KANNUR UNIVERSITY

(Abstract)

Scheme and first & second semester Syllabus of the B.Sc. Life Science (Zoology) & Computational Biology Programme (FYUGP) in Affiliated colleges under Kannur University - with effect from 2024 Admission- Approved- Orders - Issued

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ACADEMIC C SECTION

ACAD C/ACAD C1/23339/2024 Dated: 26.11.2024

Read:-1. U O No. FYUGPSC/FYSC-I/5074/2024 dated: 18/04/2024 and 06.08.2024

2. E mail dated 01.07.2024 from Dr Dr. Sinosh Skariyachan, Assistant Professor, Department of Microbiology, St. Pius X College, Rajapuram.

3. E mail dated 05.10.2024 from the Dean, Faculty of Science

4. Minutes of the meeting of the Standing Committee held on 07/10/2024.

5. The Orders of the Vice Chancellor in file No FYUGPSC/FYSC-III/9089/2024(PART-II) dated 19.10.2024

6. E mail dated 08.11.2024 from Dr. Sinosh Skariyachan.

7. Minutes of the meeting of the standing committee held on 13.11.2024

8. The Orders of Vice Chancellor dtd 26.11.2024

ORDER

1.The Regulations of Kannur University Four Year Under Graduate Programmes (KU-FYUGP Regulations 2024) for Affiliated Colleges was implemented w.e.f. 2024 admission and certain modifications were effected thereafter vide papers read (1) above.

2. In the absence of Board of Studies for B Sc Life Sciences (Zoology) & Computational Biology, Dr. Sinosh Skariyachan, Assistant Professor, Department of Microbiology, St. Pius X College, Rajapuram, who was entrusted to prepare the Syllabus of the Programme, submitted the Draft Scheme and Syllabus (I st and II nd Semester only) of the B.Sc. Life Sciences (Zoology) & Computational Biology programme, to be implemented in Affiliated Colleges under Kannur University w e f 2024 admission, in tune with KUFYUGP Regulations 2024.

3. Subsequently, as ordered, the syllabus of the B.Sc. Life Sciences (Zoology) & Computational Biology programme has been forwarded to the Dean, Faculty of Science for verification and the Dean, Faculty of Science, after making several modifications, recommended to approve the Syllabus vide paper read (3)

4. Considering the matter, the Vice Chancellor ordered to place the same before the consideration of the Standing Committee of the Academic Council.

5.The Standing Committee of Academic council, vide paper read 4 above, considered the matter and recommended to approve the Scheme and Syllabus of the B Sc Life Sciences (Zoology) & Computational Biology Programme(FYUGP).

6.The Vice Chancellor in view of the Recommendation of the Standing Committee of the Academic Council and in exercise of the power of Academic Council, approved the Scheme & First and Second semester syllabus of the B.Sc. Life Sciences (Zoology) & Computational Biology programme.

7.However, on verification of the Syllabus with approved Regulation, certain discrepancies were noted in the Course code of the Scheme part and in the detailed Syllabus.

8.Subsequently, Dr. Sinosh Skariyachan submitted the modified Scheme and I & II Semester

Syllabus vide paper read 6.

9.Considering the matter, the Vice Chancellor ordered to place the modified Scheme and I &II Semester Syllabus of the B.Sc.Life Sciences (Zoology) & Computational Biology programme before the consideration of Standing Committee of the Academic Council.

10.The Standing Committee of the Academic Council (vide paper read 7 above) recommended to approve the modified Scheme and I & II Semester Syllabus of the B.Sc. Life Sciences (Zoology) & Computational Biology Programme.

11. The Vice Chancellor, after considering the recommendation of the Standing Committee of the Academic Council and in exercise of the powers of the Academic Council, conferred under Section 11(1) Chapter III of Kannur University Act, 1996 and all other enabling provisions read together with, ***approved the Scheme (all Semesters) and the First and Second Semester Syllabus of the B.Sc. Life Sciences (Zoology) & Computational Biology programme (FYUGP) in Affiliated Colleges under Kannur University and accorded sanction to implement the same w.e.f. 2024 admission, subject to the report to the Academic Council.***

12. The Scheme & First and Second semester Syllabus of the B.Sc.Life Sciences (Zoology) & Computational Biology programme (FYUGP) in Affiliated Colleges under Kannur University w.e.f. 2024 admission are appended with thie U.O. and uploaded in the University website.

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To: The Principals of Affiliated colleges under Kannur University offering B.Sc. Life Science (Zoology) & Computational Biology programme

Copy To: 1. The Examination Branch (through PA to CE)
2. PS to VC/ PA to R
3. DR/AR (Academic)
4. JR (Exam)
5. The IT Cell (For uploading in the website)
6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY

(Abstract)

Kannur University -FYUG Life Science (Zoology) & Computational Biology Programme in Affiliated colleges - Third & Fourth semester Syllabus - Approved and implemented with effect from 2024 Admission-- Orders - Issued

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ACADEMIC C SECTION

ACAD C/ACAD C1/23339/2024 Dated: 14.08.2025

Read:-1. U O No. ACAD C/ACAD C1/23339/2024 Dated: 26.11.2024

2. E mail dated 30.05.2025 from Dr. Sinosh Skariyachan, Assistant Professor, Department of Microbiology, St. Pius X College, Rajapuram.

3. Minutes of the meeting of all Deans of Faculties held on 04.06.2025

4. Orders of Vice Chancellor in file No. Acad C/Acad C3/2948/2025 dated 04.06.2025

ORDER

1. As per the paper read as (1) above, the Scheme & first and second semester Syllabus of the FYUG Life Science (Zoology) & Computational Biology Programme in Affiliated colleges under Kannur University were implemented w.e.f. 2024 admission.

2. In the absence of Board of Studies for B Sc Life Sciences (Zoology) & Computational Biology, Dr. Sinosh Skariyachan, Assistant Professor, Department of Microbiology, St. Pius X College, Rajapuram, who was entrusted to prepare the Syllabus of the Programme, submitted the third and fourth semester syllabus of the B.Sc. Life Sciences (Zoology) & Computational Biology programme w e f 2024 admission for approval.

3. Subsequently, as ordered, the syllabus of the FYUG Life Sciences (Zoology) & Computational Biology programmewas forwarded to the Dean, Faculty of Science for verification

4. The Dean, Faculty of Science, vide the paper read 3, recommended to approve the third and fourth semester syllabus of FYUG Life Sciences (Zoology) & Computational Biology Programme w e f 2024 admission.

5.The Vice Chancellor, after considering the recommendation of the Dean, Faculty of Science and in exercise of the powers of the Academic Council conferred under Section 11(1) Chapter III of Kannur University Act, 1996 and all other enabling provisions read together with, approved the third and fourth semester Syllabus of the FYUG Life Sciences (Zoology) & Computational Biology programme in Affiliated Colleges under Kannur University and accorded sanction to implement the same w.e.f. 2024 admission, subject to the reporting to the Academic Council.

6. The first to Fourth semester Syllabus of the FYUG Life Sciences (Zoology) & Computational Biology Programme in Affiliated colleges under Kannur University w.e.f. 2024 admission are appended herewith.

Orders are issued accordingly

Sd/-

Bindu K P G

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To: 1. The Controller of Examination (Through PA to CE)
2. Dr. Sinosh Skariyachan, Assistant Professor, Department of Microbiology, St. Pius X College, Rajapuram.
3. The Principals of all affiliated Colleges.

Copy To: 1. Computer Programmer
2. PS to VC/ PA to R
3. DR/AR (Academic)
4. JR (Exam)
5. Web Manager (For uploading in the website)
6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY

FYUGP

LIFE SCIENCES (ZOOLOGY) & COMPUTATIONAL BIOLOGY SYLLABUS

(w.e.f. 2024 Admission)

KANNUR UNIVERSITY

VISION AND MISSION

Vision

To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavours.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

About the program

Life Sciences (Zoology) & Computational Biology program is ideal for students interested in the dynamic interface between biology and technology, providing a broad skill set relevant to modern scientific and technological careers. It represents a powerful interdisciplinary science that merges the study of animal life with advanced computational techniques. This fusion allows students to explore complex biological phenomena at unprecedented depths. Zoology provides foundational knowledge about biochemistry, molecular biology, evolution, ecology while computational biology leverages algorithms, data analysis, and modeling to interpret and predict biological patterns. The program creates a dynamic interdisciplinary field that deepens students' understanding of cellular processes and molecular structures in animals. Molecular modeling, a crucial aspect of computational biology, involves creating three-dimensional models of biomolecules. This technique is invaluable in zoology for studying the structure and function of proteins, nucleic acids, and other biomolecules within living cells. Through molecular modeling, students can visualize the effects of genetic mutations, explore protein folding, and design vaccines and drugs that can interact with specific molecular targets in prokaryotes and eukaryotes. This comprehensive approach combines zoological studies with advanced computational techniques, enabling students to model and analyze complex biological systems. As a result, they develop a thorough grasp of how cellular interactions and molecular structures influence animal physiology, behavior, and evolution, preparing them for innovative research and practical applications in various scientific and technological fields.

The four-year BSc (Honors) with Research program in Life Sciences (Zoology) and Computational Biology at Kannur University is designed to give a strong emphasis on cell biology and molecular modeling, enabling students to simulate cellular interactions and visualize biomolecular structures. This curriculum equips students with a versatile skill set, preparing them for diverse roles in scientific research, medical and pharmaceutical industries, environmental conservation, and advanced technological applications or to continue their studies at the postgraduate level or in research.

Graduate Attributes

Kannur University is fundamentally dedicated to nurturing well-rounded individuals with a comprehensive set of graduate attributes. Graduates from Kannur University emerge equipped with a multidisciplinary approach, allowing them to integrate knowledge across various

domains for a holistic understanding of complex issues. With a strong emphasis on critical thinking and effective problem-solving skills, Kannur University's graduates demonstrate intellectual curiosityand the ability to tackle challenges creatively. Proficient in communication and social interaction, they engage adeptly in diverse settings, fostering Kannur University FYUGP – Regulations and Curriculum Framework - 2024 collaboration and effective interpersonal connections. Moreover, the graduates embody effective citizenship and leadership, showcasing a sense of responsibility, community engagement, and leadership qualities. With a global perspective, ethical grounding, and a commitment to environmental sustainability, our students are well-prepared for active participation in an interconnected world. Embracing self-directed and lifelong learning, they continually adapt to evolving challenges, embodying the university's commitment to producing resilient, knowledgeable, and socially responsible individuals.

Program Outcomes (POs):

Program Outcomes (POs) serve as a foundational framework defining the skills, knowledge, and attributes that students at Kannur University are expected to acquire upon completion of a specific academic program. Tailored to the unique goals of each program, POs articulate the overarching learning objectives that guide curriculum design and assessment. These outcomes encompass a diverse range of competencies, including critical thinking, problem-solving, effective communication, and discipline-specific expertise. POs play a crucial role in shaping educational experiences, ensuring alignment with academic standards and industry expectations. By articulating clear and measurable expectations, POs contribute to the continuous improvement of academic programs and provide a roadmap for students to develop into well-rounded, competent professionals within their chosen fields.

PO1: Critical Thinking and Problem-Solving-Apply critical thinking skills to analyze information and develop effective problem-solving strategies for tackling complex challenges.

PO2: Effective Communication and Social Interaction-Proficiently express ideas and engage in collaborative practices, fostering effective interpersonal connections.

PO3: Holistic Understanding-Demonstrate a multidisciplinary approach by integrating knowledge across various domains for a comprehensive understanding of complex

issues.

PO4: Citizenship and Leadership-Exhibit a sense of responsibility, actively contribute to the community, and showcase leadership qualities to shape a just and inclusive society.

PO5: Global Perspective-Develop a broad awareness of global issues and an understanding of diverse perspectives, preparing for active participation in a globalized world.

PO6: Ethics, Integrity and Environmental Sustainability-Uphold high ethical standards in academic and professional endeavors, demonstrating integrity and ethical decision-making. Also acquire an understanding of environmental issues and sustainable practices, promoting responsibility towards ecological well-being.

PO7: Lifelong Learning and Adaptability-Cultivate a commitment to continuous self-directed learning, adapting to evolving challenges, and acquiring knowledge throughout life.

Program Specific Outcomes (PSOs)

The completion of Four Year UG program in Life Sciences (Zoology) & Computational Biology, will give a robust foundation in both Zoology and Computational biology, ready to contribute to advancements in science, technology, and environmental stewardship. The program specific outcomes (PSOs) will be as follows:

PSO1: Comprehensive biological knowledge:

- Develop a strong foundational understanding of various life sciences disciplines, including Animal Physiology, Biochemistry, Cell Biology, Molecular Biology, Genetics and Bioinformatics.
- Gain insights into the complexity of biological systems at molecular, cellular, organismal, and ecological levels.

