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

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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

# 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<br>2. Branches of Life Sciences | **2** |
| | **Biomolecules** | |
| **2** | 1. Micro, macro & trace elements/ mineral ions<br>2. Water – molecular structure & dipolar nature, dissociation<br>3. Concept of pH, buffers, Henderson- Hassel Balch equation, biological functions of water<br>4. Macromolecules - Classification of carbohydrates, biological functions of carbohydrates<br>5. Classification of amino acids<br>6. Structural levels of proteins – primary, secondary, tertiary, and quaternary structure, Classification of proteins, biological importance of proteins and amino acids.<br>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.<br>2. Concept of active sites<br>3. Mechanism of enzyme action (lock and key & induced fit hypothesis)<br>4. Factors influencing the velocity of enzyme action- effect of pH, temperature,enzyme and substrate concentration<br>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<br>2. Qualitative tests for identification of carbohydrates, proteins and lipids.<br>3. Separation of amino acids (or any other compounds) from a mixture by using Paper Chromatography (Demonstration).<br>4. Estimation of glucose by colorimeter (Demonstration)<br>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<br>Plasma Membrane & Cytoskeleton: Plasma membrane: Structure (Fluid mosaic model), General Functions, Cytoskeleton: Microtubules, Microfilaments, Intermediate filaments<br>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<br>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<br>2. Study of mitotic stages – Squash preparation of onion root tip<br>3. Staining of buccal epithelial cells.<br>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<br><br>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)<br><br>Animal Distribution (Zoogeography):, Disjunct distribution, Distribution by dispersal, Distribution by vicariance, Continental drift theory<br><br>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)<br>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<br><br>2. Nutrient Cycling: Carbon cycle, Nitrogen cycle, Phosphorus cycle | **20** |
| | **Biodiversity and Community Ecology** | |

| | | |
|---|---|---|
| **3** | 1. What is biodiversity?<br>2. Types of diversity: Genetic Diversity, Species diversity, Ecosystem diversity<br>3. Biodiversity Hotspots<br>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<br>2. Conservation of genetic diversity of populations and species: Management plans for invasive species, In situ conservation & ex-situ conservation and reintroduction,<br>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<br>Micronutrients: Vitamins and Minerals, Pre and Probiotics, Organic Foods, Phytochemicals and Antioxidants<br>Introduction to Nutraceuticals- Classification, Uses and Roles | **10** |
| | **Basal Metabolism** | |
| **2** | Basal Metabolic Rate (BMR) and Resting Metabolic Rate (RMR)<br>Factors affecting BMR, Daily Energy Expenditure<br>Xenobiotics- Definition, Examples<br>Body Mass Index (BMI | **10** |
| | **Malnutrition** | |
| **3** | Malnutrition-Definition, Causes<br>Gastrointestinal Disorders- Lactose Intolerance, Food Poisoning<br>Vitamin Deficiency Diseases- Anaemia, Rickets, Scurvy, Goitre | **10** |
| | **Lifestyle Diseases** | |
| **4** | Lifestyle Diseases- Definition, brief overview<br>Diabetes mellitus, Coronary Artery Disease, Obesity<br>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.<br>2. Types of Biological data- Genomic DNA, cDNA, rDNA, ESTs, GSSs<br>3. Biological Databases- Primary Databases: nucleotide and protein sequence databases, Secondary Databases, Tertiary/composite database, Structure Database Genomic Databases, metabolic pathway database- KEGG.<br>4. Fiel format of GenBank-GBFF, PDB-Flat files, Importance of Biological Databases<br>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<br>2. Similarity searching programs- BLAST and FASTA, variants of BLAST, BLAST algorithms<br>3. Scoring matrices: Basic concept, Matrices for nucleic acid and protein sequences, PAM and BLOSUM matrices.<br>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<br>2. Methods for Phylogenetic analysis- MSA, Substitutional matrices, Tree building- Distance based and character-based methods, Tree evaluation- Bootstrapping/Jackknifing<br>3. Computational Biology tools for phylogenetic data analysis<br>4. Practical applications of Phylogenetic data analysis. | **15** |
| **Practical in Computational Biology** | | |
| **4** | 1. Bibliographic searches from various literature databases<br>2. Sequence retrieval from nucleic acid and protein sequence databases<br>3. Similarity searching by FASTA and BLAST<br>4. PDB structure retrieval and visualization by RASMOL, UCSF Chimera and PyMol<br>5. Pair wise alignment and comparison of molecular sequences<br>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<br>2. Determination of clotting time-Drop method<br>3. Determination of ABO blood groups using antisera<br>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.<br>2. Motivation of biological database - Central dogma of life<br>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.<br>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).<br>2. Sampling & selection bias, probability sampling, random sampling, sampling designs.<br>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<br>2. Protein Sequence Retrieval – UniProt<br>3. PDB structure retrieval and visualization by RASMOL<br>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<br>2. Basic Terminology- Key terms and concepts (e.g., phylogeny, clade, node, branch). Differences between phenetic and cladistic approaches<br>3. Evolutionary Theory and Genetic Variation: Principles of Evolution-Natural selection, genetic drift, gene flow, and mutation, Speciation and evolutionary theory<br>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).<br>2. Multiple sequence alignment-Methods and Tools<br>3. Sequence Alignment- Importance of accurate alignment<br>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<br>2. Character-Based Methods- Maximum Parsimony (MP) method<br>3. Steps to construct a parsimony tree, Strengths and limitations of MP.<br>4. Applications of Molecular Phylogenetics in Disease Diagnosis | **10** |
| **Practical in Computational Biology** | | |
| **4** | 1. Retrieval of Nucleotide sequence from GenBank<br>2. Retrieval of Protein sequence from GenBank<br>3. Sequence Similarity Search using BLASTN<br>4. Sequence Similarity Search using BLASTP<br>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