www.easybiologyclass.com/biostatistics-introduction-significance-applications-and-limitations-of-statistics/>
2. <https://testbook.com/learn/maths-tabulation/>
3. <https://statisticsbyjim.com/basics/measures-central-tendency-mean-median-mode/#:~:text=Measures%20of%20central%20tendency%20are,central%20location%20of%20a%20distribution.>
4. <https://bolt.mph.ufl.edu/6050-6052/unit-3/module-5/>
5. <https://www.studocu.com/en-us/document/washington-state-university/statistical-methods-in-research-i/lecture-notes-lecture-14-correlation-and-regression/776404>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	3	2	3	1
CO2	3	2	2	1	2	3
CO3	2	1	3	2	1	3
CO4	3	3	3	3	2	2
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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
21UBCN41	HERBAL MEDICINE	NME – 2	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
II	IV	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 course covers the use and applications of traditional herbs in the field of medicine.

COURSE OBJECTIVES:

To help the students

- gain awareness of the current basic scientific research on some of the important herbal agents used in Traditional Medicine.
- acquire knowledge of popular herbal formulae and their general usage.
- understand the practises employed in traditional medicine.
- identify the potential herbal formulations in application.
- employ novel strategies for micro propagation of rare medicinal plants

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 theoretical aspects of extraction, purification and identification of natural products	Upto K3
CO 2	develop techniques for new product development from natural sources.	Upto K3
CO 3	design methods of standardization for herbal drug or formulations	Upto K3
CO 4	identify phytoconstituents and adulterants in herbal drugs	Upto K3
CO 5	explain various concepts and designs for quality control of herbs	Upto K3

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



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HERBAL MEDICINE

UNIT– I: Introduction

Scope – Alternative systems of medicine – advantages; human system – herbals for human system (brief)

UNIT– II: Secondary Metabolites

Source – different types – action – medicinal plants – pharmacological action– toxicity

UNIT– III: Herbal Cultivation

Plant – types – Methodology – marketing – economic potential– pharmacological companies – manufacture – patency – GATT– TRIPS–WTO.

UNIT– IV: Herbal Gardening

Types, methodologies – application; home gardens – types– methodologies –application – homemade remedies – herbal formulations – herbal physiotherapy

UNIT– V: Plant Propagation

Definition – types – grafting; endangered plants– need for conservation; techniques– tissue culture– requirements–techniques – Micro propagation

TEXT BOOKS:

1. Kumar, N. (2006). *Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants*. Oxford and IBH Publishing.
2. Ramawat, K. G. (2007). *Practicals in Biotechnology: Secondary Metabolites*. CRC Press.

REFERENCE BOOKS:

1. Warrier, P. K. (1993). *Indian Medicinal Plants: A Compendium of 500 Species* (Vol. 1–5). Orient Blackswan.
2. Bartram, T. (1998). *Bartram's Encyclopedia of Herbal Medicine*. United Kingdom: Robinson.

DIGITAL TOOLS:

- <https://www.slideshare.net/jagdishsamabd/alternative-system-of-medicine>
- <https://doi.org/10.3390/ijpb13010003>
- <http://www.isec.ac.in/29%20Culti%20of%20Medi%20Crops%20&%20Arom%20Crop%20as%20a%20Means%20of%20Diver%20in%20Agri.pdf>
- <http://eagri.org/eagri50/HORT281/lec34.html>
- <https://monographs.iarc.fr/ENG/Monographs/vol82/mono82-6A.pdf>
- <http://www.motherherbs.com/herbs-farming.html>
- https://en.wikipedia.org/wiki/Plant_propagation

Mapping of CO with PSO

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

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

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