PSO2: Integration of computational skills:

- Acquire computational skills necessary for analyzing and interpreting biological data, including programming, data management, and statistical analysis.
- Learn to use bioinformatics tools, algorithms, and computational models to solve biological problems.

PSO3: Cell Biology and molecular modeling expertise:

- Understand cellular processes and molecular mechanisms through detailed study and computational modeling.
- Gain proficiency in simulating cellular interactions and visualizing biomolecular structures.

PSO4: Interdisciplinary approach:

- Integrate principles from life sciences and computational biology to develop a holistic understanding of biological phenomena.
- Apply interdisciplinary methods to address complex biological questions and challenges.

PSO5: Research and analytical skills:

- Engage in hands-on research projects, laboratory work, and field studies to develop practical skills.
- Enhance critical thinking and problem-solving abilities through independent and collaborative research activities.

PSO6: Application of theoretical knowledge:

- Translate theoretical concepts into practical solutions for real-world problems in biology and related fields.
- Utilize computational tools to develop innovative strategies in areas such as biotechnology, healthcare, and environmental conservation.

PSO7: Career preparedness:

- Equip students with the knowledge and skills necessary for careers in research, healthcare, pharmaceuticals, environmental science, biotechnology and data science.
- Prepare students for advanced studies at the postgraduate level or specialized research roles in academia and industry.

PSO8: Innovation and problem-solving:

- Cultivate the ability to think creatively and innovatively to solve biological problems using computational approaches.
- Develop solutions that address contemporary challenges in biology, healthcare, and environmental science.

List of Courses (Category-wise)

Disciple Specific Core (DSC) courses (Major):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	I	KU1DSCZCB101	LIFESCIENCES & BIOMOLECULES	3	0	1	4	3	0	2	5	35	65	100
2	II	KU2DSCZCB104	FUNDAMENTALS OF COMPUTATIONAL BIOLOGY	3	0	1	4	3	0	2	5	35	65	100
3	III	KU3DSCZCB201	GENOMIC ALGORITHMS: THE ART AND SCIENCE OF BIOINFORMATICS	3	0	1	4	3	0	2	5	35	65	100
4		KU3DSCZCB202	GENOMIC GUIDANCE & PUBLIC HEALTH	4	0	0	4	4	0	0	4	30	70	100
5	IV	KU4DSCZCB205	CELL BIOLOGY & IMMUNOLOGY	3	0	1	4	3	0	2	5	35	65	100
6		KU4DSCZCB206	STRUCTURAL PERSPECTIVES OF PROTEINS-PROTEIN BIOINFORMATICS	3	0	1	4	3	0	2	5	35	65	100
7.		KU4DSCZCB207	GENOMICS AND PROTEOMICS: MAPPING THE BLUEPRINT OF LIFE	3	0	1	4	3	0	2	5	35	65	100
8	V	KU5DSCZCB301	DEVELOPMENTAL BIOLOGY	3	0	1	4	3	0	2	5	35	65	100
9		KU5DSCZCB302	MOLECULAR MODELING AND INTERACTION PREDICTION	3	0	1	4	3	0	2	5	35	65	100
10		KU5DSCZCB303	GENETICS & MOLECULAR BIOLOGY	4	0	0	4	4	0	0	4	30	70	100
11	VI	KU6DSCZCB304	DATA-DRIVEN DRUG DISCOVERY: THE EVOLUTION OF CHEMOINFORMATICS & MEDICINAL CHEMISTRY	3	0	1	4	3	0	2	5	35	65	100
12		KU6DSCZCB305	ANIMAL PHYSIOLOGY	3	0	1	4	3	0	2	5	35	65	100
13		KU6DSCZCB306	VIRTUAL SCREENING AND COMPUTER-AIDED DRUG DESIGN	4	0	0	4	4	0	0	4	30	70	100
14		KU7DSCZCB401	INNOVATIONS IN HEALTH INFORMATICS	3	0	1	4	3	0	2	5	35	65	100

15	VII	KU7DSCZCB402	ADVANCE CELL & MOLECULAR BIOLOGY	3	0	1	4	3	0	2	5	35	65	100
16		KU7DSCZCB403	FRONTIERS OF IMMUNOINFORMATICS AND COMPUATIONAL VACCINOLOGY	3	0	1	4	3	0	2	5	35	65	100
17		KU7DSCZCB404	RESEARCH METHODOLOGY	3	0	1	4	3	0	2	5	35	65	100
18		KU7DSCZCB405	AGRIINFORMATICS IN MODERN AGRICULTURE	3	0	1	4	3	0	2	5	35	65	100
19	VIII	KU8DSCZCB406	ECOLOGY & EVOLUTION	3	0	1	4	3	0	2	5	35	65	100
20		KU8DSCZCB407	COMPUTER ASSISTED NANOTECHNOLOGY	3	0	1	4	3	0	2	5	35	65	100
21		KU8DSCZCB408	ENVIRONMENTAL SCIENCE	3	0	1	4	3	0	2	5	35	65	100

Disciple Specific Core (DSC) courses (Minor):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	I	KU1DSCZCB102	CELL BIOLOGY	3	0	1	4	3	0	2	5	35	65	100
2		KU1DSCZCB103	FAUNA AND HABITAT	3	0	1	4	3	0	2	5	35	65	100
3	II	KU2DSCZCB105	INTRODUCTION TO HUMAN PHYSIOLOGY	3	0	1	4	3	0	2	5	35	65	100
4		KU2DSCZCB106	BIOINFORMATICS ESSENTIALS	3	0	1	4	3	0	2	5	35	65	100
5	III	KU3DSCZCB203	HUMAN PHYSIOLOGY & ENDOCRINOLOGY	3	0	1	4	3	0	2	5	35	65	100
6		KU3DSCZCB204	DIGITAL DNA: EXPLORING COMPUTATIONAL BIOLOGY AND BIOINFORMATICS	3	0	1	4	3	0	2	5	35	65	100

Disciple Specific Elective (DSE) courses:

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	V	KU5DSEZCB301	GENERAL PARASITOLOGY	4	0	0	4	4	0	0	4	30	70	100
2		KU5DSEZCB302	PHARMACO INFORMATICS- THE GENETIC BLUEPRINT OF PERSONALIZED THERAPY	4	0	0	4	4	0	0	4	30	70	100

3		KU5DSEZCB303	GENERAL ENTOMOLOGY	4	0	0	4	4	0	0	4	30	70	100
		ANY TWO ELECTIVES SHOULD BE STUDIED IN V SEM												
5	VI	KU6DSEZCB304	MEDICAL PARASITOLOGY	4	0	0	4	4	0	0	4	30	70	100
6		KU6DSEZCB305	BIOINFORMATICS IN PLANT BREEDING AND GENETICS	4	0	0	4	4	0	0	4	30	70	100
7		KU6DSEZCB306	AGRICULTURAL ENTOMOLOGY	4	0	0	4	4	0	0	4	30	70	100
8		KU6DSEZCB307	GENETIC ENGINEERING AND BIOINFORMATICS OF GMOS	4	0	0	4	4	0	0	4	30	70	100
		ANY TWO ELECTIVES SHOULD BE STUDIED IN VI SEM												
9	VIII	KU8DSEZCB401	HUMAN GENETICS	4	0	0	4	4	0	0	4	30	70	100
10		KU8DSEZCB402	DATA ANALYSIS IN NEXT GENERATION SEQUENCING, GENOMICS & TRANSCRIPTOMICS	4	0	0	4	4	0	0	4	30	70	100
11		KU8DSEZCB403	PROTEOMICS AND METABOLOMICS	4	0	0	4	4	0	0	4	30	70	100
12		KU8DSEZCB404	WILDLIFE CONSERVATION AND MANAGEMENT	4	0	0	4	4	0	0	4	30	70	100
13		KU8DSEZCB405	MEDICAL BIOTECHNOLOGY AND BIOINFORMATICS	4	0	0	4	4	0	0	4	30	70	100

14		KU8DSEZCB406	COMPUTATIONAL METHODS IN RECOMBINANT DNA TECHNOLOGY	4	0	0	4	4	0	0	4	30	70	100
		ANY THREE ELECTIVES CAN BE STUDIED IN VIII SEM OR ANY THREE MOOC COURSES												

GENERAL FOUNDATION COURSES (MDC, VAC, SEC)

Multi-Disciplinary Courses (MDC):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	I	KU1MDCZCB101	NUTRITION AND NEUTRACEUTICALS	3	0	0	3	3	0	0	3	25	50	75
2	II	KU2MDCZCB102	MOLECULAR PHYLOGENETICS	3	0	0	3	3	0	0	3	25	50	75

Value Added Courses (VAC):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	III	KU3VACZCB201	LIFE SCIENCES & BIOINFORMATICS: DECODING THE BLUEPRINT OF LIFE	2	0	1	3	2	0	2	4	25	50	75
2	IV	KU4VACZCB202	ETHICS IN BIOLOGICAL RESEARCH	2	0	1	3	2	0	2	4	25	50	75
3		KU4VACZCB203	INFORMATICS AND METHODS IN DRUG DESIGN	2	0	1	3	2	0	2	4	25	50	75

Skill Enhancement Courses (SEC):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	IV	KU4SECZCB201	APICULTURE	2	0	1	3	2	0	2	4	25	50	75
2	V	KU5SECZCB301	STRUCTURAL BIOINFORMATICS AND PROTEIN STRUCTURE PREDICTION	2	0	1	3	2	0	2	4	25	50	75
3	VI	KU6SECZCB302	ORNAMENTAL FISH FARMING AND AQUARIUM MANAGEMENT	2	0	1	3	2	0	2	4	25	50	75

Internship & Dissertation:

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1.	IV/V	KU4INTZCB201	INTERNSHIP	0	0	2	2	0	0	4	4	15	35	50
2.	VIII	KU8RPHZCB301	RESEARCH PROJECT	0	0	12	12	0	0	24	24	30	70	100

*L-Lecture, T-Tutorial, P-Practical

Semester I

KU1DSCZCB101: LIFE SCIENCES AND BIOMOLECULES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC A1	100-199	KU1DSCZCB101	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

COURSE DESCRIPTION:

Biochemistry is the scientific field that investigates the chemical processes occurring within and related to living organisms. This course offers a thorough analysis of the molecular mechanisms behind the biological functions, focusing on the structure, function, and regulation of biomolecules. Students will achieve a detailed understanding of the fundamental principles that govern cellular processes and their importance in health and diseases.

Course Prerequisite: Basic knowledge in Biology gained during a +2 level.

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand the concept of life and the interaction of biomolecules in living system	U
CO2	Application of common laboratory techniques used in biochemistry.	A
CO3	Perceive the importance of biochemistry in other fields like biotechnology, agriculture, environmental science, medicine, and protein bioinformatics	An
CO4	Equip the students to basic biochemical concepts	A
CO5	Comprehend the basic principles of biochemistry	U

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO8**
CO 1	✔		✔		✔	✔	✔	✔

CO 2	✔		✔		✔	✔	✔	✔
CO 3	✔		✔		✔	✔	✔	✔
CO 4	✔		✔		✔	✔	✔	✔
CO 5	✔		✔		✔	✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to Life Sciences	
1	1. Concept of Life 2. Branches of Life Sciences	**2**
	Biomolecules	
2	1. Micro, macro & trace elements/ mineral ions 2. Water – molecular structure & dipolar nature, dissociation 3. Concept of pH, buffers, Henderson- Hassel Balch equation, biological functions of water 4. Macromolecules - Classification of carbohydrates, biological functions of carbohydrates 5. Classification of amino acids 6. Structural levels of proteins – primary, secondary, tertiary, and quaternary structure, Classification of proteins, biological importance of proteins and amino acids. 7. Lipids. Basic structure and biological importance of lipids, Classification of lipids-Simple Lipids – Fats, oils and waxes, Compound lipids - Phospholipids (lecithin, cephalin), Glycolipids (cerebrosides, gangliosides), Lipoproteins, Derived Lipids - Steroids (cholesterol), Prostaglandins	**25**
	Enzymes - Enzyme classification and Functions	

3	1. Enzymes- Classification and Nomenclature (IUB) – 6 major classes. 2. Concept of active sites 3. Mechanism of enzyme action (lock and key & induced fit hypothesis) 4. Factors influencing the velocity of enzyme action- effect of pH, temperature,enzyme and substrate concentration 5. Regulation of enzyme action- activation and inhibition (competitive, non- competitive, allosteric and feedback)	**18**
	Practical in Zoology	
4	1. Detection of pH of water using pH paper 2. Qualitative tests for identification of carbohydrates, proteins and lipids. 3. Separation of amino acids (or any other compounds) from a mixture by using Paper Chromatography (Demonstration). 4. Estimation of glucose by colorimeter (Demonstration) 5. Estimation of protein by colorimeter (Demonstration)	**25**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. David L. Nelson and Michael Cox (2012): Lehninger Principles of Biochemistry 6th Edition, ISBN-10: 1429234148, W.H. Freeman, 1328 pages
2. David L. Nelson and Michael Cox (2017): Lehninger Principles of Biochemistry 7th Edition, ISBN-10: 1-4641-2611-9, W.H. Freeman, 1172 pages David P. Plummer (2017)- Introduction to Practical Biochemistry, 3rd Edition,ISBN-10: 9780070994874, McGraw Hill Education, 498 pages
3. Donald Voet, Charlotte W. Pratt and Judith G. Voet (2001): Principles of Biochemistry 4th Edition, ISBN-10: 9780471417590, Wiley
4. Geoffrey L Zubay (1999): Biochemistry 4th Edition, ISBN-10: 0697219003,Wm. C. Brown Publishers, 1104 pages

Suggested Readings:

1. Biochemistry" by Lubert Stryer et al.
2. Molecular Biology of the Cell" by Bruce Alberts et.al

Assessment Rubrics:

Theory

Evaluation Type	Marks
End Semester Evaluation L	50
Continuous Evaluation L	25

a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

KU1DSCZCB102: CELL BIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC B1	100-199	KU1DSCZCB102	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

COURSE DESCRIPTION:

This course helps the students to gather overall knowledge regarding the basic unit of life, the Cell. This course is designed to enable them to understand the functions of Cellular components in supporting all the life processes. Students also achieve a comprehensive & detailed understanding of the chemical basis of Heredity and its various applications in day today life.

Course Prerequisite: Basic knowledge in Biology gained during a +2 level**.**

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Learn the role of cell in supporting life activities & comprehend the activities of cellular organelles	U
CO2	Understand the structure and functions of cell organelles	U
CO3	Recognize the cyclic cellular events take place inside the cell	An
CO4	Equip the students to the theoretical as well as practical skills of cellular biology relevant to clinical and research applications	E

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔	✔	✔	✔	✔	✔
CO 2	✔		✔	✔	✔	✔	✔	✔
CO 3	✔		✔	✔	✔	✔	✔	✔

CO 4	✔		✔	✔	✔	✔	✔	✔
CO 5	✔		✔	✔	✔	✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Overview of Cells and Structure & Functions of Cell Organelles	
1	Cell types: Prokaryotic & Eukaryotic cell Plasma Membrane & Cytoskeleton: Plasma membrane: Structure (Fluid mosaic model), General Functions, Cytoskeleton: Microtubules, Microfilaments, Intermediate filaments Mitochondria: Structure, Oxidative phosphorylation, Electron transport chain, Peroxisomes: Functions, Endoplasmic Reticulum: Types, Functions, Golgi Body: Forms, Functions, Lysosomes: Polymorphism, Functions, GERL concept	**20**
	Nucleus	
2	Nucleus: Structure, Nuclear envelope, nuclear pore complex, Nucleolus-functions Chromosomes: Types, Chromatin-Euchromatin & Heterochromatin Nucleosome Concept, Barr body	**10**
	Cell Reproduction	
3	Cell Cycle, Mitosis, Meiosis	**10**
	Practical in Zoology	
4	1. Study of Ocular Micrometer and Stage Micrometer 2. Study of mitotic stages – Squash preparation of onion root tip 3. Staining of buccal epithelial cells. 4. Preparation of blood smear and study of any three WBCs	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. De Roberties, E. D. P. et al.: Cell and Molecular Biology 7th/8th edition TMH

2. Freifelders Essentials of Molecular Biology, 4thEd (2015)
3. Gerlad Karp: Cell and Molecular Biology 6th/7th edition Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments VI edition. John Wiley and Sons.Inc.
4. Koshy Thomas& Joe Prasad Mathew (Editors)(2011)Cell Biology and Molecular Biology.
5. Rastogi S. C. (1998) Cell Biology. Tata Mc. Graw Hill Publishing Co., New Delhi.
6. Ali, S (2014) The Cell: Organization Function and Regulatory Mechanisms, Pearson
7. Rastogi V. B.(2016): Principles of Molecular Biology, 2nd edition Med Tech Science Press

Suggested Readings:

1. Karp, G., Iwasa, J., & Marshall, W. (2020). *Karp's Cell and Molecular Biology*.
2. Rastogi V. B.(2021): Cell Biology, 1st edition Med Tech Science Press
3. Watson, J. D. (2014). Molecular Biology of the Gene. Pearson. 7th Edition. (ForModules 3 & 4)
4. Cooper GM. The Cell: A Molecular Approach. 2nd edition. Sunderland (MA):Sinauer Associates; 2000.
5. Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 4th edition. New York: Garland Science; 2002.
6. Brown TA. Genomes. 2nd edition. Oxford: Wiley-Liss; 2002.
7. Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., et al. (2005) Molecular cell biology. 5th Edition, W.H. Freeman and Co., New York.

KU1DSCZCB103: FAUNA AND HABITAT

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC C1	100-199	KU1DSCZCB103	3+1	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

COURSE DESCRIPTION:

Discover the core concepts of Ecology. Explore the ecological organization, interactions, and energy flow. Examine biodiversity, community dynamics, and human impacts on ecosystems. Acquire crucial knowledge for understanding and promoting a sustainable world. This course also provides the students essential knowledge and skills for further studies in environmental science, biology, and related fields, fostering an understanding of ecological systems and the importance of environmental stewardship.

Course Prerequisite: Basic knowledge in Biology gained during a +2 level

COURSE OUTCOMES

	Expected Outcome	**Learning Domains**
CO1	Comprehend the core concept of ecology	U
CO2	Understand the main components of ecosystems	A
CO3	Assess the impact of human activities on ecosystems	E
CO4	Suggest proper steps to conserve biodiversity and alleviation of climate change	An

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔			✔		✔	✔	✔
CO 2	✔			✔		✔	✔	✔
CO 3	✔			✔		✔	✔	✔
CO 4	✔			✔		✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Distribution of Life on Earth	
1	Biosphere and its subdivisions Terrestrial environments: Biomes, Principal terrestrial biomes: Temperate, Deciduous forests, Coniferous forests, Tropical forests, Grasslands, Tundra, Desert, Aquatic environments: Inland waters (lotic and lentic), Oceans (benthic,pelagic, photic, littoral, intertidal, estuary, neritic zones) Animal Distribution (Zoogeography):, Disjunct distribution, Distribution by dispersal, Distribution by vicariance, Continental drift theory Animal Ecology: Hierarchy of ecology: Organisms, populations and communities, Environment and niche, Habitat, Population ecology: density, natality, mortality, age structure, carrying capacity(K), Population interactions: Types of interaction: Positive interactions (mutualism, commensalism), Negative interactions (predation, competition, parasitism) Ecological warfare by Predator and parasites: Mimicry, Keystone species, Social insects	**25**
	Ecosystem: Basic concepts, Components of Ecosystem	
2	1. Components of Ecosystems: Trophic levels: Producers, consumers, and decomposers, Food chains and Food webs, Energy flow in ecosystems, Ecological pyramids 2. Nutrient Cycling: Carbon cycle, Nitrogen cycle, Phosphorus cycle	**20**
	Biodiversity and Community Ecology	

3	1. What is biodiversity? 2. Types of diversity: Genetic Diversity, Species diversity, Ecosystem diversity 3. Biodiversity Hotspots 4. Threats to Biodiversity- Habitat destruction, habitat degradation, overexploitation, invasive species,climate change	**15**
Human Impact and Conservation		
4	1. Values of biodiversity: Ethical dimension of biodiversity 2. Conservation of genetic diversity of populations and species: Management plans for invasive species, In situ conservation & ex-situ conservation and reintroduction, 3. Climate change: Acid rain, Greenhouse effect, Global warming	**10**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. Muller-Dombols, D. and Ellenberg, H. (1974). Aims and Methods of Vegetation Ecology, Wiley, New York.
2. Odum, E.P. (1983), Basic Ecology, Sanders, Philadelphia.
3. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
4. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
5. Singh, J.S. (ed.) (1993). Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
6. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
7. Botkin, D.B. and Keller, E.A. (2000). Environment Science: Earth as a livingplanet. Third Edition. John Wiley and Sons Inc.

Suggested Readings

1. https://www.biologysimulations.com/ecology
2. https://www.labster.com/course-packages/ecology
3. https://biomanbio.com/HTML5GamesandLabs/EcoGames/ecology.html
4. https://www.pbslearningmedia.org/subjects/science/life-science/ecology/?rank_by=recency
5. https://simbio.com/

Assessment Rubrics:
Theory

Evaluation Type		Marks
End Semester Evaluation L		50
Continuous Evaluation L		25
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

KU1MDCZCB101: NUTRITION AND NUTRACEUTICALS

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
I	MDC	100	KU1MDCZCB101		3	45
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture/Tutorial	Practical		CE	ESE	Total	
3	-		25	50	75	1.5

COURSE DESCRIPTION

Nutrition and Nutraceuticals is an emerging healthcare topic. This course aims to introduce various concepts related to nutrients, diet and diet management. Daily requirement of various nutrients, and the need to maintain nutrient adequate intake is introduced. Various metrics like Basal Metabolic Rate, Body Mass Index, etc. will be introduced. Students taking this course can plan their diet for a healthy and well-maintained body.

Course Prerequisite: Basic knowledge in Biology gained during a +2 level**.**

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Learn about different nutrient types	U
CO2	Acquaint about diet related indices	A
CO3	Plan diet for different conditions	U
CO4	Idea about food safety regulations in India	U
CO5	Learn about daily requirement of different nutrients	U

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔	✔		✔	✔	✔
CO 2	✔		✔	✔		✔	✔	✔
CO 3	✔		✔	✔		✔	✔	✔

CO 4	✔		✔	✔		✔	✔	✔
CO 5	✔		✔	✔		✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Nutrients and Supplements	
1	Food, Nutrition and Health-Macronutrients: Carbohydrates, Proteins and Lipids Micronutrients: Vitamins and Minerals, Pre and Probiotics, Organic Foods, Phytochemicals and Antioxidants Introduction to Nutraceuticals- Classification, Uses and Roles	**10**
	Basal Metabolism	
2	Basal Metabolic Rate (BMR) and Resting Metabolic Rate (RMR) Factors affecting BMR, Daily Energy Expenditure Xenobiotics- Definition, Examples Body Mass Index (BMI	**10**
	Malnutrition	
3	Malnutrition-Definition, Causes Gastrointestinal Disorders- Lactose Intolerance, Food Poisoning Vitamin Deficiency Diseases- Anaemia, Rickets, Scurvy, Goitre	**10**
	Lifestyle Diseases	
4	Lifestyle Diseases- Definition, brief overview Diabetes mellitus, Coronary Artery Disease, Obesity Aging- Role of Antioxidants	**10**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. Khanna, K., Gupta, S., Passi, S. J., Seth, R., Mahna, R., & Puri, S. (1997).Textbook of Nutrition and dietetics.
2. Clinical Dietetics Manual, Published by Indian dietetic association, ElitePublishing House

Suggested Readings:

1. Animal Nutrition by Peter McDonald, James Sillence, and C. John C. Phillips.
2. Nutrition of the Dog and Cat: Waltham Symposium Number 7" edited by P. J. Rogers and Ian H. McDonald.
3. Handbook of Vitamins, Minerals, and Hormones" edited by Robert J. Shils, Maurice Edward Shils, and Moshe Shike.
4. Wildlife Feeding and Nutrition" by Charles T. Robbins and Dale T. H. Elwood. Clinical Nutrition for the Small Animal Practitioner" by Theresa Fossum.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		50
Continuous Evaluation L		25
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5

c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

Semester II

KU2DSCZCB104- FUNDAMENTALS OF COMPUTATIONAL BIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC A2	100-199	KU2DSCZCB104	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

COURSE DESCRIPTION:

The "Fundamentals of Computational Biology" course offers a comprehensive introduction to the computational methods and tools used to analyze and interpret biological data. The course covers a range of essential topics including types of biological data, biological databases, sequence alignment, and molecular phylogeny. Students will gain practical experience with bioinformatics software and databases, and develop the skills necessary to tackle complex biological questions using computational approaches.

Course Prerequisite: NIL

COURSE OUTCOMES:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic concepts in Bioinformatics/Computational biology and its applications in various fields	U
2	Classify and distinguish between different types of biological data	A
3	Effectively manage and integrate data from diverse biological databases to support comprehensive analyses.	A
4	Utilize sequence alignment techniques to draw meaningful biological conclusions and support research hypotheses.	U/A
5	Analyze phylogenetic trees to understand evolutionary relationships and classify species accurately.	A

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔				✔		
CO 2	✔	✔		✔		✔		
CO 3		✔			✔			
CO 4		✔	✔			✔		✔
CO 5	✔	✔					✔	

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to Bioinformatics & Biological Databases	
1	1. Bioinformatics and Computational Biology- Scope, Opportunities and Applications. 2. Types of Biological data- Genomic DNA, cDNA, rDNA, ESTs, GSSs 3. Biological Databases- Primary Databases: nucleotide and protein sequence databases, Secondary Databases, Tertiary/composite database, Structure Database Genomic Databases, metabolic pathway database- KEGG. 4. Fiel format of GenBank-GBFF, PDB-Flat files, Importance of Biological Databases 5. Database Search Tools- Entrez, SRS	**15**
	Sequence Alignment and similarity searching	
2	1. Sequence Alignment: Local and Global, Pair wise alignment, Dot plot, Scoring Methods, Needleman Wunsch Algorithm, Smith Waterman Algorithm, Gap penalties 2. Similarity searching programs- BLAST and FASTA, variants of BLAST, BLAST algorithms 3. Scoring matrices: Basic concept, Matrices for nucleic acid and protein sequences, PAM and BLOSUM matrices. 4. Multiple sequence alignment-Major Methods and Tools	**10**
	Molecular Phylogenetics	

3	1. Molecular Phylogeny: Cladistics, Introduction, Advantages, Phylogenetic trees, Tree topologies. Molecular clock hypothesis 2. Methods for Phylogenetic analysis- MSA, Substitutional matrices, Tree building- Distance based and character-based methods, Tree evaluation- Bootstrapping/Jackknifing 3. Computational Biology tools for phylogenetic data analysis 4. Practical applications of Phylogenetic data analysis.	**15**
Practical in Computational Biology		
4	1. Bibliographic searches from various literature databases 2. Sequence retrieval from nucleic acid and protein sequence databases 3. Similarity searching by FASTA and BLAST 4. PDB structure retrieval and visualization by RASMOL, UCSF Chimera and PyMol 5. Pair wise alignment and comparison of molecular sequences 6. Multiple sequence analysis of molecular sequences using CLUSTALW	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. Pevsner J. Bioinformatics and Functional Genomics, 3rd Edition.Wiley-Blackwell. 2015. ISBN: 978-1-118-58178-0
2. Baxevanis AD, Ouellettee BFF. Bioinformatics. A practical guide to the analysis of genes and Proteins. Third edition. John Wiley & Sons. 2006. ISBN: 978-0-471- 47878-2.
3. Xinog J, Essentials of Bioinfomatics, Texas A & M University, Cambridge University press. 2006. ISBN: 9780521600828
4. Cohen NC. Guidebook on Molecular Modeling in Drug Design. Academic Press, Elsevier. 1996. ISBN: 9780121782450

Suggested Readings:

1. Arabnia HR, Tran QN. Emerging Trends in Applications and Infrastructures for Computational Biology, Bioinformatics, and Systems Biology.Elsevier Science & Technology. 2016. ISBN: 9780128042038.
2. Ghosh Z, Mallick B. Bioinformatics: Principles and Applications. Oxford University Press, 2008. ISBN: 978019569230.
3. Campbell AM. Discovering Genomics, Proteomics, and Bioinformatics. CSHL Press, 2007. ISBN-13: 978-0805382198.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		50
Continuous Evaluation L		25
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2DSCZCB105: INTRODUCTION TO HUMAN PHYSIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC B2	100-199	KU2DSCZCB105	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

COURSE DESCRIPTION:

This course is designed to give a clear idea about the various organ systems in body and their physiological functions. It also aims at giving an idea on the common disorders associated with the organ systems. Moreover, it gives importance to practical experiments too.

Course Prerequisite: Basic knowledge in Biology gained during a +2 level and who gained the basics from

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand various organ systems in human body	U
CO2	An insight into various physiological mechanisms occurring in human body	An
CO3	Explore the disorders associated with the organ systems	U
CO4	Equip the students with practical knowledge through laboratory experiments in physiology	An

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔		✔	✔	✔	✔
CO 2	✔		✔		✔	✔	✔	✔
CO 3	✔		✔		✔	✔	✔	✔

CO 4	✔		✔		✔	✔	✔	✔

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Digestive System	
1	General Structure of Human Digestive System, Mechanical and Chemical digestion and absorption of major nutrients- Carbohydrates, Proteins and Lipids, Balanced diet, Malnutrition- Obesity, Deficiency Disorders- Kwashiorker, Marasmus, Xerophthalmia, Beriberi, Pernicious anaemia, Scurvey, Rickets, Osteomalacia,	**10**
	Respiratory System and Cardio Vascular System	
2	Mechanism of respiration, Transport of Gases, Lung volumes- RV, TV, IRV, ERV, VC, TLC, Hypoxia, Hypercapnia, Asphyxia, Cyanosis. Structure and functions of blood cells, Anaemia, Polycythemia, Leukemia, Leucopenia, Conducting system of heart, Heart Rate, Tachycardia, Bradycardia, ABO blood groups, significance, Erythroblastosis foetalis, Cardiovascular disorders- Mitral Stenosis, Angina, Atherosclerosis, Arteriosclerosis, ASD, VSD, Myocardial Infarction, Blood Pressure- Hypo and Hypertension	**20**
	Excretory System	
3	Ultra structure of Nephron, Juxta Gomerular Apparatus, Physiology of urine formation, Nephrosis, Nephritis, Albuminurea, Glycosuria, Brief note on dialysis	**10**
	Practicals in Zoology	
4	1. Preparation of blood smear and study of blood cells 2. Determination of clotting time-Drop method 3. Determination of ABO blood groups using antisera 4. Determination of abnormal constituents of urine- albumin, glucose and bile	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. Barrett, K. E.; Barman, S. M.; Brooks, H. L.& Yuan, J. X. J. (2019). Ganong's Reviewof Medical Physiology 26th Ed. Mc Graw Hill Education.
2. 2. Hall, J. E. & Hall, M. E. (2020). Guyton and Hall Text book of Medical Physiology, 14th Ed. Elsevier.
3. Geetha, N (2022) Human Physiology
4. Sherwood L (2015) Human Physiology: From Cells to Systems 9th edition

Suggested Readings:

1. Tortora GJ & Derrickson BH: Principles of Anatomy and Physiology (2017) 15th edition
2. Jain A K; Text book of Physiology (2019) Avichal Publishing Company

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		50
Continuous Evaluation L		25
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5

c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2DSCZCB106- BIOINFORMATICS ESSENTIALS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC C2	100-199	KU2DSCZCB106	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

COURSE DESCRIPTION:

This course provides a comprehensive introduction to the field of bioinformatics, focusing on essential concepts and techniques used in biological data analysis. Students will explore the fundamentals of biological databases, sequence alignment, bioinformatics algorithms, and statistical methods. Through lectures, hands-on exercises, students will gain practical skills and theoretical knowledge to tackle real-world biological problems.

Course Prerequisite: NIL

COURSE OUTCOMES:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic concepts in Bioinformatics/Computational biology and its applications. Understand biological databases available online and sequence alignment using bioinformatics tools.	U
2	Able to gain fundamental knowledge about the major algorithms used in computational biology	A
3	Able to implement scripts of BioPerl and Biopython and in analysis of sequence information of macromolecules	A
4	Able to implement MATLAB programming for bio-statistical applications.	U/A
5	Able to understand the applications of biostatics in computational biology exercise.	U/A

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1		✔	✔			✔	✔	✔
CO 2		✔						
CO 3		✔		✔	✔			
CO 4						✔		
CO 5		✔					✔	

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Foundations of Bioinformatics	
1	1. Introduction to Bioinformatics: History, definition, goals, Scope and applications of bioinformatics. 2. Motivation of biological database - Central dogma of life 3. Alignment of pairs of sequences; Introduction- Definition of sequence alignment, Pairwise sequence alignment and Multiple sequence alignment.	**10**
	Major Algorithms in Computational biology-I	
2	1. Introduction to BioPerl and BioPerl Objects, BioPython in Computational biology, NCBI tool Kits Introduction to the NCBI C++ Toolkit: Introduction to C++ modules - CORELIB, ALGORITHM, CGI, CONNECT, CTOOL, DBAPI, GUI, HTML, OBJECT MANAGER, SERIAL and UTIL module. 2. Matlab: Introduction to MatLab and molecular forces; Bioinformatics ToolBox, Statistics ToolBox, Distributed computing server, Signal Processing ToolBox. The Matlab working environment. Variables, constants and reserved words. Arrays and matrices.	**15**
	Statistical Methods	

3	1. Scope of biostatistics: definition, data collection, presentation of data, graphs, charts (scale diagram, histogram, frequency polygon, frequency curve, logarithmic curves). 2. Sampling & selection bias, probability sampling, random sampling, sampling designs. 3. Descriptive statistics: Measure of central tendency (arithmetic mean, geometric mean, harmonic mean, median, quartiles, mode); Measure of dispersion	**15**
Practical in Computational Biology		
4	1. Bibliographic searches from various literature databases 2. Protein Sequence Retrieval – UniProt 3. PDB structure retrieval and visualization by RASMOL 4. Multiple sequence analysis of molecular sequences using CLUSTALW	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. Pevsner J. Bioinformatics and Functional Genomics, 3rd Edition.Wiley-Blackwell. 2015. ISBN: 978-1-118-58178-0
2. Baxevanis AD, Ouellettee BFF. Bioinformatics. A practical guide to the analysis of genes and Proteins. Third edition. John Wiley & Sons. 2006. ISBN: 978-0-471- 47878-2.
3. Xinog J, Essentials of Bioinfomatics, Texas A & M University, Cambridge University press. 2006. ISBN: 9780521600828
4. Cohen NC. Guidebook on Molecular Modeling in Drug Design. Academic Press, Elseiver. 1996. ISBN: 9780121782450

Suggested Readings:

1. Arabnia HR, Tran QN. Emerging Trends in Applications and Infrastructures for Computational Biology, Bioinformatics, and Systems Biology.Elsevier Science & Technology. 2016. ISBN: 9780128042038.
2. Ghosh Z, Mallick B. Bioinformatics: Principles and Applications. Oxford University Press, 2008. ISBN: 978019569230.
3. Campbell AM. Discovering Genomics, Proteomics, and Bioinformatics.CSHL Press, 2007. ISBN-13: 978-0805382198.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		50
Continuous Evaluation L		25
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2MDCZCB102- MOLECULAR PHYLOGENETICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MDC 2	100-199	KU2MDCZCB102	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	0	25	50	75	1.5

COURSE DESCRIPTION:

This course provides a comprehensive introduction to phylogenetics, the study of evolutionary relationships among biological entities. Designed for students from diverse backgrounds, the course covers fundamental concepts, methodologies, and tools used to infer phylogenies and interpret evolutionary patterns. This course aims to understand the biological databases, sequence analysis, and molecular phylogeny. Students will explore different types of biological databases, submission protocols for sequences, sequence accuracy, and various file formats. Additionally, the course covers sequence similarity concepts, sequence alignment methods, multiple sequence alignments (MSA), databases related to MSA, and molecular phylogeny principles. Practical applications and tools for phylogenetic analysis are also discussed.

Course Prerequisite: NIL

COURSE OUTCOMES:

CO No.	Expected Outcome	Learning Domains
1	Understand Basic Phylogenetic Concepts: Describe key principles of phylogenetics and evolutionary biology.	U
2	Construct Phylogenetic Trees: Use various methods to build phylogenetic trees from biological data.	A
3	Interpret Phylogenetic Trees: Analyze and interpret the evolutionary relationships depicted in phylogenetic trees.	A
4	Utilize Phylogenetic Tools: Apply computational tools and software to perform phylogenetic analyses.	U/A

5	Evaluate Phylogenetic Methods: Critically assess different phylogenetic methods and their applications.	A

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔				✔		
CO 2	✔	✔		✔		✔		
CO 3		✔			✔			
CO 4		✔	✔			✔		✔
CO 5	✔	✔					✔	

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to Molecular Phylogenetics	
1	1. Overview and Importance: Definition and scope of molecular phylogenetics. Historical development and milestones in the field. Applications in biology, medicine, and conservation 2. Basic Terminology- Key terms and concepts (e.g., phylogeny, clade, node, branch). Differences between phenetic and cladistic approaches 3. Evolutionary Theory and Genetic Variation: Principles of Evolution-Natural selection, genetic drift, gene flow, and mutation, Speciation and evolutionary theory 4. Genetic Markers and Molecular Data- Types of genetic markers (e.g., mtDNA, rDNA, microsatellites). Molecular evolution and rates of evolution	**10**
	Data Acquisition and Sequence Alignment	

2	1. Sources of Molecular Data- DNA, RNA, and protein sequences, Public databases (GenBank, EMBL, DDBJ). 2. Multiple sequence alignment-Methods and Tools 3. Sequence Alignment- Importance of accurate alignment 4. Methods for pairwise and multiple sequence alignment, Tools and software (e.g., ClustalW, MUSCLE)	**10**
Phylogenetic Tree Construction Methods		
3	1. Distance-Based Methods- Basic concepts of distance-based methods-UPGMA (Unweighted Pair Group Method with Arithmetic Mean), Neighbor-Joining method 2. Character-Based Methods- Maximum Parsimony (MP) method 3. Steps to construct a parsimony tree, Strengths and limitations of MP. 4. Applications of Molecular Phylogenetics in Disease Diagnosis	**10**
Practical in Computational Biology		
4	1. Retrieval of Nucleotide sequence from GenBank 2. Retrieval of Protein sequence from GenBank 3. Sequence Similarity Search using BLASTN 4. Sequence Similarity Search using BLASTP 5. Tools and software's for phylogenetics analysis	**10**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Reading

1. Pevsner, J. (2015). Bioinformatics and Functional Genomics (3rd ed.). John Wiley Sons.
2. Yang, Z. (2006). Computational Molecular Evolution. Oxford University Press

Suggested Readings:

1. Arabnia HR, Tran QN. Emerging Trends in Applications and Infrastructures for Computational Biology, Bioinformatics, and Systems Biology.Elsevier Science & Technology. 2016. ISBN: 9780128042038.
2. Ghosh Z, Mallick B. Bioinformatics: Principles and Applications. Oxford University Press, 2008. ISBN: 978019569230.

Assessment Rubrics:

Theory

Evaluation Type	Marks
End Semester Evaluation L	50
Continuous Evaluation L	25

a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		75

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		15
Continuous Evaluation P		10
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		25

Any components from the above table can be taken for CE not exceeding 10 Marks

Semester III

KU3DSCZCB201- GENOMIC ALGORITHMS: THE ART AND SCIENCE OF BIOINFORMATICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC A3	200-299	KU3DSCZCB201	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	1.5

COURSE DESCRIPTION:

This course delves into the major algorithms used in computational biology and the statistical methods essential for analyzing biological data. Students will acquire fundamental knowledge of bioinformatics algorithms and gain practical experience in implementing scripts using BioPerl, Biopython, MATLAB, and R. The course is designed for students with a background in biology, computer science, or related fields, aiming to provide the tools necessary to address complex bioinformatics challenges and analyze sequence information of macromolecules effectively.

Course Prerequisite: A background in biology, computer science, or a related field.

COURSE OUTCOMES:

	Expected Outcome	Learning Domains
CO1	Able to gain fundamental knowledge about the major algorithms used in computational biology	U
CO2	Able to implement scripts of BioPerl and Biopython in analysis of sequence information of macromolecules	A
CO3	Able to implement MATLAB programming for bio-statistical applications	A
CO4	Able to apply R- programming concepts to extrapolating functional information of macromolecules	A
CO5	Able to understand the applications of biostatics in computational biology exercise.	U/An
CO6	Able to understand with the bivariate distributions and analyse the statistical significance of various exercises in computational biology	U/An

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1		✓		✓			✓	
CO 2		✓						
CO 3						✓	✓	✓
CO 4		✓						
CO 5		✓			✓			✓
CO 6	✓			✓				✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to BioPerl & BioPython	
1	1. Major Algorithms in Computational biology: PERL Basics of Per Introduction to BioPerl and BioPerl Objects - Brief description (Seq, PrimarySeq, LocatableSeq, RelSegment, LiveSeq, LargeSeq RichSeq, SeqWithQuality, SeqI), Location objects, Interface object and Implementation objects. 2. Major Algorithms in Computational Biology-Python: Introductio to python. Python basics – Variables, Operators, Data types an Assignments. Statements – Input/output statements, flow contr Introduction to object-oriented programming in python. BioPytho in Computational biology (Brief description)	**15**
	Introduction to NCBI Tool Kit, MATLAB & R-Language	
2	1. Major Algorithms in Computational Biology- NCBI tool Kit Introduction to the NCBI C++ Toolkit: Introduction to C++ modules - CORELIB, ALGORITHM, CGI, CONNECT, CTOOL, DBAPI, GUI, HTML, OBJECT MANAGER, SERIAL and UTIL module. 2. Major Algorithms in Computational Biology-MATLAB Introduction to MatLab and molecular forces; Bioinformatic ToolBox, Statistics ToolBox, Distributed computing server, Signa Processing ToolBox. The Matlab working environment. Variable constants and reserved words. Arrays and matrices. 3. Overview of the R language: Defining the R project, Obtaining R, Generating R codes, Scripts, Text editors for R, Graphical Use Interfaces (GUIs) for R, Packages. R Objects and data structures:	**10**

	Variable classes, Vectors and matrices, Data frames and lists, Data sets included in R packages	
	Biostatistics	
3	1. Scope of biostatistics: definition, data collection, presentation o data, graphs, charts (scale diagram, histogram, frequency polygon frequency curve, logarithmic curves). Sampling & selection bia probability sampling, random sampling, sampling design Descriptive statistics: Measure of central tendency (arithmetic mean, geometric mean, harmonic mean, median, quartiles, mode Measure of dispersion (range, quartile deviation, mean deviation and standard deviation, coefficient of variation). 2. Bi-Variate Distribution: Correlation and regression analysis (simple and linear) curve fitting (linear, non-linear and exponential). Comparison of means: Test statistics; t-test, F distribution, one way and two ay ANOVA	**15**
	PracticalinComputational Biology	
4	1. Measurement and Sampling: To select a simple random sample from the population and enter these data into SPSS/Minitab/or any other statistical software. 2. Diagrammatic & Graphical representation: To plot line diagrams, bar diagram. Pie chart, Histogram and frequency distribution of the collected data. 3. Summary Statistics: To calculate and interpret summary statistics for the data in your sample. 4. Correlation: Calculation & interpretation of correlation and regression between variables. 5. Implementing t- test.	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. John Lewis, Peter Joseph DePasquale, Joseph Chase, Joe Chase. Java Foundations by Addison- Wesley, 2010.
2. D. Curtis Jamison. Perl Programming for Biologists by, Wiley-IEEE, 2003.
3. Mitchell LModel. Bioinformatics Programming Using Python by, O'Reilly Media, Inc., 2009.
4. Alain F. Zuur, Elena N. Ieno, and Erik Meesters. A Beginner's Guide to R. Use R. Springer,2009.
5. Marcello Pagano & Kimberlee Gauvreu. Principles of Biostatistics. Thompson Learning.

Suggested Readings:

1. Kaladhar D S V G K. BioJava: A Programming Guide by, 2012.
2. Jason M. Kinser. Python for bioinformatics, Jones & Bartlett Learning, 2009.
3. Curtis Jamison D. Perl Programming for Biologists, John Wiley & Sons,2003

4. James Tisdall. Mastering Perl for Bioinformatics, O'Reilly Media, Inc,2003.
5. Ronadd N Forthofer and Eun Sul Lee. Introduction to Biostatistics, Academic Press.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		**15**
Continuous Evaluation P		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3DSCZCB202: GENOMIC GUIDANCE AND PUBLIC HEALTH

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC A4	200-299	KU3DSCZCB202	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	0	0	30	70	100	2

COURSE DESCRIPTION:

Have you ever wondered how traits are transferred from one generation to another? This course explores the captivating realm of genetics, delving into the fundamental principles of inheritance, advanced diagnostic methods, and the ethical issues related to genetic information.

Course Prerequisite: Knowledge gained during the previous semesters of this programme.

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Explain the principles behind Mendel's laws and their application in Predicting inheritance patterns.	An
CO2	Applyknowledge of chromosomal anomalies to identify potential genetic disorders in humans.	E
CO3	Describe the principles and applications of different cytogenetic tools	U
CO4	Analyze the advantages and limitations of various prenatal testing options.	E
CO5	Explain then importance of accurate diagnosis and risk calculation in Genetic counselling.	E

****Remember(R),Understand(U),Apply(A),Analyse(An),Evaluate(E),Create(C)***

Mapping of Course Outcomes to PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	✓		✓		✓	✓	✓	✓
CO 2	✓		✓		✓	✓	✓	✓
CO 3	✓		✓		✓	✓	✓	✓
CO 4	✓		✓		✓	✓	✓	✓
CO 5	✓		✓		✓	✓	✓	✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Basics of Inheritance	
1	Structure and chemistry of DNA, Molecular organization of DNA Genetic Code, Mendel's laws and inheritance pattern Autosomal Dominant inheritance, Autosomal Recessive inheritance Sex linked inheritance, Co-dominance, Incomplete dominance.	**10**
	Human Karyotype and Inheritance	
2	Banding techniques, Human karyotype Chromosomal anomalies in humans- Down's syndrome, Turner's syndrome Klinefelter's syndrome In-situ Hybridization technique, Fluorescent in situ hybridization Comparative genomic hybridization.	**15**
	Molecular cytogenetics	
3	In-situ Hybridization technique, Fluorescent in situ hybridization Comparative genomic hybridization.	**10**
	Prenatal Diagnosis	

4	Prenatal diagnosis: Different methods of prenatal diagnosis, Identification of pregnancies at risk, Maternal age, Population screening, Maternal serum biochemistry (for neural tube defects, downs syndrome), Ultra sonograph Previous child with Mendelian disorder & family history of Mendelian disorders.	**20**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. (Books,Journals,E-sourcesWebsites/web links)
2. Gardner,A,Howell,RT andDaviesT.,2008.VivaBooks,New Delhi
3. MangeJEandMange AP,1994.Basic Human Genetics.Sinauer Associates, Sunderland.

Suggested Readings

1. (Books,Journals,E-sourcesWebsites/web links) https://www.genome.gov/
   National Human Genome Research Institute (NHGRI): A comprehensive website with educational resources, news, and research updates on all aspects of genetics.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		100

Any components from the above table can be taken for CE not exceeding 30 Marks

KU3DSCZCB203: HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC B3	200-299	KU3DSCZCB203	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	1.5

COURSE DESCRIPTION:

This course is designed to give a clear idea about the various organ systems in human body and their physiological functions. It also incorporates the structure of major endocrine organs and the functions of hormones secreted by them and emphasizes their role in the regulation of the functioning the organ systems It also aims at giving an idea on the common disorders associated with the organ systems. Moreover, it gives importance to practical experiments too.

Course Prerequisite: Knowledge gained during the previous semesters of this programme.

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand various organ systems in human body	U
CO2	An insight into various physiological mechanisms occurring in human body	An
CO3	Comprehend the structure of various endocrine glands and the functions and regulatory role of their hormone on the organ systems	U
CO4	Explore the major disorders associated with the organ systems as well as the endocrine disorders	U
CO5	Equip the students with practical knowledge through laboratory experiments in physiology	An

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✓		✓		✓	✓	✓	✓
CO 2	✓		✓		✓	✓	✓	✓
CO 3	✓		✓		✓	✓	✓	✓
CO 4	✓		✓		✓	✓	✓	✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Nerves and Muscles	
1	Membranes Potential, Transmission of impulse through myelinated and non myelinated nerve fibres, All or none law, Synaptic transmission Neurotransmitters (eg., Acetylcholine, Adrenaline, GABA, Dopamine Serotonin, Glycine)Skeletal muscle: Ultra structure, Mechanism of contraction and relaxation of muscle, Mention muscle proteins, Structure and function o neuromuscular junction Mention - Triad, Motor Unit, Fatigue, Simple muscle twitch, Cardiac Muscle, Smooth Muscle.	**15**
	Endocrine System	
2	Hormones- Major classes- Steroid hormones, Peptide hormones, Amino acid derivatives, General structure and functions of Pituitary, Endocrine Pancreas Adrenal glands and Thyroid gland, Mention the functions of Pineal gland Thymus and Parathyroid glands. Gastro intestinal hormones Common endocrin disorders-Dwarfism, Gigantism, Cushing Syndrome, Addison's Disease Diabetes mellitus, Diabetes insipidus, Exophthalmic goiter.	**15**
	Hormones and Reproduction	
3	Structure of Ovum and Sperm, gametogenesis Hormonal control of menstrual cycle. Hormonal control of Gestation and Parturition. Hormonal control of Lactation.	**10**

	Practicalsin Zoology	
4	i. Cardiac Efficiency Test (Harward Method) ii. Histology- Study of Permanent slides/Pictures with neat labelled sketches and notes 1. T.S. of Nerve 2. Striated Muscle 3. Cardiac Muscle 4. Smooth Muscle 5. Sperm 6. Ovum 7. C.S. of Thyroid follicle 8. Islets of Pancreas	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings

1. Barrett KE, Barman SM, Brooks HL & Yuan J X J (2019) Ganong's Review of Medical Physiology 26th Ed. Mc Graw Hill Education.
2. Hall, J. E. & Hall, M. E. (2020) Guyton and Hall Text book of Medical Physiology,14th Ed. Elsevier.
3. Geetha, N (2022) Human Physiology Jaypee Brothers Medical Publishers
4. Sherwood L (2015) Human Physiology From Cells to Systems 9th edition, Brooks/Cole Pub.
5. Sembulingam K and Sembulingam P(2022) Essentials of Medical Physiology 9th edition, Jaypee Brothers Medical Publishers

Suggested Readings:

1. Tortora GJ & Derrickson BH (2017) Principles of Anatomy and Physiology 15th edition
2. Jain A K (2019) Textbook of Physiology Avichal Publishing Company
3. Chatterjee CC (2022) Human Physiology 14th edition, CBS Publishers & Distributers
4. Bijlani RL & Manjunatha S (2010) Understanding Medical Physiology 4th edition, Jaypee Brothers Medical Publishers
5. Marya RK: Medical Physiology (2016) 4th edition, AITBS Publishers.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		**15**
Continuous Evaluation P		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3DSCZCB204- DIGITAL DNA: EXPLORING COMPUTATIONAL BIOLOGY AND BIOINFORMATICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC C3	200-299	KU3DSCZCB204	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	1.5

COURSE DESCRIPTION:

This course delves into the major algorithms used in computational biology essential for analyzing biological data. Students will acquire fundamental knowledge of bioinformatics algorithms and gain practical experience in implementing scripts using BioPerl, Biopython, MATLAB, and R. The course is designed for students with a background in biology, computer science, or related fields, aiming to provide the tools necessary to address complex bioinformatics challenges and analyze sequence information of macromolecules effectively.

Course Prerequisite: A background in biology, computer science, or a related field.

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Able to gain fundamental knowledge about the major algorithms used in computational biology	U
CO2	Able to implement scripts of BioPerl and Biopython in analysis of sequence information of macromolecules	A
CO3	Able to implement MATLAB programming for bio-statistical applications	A
CO4	Able to apply R- programming concepts to extrapolating functional information of macromolecules	A

* ***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1		✓		✓			✓	
CO 2		✓						
CO 3						✓	✓	✓
CO 4		✓						

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to BioPerl & BioPython	
1	1. Major Algorithms in Computational biology: PERL Basics of Perl Introduction to BioPerl and BioPerl Objects - Brief descriptions (Seq, PrimarySeq, LocatableSeq). 2. Major Algorithms in Computational Biology-Python: Introductio to python. Python basics – Variables, Operators, Data types an Assignments. Statements – Input/output statements, BioPython i Computational biology (Brief description)	**15**
	Introduction to NCBI Tool Kit, MATLAB	
2	1. Major Algorithms in Computational Biology- Introduction to the NCBI C++ Toolkit 2. Major Algorithms in Computational Biology-MATLAB: Introduction to MatLab and molecular forces. 3. Biostatistics- Scope of biostatistics: definition, data collection, presentation of data, Sampling & selection bias, probability sampling, random sampling, sampling designs. Descriptive statistics, Bi-Variate Distribution.	**10**
	Introduction to R language	

3	1. Overview of the R language: Defining the R project, Obtaining R Generating R codes, Scripts, Text editors for R, Graphical Use Interfaces (GUIs) for R, Packages. R Objects and data structure Variable classes, Vectors and matrices, Data frames and lists, Dat sets included in R packages.	**15**
	Practical inComputational Biology	
4	1. Retrieving and Displaying a DNA Sequence from NCBI using BioPerl. 2. Calculation of mean, median, mode, standard deviation, variance, standard error, coefficient of variation for a variable. 3. Construction of bar diagram, pie diagram, line diagram, histogram and box plot for a data.	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. John Lewis, Peter Joseph DePasquale, Joseph Chase, Joe Chase. Java Foundations by Addison- Wesley, 2010.
2. D. Curtis Jamison. Perl Programming for Biologists by, Wiley-IEEE, 2003.
3. Mitchell L Model. Bioinformatics Programming Using Python by, O'Reilly Media, Inc., 2009.
4. Alain F. Zuur, Elena N. Ieno, and Erik Meesters. A Beginner's Guide to R. Use R. Springer,2009.

Suggested Readings:

1. Kaladhar D S V G K. BioJava: A Programming Guide by, 2012.
2. Jason M. Kinser. Python for bioinformatics, Jones & Bartlett Learning, 2009.
3. Curtis Jamison D. Perl Programming for Biologists, John Wiley & Sons,2003
4. James Tisdall. Mastering Perl for Bioinformatics, O'Reilly Media, Inc,2003.

Assessment Rubrics:

Theory

	Evaluation Type	Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

	Evaluation Type	Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3VACZCB201- LIFE SCIENCES & BIOINFORMATICS: DECODING THE BLUEPRINT OF LIFE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	VAC 1	200-299	KU3VACZCB201	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	1	0	15L+10P	35L+15P	75	1.5

COURSE DESCRIPTION:

This value-added course introduces undergraduate students to computational methods for diagnosing human diseases. It covers the identification of disease-associated genes, gene prediction, pathway analysis, and network biology. Students will explore both common (e.g., cancer, diabetes) and rare genetic diseases (e.g., mitochondrial disorders) using bioinformatics tools and databases. Hands-on sessions with platforms like DisGeNET, GSEA, STRING, and GTEx will equip students with practical skills in disease gene discovery and data integration.

Course Prerequisite: Nil

COURSE OUTCOMES:

	Expected Outcome	Learning Domains
CO1	Understand and explain computational methods used to identify disease-associated marker genes in various common human diseases such as cancer, diabetes, cardiovascular diseases, and chronic kidney disease.	U
CO2	Apply gene prediction algorithms (ab-initio and homology-based) and interpret the significance of genetic variants using curated clinical databases such as ClinVar and dbSNP.	A/An
CO3	Perform gene enrichment and pathway analysis using tools like KEGG, Reactome, and GSEA to elucidate the molecular basis of rare genetic and neurodegenerative disorders.	A/An
CO4	Construct and analyze molecular interaction and gene co-expression networks using STRING, Cytoscape, and WGCNA, integrating multi-omics data for systems-level understanding of disease biology.	An/E
CO5	Develop hands-on proficiency in using publicly available databases and software platforms for expression analysis (e.g., GTEx, GEO) and disease modeling with real-world case studies, especially in mitochondrial and chronic diseases.	A/C

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✓	✓		✓				
CO 2		✓	✓			✓		
CO 3		✓		✓				✓
CO 4			✓	✓	✓			✓
CO 5		✓			✓	✓	✓	

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Computational Diagnosis of Common Human Diseases	
1	1. Identification and analysis of disease-specific marker genes-: Cancer, Diabetes Mellitus, Cardiovascular Diseases (CVD), Chronic Kidney Disease (CKD). 2. Sequence similarity-based gene discovery (e.g., BLAST, FASTA). 3. Ab-initio gene prediction tools (e.g., GENSCAN, AUGUSTUS). 4. Pathway analysis using KEGG, Reactome. 5. Gene Set Enrichment Analysis (GSEA). 6. Construction and interpretation of molecular interaction networks.	**10**
	Computational Diagnosis of Rare Genetic Diseases	
2	1. Gene enrichment analysis for neurodegenerative disorders- Parkinson's Disease, Alzheimer's Disease, Muscular Dystrophy 2. Supervised and unsupervised learning approaches for gene selection (e.g., Random Forest, PCA, K-means) 3. Interpreting genetic variants using databases (e.g., ClinVar, dbSNP). 4. Microarray and RNA-Seq data analysis. 5. Gene clustering and biological network construction. 6. Integration of multi-layered data for disease modeling.	**10**

Computational Approaches to Mitochondrial Diseases		
3	1. Focus on Mitochondrial Encephalopathy, MIDD (Maternally Inherited Diabetes and Deafness)-mitochondrial genetics and inheritance. 2. Multi-omics data integration (genomics, transcriptomics proteomics, metabolomics). 3. Gene co-expression network analysis (e.g., WGCNA). 4. Genome-scale metabolic modeling (e.g., COBRA toolbox). 5. Applications of CRISPR-Cas in mitochondrial genome editing. 6. Case Study in Computational Diagnosis- Chronic Kidney Disease (CKD)- Disease-specific gene and biomarker selection Next-Generation Sequencing (NGS) data analysis pipelines.	**10**
4	1. Identification of Disease-Associated Genes Using DisGeNET and OMIM. 2. Gene Set Enrichment Analysis (GSEA) Using Web-Based DAVID. 3. Molecular Network Construction Using STRING and Cytoscape 4. Expression Profile Analysis Using GTEx and GEO Datasets.	**10**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. Cannataro M, Pietro Hiram Guzzi Agapito G, Zucco C, Milano M. Artificial Intelligence in Bioinformatics, Elsevier, 2022.
2. Setubal JC, Waldeyr Mendes Silva. Advances in Bioinformatics and Computational Biology, Springer Nature, 2020.
3. Glaab E. Computational systems biology approaches for Parkinson's disease. Cell and tissue research, 2018.
4. Jayaraj JM, Kuriakose BB, Alhazmi AH, Muthusamy K. Structural and functional insights on vitamin D receptor and CYP24A1 deleterious single nucleotide polymorphisms: A computational and pharmacogenomics perpetual approach. Cell Biochemistry and Function, 2021.

Suggested Readings:

1. Zvelebil, Marketa, Jeremy O Baum. Understanding Bioinformatics, published by Garland Science, 2008.
2. Pevsner, Jonathan. Bioinformatics and Functional Genomics. 3rd edition, published by Wiley-Blackwell, 2015.
3. Brown, Stuart M. Next-Generation DNA Sequencing Informatics. published by Cold Spring Harbor Laboratory Press, 2015.

4. Alberts Bruce, Johnson Alexander, Lewis Julian, Morgan David, Raff Martin, Roberts Keith, Walter Peter. Molecular Biology of the Cell, 6th Edition. Garland Science, 2015.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**35**
Continuous Evaluation		**15**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**50**

Any components from the above table can be taken for CE not exceeding 15 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

SEMESTER IV

KU4DSCZCB205: CELL BIOLOGY AND IMMUNOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC A5	200-299	KU4DSCZCB205	4	75

Learning Approach(Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	1.5

COURSE DESCRIPTION:

This course provides students with comprehensive knowledge about the cell, the fundamental unit of life. It is designed to help students understand the functions of cellular components in supporting all life processes. Through this course students will gain an in-depth understanding of the immune system and its role in animal biology. The course delves into the intriguing field of immunology, explaining the body's remarkable defense mechanisms. It aims to equip students with a foundational grasp of immunology, offering valuable insights into how the body defends itself and maintains health. The historical roots and fundamental principles of immunology are covered in this course. Participants will gain a thorough understanding of the key players in the immune system, including the organs and cells, and the mechanisms that protect the body. The course explores different types of immunity and examines how the immune system mounts primary and secondary responses to combat invaders and adapts throughout our lives.

Course Prerequisite: Knowledge gained during the previous semesters of this programme

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand the role of cells in supporting life and grasp the functions of cellular organelles.	U
CO2	Gain knowledge of the basic principles of inheritance.	U
CO3	Identify abnormal cellular structures and functions linked to diseases like cancer, infections, and genetic disorders.	An
CO4	Comprehend the immune system of animals and its application for human health.	An

**Remember(R),Understand(U),Apply(A),Analyse(An),Evaluate(E),Create(C)*

Mapping of Course Outcomes to PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	✓		✓		✓	✓	✓	✓
CO 2	✓		✓		✓	✓	✓	✓
CO 3	✓		✓		✓	✓	✓	✓
CO 4	✓		✓		✓	✓	✓	✓
CO 5	✓		✓		✓	✓	✓	✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Overview of Cells and Structure & Function of Cell organelles	
1	Cell types- Prokaryotic & Eukaryotic cell, Virus & Mycoplasma.Plasma membrane: Structure (Fluid mosaic model), Functions (Transport & Cytosis), Cytoskeleton: Microtubules, microfilaments, intermediat filaments, Mitochondria: Structure, oxidative phosphorylation, electron transport chain, Endosymbiotic hypothesis, Peroxisomes-Function Nucleus-structure, nuclear envelop, nucleolus, nuclear pore complex Functions. Types of Chromosomes, Chromatin-Euchromatin & heterochromatin, Nucleosome concept.	15
	Cell Reproduction and Cancer	
2	Cellcycle, Mitosis, Meiosis Cancer- Types, Characteristics, Cancer Therapy	10
	Immunology	
3	Types of Immunity- Natural and Acquired immunity, Active and passive immunity, Cell mediated immunity, Humoral immunity. Immune response Primary immune response, Secondary immune response Cells and Organs of Immune System, Thymus. Spleen, Lymphnodes, Mucosa Associated Lymph Tissue, Tcells, BCells, Granulocytes, Mast Cells& Dendritic Cells Antibody- structure, Immune Disorders- Types of hypersensitivity I,II,III&IV, Brief accounts of allergy and anaphylaxis, AIDS, SCIDS, Autoimmunity-System specific, Organ specific,	15

	Vaccination-Definition, principles, Vaccines-types (Brief account National Immunization Programme, BCG, DPT, OPV Transplantation Immunology-Types of grafts, Graft rejection, Prevention of Graft rejection Immunotherapy. Immunological Techniques- ELIZA, RIA	
	Practicals in Zoology	
4	1. Blood Grouping (ABO & Rhfactor) 2. Histology Slides-Lymphocyte, Thymus, Tonsil, Spleen, 3. Studyof mitotic stages – Onion root tip squash preparation. 4. Staining of buccal epithelial cells. 5. Preparation of blood Smear and identification of anythree WBCs	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. De Roberties, E. D. P. et al.: Cell and Molecular Biology 7th/8th edition TMH
2. Freifelders Essentials of Molecular Biology, 4thEd (2015)
3. Gerlad Karp: Cell and Molecular Biology 6th/7th edition Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments VI edition. John Wiley and Sons.Inc.
4. Koshy Thomas& Joe Prasad Mathew (Editors)(2011)Cell Biology and Molecular Biology.
5. Rastogi S. C. (1998) Cell Biology. Tata Mc. Graw Hill Publishing Co., New Delhi.
6. Ali, S (2014) The Cell: Organization Function and Regulatory Mechanisms, Pearson
7. Rastogi V. B.(2016): Principles of Molecular Biology, 2nd edition Med Tech Science Press
8. Kindt TJ (2006) Kuby Immunology, Publisher: W H Freeman & Co
9. Chakravarty (2006) Immunology and Immunotechnology
10. Joshi KR (2007) Immunology
11. Tizard IR (2006) Immunology: An Introduction, Publisher: Cengage Learning
12. Khan (2009) Elements of Immunology, Publisher: Dorling Kindersley(India)

Suggested Readings:

1. Karp GIJ & Marshall W (2020) Karp's Cell and Molecular Biology.
2. Rastogi VB(2021) Cell Biology, 1st edition Med Tech Science Press
3. Watson JD (2014) Molecular Biology of the Gene. Pearson. 7th Edition. (ForModules 3 & 4)
4. Cooper GM. The Cell: A Molecular Approach. 2nd edition. Sunderland (MA):Sinauer Associates; 2000.

5. Alberts B, Johnson A, Lewis J et al. Molecular Biology of the Cell. 4th edition. New York: Garland Science; 2002.
6. Brown TA. Genomes. 2nd edition. Oxford: Wiley-Liss; 2002.
7. Lodish, H, Berk A, Matsudaira P, Kaiser CA, Krieger M, Scott MP et al.(2005) Molecular cell biology. 5th Edition, W.H. Freeman and Co., New York.
8. Panicker S & Abraham G (2008) Microbiology and Immunology, Zoological Society of Kerala, Kottayam.
9. Abbas, Basic Immunology, 3rd Edition, Elsevier
10. Yada PR (2004) Immunology, Discovery Publishing House
11. Marcus DA, Goldsby RA, Osborne BA (2003) Immunology, WH Freeman & Co.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		**Marks**
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5

d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4DSCZCB206- STRUCTURAL PERSPECTIVES OF PROTEINS-PROTEIN BIOINFORMATICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC A6	200-299	KU4DSCZCB206	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	1.5

COURSE DESCRIPTION:

This course offers a comprehensive introduction to Structural Bioinformatics, focusing on the relationship between biomolecular structure and function. It covers the hierarchical organization of protein structures, including motifs, folds, and domains, and introduces key structure databases such as PDB, SCOP, and CATH. Students will explore molecular interactions, protein–DNA binding, and the principles behind experimental techniques like X-ray crystallography and NMR. Practical sessions emphasize structure prediction, evolutionary analysis, and structural data interpretation using computational tools. Hands-on computational exercises, preparing students for advanced studies or careers in structural biology, drug design, and computational life sciences.

Course Prerequisite: Basic knowledge in biology and bioinformatics.

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand the levels of protein structure and the correlation between amino acid properties and protein function.	U
CO2	Interpret and utilize structural bioinformatics databases such as PDB, CATH, and SCOP for protein structure classification and evolution.	A
CO3	Analyze the hierarchical organization of protein architecture including helices, sheets, motifs, folds, and domains.	An
CO4	Explain biomolecular interactions and their underlying forces, especially in protein-protein and protein-DNA binding contexts.	U
CO5	Describe the principles and methodologies of experimental techniques like X-ray crystallography and NMR used for structural determination.	U
CO6	Perform hands-on computational tasks including structure prediction, phylogenetic analysis, and quality assessment of molecular models.	A/E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✓		✓					
CO 2		✓	✓			✓		
CO 3	✓		✓					
CO 4			✓	✓				
CO 5	✓				✓			
CO 6		✓			✓	✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to Structural Bioinformatics	
1	1. Protein Structure Levels and Their Biological Significance: Amino acids fundamental building blocks, Peptide bond, rigid plana peptide unit, cis and trans configuration, Physical properties o amino acids. Protein Function: Relationship between structure and function. 2. Data representation and Databases- PDB, mmCIF and othe formats, structure based databases for proteins and nucleic acids Comparative features-the CATH domain structure Database Protein structure evolution and the SCOP Database.	**15**
	Structural Hierarchy	
2	1. Structural Hierarchy: Helices – Classic α- Helix and π Helices, Left Handed α-Helix and Collagen Helix. β-Sheets -β-sheets - paralle and Anti-parallel, Turns and Loops. Super secondary and Tertiary structure and Quaternary Structure, Quaternary Structure Complex 3D Networks. Motifs and domains.	**10**

	2. Classes in Protein Architecture – Folds, α-Class, Bundles, Folded leaves, Hairpin arrays. β- Class folds, Anti-parallel β domain parallel and Anti-parallel Combinations. α/β and α+β- Class, α/β Barrels, Open twisted α/β folds, Leucine-rich α/β folds. α+β fold Quaternary structure. 3. Overview of the prediction of primary, secondary and tertiary structure of proteins with suitable computational biology tools.	
Biomolecular Interactions		
3	1. Intermolecular Interactions Protein-protein interactions, protein – DNA interactions, DNA binding proteins, Types of interactions o DNA with proteins and small molecules. Different forces involved in the interactions. Molecular Docking (Brief description). 2. Introduction to X-ray Crystallography: Crystal system, Bragg's law, diffraction of crystals, structure factor, atomic scattering factor, crystallization, data collection, structure solution and refinement, Structure validation. NMR Spectroscopy.	**15**
Practicals in computational biology		
4	1. Phylogenetic and evolutionary analysis of molecular sequences- Phylogenetic tree building and evaluation 2. Compare structural classification using SCOP and CATH databases. 3. Prediction of secondary structures of proteins and disordered regions 4. Prediction of secondary structures and folding of RNA. 5. Analyze structural quality and features from X-ray crystallographic data.	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. Bourne, PE, and H. Weissig. Structural Bioinformatics Wiley-Liss, 2003.
2. Hans-Dieter Höltje, Wolfgang Sippl, Didier Rognan. Molecular Modeling, Gerd Folkers, 2008.
3. Alberte Pullman. Modeling of Bimolecular Structures and Mechanisms, Joshua Jortner, 1995.
4. Jill P. Mesirov, Klaus Schulten, De Witt L. Sumners. Mathematical Approaches to Biomolecular Structure and Dynamics by, 1996.

5. Peter T. Cummings, Phillip R, Westmorland, Brice Carnahan. Foundations of Molecular Modeling and Simulation by, Published by American Institute of Chemical Engineers, 2001.

Suggested Readings:

1. Nicolas Claude Cohen, Guidbook on molecular modeling in drug design Academic Press. Elsevier, 1996.
2. Tamar Schlick. Molecular Modeling and Simulation: An Interdisciplinary Guide: An Interdisciplinary Guide. Second Edition, Springer. 2010.
3. Tamar Schlick, Innovations in Biomolecular Modeling and Simulations, Volume 2, RSC Publishing. 2012.
4. Timothy J. Barth, Michael Griebel, David E.Keyes, Risto M. Nieminen, Dirk Roose, Tamar Schlick. New Algorithms for Macromolecular Simulation by, Published by Springer, 2006.
5. Pesole G, Frascotti P, Gissi C, Licciulli G, Saccone C. Bioinformatics for beginners: Genes, genomes, molecular evolution, databases and analytical tools. Wiley-Blackwell, 2008.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type	Marks

End Semester Evaluation P		**15**
Continuous Evaluation P		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4DSCZCB207- GENOMICS AND PROTEOMICS: MAPPING THE BLUEPRINT OF LIFE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC A7	200-299	KU4DSCZCB207	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	1.5

COURSE DESCRIPTION:

This course introduces the fundamental concepts of genomics, proteomics, and genetic mapping. It covers key techniques such as gene mapping, DNA polymorphism, protein separation methods (SDS-PAGE, 2D electrophoresis), chromatography, and mass spectrometry (HPLC-MS, MALDI-TOF MS). Students will learn classical and modern DNA sequencing methods, including Sanger and Next Generation Sequencing, as well as applications of microarrays, PCR, cDNA library construction, and functional genomics tools. The course prepares students for advanced studies in molecular biology and biotechnology.

Course Prerequisite: Knowledge gained during the previous semesters of this programme.

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand the fundamental principles of genomics, proteomics, and metabolomics.	U
CO2	Explain genetic mapping techniques and the application of genetic markers.	U
CO3	Apply protein analysis techniques such as SDS-PAGE, 2D electrophoresis, and mass spectrometry.	A
CO4	Analyse various DNA sequencing methods including Maxam-Gilbert, Sanger, and Next Generation Sequencing.	An
CO5	Evaluate and integrate molecular biology tools such as PCR, cDNA library construction, microarrays, and ESTs in genomics research.	E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✓			✓				
CO 2	✓				✓			
CO 3			✓			✓		
CO 4		✓	✓					
CO 5		✓			✓			✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to Genomics, Proteomics and Metabolomics	
1	1. Introduction to Genomics, Proteomics and Metabolomics, - geneti mapping, linkage mapping, types of genetic mapping, 2. Application of gene mapping, genetic markers, application of genetic markers, DNA polymorphism-SNP, DNA typing. 3. Overview of genome, genome sequence acquisition and analysis comparative homologies, evolutionary changes, Microarrays sequence specific tags, sequence tagged sites, ISH, FISH. Application.	**15**
	DNA sequencing	
2	1. DNA sequencing: Maxam and Gilbert method, Sanger method Ladder, Fluorescent, Shotgun, Automation DNA sequencing Implications of DNA sequencing. Basics about Next Generation Sequencing. Southern blotting, Northern blotting. 2. Construction of cDNA and genomic DNA libraries; Polymerase Chain Reaction (PCR), Yeast two-hybrid system, SAGE Adaptation for Downsized Extract (SADE), ESTs.	**10**

	Protein digestion techniques	
3	1. SDS-PAGE, 2D-Electrophoresis, Isoelectric focusing (IEF) Chromatography, basic principles, normal phase and reverse phase chromatography, High Performance Liquid Chromatography- 2. Mass Spectroscopy (HPLC-MS). MALDI TOF MS. Tools for the analysis- use and application of these techniques.	**15**
	Practicals	
4	1. Demonstration of Plant Genomic DNA isolation. 2. In silico analysis of SNPs and DNA typing using NCBI dbSNP and BLAST tools. 3. Genome exploration and gene mapping using the Ensembl Genome Browser. 4. Virtual restriction digestion and gel electrophoresis using NEBcutter online tool. 5. Simulation of peptide mass fingerprinting using MALDI-TOF MS with Expasy tools. 6. PCR simulation and amplification of DNA using an interactive virtual lab platform.	**30**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. Leibler DC. 2002. Introduction to proteomics, tools for the new biology. Humana press.
2. Hunt SP, Livesey FJ, 2000. Functional genomics, Oxford University press.
3. Cantor CR, 1999. Genomics. John Wiley, NY.
4. Westermier R, Naven T, 2002. Proteomics in practice: A laboratory manual of proteome analysis. John Wiley- VCH.

Suggested Readings:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education.
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley.
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi.
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		**15**
Continuous Evaluation P		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks.

KU4VACZCB202: ETHICS IN BIOLOGICAL RESEARCH

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	VAC2	200-299	KU4VACZCB202	3	45

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE(Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	1	0	15L+10P	35L+15P	75	1.5

COURSEDESCRIPTION:

The course will cover the basics of ethical concerns in biological research and provide updates on research ethics guidelines. It will address ethical dilemmas that arise during research activities and the outcomes of research. Specifically, the course consists of modules on: Best practices and misconduct in science; research involving human subjects, research involving animals, and emerging biotechnologies. As an applied ethics course, the focus within these areas will involve describing typical practices in biological research, examining ethical principles, professional standards, and legal frameworks that influence responsible research conduct, and fostering ethical problem-solving abilities.

Course Prerequisite: Nil

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Gain an understanding of ethical concerns in experiments involving animals and humans.	U
CO2	Acquire knowledge regarding the regulations and ethical considerations in research and publishing.	U
CO3	Investigate alternative methods such as simulation, informatics, and organs-on-chips	An
CO4	Assess the advantages and disadvantages of animal and human experimentation, genome research, and stem cell research.	An
CO5	Develop skills in debating and creating animations, videos, and edits for biological research.	A

****Remember(R), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C)***

Mapping of Course Outcomes to PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	✓		✓		✓	✓	✓	✓
CO 2	✓		✓		✓	✓	✓	✓
CO 3	✓		✓		✓	✓	✓	✓
CO 4	✓		✓		✓	✓	✓	✓
CO 5	✓		✓		✓	✓	✓	✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction	
1	Importance of ethics in Biological Research, Conflicts of interest. Scientific misconduct: fabrication, falsification, plagiarism. Ethical Issues associated with Gender Bias: Forms of gender discrimination, Value of a gender approach	5
	Publication Ethics	
2	Publication Ethics: Selective reporting, misinterpretation of data. Redundant publications: Duplicate and overlapping publications, Journal finder tools-JANE, Elsevier Journal finder, Springer, Journal suggester. Plagiarism software-Turnitin, Urkund. Predatorypublications and journal Databases and Research Metrices :Indexing databases. Web of Science: Scopus, PubMed, Google scholar; Journal citation report, Impact factor. Metrices -hindex, G index, i10index.	10

	Research Involving Animals	
3	The use of animals in basic biological research, Study of human disease genetically modified animals in the study of human diseases and disorders Role of ethics committee. Safe disposal of animal wastes Pros and cons of anima experimentation-Impact of experimentations on animals. Ethics, Principles and legislation in animal experimentation- Principle of the 4R's-Reduction, Refinement, Replacement and Responsibility; Legislation regulation and policy relating to scientific procedures on animals; Choice o the animal model; Housing and environmental enrichment. Relevance o animal experimentations and possible alternatives Ethics of research involving humans.	**15**
4	1. Studyof Journal finder tools-JANE, Elsevier Journal finder, Springer, Journal, suggester 2. Plagiarism software-Turnitin, Urkund 3. Web of Science : Scopus, PubMed, Google scholar.	**10**
5	**Teacher Specific Module**	**5**

Essential Reading:

1. Muralidhar K,Ghosh A, Singhvi AK(Ed.) 2019.Ethics in Science Education, Research and Governance. Indian National Science Academy, NewDelhi. 137pp.CSIR Guidelines for Ethics in Research and in Governance 2019.
2. Resnik DB(1998) The Ethicsin Science-an introduction. Routledge, NewYork,1998.

Suggested Readings:

1. Mathaiyan J, Chandrasekaran A, Davis S (2013) Ethics of genomic research. Perspect Clin. Res. 4(1):100-4. doi: 10.4103/2229-3485.106405. PMID: 23533991; PMCID:PMC3601693.
2. Gupta JA (2013) Ethical issues and challenges in bioethics education from a gender perspective. UNESCO: International Conference on Gender and Bioethics, Kazan, Russian Federation.
3. Kiani AK, Pheby D, Henehan G, Brown R, Sieving P, 2022. Ethical Considerations regarding animal experimentation. J Prev Med Hyg;63(suppl.3): E255- E266.
4. Denzin,NK(1994) Hand Book of Qualitative Research. New Delhi: Sage Publications.
5. Mathur R, ICMR (2017) Ed. National ethical guidelines for biomedical and health research involving human participants: Eds.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**35**
Continuous Evaluation		**15**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**50**

Any components from the above table can be taken for CE not exceeding 15 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4VACZCB203- INFORMATICS AND METHODS IN DRUG DESIGN

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	VAC 3	200-299	KU4VACZCB203	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	1	0	15L+10P	35L+15P	75	1.5

COURSE DESCRIPTION:

This value-added course introduces students to the foundational concepts and applications of pharmacoinformatics in modern drug design. It covers drug classification, sources, and screening filters, and explores essential informatics tools and databases used in the identification and analysis of bioactive compounds. Students will learn about various drug targets, drug-target interactions, and networks, along with key principles of pharmacokinetics and pharmacodynamics. The course is strengthened by hands-on computational biology practicals focusing on compound retrieval, drug-likeness prediction, target analysis, and molecular docking.

Course Prerequisite: Nil

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Understand the basic principles, scope, and applications of pharmacoinformatics in drug discovery.	U
CO2	Classify drugs based on their origin and properties and apply common filters used in drug design.	A
CO3	Utilize informatics approaches to explore drug targets and analyze drug-target interactions.	A/An
CO4	Interpret key pharmacokinetic and pharmacodynamic models relevant to drug action and metabolism.	An/U
CO5	Perform computational tasks including compound retrieval, drug-likeness evaluation, target identification, and molecular docking.	A/C

* ***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✓			✓				
CO 2	✓					✓		
CO 3		✓		✓		✓		
CO 4	✓		✓			✓		
CO 5		✓			✓	✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Foundations of Pharmacoinformatics and Drug Discovery	
1	1. Basics of pharmacoinformatics: Definition, branches, scope and applications. 2. Concepts of drugs: Classification, Major sources, Common filters for drugs design. 3. Data Mining Tools and Databases for Drug Design-PubChem, ChEMBL, and PhytoChem DB for data mining and compound selection.	**10**
	Informatics Approaches to Drug Targets and Drug-Target Interaction	
2	1. Classification of drug targets: intrinsically disordered proteins, ion channels, chromatin-associated proteins, noncoding RNA membranes; Drug-target interactions, Drug-target network.	**5**
	Pharmacokinetics & Pharmacodynamics	

3	1. Overview, One-compartment model, Two-compartment model Multi-compartment models, Pharmacokinetic parameters Bioavailability. 2. Drug receptor action, direct physiological action, Drug-drug interactions, drug metabolism, Drug potency and efficacy, Therapeutic index.	**15**
4	1. Retrieve and analyze bioactive compounds from chemical and phytochemical databases. 2. Evaluate the drug-likeness and pharmacokinetic properties of selected compounds. 3. Identify potential drug targets and study drug-target interactions through network analysis. 4. Molecular docking and interpret ligand-receptor binding interactions.	**10**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. Durai Ananda. Elementary Pharmacoinformatics, BSP 2014.
2. Tagelsir Mohamed Gasmelseid. Pharmacoinformatics and Drug Discovery Technologies: Theories and Applications: Idea Group,U.S.; 1 edition 2012
3. Sara E Rosenbaum. Basic Pharmacokinetics and Pharmacodynamics: An Integrated Textbook and Computer SimulationsWiley; 1 edition 2011.
4. Thomas N. Tozer PharmD, Malcolm Rowland. Introduction to Pharmacokinetics and Pharmacodynamics: The Quantitative Basis of Drug Therapy 1st Edition LWW; 1 edition, 2006.

Suggested Readings:

1. Gringauz A. Introduction to Medicinal Chemistry: How Drugs Act and Why, Wiley-VCH, 1997.
2. Katzung BG. Basic and Clinical Pharmacology (13th ed.), McGraw-Hill Education, 2015.
3. Bender A and Gul S. Chemogenomics and Chemical Genetics, Springer,2011
4. Schneider G. Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery. Humana Press. 2004.
5. Azzopardi L M. Validation Instruments for Community Pharmacy: Pharmaceutical Care for the Third Millennium. CRC Press, 2000.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**35**
Continuous Evaluation		**15**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**50**

Any components from the above table can be taken for CE not exceeding 15 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4SECZCB201: APICULTURE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	SEC1	200-299	KU4SECZCB201	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	1	0	15L+10P	35L+15P	75	1.5

COURSE DESCRIPTION:

This course aims to provide an introduction to beekeeping with a focus on honey bees. Participants will learn about honey bee biology and how to care for them throughout the year. The course will cover how to identify common honey bee diseases and pests, along with treatment methods. Additionally, it will include the history of bees and an overview of apiculture. By the end of the course, students will be equipped to manage honey bee colonies for optimal health and honey production.

Course Prerequisite: Nil

COURSE OUTCOMES:

	Expected Outcome	**Learning Domains**
CO1	Gain a comprehensive understanding of apiculture principles.	U
CO2	Study and analyze the behaviour of honey bees in their natural habitat and recognize the critical role of honey bees in preserving biodiversity	An
CO3	Learn the construction methods of artificial beehives and master the techniques for maintaining beehives to ensure bee health and productivity	U
CO4	Explore the economic value of honey, beeswax, and venom understand their uses in various industries and their market demand.	U

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✓		✓		✓	✓	✓	
CO 2	✓		✓		✓	✓	✓	
CO 3	✓		✓		✓	✓	✓	
CO 4	✓		✓		✓	✓	✓	

COURSE CONTENTS

Contents for Classroom Transaction:

Module	Description	Teaching Hours
	Introduction to Bee Keeping	
1	History of bee keeping- Scope of Apiculture, Life cycle of Honey bee Classification of honey bee (Rock bee, Little Bee, Dammer bee), Socia organization of Honey bee, Functions of Queen, drones and worker bee in a colony, Food of the bee- Honey and pollen-royal jelly, Feeding methods Artificial feeding.	**10**
	Principles of Apiculture	
2	Bee keeping methods: Primitive bee keeping- Wall hive, Pot hive, log hive bamboo hive, Modern bee keeping-Langstroth hive, Newton hive Swarming, Types of swarming, Prevention and control, Queen rearing Principles and procedure.	**10**
	Products and Enemies of Honey Bee	
3	Honey: Collection and Extraction, Preservation and Storage, Chemical composition, Nutritive value, Medicinal values, Honey as daily food, Bee wax, Bee wax production, Extraction of Bees Wax- Characteristics and uses of Wax, Bee Venom, Collection method, Composition of bee venom. Uses of Bee venom, Enemies of bees: Mites, Greater wax moth, lesser wax moth, ants, wasps, beetles, birds and their management, Diseases of bees: adult and brood diseases- Bacterial, Fungal, Viral & Protozoan. Prevention and control of diseases of Bees.	**10**

4	Mount Honey Bee mouth parts Mount Honey Bee pollen basket Identification of Queen, Worker and Drone Demonstration of honey extraction	**10**
5	**Teacher Specific Module**	**5**
	Directions	

Essential Readings:

1. Arumugam N, Murugan T, Rajeshwar J and Prabhu R (2011) Applied Zoology. Nagercoil: Saras Publications.
2. Singh S (1962) Bee Keeping in India, KAR Delhi.

Suggested Reading:

1. Johnson J and Chandra J I (2005) Apiculture. Marthandam: Olympic Grafix.
2. Sharma P and Singh L (1987) Hand book of bee Keeping, Controller Printing and Stationery, Chandigarh.
3. Stephen R (1998) Introduction to Bee Keeping, Vikas Publishing house, NewDelhi.
4. Nagaraja N and Rajagopal D (2009) Honey bee diseases, Parasites, Pest, Predators and their Management. MJP publishers, Chennai.

Assessment Rubrics:

Theory

Evaluation Type		**Marks**
End Semester Evaluation		**35**
Continuous Evaluation		**15**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**50**

Any components from the above table can be taken for CE not exceeding 15 Marks

Practicals

Evaluation Type	**Marks**
End Semester Evaluation **P**	**15**

Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks