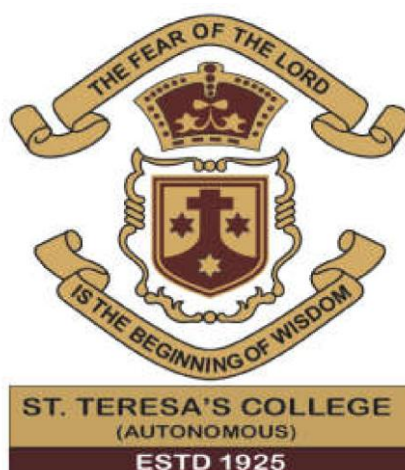

**ST. TERESA'S COLLEGE (AUTONOMOUS)
ERNAKULAM**

Affiliated to Mahatma Gandhi University, Kottayam



**CURRICULUM AND SYLLABUS FOR THE
UNDERGRADUATE PROGRAMME (HONOURS)**

Faculty : Science
Programme Title : Bachelor of Science (Honours) Zoology
Programme Code : BHZOO

**Under Choice Based Credit and Semester System
(2024 Admission Onwards)**

PREFACE

The domain of higher education in Kerala is changing in keeping with the needs of the times. One of the core factors in the education system is the curriculum which is student centric and ensures the holistic development of the learner.

The Four Year Under Graduate Programme which is being implemented fosters a spirit of enquiry in the learner and enhances critical thinking skills. St. Teresa's College (Autonomous) has taken meticulous care in the conception of the new well-balanced curriculum by retaining the fundamental prerequisites mentioned by the University/Higher Education Council. The new syllabus encompasses a variety of courses that will encourage the learner to take a multi-disciplinary approach to learning and will help them gain skills required in the contemporary times.

As an autonomous institution under Mahatma Gandhi University, St. Teresa's College offers a significant number of Programmes that will give the learner employable skills that are in demand. This curriculum offers the learner several options right from choosing the courses to whether they want to pursue a three year under graduate programme or a four-year honours programme.

The teachers have taken a lot of effort in developing Programmes and Course outcomes that will help the learner to become evolved global citizens. Due care has been taken to ensure the development of the cognitive and intellectual skills along with enhancing their social competencies. The curriculum is designed in such a way that it will help the students to become independent thinkers with research aptitude.

I congratulate the efforts taken by the Principal Prof. Dr. Alphonsa Vijaya Joseph and her team for restructuring the syllabus in keeping with the latest demands in academia. We trust that the syllabus will transform minds and encourage them to explore the ever-widening horizons of knowledge.

Dr. Sr. Vinitha
Manager

FOREWORD

A New Era of Learning: St. Teresa's College Embraces the FYUGP

The National Education Policy (NEP) 2020 marks a pivotal shift in Indian education, and here in Kerala, the state government's Undergraduate Programme (Honours) ushers in a transformative era. This programme goes beyond mere innovation; it places the learner at the center of the educational experience.

The Undergraduate Programme (Honours) curriculum prioritizes the holistic development of our young learners. It fosters not only academic excellence but also cultivates essential 21st century skills and values. This approach provides a strong foundation in research and represents a significant departure from the traditional model, offering students unmatched flexibility, seamless exploration, and opportunities.

There is an option to exit with a degree after year three. The Undergraduate Programme (Honours) envisions Skill-Based Learning focusing on practical skills, credit system transparency and Research Integration leading to an Honours degree. This flexibility empowers students to curate their academic journeys. They can choose courses and programmes that align with their passions and career aspirations. This approach fosters a generation of confident and globally competitive graduates, well-equipped to thrive in a dynamic world.

St. Teresa's College (Autonomous), Ernakulam, is proud to be at the forefront in implementing the Undergraduate Programme (Honours). Our meticulously designed syllabus adheres to the guidelines set forth by Mahatma Gandhi University while incorporating the latest advancements in each field. We are further committed to providing Online Learning Opportunities, Internship Embedded Programmes that provide valuable real-world experience, Indian Knowledge System Courses that explore and celebrate India's rich heritage, Collaborative Learning with national and international institutions for teaching and research and Industry Partnerships to initiate industry-sponsored projects, connecting students with real-world applications.

I extend my deepest gratitude to all who have contributed to designing the curriculum and syllabi for our various Undergraduate Programmes (Honours). This is a testament to the visionary leadership of our Provincial Superior and Manager, Rev. Dr. Sr. Vinitha, the unwavering support of our Director, Rev. Sr. Emeline, and the tireless efforts of Prof. Dr. Kala M.S., Vice Principal, Dr. Usha Nair, Controller of Examinations, Dr. Priya K. Nair, NEP Coordinator, Dr. Sajitha Kurup, IQAC Coordinator, the Curriculum Team, the Boards of Studies members, and the University Undergraduate Programme (Honours) mentors. Their expertise and dedication have ensured this syllabus will empower our students to reach their full potential.

We at St. Teresa's College are confident that the FYUGP will provide a transformative learning experience for our students, preparing them for success in their chosen fields and as future leaders.

Prof. Dr. Alphonsa Vijaya Joseph
Principal

ACKNOWLEDGEMENT

My heartfelt gratitude to all those who contributed to the development and refinement of the Four-Year Undergraduate Programme (FYUGP) syllabus. This endeavor have been possible with the collective effort and dedication of numerous individuals.

I extend my gratefulness to all the members of the Board of Studies: The Department is highly indebted to Dr. Mini. K.D, Associate Professor, Department of Zoology, Sree Sankara College, Kalady, for her sincere effort to restructure various courses of the programme. My sincere thanks and heartfelt gratitude to Dr. Vidia Panicker, Associate Professor, Department of Zoology, Sree Narayana College, Chempazhanthy, Thiruvananthapuram, for her invaluable suggestions and timely help in framing the syllabus. My immense thanks to Dr. Jeeja Tharakan, Assistant Professor, Department of Zoology, St. Aloysius College, Elthuruth, Thrissur, for her cooperation. I gratefully acknowledge Dr. K. Manjusha, Assistant Professor, Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Panangad and Dr. Beena P. S., Senior Scientist, OmicsGen Life Sciences Pvt. Ltd., Kakkanad for the timely guidance and suggestions in framing the syllabus.

I would like to place on record my deep sense of gratitude to Rev. Dr. Sr. Vinitha, Provincial Superior and Manager, whose leadership and support has provided valuable guidance and resources, fostering an environment conducive to innovation and excellence, Prof. Dr. Alphonsa Vijaya Joesph, Principal, for her unwavering commitment to academic excellence, Rev. Sr. Emeline CSST, Director and Dr. Sajimol Augustine M., Senior Administrator for their unstinted support during the various stages of syllabus preparation, Prof. Dr. Kala M. S., Vice-Principal, for her invaluable contributions throughout the syllabus preparation process by providing valuable insights and feedback, enriching the syllabus with her extensive expertise and experience.

The guidance of Dr. Sajitha Kurup, the Internal Quality Assurance Cell (IQAC) Coordinator and Dr. Priya K Nair, Nodal Officer of FYUGP deserves special recognition for their diligent efforts to ensure the quality and integrity of our academic programmes.

I express my deepest appreciation to the faculty members, whose expertise, insights, and commitment to excellence have shaped the curriculum. I deeply appreciate the extreme sincerity and care extended by the faculties of Zoology Department, Dr. Meera Jan Abraham, Dr. Helvin Vincent, Ms. Akhila Anilkumar, Ms. Parvathy K. R., Ms. Indu Vasudevan, Dr. Keziya James, Ms. Gayathri R. and Ms. Shana Nazrin M. N., in framing the syllabus. Their steadfast support have been invaluable throughout the process.

Dr. Soja Louis

Chairperson, Board of Studies in Zoology,
St. Teresa's College (Autonomous), Ernakulam

**FOUR YEAR UNDERGRADUATE PROGRAMME IN B.Sc. (Hons.) Zoology UNDER
CHOICE-BASED CREDIT AND SEMESTER SYSTEM
(2024 ADMISSION ONWARDS)**

PREAMBLE

The Department of Zoology of St. Teresa's College (Autonomous), Ernakulam meticulously designed the B.Sc. (Hons.) Zoology Programme with the aim to foster the holistic development of students, guiding them to discover their true potential and aptitude through carefully curated courses.

The curricula of Four Year Under Graduate Programme (FYUGP) focuses on both basic and advanced concepts in Zoology. It inspires the students to seek higher studies in Zoology, facilitate placements and become an entrepreneur. It will also enable the students to get employed in the Biological Research Institutes, Industries, and Educational Institutes and in the various departments of State and Central Govt. based on the subject Zoology. The new courses that will be effective from the academic year 2024 - 2025 onwards have been drawn-up to accommodate the widening horizons of the discipline of Biological Sciences. We have followed the NEP/UGC guidelines in restructuring the syllabus and the use of animals is reduced for the practicals.

This course is designed to ignite the passion of students who seek to explore the fascinating realm of Zoology. The syllabus is structured to establish a robust foundation by starting with Wonders of Animal Kingdom, thereby laying the groundwork for their journey towards academic excellence. It encompasses a broad spectrum of courses from Human Physiology and Endocrinology, Reproductive Biology and Teratology, Parasitology, Sex Education, Advanced Genetics to Advanced Ecology. The curriculum also embraces interdisciplinary domains such as Biophysical techniques, Biochemistry, Biotechnology, Biostatistics and Research Methodology to Bioinformatics and Computational Biology. Animal-Derived Value-Added Products, Applied Zoology, Biological Specimen Preparation Techniques and Fishing and Fish Processing are integrated to foster practical proficiency. Additionally, specialized courses in health such as First Aid and Medical Care, Health, Nutrition and Wellness, Fitness Science and Epidemic Science are incorporated to reinforce health awareness and employability in health sectors. The multidisciplinary nature of the Zoology courses ensures relevance across various programmes, while practical sessions facilitate hands-on experience at the molecular, cellular and organism levels of several animals to human levels as well as instrumental aspects in biology. The courses pertaining to stress management are Ornamental Fish Farming, Pet management and Poultry and Animal Husbandry while courses for environmental responsiveness are Waste Management Practices, Sustainable Tourism Practices, Wildlife Conservation, Advanced Ecology, Toxicological Science and Climate Change and Disaster Management all of which are updated courses adding to survival of nature and animals. Notable features of the B.Sc. (Hons.) Zoology programme include research prospects and advanced elective options, and faculty renowned for expertise in emerging research fields.

Outcome based education involves assessment and evaluation practices in education, reflecting the attainment of expected learning and mastery in the programme. It is a systematic way to determine if a programme has achieved its goal. This approach of learning makes the student an active learner, the teacher a good facilitator and together they lay the foundation for life-long learning. The process includes framing of specific course outcomes at various appropriate levels of taxonomy, mapping the course outcomes of each course with the Programme Specific Outcomes and finally calculating the course attainment based on the marks scored by the student in both the Internal and External assessments.

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DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES IN ZOOLOGY (2021-2024)

Sl. No.	Name of the member	Official Address	Designation
1	Dr. Soja Louis	Associate Professor and HOD Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Chairperson
2.	Dr. Vidia Panicker	Associate Professor Department of Zoology, Sree Narayana College, Chempazhanthy, Thiruvananthapuram - 695587	Subject Expert
3.	Dr. Mini. K.D.	Associate Professor Department of Zoology, Sree Sankara College, Kalady - 683574	University Nominee
4.	Dr. Jeeja Tharakan	Assistant Professor Department of Zoology, St. Aloysius College, Elthuruth, Thrissur - 680611	Subject Expert
5.	Dr. Beena P. S.	Senior Scientist OmicsGen Life Sciences Pvt. Ltd., Veegaland Homes, K Chittilappilly Tower, 2nd Floor, Opp. NPOL Main Gate, NGO Quarters-Bharata Mata College Road, Thrikkakara P.O, Kakkanad, Kochi - 682021	Expert from the Industry
6.	Dr. K. Manjusha	Assistant Professor Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Panangad, Ernakulam - 682506	Alumna
7.	Dr. Meera Jan Abraham	Associate Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member
8.	Dr. Helvin Vincent	Assistant Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member
9.	Indu Vasudevan	Assistant Professor Department of Zoology,	Member

		St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	
10.	Dr. Keziya James	Assistant Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member
11.	Akhila Anilkumar	Assistant Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member
12.	Parvathy K. R.	Assistant Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member
13.	Gayathri R.	Assistant Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member
14.	Shana Nazrin M. N.	Assistant Professor Department of Zoology, St. Teresa's College (Autonomous), Ernakulam, Kochi- 682011	Member

PROGRAMME OUTCOMES (PO)

On completion of a UG Programme from St. Teresa's College (Autonomous), students should be able to demonstrate the programme outcomes listed below:

PO 1. Disciplinary knowledge and Critical thinking

- Express mastery of foundational knowledge and skills essential for functioning adeptly as an entry-level professional within the discipline.
- Critically evaluate practices, policies and theories to enhance knowledge and comprehension.
- Synthesize disciplinary knowledge and critical thinking skills to address real-world challenges and opportunities effectively.

PO 2. Scientific Temper, Analytical reasoning and Problem solving

- Develop a deep appreciation for the scientific method and a commitment to evidence-based inquiry.
- Employ innovative methods, assess current knowledge boundaries both quantitatively and qualitatively, and make informed decisions to address societal issues.
- Identify unfamiliar challenges and address them using logical, analytical and critical thinking skills acquired from diverse domains of knowledge and apply these learnings to real-world scenarios.

PO 3. Multidisciplinary/ Interdisciplinary/ Transdisciplinary Approach

- Develop interdisciplinary/ multidisciplinary/ transdisciplinary knowledge base stemming from the learning they engage with their programme of study.
- Develop a collaborative - multidisciplinary/ interdisciplinary/ transdisciplinary - approach to formulate constructive arguments and rational analysis towards common goals and objectives.
- Develop a transdisciplinary approach that transcends traditional disciplinary frameworks, integrating insights from academia, industry, government, and civil society to address complex real-world problems.

PO 4. Communication Skills and Digital Competency

- Develop language skills through engaging interactions within relevant contexts.
- Express effective communication skills, especially leveraging technology in diverse social and global settings.

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- Develop proficiency in attentive listening, critical reading and writing, and articulate presentation of complex information to various audiences effectively.

PO 5. Leadership, Teamwork and Interpersonal Skills

- Develop the knowledge, abilities, and ethical frameworks necessary to lead with integrity, vision, and resilience in diverse contexts.
- Develop the interpersonal and collaborative skills necessary to work effectively in diverse teams and foster a culture of inclusivity, mutual respect, and collective accountability.

PO 6. Social Consciousness and Responsibility

- Develop a deep understanding of the social, economic, and environmental challenges facing local and global communities.
- Develop ethical decision-making frameworks and a sense of civic responsibility to contribute positively to society.
- Participate in initiatives aimed at enhancing societal welfare, with a particular focus on economically disadvantaged and marginalized populations.
- Cultivate a sense of global citizenship and interconnectedness, recognizing their interconnectedness with people, cultures, and ecosystems around the world.

PO 7. Equity, Inclusiveness and Sustainability

- Appreciate equity, inclusiveness, sustainability and diversity.
- Develop ethical and moral reasoning emphasizing the values of unity, secularism, and national integration and fostering the ability to engage as dignified citizens.
- Comprehend and value diversity encompassing caste, ethnicity, gender and marginalized groups, as well as effectively manage diversity through an inclusive approach whenever feasible.

PO 8. Moral and Ethical Reasoning

- Practice moral and ethical principles in personal conduct in tune with the vision and mission of the college.
- Formulate a stance or argument on ethical matters from diverse viewpoints, integrating ethical standards into all endeavors.

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- Develop ethical leadership qualities and a sense of responsibility to promote ethical behavior and social justice in their communities and professions.

PO 9. Research, Collaboration and Networking

- Develop a research culture for lifelong learning and showcase proficiency in generating new knowledge.
- Collaborate and network with educational institutions, research organisations and industrial units at national and international levels.
- Assess and utilize various data and information sources to effectively communicate, collaborate and network using diverse digital platforms.

PO 10. Lifelong Learning

- Develop the capacity for self-directed learning and the pursuit of knowledge beyond formal education, empowering one to remain relevant and competitive in their chosen fields.
- Foster a mindset of continual learning and adaptability, enabling individuals to thrive amid the changing demands of the workplace and industries through upskilling and reskilling efforts.

FEATURES AND OBJECTIVES OF STC - UGP (HONOURS)

The features and objectives of the STC - UGP (Honours) shall be:

1. The features, meaning, and purpose of UGP (Honours) shall be as stipulated by the UGC and as adapted by the Kerala State Higher Education Curriculum Framework (KSHECF) for undergraduate education.
2. The practice of lateral entry of students to various semesters exists, but an exit with a Degree shall be awarded only upon successful completion of 133 credits as per the conditions stipulated in this regulation.
3. FYUGP shall have three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and (c) 4-year UG Degree (Honours with Research).
4. Students who choose to exit after 3 years shall be awarded UG Degree in their respective Discipline/ Disciplines after the successful completion of the required minimum Courses with 133 credits.
5. A 4-year UG Degree (Honours) in the Discipline/ Disciplines shall be awarded to those who complete the FYUGP with a specific number of Courses with 177 credits including 8 credits from a graduate project/ dissertation in their major discipline.
6. Students who acquire minimum 75% in their graduation (upto 6th semester) are eligible for Honours with Research Programme. However if necessary, college may conduct screening test for the Honours with research programme in accordance with time to time regulations of the M.G. University.
7. 4-year UG Degree (Honours with Research): Students who aspire to pursue research as a career may opt for 4-year UG Degree Honours with Research stream under FYUGP with a specific number of Courses with 177 credits including 12 credits from a research project in their major discipline.
8. The recognized research departments or departments with at least two faculty members having Ph.D. shall offer the Honours with Research programme.
9. Students who have chosen the Honours with Research stream shall do their entire fourth year under the mentorship of a mentor.
10. The mentor shall prescribe suitable advanced level/capstone level courses for a minimum of 20 credits to be taken within the institutions along with the courses on research methodology, research ethics, and research topic-specific courses for a minimum of 12 credits which may be obtained either within the institution or from other recognized institutions, including online and blended modes.

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11. Students who have opted for the Honours with research should successfully complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to defend successfully the research project to obtain 12 credits under a faculty member of the College. The research shall be in the Major/ allied discipline.
 12. The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.
 13. The proposed FYUGP curriculum comprises Three Broad Parts: a) Foundation Components, b) Discipline Specific Pathway components (Major/ Minor), and c) Discipline Specific Capstone Components.
 14. The Foundation component of the FYUGP shall consist of a Set of General Foundation Courses and a Set of Discipline Specific Foundation Courses.
 15. General Foundation Courses shall be grouped into 4 major baskets as Ability Enhancement Courses (AEC), Skill Enhancement Courses (SEC), Value Addition Courses (VAC), and Multi-Disciplinary Courses (MDC).
 16. Ability Enhancement Courses shall be designed specifically to achieve competency in English, other languages as per the student's choice with special emphasis on language and communication skills.
 17. English or other language courses shall be designed to enable the students to acquire and demonstrate the core linguistic skills, including critical reading, academic and expository writing skills as well as the cultural and intellectual heritage of the language chosen. Separate courses will be designed for Science, Humanities and Commerce streams.
 18. Multi-Disciplinary Courses (MDC) shall be so designed as to enable the students to broaden their intellectual experience by understanding the conceptual foundations of Science, Social Sciences, Humanities, and Liberal Arts. Students shall not be eligible to take the MDC in the same discipline that they have studied during their +2. Third semester MDC can be Kerala specific content.
 19. Skill Enhancement Courses (SEC) shall be designed to enhance 21st century workplace skills such as creativity, critical thinking, communication, and collaboration.
 20. Discipline Specific Courses shall include Discipline Specific Pathway Courses, both Major and Minor streams, enabling students to gain basic knowledge in the chosen discipline.
 21. Discipline Specific Foundation Courses shall focus on foundational theories, concepts, perspectives, principles, methods, and critical thinking essential for taking up advanced/ Capstone Courses. Practical courses shall be included in discipline specific foundation courses.

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22. The curriculum of the SEC should be designed in a manner that at the end of year-1, year-2, year-3, and year-4 students are able to meet the level descriptors for levels 5, 6, 7, and 8 of the UGC Guidelines on National Skills Qualifications Framework (NSQF).
 23. Value Addition Courses (VAC) shall be so designed as to empower the students with personality development, perspective building, and self-awareness.
 24. Discipline Specific Pathway Components (Major/ Minor) shall provide the students with an opportunity to pursue in-depth study of a particular subject or discipline and develop competency in that chosen area, which includes Discipline Specific Core (DSC) courses and Discipline Specific Elective (DSE) courses as Major and Minor courses.
 25. Major components consist of three types: Discipline Specific Core or the Discipline Specific Elective Courses, and the research /laboratory/ fieldwork.
 26. Minor Courses can be selected from any discipline that may supplement or complement the Major Courses.
 27. Students who complete a sufficient number of Courses in a discipline or an interdisciplinary area of study other than their chosen Major shall qualify for a Minor in that discipline or in a chosen interdisciplinary area of study.
 28. Major Components shall be the main focus of study. By selecting a Major, the student shall be provided with an opportunity to pursue an in-depth study of a particular discipline.
 29. Each Board of Studies (BoS) shall identify specific Courses or baskets of Courses towards Minor Course credits. Students shall have the option to choose Courses from disciplinary/ interdisciplinary minors and skill-based courses related to a chosen programme.
 30. Students can opt for a change of Major at the end of the second semester to any Minor discipline studied among the foundation level courses. Students also can opt for a change of Major at the end of the second semester to any MDC.
 31. Students should opt their 5th and 6th semester VAC and SEC from their Major disciplines only.
 32. Course cum Credits Certificate: After the successful completion of a semester as proof for re-entry to another institution this certificate is essential. This will help the learner for preserving the credits in the Academic Bank of Credits.
 33. The Advanced Level/ Capstone Level Courses shall be designed in such a manner as to enable students to demonstrate their cumulative knowledge in their main field of study, which shall include advanced thematic specialization or internships or community engagement or services, vocational or professional training, or other kinds of work experience.

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34. Advanced/ Capstone level Major Specialization shall include Courses focused on a specific area of study attached to a specific Major, which could be an Elective Course. They shall include research methodology as well.
 35. The student has the option to register for and attend a course without taking part in the CCA and ESE of that course. Such a course is called the Audit Course. If the student has 75% attendance in an Audit Course, he/she/they is eligible for a pass in that course, without any credit (zero-credit). The Audit Course will be recorded in the final grade card of the student.
 36. All students shall undergo Summer Internship or Apprenticeship in a Firm, Industry or Organization; or Training in labs with faculty and researchers or other Higher Education Institutions (HEIs) or Research Institutions.
 37. Students will be provided the opportunities for internships with local industries, business organizations, agriculture, health and allied sectors, Local Government institutions (such as panchayats, municipalities), State Planning Board, State Councils/ Boards, Research Institutions, Research Labs, Library, elected representatives to the parliament/ state assembly/ panchayath, media organizations, artists, crafts persons etc. These opportunities will enable the students to actively engage with the practical aspects of their learning and to improve their employability.
 38. The college will provide opportunities for field-based learning/minor projects enabling them to understand the different socio-economic and development-related issues in rural and urban settings. The college will provide the students with opportunities for Community engagement and services, exposing them to socio-economic issues to facilitate theoretical learning in real-life contexts.
 39. Additional Credits will be awarded for those who actively participating in Social Activities, which may include participation in National Service Scheme (NSS), Sports and Games, Arts, participation in college union related activities (for respective elected/ nominated members), National Cadet Corps (NCC), adult education/ literacy initiatives, mentoring school students, and engaging in similar social service organizations that deemed appropriate to the University.
 40. Grace marks shall be awarded to a student for meritorious achievements in co-curricular activities (in Sports/ Arts/ NSS/ NCC etc.). Such a benefit is applicable in the same academic year spreading over two semesters, in which the said meritorious achievements are earned. Eligibility and other rules of awarding the grace marks will be in accordance with M. G. University rules and regulations from time to time.
 41. Options will be made available for students to earn credit by completing quality- assured

remote learning modes, including Online programmes offered on the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) or other Online Educational Platforms approved by the competent body/university from time to time.

42. Students shall be entitled to gain credits from courses offered by other recognized institutions directly as well as through distance learning.
43. For the effective operation of the FYUGP, a system of flexible academic transaction timings shall be implemented for the students and teachers.

ELIGIBILITY FOR ADMISSION

The eligibility for B.Sc. Zoology Programme is Pass in +2 Examination with Biology as an optional subject.

COURSE STRUCTURE OF THE STC-UGP (HONOURS) PROGRAMMES

The STC-UGP consists of the following categories of courses and the minimum credit requirements for pathway option-one shall be as follows;

Sl. No.	Categorization of Courses for all Programmes	Minimum Number of Credit Required	
		3-year UG	4-year UG
1	Major	68	88
2	Minor	24	24+12*
3	Multi-Disciplinary Courses (MDC)	9	9
4	Skill Enhancement Courses (SEC)	9	9
5	Ability Enhancement Courses (AEC)	12	12
6	Value Addition Courses (VAC)	9	9
7	Summer Internship, field-based learning etc.	2	2
8	Research Project / Dissertation		12/8**
	Total Credits	133	177

* The students can acquire advanced/ capstone level courses with 12 credits from their DSC/ DSE/ Minor courses depending up on their pathway choice. The Minor courses can be of level 300 or above.

** The students pursuing Honours with research have to complete a project with 12 credits and for the Honours degree students have to complete a project with 8 credits and DSC/ DSE capstone/ advanced level course in the 8th semester.

ACADEMIC LEVELS OF PATHWAY COURSES

Semester	Difficulty level	Nature of Course
1 and 2	100-199	Foundation level or introductory courses
3 and 4	200-299	Intermediate level courses
5 and 6	300-399	Higher level courses
7 and 8	400-499	Advanced/ Capstone level courses

PROGRAMME PATHWAY AND CURRICULUM STRUCTURE

Students who have joined for the programme under STC - UG (Honours) Programme shall follow the pathway format below for their UG (Honours) Programme.

Major with Multiple Disciplines of Study: This pathway is recommended for students who wish to develop core competencies in multiple disciplines of study. In this case, the credits for the minor pathway shall be distributed among the constituent disciplines/ subjects. If a student pursuing FYUG Degree Programme is awarded a major Degree in a particular discipline, he/she/they are eligible to get mentioned his core competencies in other disciplines of his choice if he has earned 12 credits from the pathway courses of that discipline.

Example: Physics Major with Minors in Chemistry and Mathematics, Economics Major with Minors in History and English, Commerce Major with Minors in Economics and Statistics.

PATHWAY FORMAT - DEGREE MAJOR WITH MULTIPLE DISCIPLINES OF STUDY

Course Components	No. of Courses												
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8	Total	
DSC A (4 Credit /Course)	1(P)	1(P)	3 (2P)	3 (2P)			5	4	17	7 Out of 17 can be opted as DSE	3	2	22
DSC B and C (4 Credit /Course)	2(P)	2(P)	1(P) (B or C)	1(P) (C or B)					6		3 [#] (Minor/ DCE)		9
Multidisciplinary Courses (MDC) (3 Credit/Course)	1(P)	1(P)	1*						3	*Cannot opt from DSC			3
Ability Enhancement Courses (AEC) (3 Credit /Course)	1 (English) 1 (OL)	1 (English) 1 (OL)							4				4
Skill Enhancement Courses (SEC) (3 Credit /Course)				1*			1**	1**	3	*Cannot opt from DSC A ** From DSC A only			3
Value Addition Courses (VAC) (3 Credit /Course)			1*	1*				1**	3	*Cannot opt from DSC A ** From DSC A only			3
Project/ Dissertation 12 credits for Honours with Research and 8 for Honours												12/8 (1 DSC / DSE for Honours)	
Total Courses	6	6	6	6			6	6	36		6	2+1	
Total Credits	21	21	22	22		2	23	22		Total Credits 133	24	20	Total Credits 177
Total Hours per Week	25	25	25	25			25	25		Exit option available	25	25	

Student can opt 3 courses from DCE (400-499 level) or Minor (300-399 level) in Semester 7

ATTENDANCE

A student shall be permitted to register for the end-semester evaluation of a specific course to acquire the credits only if he has completed 75% of the prescribed classroom activities in physical, online, or blended modes, including any makeup activities as specified by the course faculty of that particular course.

OUTCOME BASED APPROACH

The curriculum will be designed based on Outcome Based Education (OBE) practices.

ASSESSMENT AND EVALUATION

a. Theory Examination

- i. The assessment shall be a combination of Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).
- ii. 30% weightage shall be given for CCA. The remaining 70% weight shall be for the ESE.
- iii. Teacher Specific Content will be evaluated under CCA.
- iv. CCA will have two subcomponents Formative Assessment (FA) and Summative Assessment (SA). Each of these components will have equal weightage and to be conducted by the course faculty/ course coordinator offering the course.
- v. FA refers to a wide variety of methods that teachers use to conduct in-process evaluations of student comprehension, learning needs, and academic progress during a lesson, unit, module or course.
- vi. Summative Assessments (SA) are used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period- typically at the end of a project, unit, module, course or semester.
- vii. There shall be theory and practical examinations at the end of each semester.
- viii. Regarding evaluation, one credit may be evaluated for 25 marks in a semester; thus, a 4-credit course will be evaluated for 100 marks; 3-credit courses for 75 marks, 2 credit courses for 50 marks.

b. Practical Examination

The end semester practical examination will be conducted and evaluated by the institution.

- i. There shall be a CCA of practical courses conducted by the course faculty/ course coordinator.
- ii. The scheme of evaluation of practical courses will be as given below:

Components for the Evaluation of Practical Courses	Weightage
CCA of practical/practicum.	30%
ESE conducted under the supervision of internal examiner	70%

- iii. Those who have completed the CCA alone will be permitted to appear for the ESE.

c. Duration of Examination

Questions shall be set as per the defined Outcome. The question setter shall ensure that there will be Time and Mode (T and M) flexibility for all External Examinations. BoS can recommend the T and M from the following list.

Mode	Time (in Hours)	
	Minimum	Maximum
Written Examination	1	2
Multiple Choice	1	1.5
Open Book	1	2
Any Other Mode	1	2

d. Evaluation of Project/ Dissertation

The evaluation of project work shall be CCA with 30% and ESE 70%. The scheme of evaluation of the Project is given below:

Project type	Maximum	CCA	ESE
	Marks		
Research Project of Honours with Research (12 credits)	200	60	140
Project of Honours (8 credits)	100	30	70

e. Evaluation of Internship

The evaluation of internship shall be done by a committee constituted by the Department

Council. The scheme of CCA and ESE is given below:

Components of Evaluation of Internship	Weightage	Marks for Internship 2 Credits/ 50 Marks
CCA	30%	15
ESE	70%	35

The department council may decide any mode for the completion of the Internship. If in case evaluation is not specified in any of the selected internship programme, institution can adopt a proper evaluation method as per the weightage specified in the table above.

f. Letter Grades and Grade Points

Mark system is followed for evaluating each question. For each course in the semester, letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given below- The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative Grade Point Average (CGPA) is based on the grades in all courses taken after joining the programme of study.

Based on the marks obtained, the weighted grade point will be mentioned in the student's grade cards.

Letter Grade	Grade Point	Percentage of Marks (Both Internal and External Marks put together)	Class
O (Outstanding)	10	95% and above	First Class with Distinction
A+ (Excellent)	9	Above 85% and below 95%	
A (Very good)	8	Above 75% and below 85%	
B+ (Good)	7	Above 65% and below 75%	First Class
B (Above average)	6	Above 55% and below 65%	
C (Average)	5	Above 45% and below 55%	Second Class
P (Pass)	4	Above 35% and below 45% Aggregate (external and internal put together) with a minimum of 30% in external	Third Class
F (Fail)	0	Below an aggregate of 35% or below 30% in external evaluation	Fail
Ab (Absent)	0		Fail

When students take audit courses, they may be given pass (P) or fail (F) grade without any credits.

Computation of SGPA and CGPA

The following method is recommended to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- i. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in the semester, i.e.

$$\text{SGPA } (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

Where S_i is the SGPA in the i^{th} semester, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

$$\text{SGPA} = \frac{\text{Sum of the credit points of all the courses in a semester}}{\text{Total credits in that semester}}$$

Illustration - Computation of SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	DSC A	4	A	8	4 x 8 = 32
I	DSC B	4	B+	7	4 x 7 = 28
I	DSC C	4	B	6	4 x 6 = 24
I	MDC	3	B	6	3 x 6 = 18
I	AEC 1	3	O	10	3 x 10 = 30
I	AEC 2	3	C	5	3 x 5 = 15
	Total	21			147
	SGPA				147/21 = 7

- ii. The CGPA is also calculated in the same manner considering all the courses undergone by a student over all the semesters of a programme, i.e.

$$\text{CGPA} = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where S_i is the SGPA in the i^{th} semester, C_i is the total number of credits in the i^{th} semester.

$$\text{CGPA} = \frac{\text{Sum of the credit points of all the courses in six/ eight semesters}}{\text{Total credits in six (133)/ eight (177) semesters}}$$

- iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the

transcript.

Modifications to the Regulations

All rules and regulations pertaining to STC - UGP are subject to change as per modifications by Mahatma Gandhi University, Kottayam.

COURSE CODE FORMAT

The programme is coded according to the following criteria.

1. The first letter plus second letter from the name of the programme i.e., ZO
2. One digit to indicate the semester. i.e., ZO1 (Zoology, 1st semester)
3. Following letters to indicate the pathway components
 - a. Major courses - DSCA
 - b. Elective courses - DSEA
 - c. Minor courses - DSCB1 for minor 1, DSCB2 for minor 2 (if any) and so on.
 - d. Multi-Disciplinary Courses - MDC
 - e. Value Addition Courses - VAC
 - f. Skill Enhancement Courses - SEC
 - g. Ability Enhancement Courses - AEC
 - h. Capstone courses (Sem 7 and 8) DCCA
 - i. Capstone Elective DCEA (Sem 7 and 8)
 - j. Minor in Sem 7 (level 300), course code is DSCB1, DSCB2 (if any) and so on.
4. Two digits to be followed to indicate the course number of that semester specific to course type. For eg: ZO3DSCA01, ZO3DSCA02, ZO3DSCA03 so on for core courses. ZO3DSEA01, ZO3DSEA02 and so on for elective courses.
5. The letter B to indicate Bachelors Programme.
6. 24 to indicate the year of introduction i.e., ZO1DSCA01B24
7. The code for projects - ZO8DCCPRB24 for 8 credit project and ZO8DCCPRRB24 for 12 credit project.
8. The letter I denotes internship: ZO4IB24

SYLLABUS INDEX
Name of the Major Subject: **ZOOLOGY**

Semester: 1

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution/week			
					L	T	P	O
ZO1DSCA01B24	Marvels of the Animal Kingdom	DSC A	4	5	3	0	2	0
ZO1DSCB101B24	Marvels of the Animal Kingdom	DSC B	4	5	3	0	2	0
ZO1MDC01B24	Ornamental Fish Farming	MDC	3	4	2	0	2	0

Semester: 2

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution/week			
					L	T	P	O
ZO2DSCA01B24	Environmental Biology	DSC A	4	5	3	0	2	0
ZO2DSCB101B24	Environmental Biology	DSC B	4	5	3	0	2	0
ZO2MDC01B24	Pet management	MDC	3	4	2	0	2	0

Semester: 3

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution/week			
					L	T	P	O
ZO3DSCA01B24	Animal Diversity - Non Chordata I	DSC A	4	5	3	0	2	0
ZO3DSCA02B24	Animal Diversity - Non Chordata II	DSC A	4	5	3	0	2	0
ZO3DSEA01B24	Ethology	Any 1 DSE	4	4	4	0	0	0
ZO3DSEA02B24	Animal-Derived Value-Added Products							
ZO3DSCB101B24	Applied Zoology	DSC B/C (MINOR)	4	5	3	0	2	0
ZO3MDC01B24	Human Diseases and its management	MDC	3	3	3	0	0	0
ZO3VAC01B24	Wellness Science and Human Rights	VAC	3	3	3	0	0	0

Semester: 4

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution /week			
					L	T	P	O
ZO4DSCA01B24	Animal Diversity - Chordata I	DSC A	4	5	3	0	2	0
ZO4DSCA02B24	Biochemistry	DSC A	4	5	3	0	2	0
ZO4DSEA01B24	Health, Nutrition and Wellness	Any 1 DSE	4	4	4	0	0	0
ZO4DSEA02B24	Toxicological Science							
ZO4DSCB101B24	Human Physiology	DSC B/C (MINOR)	4	5	3	0	2	0
ZO4SEC01B24	First Aid and Medical Care	SEC	3	3	3	0	0	0
ZO4VAC01B24	Fitness Science	VAC	3	3	3	0	0	0
ZO4IB24	INTERNSHIP		2					

Semester: 5

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution /week			
					L	T	P	O
ZO5DSCA01B24	Animal Diversity - Chordata II	DSC A	4	5	3	0	2	0
ZO5DSCA02B24	Cell and Molecular Biology	DSC A	4	5	3	0	2	0
ZO5DSEA01B24	Basic Genetics	Any 1 DSE-1	4	4	4	0	0	0
ZO5DSEA02B24	Climate Change and Disaster Management							
ZO5DSEA03B24	Biotechnology	Any 1 DSE-2	4	4	4	0	0	0
ZO5DSEA04B24	Wildlife Conservation							
ZO5DSEA05B24	Forensic Biology	Any 1 DSE-3	4	4	4	0	0	0
ZO5DSEA06B24	Man and Nature							
ZO5SEC01B24	Food and Water Quality Assessment	SEC	3	3	3	0	0	0

Semester: 6

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.		Credit	Hours/week	Hour Distribution /week			
						L	T	P	O
ZO6DSCA01B24	Reproductive Biology and Teratology	DSC A		4	5	3	0	2	0
ZO6DSCA02B24	Human Physiology and Endocrinology	DSC A		4	5	3	0	2	0
ZO6DSEA01B24	Microbiology and Basic Immunology	Any 1	DSE-1	4	5	3	0	2	0
ZO6DSEA02B24	Fishing and Fish Processing								
ZO6DSEA03B24	Evolution and Zoogeography	Any 1	DSE-2	4	4	4	0	0	0
ZO6DSEA04B24	Entomology								
ZO6SEC01B24	Ecotourism and Sustainable Practices	SEC		3	3	3	0	0	0
ZO6VAC01B24	Sex Education	VAC		3	3	3	0	0	0


Semester: 7

Course Code	Title of the Course	Type of the Course DCC, DCE, DSC B etc.		Credit	Hours/week	Hour Distribution /week				
						L	T	P	O	
ZO7DCCA01B24	Biophysical techniques	DCC		4	5	3	0	2	0	
ZO7DCCA02B24	Biostatistics and Research Methodology	DCC		4	4	4	0	0	0	
ZO7DCCA03B24	Advanced Genetics	DCC		4	4	4	0	0	0	
ZO7DCEA01B24	Bioinformatics and Computational Biology	Any 3	DCE	4	4	4	0	0	0	
ZO7DCEA02B24	Advanced Immunology									
ZO7DCEA03B24	Biological Specimen Preparation Techniques									
ZO7DCEA04B24	Nanobiotechnology									
ZO7DCEA05B24	Aquaculture Practices									
ZO7DSCB101B24	Poultry and Animal Husbandry	DSC B		3 DSC B/ Any 3 DCE	4	4	4	0	0	0
ZO7DSCB102B24	Parasitology	DSC B			4	4	4	0	0	0
ZO7DSCB103B24	Solid Waste Management	DSC B			4	4	4	0	0	0

Semester: 8

Course Code	Title of the Course	Type of the Course DCC, DCE, etc.		Credit	Hours/week	Hour Distribution /week			
						L	T	P	O
ZO8DCCA01B24	Advanced Ecology	Compulsory for all	DCC	4	5	3	0	2	0
ZO8DCCA02B24	Animal Systematics		DCC	4	5	3	0	2	0
ZO8DCCA03B24	Advanced Biochemistry	1 DCC/ DCE (For UG Degree Honours)	DCC	4	5	3	0	2	0
ZO8DCEA01B24	Epidemic Science		DCE						
ZO8DCEA02B24	Developmental Biology								
ZO8DCCPRB24	Project* (UG Degree-Honours)			8					
ZO8DCCPRRB24	Project* (UG Degree-Honours with research)			12					
12 credits Dissertation (or) 1 DCE Course + 8 credits Internship project									

SEMESTER 1

	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	MARVELS OF THE ANIMAL KINGDOM					
Type of Course	MAJOR					
Course Code	ZO1DSCA01B24					
Course Level	100-199					
Course Summary	This is an introductory course that enables the learner to know more about the different life forms, their amazing behavior and interaction with their surroundings. This course helps beginners to build an interest in animal sciences and continue in this stream.					
Semester	I	Credits			4	Total Hours
Course Details	Learning Approach	Lecture 3	Tutorial	Practical 1	Others	
Pre-requisites, if any	The student shall have an interest and observation on animal behavior.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Differentiate the diversity of animals in different habitats.	U	1,2
2	Explain the incredible world of animals.	U, Ap	1
3	Compare the specialized behavior and features of insects, birds, and other animals.	U	1,2
4	Explain the significance of mimicry, coloration and camouflage in social behavior of animals.	A	1,2
5	Describe the importance of conservation of diversity.	U	1,6
6	Examine the innovative work of scientists/ philosophers/ entrepreneurs in the field of biological sciences.	A	1,2,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Web of life			(15 Hrs)	
1	1.1	Definition of life. Distinguish between living and nonliving- discuss the status of viruses. Position of animals in the living world. Habitats of animals - discuss terms like arial, arboreal, aquatic, and terrestrial. Compare the roles of animals and plants.	5	2
	1.2	Feeding habits in animals - Herbivores, Carnivores, Omnivorous and Detritivores. Interconnectedness among organisms - prey, predator, symbiosis, mutualism, parasitism (brood parasitism in birds, insects, and fishes) and commensalism (with examples)	5	3
	1.3	Hierarchy in animal kingdom. Distinguish non-chordates and chordates. Position of human beings with special reference to brain capacity/learning/communication.	5	1
Module II: Amazing behavior of animals			(15 Hrs)	
2	2.1	Bioluminescence in animals - <i>Noctiluca</i> , firefly, glowworm, angler fish (discuss mechanisms and uses). Different types of animal tracks (in brief).	3	5
	2.2	Social organization, communication in honey bee, importance in pollination. Causes of population decline.	2	3
	2.3	Regeneration in animals - hydra, planaria, star fish, lizard. Cannibalism in spider and scorpion. Breeding and parental care in animals (one example each from fishes, amphibians, birds, and reptiles). Pisces - Ovo-viviparous (Black Molly/Guppy), Mouth brooders (Tilapia), Brood pouches (Sea horse) Amphibia - Mouth brooders (Darwin's Frog), Egg carriers (Midwife Toad). Egg laying mammals, true mammals, pouched mammals.	10	5
Module III: Survival strategies			(15 Hrs)	
3	3.1	Mimicry, coloration - butterfly, leaf insect, stick insect, chameleon (add). Animals as bioindicators. Echo-location in bats, whales, and dolphins.	2	4
	3.2	Corals - habitat, coral diversity, and its importance. Importance of mangroves, Pearl formation. Animal architects - termites, weaver bird, beavers, spider web, aquatic animal (Ghost crab/Fiddler crab), Adaptive features of desert animals - Reptiles (<i>Phrynosoma</i>) and Mammals (Camel)	5	1
	3.3	Self-defense in animals - venomous and non-venomous	5	3


		snakes. Fascinating world of birds (flying pattern, economic importance of feathers and migration) and fishes (schooling and migration).		
	3.4	<p>Footsteps to follow - Ideas from biological sciences</p> <ul style="list-style-type: none"> • Dr. Varghese Kurien - White revolution • Dr. Salim Ali - Ornithology • Chipko movement- Sunder Lal Bahuguna • Contributions of Pokudan <p>Curious facts about nature and animals-e.g.: Why salient valley is called so?</p>	3	6
Module IV: Marvels of the Animal Kingdom- PRACTICAL			(30 Hrs)	
4	4.1	<ul style="list-style-type: none"> • Observing the developmental stages of butterfly • Development of chick - incubation and hatching (observation). • Breeding of guppy fish. Aquarium setting-group activity. • A study of symbiosis (Termite and Trychonympha, hermit crab and sea anemone), Camouflage (leaf insect, chameleon), Cannibalistic mate-eating animals (Spider and Praying Mantis) • Observing Animal architects: Termites, Harvester ant and Baya weaver bird. • Study of bioluminescent organisms - <i>Noctiluca</i>, glow worm, fire fly, angler fish. 	10	3
	4.2	<ul style="list-style-type: none"> • Identification of different types of feathers in birds. • Field study for understanding animal interactions (Report) • Identification of different animal foot tracks. • Breeding and parental care in Amphibia- Rhacophorus, Midwife toad, Darwin's frog, Caecilian. • Mounting of foraminiferan shells from sand. • Preparation and observation of paramecium culture. • Study of types of Corals - Brain, Organ pipe, Stag Horn, Mushroom coral. 	10	1
	4.3	<ul style="list-style-type: none"> • Observing and studying -First aid mechanism for animal bites - honey bee/ wasp, snake, dog. • Observations of fauna in the field (with reference to theory syllabus) and Behavioral study of any one animal (report). • Field Report - To be done in a group of ten students (submission of written/ typed report preferably along with photographs/ tables/graphs). 	10	2

References:

1. A Textbook of Zoology, Vol. II- T. Jeffery Parker and William. A. Haswell-Low
2. Biodiversity- K. C. Agarwal- Agro Botanica Publications
3. Biodiversity- S.V.S Rana- Prentice Hall Publications
4. Biology of Mollusca- D. R. Khanna
5. Chordate Zoology- P. S. Dhami and J. K. Dhami, R. Chand and Co.
6. Ecology and Environment- P. D. Sharma, R. K. Rastogi Publications
7. Essentials of Ecology and Environmental Science - S.V.S Rana
8. Fundamentals of Ecology- E. P. Odum, Sunders Publication
9. Fundamentals of Ecology- M. C. Dash-2nd edition, Tata McGraw Hill
10. Introduction to Ecology- R. Dajoz
11. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition
12. Invertebrate Zoology- P. S. Dhami and J. K. Dhami, R. Chand and Co.
13. Invertebrate Zoology- T. C. Majupuria, S. Nagin and Co.
14. Invertebrate Zoology Volume II- Jordan and Verma, S. Chand and Co.
15. Modern Biology- V. B. Rastogi
16. Modern Textbook of Zoology, Invertebrates, R. L. Kotpal Publications
17. Vertebrate Zoology Volume I- Jordan and Verma, S. Chand and Co.
18. Wildlife Laws and its Impact on Tribes- Mona Purohit, Deep and Deep Publications
19. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill

Suggested Readings:

1. Wonders of the Animal World - University Text Book of Zoology, F.Y.B.Sc. Semester I Course 1. V.V. Dalvie, G.B. Raje, P. Sardesai, N.S. Prabhu, University Press.
2. Butterflies of India - Isaac Kehimkar- BNHS Publication

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	MARVELS OF THE ANIMAL KINGDOM					
Type of Course	MINOR					
Course Code	ZO1DSCB101B24					
Course Level	100-199					
Course Summary	This is an introductory course that enables the learner to know more about the different life forms, their amazing behavior and interaction with their surroundings. This course helps beginners to build an interest in animal sciences and continue in this stream.					
Semester	I	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any			3		1	
	The student shall have an interest and observation on animal behavior.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Differentiate the diversity of animals in different habitats.	U	1,2,3
2	Explain the incredible world of animals.	U, Ap	1,3
3	Compare the specialized behavior and features of insects, birds, and other animals.	U	1,2,3
4	Explain the significance of mimicry, coloration and camouflage in social behavior of animals.	A	1,2,3
5	Describe the importance of conservation of diversity.	U	1, 3,6
6	Examine the innovative work of scientists/ philosophers/ entrepreneurs in the field of biological sciences.	A	1,2,3,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Web of life			(15 Hrs)	
1	1.1	Definition of life. Distinguish between living and nonliving- discuss the status of viruses. Position of animals in the living world. Habitats of animals - discuss terms like arial, arboreal, aquatic, and terrestrial. Compare the roles of animals and plants.	5	2
	1.2	Feeding habits in animals - Herbivores, Carnivores, Omnivorous and Detritivores. Interconnectedness among organisms - prey, predator, symbiosis, mutualism, parasitism (brood parasitism in birds, insects, and fishes) and commensalism (with examples)	5	3
	1.3	Hierarchy in animal kingdom. Distinguish non-chordates and chordates. Position of human beings with special reference to brain capacity/learning/communication.	5	1
Module II: Amazing behavior of animals			(15 Hrs)	
2	2.1	Bioluminescence in animals - <i>Noctiluca</i> , firefly, glowworm, angler fish (discuss mechanisms and uses). Different types of animal tracks (in brief).	3	5
	2.2	Social organization of honey bee, communication in honey bee, importance in pollination. Causes of population decline.	2	3
	2.3	Regeneration in animals - hydra, planaria, star fish, lizard. Cannibalism in spider and scorpion. Breeding and parental care in animals (one example each from fishes, amphibians, birds, and reptiles). Pisces - Ovo-viviparous (Black Molly/Guppy), Mouth brooders (Tilapia), Brood pouches (Sea horse) Amphibia - Mouth brooders (Darwin's Frog), Egg carriers (Midwife Toad). Egg laying mammals, true mammals, pouched mammals.	10	5
Module III: Survival strategies			(15 Hrs)	
3	3.1	Mimicry, coloration - butterfly, leaf insect, stick insect, chameleon (add). Animals as bioindicators. Echo-location in bats, whales, and dolphins.	2	4
	3.2	Corals - habitat, coral diversity, and its importance. Importance of mangroves, Pearl formation. Animal architects - termites, weaver bird, beavers, spider web, aquatic animal (Ghost crab/Fiddler crab), Adaptive features of desert animals-Reptiles (Phrynosoma) and Mammals	5	1

		(Camel)		
	3.3	Self-defense in animals - venomous and non-venomous snakes. Fascinating world of birds (flying pattern, economic importance of feathers and migration) and fishes (schooling and migration).	5	3
	3.4	Footsteps to follow - Ideas from biological sciences <ul style="list-style-type: none"> • Dr. Varghese Kurien - White revolution • Dr. Salim Ali - Ornithology • Chipko movement- Sunder Lal Bahuguna • Contributions of Pokudan Curious facts about nature and animals-e.g.: Why salient valley is called so?	3	6
Module IV: Marvels of the Animal Kingdom - PRACTICAL			(30 Hrs)	
4	4.1	<ul style="list-style-type: none"> • Observing the developmental stages of butterfly, • Development of chick - incubation and hatching (observation). • Breeding of guppy fish. Aquarium setting-group activity. • A study of symbiosis (Termite and Trychonympha, hermit crab and sea anemone), Camouflage (leaf insect, chameleon), Cannibalistic mate-eating animals (Spider and Praying Mantis) • Observing Animal architects: Termites, Harvester ant and Baya weaver bird. • Study of bioluminescent organisms - <i>Noctiluca</i>, glow worm, fire fly, angler fish. 	10	3
	4.2	<ul style="list-style-type: none"> • Identification of different types of feathers in birds. • Field study for understanding animal interactions (Report) • Identification of different animal foot tracks. • Breeding and parental care in Amphibia- Rhacophorus, Midwife toad, Darwin's frog, Caecilian. • Mounting of foraminiferan shells from sand. • Preparation and observation of paramecium culture. • Study of types of Corals - Brain, Organ pipe, Stag Horn, Mushroom coral. 	10	1
	4.3	<ul style="list-style-type: none"> • Observing and studying -First aid mechanism for animal bites - honey bee/ wasp, snake, dog. • Observations of fauna in the field (with reference to theory syllabus) and Behavioral study of any one animal (report). • Field Report - To be done in a group of ten students 	10	2

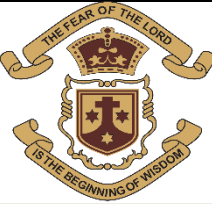
		(submission of written/ typed report preferably along with photographs/ tables/graphs.		
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References:

1. A Textbook of Zoology, Vol. II- T. Jeffery Parker and William. A. Haswell-Low
2. Biodiversity- K. C. Agarwal- Agro Botanica Publications
3. Biodiversity- S.V.S Rana- Prentice Hall Publications
4. Biology of Mollusca- D. R. Khanna
5. Chordate Zoology- P. S. Dhami and J. K. Dhami, R. Chand and Co.
6. Ecology and Environment- P. D. Sharma, R. K. Rastogi Publications
7. Essentials of Ecology and Environmental Science - S.V.S Rana
8. Fundamentals of Ecology- E. P. Odum, Sunders Publication
9. Fundamentals of Ecology- M. C. Dash-2nd edition, Tata McGraw Hill
10. Introduction to Ecology- R. Dajoz
11. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition
12. Invertebrate Zoology- P. S. Dhami and J. K. Dhami, R. Chand and Co.
13. Invertebrate Zoology- T. C. Majupuria, S. Nagin and Co.
14. Invertebrate Zoology Volume II- Jordan and Verma, S. Chand and Co.
15. Modern Biology- V. B. Rastogi
16. Modern Textbook of Zoology, Invertebrates, R. L. Kotpal, Price Publications
17. Vertebrate Zoology Volume I- Jordan and Verma, S. Chand and Co.
18. Wildlife Laws and its Impact on Tribes- Mona Purohit, Deep and Deep Publications
19. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill

Suggested Readings:

1. Wonders of the Animal World - University Text Book of Zoology, F.Y.B.Sc. Semester I Course 1. V.V. Dalvie, G.B. Raje, P. Sardesai, N.S. Prabhu, University Press.
2. Butterflies of India - Isaac Kehimkar- BNHS Publication

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	ORNAMENTAL FISH FARMING					
Type of Course	MDC					
Course Code	ZO1MDC01B24					
Course Level	100-199					
Course Summary	<p>This course delves into the intricate world of breeding and managing ornamental fish. Students will explore the principles of breeding techniques, water quality management, and the care and maintenance of breeding facilities. Through practical demonstrations and theoretical study, participants will gain the knowledge and skills necessary to successfully breed and manage ornamental fish species.</p>					
Semester	I		Credits		3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2		1		
Pre-requisites, if any	The student shall have an interest in fish keeping.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the classification of ornamental fishes.	I, U	1,3
2	Explain the biology, behaviour and breeding of ornamental fishes.	U, S	1,2,3
3	Apply management practices to maximize reproductive success and offspring survival of ornamental fishes.	A	1,2,3
4	Analyse the business strategies in ornamental fish enterprises.	An	1,2,3
<i>*Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Fundamentals of ornamental fish industry			(10 Hrs)	
1	1.1	Introduction to the ornamental fish industry, past and present trends, Ethical considerations in ornamental fish breeding.	2	1
	1.2	Species of ornamental fishes and their taxonomy, Freshwater and marine species.	3	1
	1.3	Classification of ornamental fishes: based on geographic area: exotic and indigenous, based on breeding behaviour: Livebearers (ovo- viviparous) and egg layers (oviparous), based on preferred feed.	5	1
Module II: Biology and behaviour of ornamental fishes			(10 Hrs)	
2	2.1	Anatomy of ornamental fish, Reproductive biology and Behavioural ecology.	3	2
	2.2	Breeding strategies, Environmental factors influencing breeding behaviour,	2	2
	2.3	Breeding and rearing of live bearer species, Breeding of Guppies. Breeding and rearing of Egg layers, Breeding of Angel fish.	5	2
Module III: Management and economics of ornamental fish farms			(10 Hrs)	
3	3.1	Water quality management in breeding facilities: effect of temperature, salinity, pH and organic matter in water. Water filtration systems- biological, physical; Types of filters. Aerators, Aquarium plants	2	3
	3.2	Feeding regimes and nutrition for optimal growth and health, Different kinds of feeds.	2	3
	3.3	Common diseases of aquarium fishes, diagnosis, treatment, disease prevention and biosecurity measures.	2	3
	3.4	Conditioning, packing, transport and quarantine methods	2	3
	3.5	Business planning for ornamental fish enterprises, Marketing strategies, market analysis, Prospects of fresh water and marine ornamental fish - importing, exporting and income generation.	2	3
Module IV: Ornamental Fish Farming - PRACTICAL			(30 Hrs)	
4	4.1	Familiarizing common ornamental fishes	8	3
	4.2	Setting up of freshwater aquarium.	4	3
	4.3	Identification of the live feed organisms (<i>Isochrysis</i> , <i>Moina</i> , <i>Daphnia</i> , Rotifer, Copepods, <i>Artemia</i>)	7	3
	4.4	Demonstrate the breeding of an ornamental fish (Guppy)	7	3

	4.5	Identification of the disease and its causative organism based on the symptoms.	4	3
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References:

1. Axelrod, H.R. (1967). Breeding Aquarium Fishes. Kerkwerve, Netherlands: Backhuys Biological Books.
2. Dick, Mills. (1981). Illustrated Guide to Aquarium fishes (Kingfisher) Littlehampton Book Services Ltd. ISBN 10: 0706361024.
3. Dey, V. K. (1997). Hand Book on Aquafarming: Ornamental fishes. Manual. MPEDA, Cochin.
4. Guy N. Smith. Profitable Fish Keeping.
5. Maurice Melzak. Marine Aquarium Manual. B.T. Balsford Ltd., London.
6. Ornamental aquarium fishes of India- (1999)- K. L. Tekrival and A.A. Rao- TFH United Kingdom.
7. Bamaniya P K and Bambhaniya I J. Fish food organisms, (2022), Agri-India today, Volume 02 | Issue 11. ISSN: 2583-0910
8. Edward. J. Noga. Fish Diseases, Diagnosis and Treatment. 2010.

Suggested Readings:

1. <https://www.agrifarming.in/ornamental-fish-farming-beginners>
2. <https://freshwater-aquaculture.extension.org/ornamentals/>

SEMESTER 2

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	ENVIRONMENTAL BIOLOGY					
Type of Course	MAJOR					
Course Code	ZO2DSCA01B24					
Course Level	100-199					
Course Summary	<p>The course provides a basic knowledge on Environmental Sciences, Ecosystem, their functioning, protection, conservation, and the factors polluting the environment, their impacts and remedial measures. The course also discusses the management measures to reduce the impact of toxicants and creates awareness on disaster management.</p>					
Semester	II	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Basic knowledge on environment is required.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Explain the basic concepts of Ecosystem and its functions.	U	1,2
2	Discuss the characteristics of a community and various animal interactions.	U	1,2
3	Explain biodiversity, the measures for conservation of biodiversity and address various environmental issues.	A	1,2,6,10
4	Illustrate environmental biology experiments.	A, S	1,2,10
5	Survey important biodiversity areas.	An, Ap	1,2,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Ecosystem			(18 Hrs)	
1	1.1	<p>Environment Atmosphere (Air) : Various zones of atmosphere Hydrosphere (Water) : Physical and chemical properties of water (brief account only) Lithosphere (Soil): Types of soil, Texture of soil, Soil profile Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers). Ecological pyramid- Number, Biomass, Energy. Functions of ecosystem: Food chain, Food web</p>	6	1
	1.2	<p>Types of Ecosystem: Terrestrial Ecosystems - Forest, Grassland, Desert, Tundra. Aquatic Ecosystems - Fresh water : Lentic and Lotic Marine: Zonation in marine habitat - Pelagic and Benthic Estuary: Wetland - Ramsar sites in Kerala (brief account only) Environmental cycles: Concept, Carbon cycle, Nitrogen cycle. Renewable resources: (solar, wind, hydroelectric, biomass and geothermal) and Non renewable resources (mineral and metal ore, fossil fuels).</p>	6	1
	1.3	<p>Animal interactions: Positive -Commensalism, Mutualism, Protocooperation. Negative - Predation, Parasitism, Competition, Antibiosis. (With examples) Characteristics of a community: Species diversity- richness, evenness, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Umbrella species, Flagship species. Concepts of Ecological Niche and Guild, Ecological succession, community evolution - climax, Biodiversity hotspots. (Brief account only)</p>	6	2
Module II: Environmental issues			(18 Hrs)	
2	2.1	<p>Global Environmental Issues: Global warming, Acid rain, Oil spills, Nuclear</p>	4	3

		accidents.		
	2.2	<p>National Environmental issues: Deforestation, forest fire, pollution (air, water, soil, noise, thermal, nuclear - brief account only) solid waste management, sewage, drinking water crisis and water logging.</p> <p>Toxic products and disaster: Types of toxic substances - degradable, non degradable, Impact on human - Case studies: Endosulphan tragedy, Bhopal disaster.</p>	6	3
	2.3	<p>Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands.</p> <p>Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.</p>	8	3
Module III: Conservation of biodiversity			(9 Hrs)	
3	3.1	<p>Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. Protected area concept - Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves Concept of threatened fauna - IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books)</p>	6	3
	3.2	Man-animal conflict (Tiger, Elephant, Dog, Monkey) - causes and concern	1	3
	3.3	Water conservation- rainwater harvesting, watershed management. Environment education	2	3
Module IV: Environmental Biology - PRACTICAL			(30 Hrs)	
	4.1	<ul style="list-style-type: none"> • Categorize the animals according to IUCN red list • Study of animal associations. • Identify the biodiversity hotspots • Identify the organisms by their characteristics in a community: Keystone species, indicator species, umbrella species, flagship species 	8	4,5
	4.2	<ul style="list-style-type: none"> • Identify the texture of soil samples 	12	4,5


4		<ul style="list-style-type: none"> • Identify the pH of water and soil samples using pH paper • Study of equipments - Secchi disc, Plankton net • Case study on any disaster and prepare the report 		
	4.3	Visit to any two important areas of bio diversity and prepare the report: 1. Forest, 2. Sea shore, 3. Mangrove, 4. Wet lands, 5. Bird sanctuary, 6. Wild life sanctuary, 7. Sacred groves Field study (compulsory)	10	4,5

References:

1. Erach Bharucha 2008 (UGC). Text Book of Environmental Studies of Undergraduate course. University Press.
2. J.B Sharma (2009), Environmental studies' - 3rdEd. University science Press
3. Misra S.P., Pandey S.N. 2009 Essential Environmental Students, Ane books Pvt. Ltd.
4. R.B Singh and Suresh Mishra PaulamiMaiti (1996), Biodiversity - Perception, Peril and Preservation' -- PHI Learning , Environmental Law in India: Issues and Responses
5. Rajagopalan, R. 2005.Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
6. Paul R.C., 2000.Situations of Human Rights in India. Efficient offset printers.
7. Arun kumar Palai(1999) National Human Rights Commission of India, Atlantic publishers
8. Sharma P.D. (2005)Environmental biology and Toxicology, Rastogi publication
9. Meera Asthana and Astana D.K.1990 Environmental pollution and Toxicology Alka printers.
10. Odum, E.P. 1971.Fundamentals of Ecology.W.B. Saunders College Publishing,Philadelphia
11. Alan Beeby, 2006 Anne - Maria Brennan First Ecology, Ecological principles and Environmental issues. International students edition Sec. edition Oxford University Press.
12. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
13. Landis, Wayne and Hing-hoYu, Baca Raton, 1995. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems: Lewis Publishers.

Suggested Readings:

1. Stiling Peter (2002). Ecology: Theories and applications. Prentice Hall of India pvt.Ltd. New Delhi.
2. P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam				
Programme	B.Sc. (Hons.) Zoology				
Course Name	ENVIRONMENTAL BIOLOGY				
Type of Course	MINOR				
Course Code	ZO2DSCB101B24				
Course Level	100-199				
Course Summary	<p>The course provides a basic knowledge on Environmental Sciences, Ecosystem, their functioning, protection, conservation, and the factors polluting the environment, their impacts and remedial measures. The course also discuss the management measures to reduce the impact of toxicants and creates awareness on disaster management.</p>				
Semester	II	Credits		4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	
		3		1	
Pre-requisites, if any	<p>This course can be opted as a minor by the students of all streams/open for all. Basic knowledge on environment and pollution is required.</p>				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain the basic concepts of Ecosystem and its functions.	U	1,2,3
2	Discuss the characteristics of a community and various animal interactions.	U	1,2,3
3	Explain biodiversity, the measures for conservation of biodiversity and address various environmental issues.	A	1,2,3,6,10
4	Illustrate environmental biology experiments.	S, A	1,2,3,10
5	Survey important biodiversity areas.	An,I	1,2,3,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Ecosystem			(18 Hrs)	
1	1.1	Environment Atmosphere (Air) : Various zones of atmosphere Hydrosphere (Water) : Physical and chemical properties of water (brief account only) Lithosphere (Soil) : Types of soil, Texture of soil, Soil profile Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers). Ecological pyramid- Number, Biomass, Energy. Functions of ecosystem: Food chain, Food web	6	1
	1.2	Types of Ecosystem: Terrestrial Ecosystems - Forest, Grassland, Desert, Tundra. Aquatic Ecosystems - Fresh water: Lentic and Lotic Marine: Zonation in marine habitat - Pelagic and Benthic Estuary: Wetland - Ramsar sites in Kerala (brief account only) Environmental cycles: Concept, Carbon cycle, Nitrogen cycle. Renewable resources (solar, wind, hydroelectric, biomass and geothermal) and Non renewable resources (mineral and metal ore, fossil fuels).	6	1
	1.3	Animal interactions: Positive -Commensalism, Mutualism, Protocooperation. Negative - Predation, Parasitism, Competition, Antibiosis. (With examples) Characteristics of a community: Species diversity- richness, evenness, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Umbrella species, Flagship species. Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax, Biodiversity hotspots. (Brief account only)	6	2
Module II: Environmental issues			(18 Hrs)	
2	2.1	Global Environmental Issues: Global warming, Acid rain, Oil spills, Nuclear accidents	4	3
	2.2	National Environmental issues: Deforestation, forest		

		fire, pollution (air, water, soil, noise, thermal, nuclear - brief account only) solid waste management, sewage, drinking water crisis and water logging. Toxic products and disaster: Types of toxic substances - degradable, non degradable, Impact on human - Case studies: Endosulphan tragedy, Bhopal disaster.	6	3
	2.3	Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands. Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.	8	3
Module III: Conservation of biodiversity			(9 Hrs)	
3	3.1	Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. Protected area concept - Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves Concept of threatened fauna - IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.)	6	3
	3.2	Man-animal conflict (Tiger, Elephant, Dog, Monkey) - causes and concern.	1	3
	3.3	Water conservation- rainwater harvesting, watershed management. Environment education	2	3
Module IV: Environmental biology - PRACTICAL			(30 Hrs)	
4	4.1	<ul style="list-style-type: none"> • Categorize the animals according to IUCN red list • Study of animal associations. • Identify the biodiversity hotspots • Identify the organisms by their characteristics in a community: Keystone species, indicator species, umbrella species, flagship species. 	8	4,5
	4.2	<ul style="list-style-type: none"> • Identify the texture of soil samples. • Identify the pH of water and soil samples using pH paper • Study of equipments - Secchi disc, Plankton net • Case study on any disaster and prepare the report. 	12	4,5
	4.3	Visit to any two important areas of bio diversity and	10	4,5

		prepare the report: 1. Forest, 2. Sea shore, 3. Mangrove, 4. Wet lands, 5. Bird sanctuary, 6. Wild life sanctuary, 7. Sacred groves Field study (compulsory)		
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References:

1. Erach Bharucha 2008 (UGC). Text Book of Environmental Studies of Undergraduate course. University Press.
2. J.B Sharma (2009), Environmental studies' - 3rdEd. University science Press
3. Misra S.P., Pandey S.N. 2009 Essential Environmental Students, Ane books Pvt. Ltd.
4. R.B Singh and Suresh Mishra PaulamiMaiti (1996), Biodiversity - Perception, Peril and Preservation' -- PHI Learning , Environmental Law in India: Issues and Responses
5. Rajagopalan, R. 2005.Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
6. Paul R.C., 2000.Situations of Human Rights in India. Efficient offset printers.
7. Arun kumarPalai(1999) National Human Rights Commission of India, Atlantic publishers
8. Sharma P.D. (2005)Environmental biology and Toxicology, Rastogi publication
9. Meera Asthana and Astana D.K.1990 Environmental pollution and Toxicology Alka printers.
10. Odum, E. P. 1971. Fundamentals of Ecology. W. B. Saunders College Publishing, Philadelphia
11. Alan Beeby, 2006 Anne - Maria Brennan First Ecology, Ecological principles and Environmental issues. International students' edition Sec. Edition Oxford University Press.
12. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
13. Landis, Wayne and Hing-hoYu, Boca Raton, 1995. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems: Lewis Publishers.

Suggested Readings:

1. Stiling Peter (2002). Ecology: Theories and applications. Prentice Hall of India pvt.Ltd. New Delhi.
2. P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
Affiliated to Mahatma Gandhi University, Kottayam

Programme	B.Sc. (Hons.) Zoology					
Course Name	PET MANAGEMENT					
Type of Course	MDC					
Course Code	ZO2MDC01B24					
Course Level	100-199					
Course Summary	Pet Care and Management course is an academic exploration into the multifaceted realm of animal care giving. From dogs and cats to birds, rabbits, and rodents, this course delves into essential topics like nutrition, breeding, and health. Designed for aspiring professionals in animal welfare, rescue, and veterinary nursing, it offers a concise yet comprehensive foundation for compassionate and informed pet care practices.					
Semester	II	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2		1		60
Pre-requisites, if any	The student shall have a passion in pet animals and its behavior.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
After the successful completion of the course the student should be able to:			
1	Explain the legal and safety protocols involved in pet ownership.	U	1,3
2	Examine various dog, cat, and bird breeds, and their nutrition, grooming, reproductive biology, and healthcare management.	I, A	1,2,3
3	Compare strategies for managing pets, marketing and customer service.	U	1,3
4	Explain different pet breeds and pet diseases.	U	1,2,3,10
*Remember (K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Pet Animals and Pet care -				
		Legal and safety measures	(9 Hrs)	
1	1.1	Introduction to Common pet animals: Cat, dog, birds, rabbits, hamsters, guinea pigs.	2	2
	1.2	Career opportunities associated with pet animals- Pet breeding and marketing and pet food business.	1	3
	1.3	Pet Animal welfare rules and licenses	2	1
	1.4	Animal charities and Societies: Animal Welfare Board of India:(AWBI), National Institute of Animal Welfare (NIAW), Federation of Indian Animal Protection organisations (FIAPO), Blue Cross of India (BCI)-Chennai, People for Ethical Treatment of Animals'-India'(PETA'-India)	2	1
	1.5	Zoonotic diseases (Rabies, Capnocytophaga Infection, Swineflu, Avianflu, Toxoplasmosis Andecto-Parasitic Infections) (Brief account only)	2	2
Module II: Pet Cats, Dogs and their care			(14 Hrs)	
2	2.1	Common cat breeds. General Habits, nutrition and feeding, breeding and management of Pet cats. New born Kittens- Behaviour and grooming. Feed and nutrition.	3	4
	2.2	Common diseases of cats - their diagnosis, treatment and control. Care for a sick cat. Cattery design and management.	3	2
	2.3	Common dog breeds. Selection of dog breeds-Pure bred and mix-breeds. General habits, Feeding, Grooming and nutrition. Detection of oestrus and Breeding of dogs. Desexing.	3	2
	2.4	Common diseases of dogs - Microbial, parasitic, fungal and nutritional deficiency disorders. Symptoms, diagnosis, treatment and control. Vaccination/deworming schedules.	4	2
Module III: Pet Birds and their care			(7 Hrs)	
3	3.1	Pet birds - Selection of Breeds - Friendly Pet Bird Species	2	4
	3.2	Sexing, Desexing, Containment (Aviaries selection, design, size, management). Feed and Feeding methods, Grooming (Wingtrim, Beak Trim, Nail Trim), Hygiene	3	2
	3.3	Diseases- Diagnosis, treatment and control. Caring for the Sick Bird, Supportive therapy.	2	2

Module IV: Pet Management - PRACTICAL			(30 Hrs)	
4	4.1	<ul style="list-style-type: none"> • Breed identification - dog, cat and bird. • Ecto and endoparasites of dog, cat and bird • Composition of balanced diet for the pets. • Visit to nearby Veterinary hospital and report submission on different pet diseases 	30	4, 2


References:

1. Cheryl Lopate. (2012). Management of Pregnant and Neonatal Dogs, Cats, and Exotic Pets. John Wiley andamp; Sons, Ltd.
2. Don Harper. (1995). Keeping pet birds-A practical encyclopedia. Blitz Editions
3. Elish W. Burr. (1995). Companion bird medicine. Iowa State University Press.
4. Gary A. Callerstein. (2003). The complete bird owner's handbook. Howell book house, New York, Avian publishers.
5. Gary England. 2012. Dog Breeding, Whelping and Puppy Care. Wiley-Blackwell publishers.
6. Jacqueline Boyd. (2023). Canine Nutrition: Food Feeding and Function. The Crowood Press Ltd.
7. James Serpell. (1995). The domestic dog its evolution, behaviour and interaction with people. Cambridge University Press.
8. Jane, E., Sykes. (2013). Canine andamp; Feline Infectious Diseases. Saunders publishers.
9. Linda. P. Case., 2005. The Dog, its behavior, nutrition and health. Iowa state university press, Wiley Blackwell Publishers.
10. Linda. P., Case. (2002). The Cat, Its behavior, Nutrition and Health. Iowa state university press, Wiley Blackwell Publishers.
11. Michael, E., Peterson andamp; Michelle Kutzler. (2010). Small Animal Pediatrics: The First 12 months life. W B Saunders Co Ltd.
12. Myra Savant-Harris, R.N. (2005). Puppy Intensive Care - A Breederand#39;s Guide To Care of Newborn Puppies.
13. Nityanand Pathak. (2019). Textbook on Dogs for Veterinary graduates. Satish Serial Publishing House
14. Patricia A. Schenck. (2010). Home-Prepared Dog and Cat Diets. Wiley Blackwell publishers.
15. Rabinowitz. (2009). Human-Animal Medicine: Clinical Approaches to Zoonoses, Toxicants and Other Shared Health Risks. Elsevier- health publishers.
16. Suman Kumari Joshi., Manish Kr Singh andamp; Srinivas Sathapath. 2015. A Textbook On Zoonotic Diseases. Sathish serial publishers.
17. Susan Little. (2011). The cat: clinical medicine and management. Saunders publishers.

Suggested Readings:

1. Devendra Kumar andamp; Prakash Bhatt. (2022). A text book on Pet animal management. Om Publishers.

SEMESTER 3

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	ANIMAL DIVERSITY - NON CHORDATA I					
Type of Course	MAJOR					
Course Code	ZO3DSCA01B24					
Course Level	200-299					
Course Summary	<p>The course seeks to familiarize the students about the protistan and non chordate fauna upto annelids living in and around us. It helps to instill in them a curiosity to study the anatomical and physiological peculiarities in some invertebrates through type study. It throws awareness on parasitic species which are the cause behind many diseases. The course imparts skill to identify, classify and naming animals.</p>					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
			3		1	
Pre-requisites, if any	Basic knowledge in animal diversity.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Compare parasitic protists and identify protistan diversity.	A	1,2
2	Explain the classification of the lower groups of animal kingdom and parasitic groups.	U	1,2
3	Describe the characteristics of non-chordates.	U	1,2
4	Employ the classification of various protists and non chordates.	A	1,2,10
5	Illustrate invertebrates belonging to different phyla.	U	1,2,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Protistan diversity			(18 Hrs)	
1	1.1	Kingdom Protista Salient features of Kingdom Protista Locomotion, nutrition and reproduction in Protozoans (Detailed account) Classification of Protista up to phyla 1. Phylum Rhizopoda :Eg. <i>Amoeba</i> 2. Phylum Actinopoda :Eg. <i>Actinophrys</i> 3. Phylum Dinoflagellata :Eg. <i>Noctiluca</i> 4. Phylum Parabasalia :Eg. <i>Trichonympha</i> 5. Phylum Metamonada :Eg. <i>Giardia</i> 6. Phylum Kinetoplasta :Eg. <i>Trypanosoma</i> 7. Phylum Euglenophyta :Eg. <i>Euglena</i> 8. Phylum Cryptophyta :Eg. <i>Cryptomonas</i> 9. Phylum Opalinata :Eg. <i>Opalina</i> 10. Phylum Bacillariophyta :Eg. Diatoms 11. Phylum Chlorophyta :Eg. <i>Volvox</i> 12. Phylum Choanoflagellata :Eg. <i>Proterospongia</i> 13. Phylum Ciliophora :Eg. <i>Balantidium coli</i> 14. Phylum Sporozoa :Eg. <i>Plasmodium</i> 15. Phylum Microsporidia :Eg. <i>Nosema</i> 16. Phylum Rhodophyta :Eg. Red Algae (Mention any five general characters for each phylum and its examples.)	13	1, 2
	1.2	Type Study: <i>Paramecium caudatum</i>	3	1, 2
	1.3	General Topics: Parasitic protists (diseases mode of transmission and prophylactic measures) - <i>Entamoeba</i> , <i>Trypanosoma</i> , <i>Plasmodium</i> (detailed account of life cycle), <i>Leishmania</i>	2	1, 2
	Module II: Kingdom Animalia			(7 Hrs)
2	2.1	Outline classification of Kingdom Animalia Three branches - Mesozoa, parazoa and Eumetazoa Symmetry - Types with examples Levels of organization- cellular, tissue. organ and organ system Divisions of Eumetazoa- Radiata, Bilateria, Acoelomata, Pseudocoelomata, Eucoelomata, Protostomia, Deuterostomia.	2	2
	2.2	Mesozoa: Phylum Orthonectida Eg. <i>Rhopalura</i> (mention 5 salient	2	2, 3

		features) Parazoa: Phylum Placozoa Eg. <i>Trycoplax adherens</i>		
	2.3	Phylum Porifera Salient features and classification upto classes Class I: Calcarea. Eg. <i>Sycon</i> Class II: Hexactinellida Eg. <i>Euplectella</i> Class III: Demospongia Eg. <i>Cliona</i> General Topics: <ul style="list-style-type: none"> • Canal system and Reproduction in sponges 	3	2, 3
Module III: Eumetazoa			(20 Hrs)	
3	3.1	Phylum Coelenterata Type: <i>Obelia</i> Salient features and classification upto classes Class I: Hydrozoa Eg. <i>Halistemma</i> , <i>Physalia</i> . (mention Metagenesis) Class II: Scyphozoa Eg. <i>Aurelia</i> . Class III: Anthozoa Eg. <i>Adamsia</i> General Topics: <ul style="list-style-type: none"> • Coral and coral reefs with special reference to conservation of reef fauna. • Polymorphism in Coelenterates Phylum Ctenophora General Characters and Evolutionary significance (affinities). Eg. <i>Pleurobrachia</i> Phylum Platyhelminthes Salient features and classification upto classes Class I: Turbellaria. Eg. <i>Planaria</i> . Class II: Trematoda Eg. <i>Fasciola</i> Class III: Cestoda Eg. <i>Taenia saginata</i> . General Topics: <ul style="list-style-type: none"> • Life history of <i>Fasciola hepatica</i>. • Platyhelminth parasites of Man and Dog (<i>Schistosoma</i>, <i>Taenia solium</i>, <i>Echinococcus</i>) 	11	2, 3
	3.2	Phylum Nematelminthes (Nematoda) Salient features, classification upto classes Class I: Phasmidia Eg. <i>Enterobius</i> Class II: Aphasmidia Eg. <i>Trichinella</i> General Topic: <ul style="list-style-type: none"> • Pathogenic nematodes in man. (<i>Wuchereria bancrofti</i>, <i>Ascaris lubricoides</i>, <i>Ancylostoma duodenale</i>, <i>Trichinella</i>). • Parasitic Adaptations in Helminthes. 	5	2, 3

	3.3	<p>Phylum Annelida Salient features and classification upto classes Class I: Archiannelida Eg. <i>Polygordius</i> Class II: Polychaeta Eg. <i>Nereis</i> Class III: Oligochaeta Eg. <i>Megascolex</i>. Class IV: Hirudinea Eg. <i>Ozobranchus, Hirudinaria</i></p> <p>General Topic:</p> <ul style="list-style-type: none"> Evolutionary significance of Coelom and Coelomoducts 	4	2, 3
Module IV: Animal Diversity - Non Chordata I - PRACTICAL			(30 Hrs)	
4	4.1	<p>1. General identification of protists- The students are expected to identify any 10 Protistans studied by their generic names and write the general characters of their Phylum.</p> <p>2. Identification of any 4 economically important protists/parasitic protists (Slides/ figures may be used for identification)</p> <p>3. Identification of two Protistans from pond water.</p>	6	4
	4.2	<p>Identification of invertebrates: (a) General identification and classification - The students are expected to identify, classify and describe the following Phylum -wise number of animals by their common names, generic names and 30% of these by their scientific names. Porifera-2, Coelenterata-3, Platyhelminthes-3, Annelida-2</p> <p>(b) Identification of (A) Larval forms of Fasciola- any 2 (B) Nematode parasites of man- any 3 (Slides/figures may be used for study)</p>	6	4
	4.3	<p>1. Scientific Drawing: Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.</p> <p>2. Anatomy: Study of sections (Any two) (a) Hydra (b) Ascaris (male and female) (c) Earthworm (d) Fasciola</p> <p>3. An “Animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose</p>	18	4, 5

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 14. Pechenik J A (2005) Biology of Invertebrates, (Tata McGraw Hill Publishing Co., New Delhi.)

Suggested Readings:

1. Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Invertebrate Part I and part II. S. Viswanathan Printers and Publishers. Pvt. Ltd.
2. Mayr, E. (1980). Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi)



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
Affiliated to Mahatma Gandhi University, Kottayam

Programme	B.Sc. (Hons.) Zoology					
Course Name	ANIMAL DIVERSITY- NON CHORDATA II					
Type of Course	MAJOR					
Course Code	ZO3DSCA02B24					
Course Level	200-299					
Course Summary	The course seeks to familiarize the students about the non chordate fauna living in and around us. It helps to instill in them a curiosity to study the anatomical and physiological peculiarities in some invertebrates through type study. It throws awareness on Phylum Onychophora, Phylum Arthropoda, Phylum Mollusca, Phylum Echinodermata, Hemichordata, and Minor Phyla. The course imparts skill to identify animals and their larva, inspires to be an environmental activist, skill to commercially utilize economically important animals.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Basic knowledge in animal diversity.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
After the successful completion of the course the student should be able to:			
1	Differentiate salient features of Phylum Onychophora, Arthropoda, Mollusca, Echinodermata, Hemichordata, and Minor Phyla.	A, Ap	1,2
2	Describe different systems of Prawn, pearl culture, edible molluscs, the economic importance of insects, water vascular systems, and larval forms of Echinodermata.	U, I	1,2
3.	Dissect the prawn and cockroach nervous systems and mount the prawn appendages, mouth parts of the cockroach, plant bug, and mosquito.	A, S	1,2,10
4.	Sketch invertebrates scientifically.	A	1,2,10
5	Employ the classification of species belonging to the minor	A	1,2,10

phyla and phylum Arthropoda, Mollusca, and Echinodermata.

***Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)**

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Phylum Onychophora and Phylum Arthropoda			(15 Hrs)	
1	1.1	Phylum Onychophora Salient features of the phylum Eg. <i>Peripatus</i> (Mention its affinities).	1	1,5
	1.2	Phylum Arthropoda Classification up to classes. Salient features of phylum and classes. (Brief mention only) 1. Sub Phylum - Trilobitomorpha Class -Trilobita (mention the salient features). Eg. <i>Triarthrus</i> 2. Subphylum -Chelicerata Class 1 Merostomata (Xiphosura) (Eg. <i>Limulus</i> - Living fossil) Class 2. Arachnida (Eg. <i>Palamnaeus</i> - Scorpion) Class 3 Pycnogonida (Eg. <i>Pycnogonum</i> - Sea spider) 3. Subphylum- Crustacea Class 1 Branchiopoda Eg. <i>Daphnia</i> Class 2 Ostracoda Eg. <i>Cypris</i> -seed shrimp Class 3 Copepoda Eg. <i>Cyclops</i> Class 4 Remipedia Eg. <i>Speleonectes</i> (eyeless crustacean seen in caves) Class 5. Branchiura Eg. <i>Argulus</i> (common fish louse) Class 6 Cirripedia Eg. <i>Sacculina</i> Class 7 Malacostraca Eg. <i>Squilla</i> (spot tail mantis shrimp) 4. Subphylum- Uniramia Class 1 Chilopoda Eg. <i>Scolopendra</i> - (Centipede) Class 2 Symphyla Eg. <i>Scutigera</i> - (garden centipedes or pseudocentipedes) Class 3 Diplopoda Eg. <i>Spirostreptus</i> - (Millipede) Class 4 Pauropoda Eg. <i>Pauropus</i> Class 5 Hexapoda (Insecta) Eg. <i>Bombyx mori</i> - (silk moth)	14	1, 5
Module II: Type study and General topic			(15 Hrs)	
2		Type: Prawn - <i>Fenneropenaeus</i> sp. General Topic: Economic importance of insects	15	2

Module III: Phylum Mollusca and Echinodermata			(15 Hrs)	
3	3.1	<p>Phylum Mollusca Classification up to classes. Salient features of phylum and classes. (Brief mention only) Class 1 Aplacophora Eg. <i>Neomenia</i> Class 2 Monoplacophora Eg. <i>Neopilina</i> Class 3 Amphineura Eg. <i>Chiton</i> Class 4 Gastropoda Eg. <i>Aplysia</i> Class 5 Scaphopoda Eg. <i>Dentalium</i> Class 6 Pelecypoda (Bivalvia) Eg. <i>Pinctada</i> Class 7 Cephalopoda Eg. <i>Sepia</i></p> <p>General Topics</p> <ul style="list-style-type: none"> • Pearl culture • Edible molluscs 	7	1, 2
	3.2	<p>Phylum Echinodermata Classification up to classes. Salient features of phylum and classes. Class 1 Asteroidea Eg. <i>Astropecten</i> Class 2 Ophiuroidea Eg. <i>Ophiothrix</i> Class 3 Echinoidea Eg. <i>Echinus</i> Class 4 Holothuroidea Eg. <i>Holothuria</i> Class 5 Crinoidea Eg. <i>Antedon</i></p> <p>General Topics</p> <ul style="list-style-type: none"> • Water vascular system in Echinodermata 	6	1, 2
	3.3	<p>Phylum Hemichordata Salient features and affinities Eg. <i>Balanoglossus</i></p>	1	1
	3.4	<p>Minor Phyla Salient features of</p> <ol style="list-style-type: none"> 1. Phylum Chaetognatha Eg. <i>Sagitta</i> 2. Phylum Sipunculida Eg. <i>Sipunculus</i> 	1	1
Module IV: Animal Diversity- Non Chordata II - PRACTICAL			(30 Hrs)	
4	4.1	<p>Scientific Drawing: Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.</p>	5	4
	4.2	<p>General identification and classification (Phylum, Class, Genus and Species)</p> <ol style="list-style-type: none"> a) Arthropoda - 6 b) Mollusca - 4 c) Echinodermata - 3 d) Minor Phyla - 2 	2	5
	4.3	<p>Dissections</p> <ol style="list-style-type: none"> 1. Prawn - Nervous system 2. Cockroach - Nervous system 	8	3

	4.4	Mounting:- 1. Prawn appendages. 2. Mouth parts - Cockroach/ Plant bug/ Mosquito. (Any Two)	6	3
	4.5	Taxonomic identification with key Identification of insects up to the level of order (Any Three).	3	5
	4.6	Larval identification (Any Two). (Nauplius, Zoea, Metazoea, Mysis)	1	2
	4.7	Group activity: Identification and classification of any five arthropods from college campus. (Group of 3 to 5) Geotagged photo submission in the form of print out	5	5

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1. Dhami, P.S. and Dhami, J.K., (1979). Invertebrate Zoology. S. Chand and Co. New Delhi.
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5. Jordan E. L and Verma P.S (2007). Invertebrate Zoology. S.Chand and Co.New Delhi.
6. Kotpal, R. L. (2012). Modern Textbook of Zoology: Invertebrates. R. K. Rastogi Publications.
7. Zoological Society of Kerala Study Material. Animal Diversity 2002 and 2010.

Suggested Readings:

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2. Barrington, E.J.W., (1967). Invertebrate Structure and function. ELBS and Nelson, London.
3. Hall, B. K., and Hallgrimsson, B. (2008). Strickberger's Evolution, 4th Edition. Jones and Bartlett Publishers.
4. Mayr, E. and Ashlock (1991). Principles of Systematic Zoology, 2nd Edition. McGraw Hill and Company.
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ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
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Programme	B.Sc. (Hons.) Zoology					
Course Name	ETHOLOGY					
Type of Course	MAJOR					
Course Code	ZO3DSEA01B24					
Course Level	200-299					
Course Summary	The course highlights a basic knowledge on the concepts of animal behaviour pattern and also covers some basic aspects of human ethology.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Hours
		4				
Pre-requisites, if any	Basic knowledge and observation on animal behavior.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Describe the foundational concepts of ethology.	U	1
2	Explain biological clock, animal migration and various communication strategies among animals	U	1,2
3	Describe different types of biological rhythms and their adaptive significance in regulating physiological and behavioral processes in organisms.	U	1,2
4	Apply ethological concepts in shaping human social interactions and group dynamics.	A	1,4
5	Explain Psychological tests for measuring Human Behaviour.	A	1,4,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Basic concepts			(14 Hrs)	
1	1.1	Definition, Branches of Ethology, History, Scope.	3	1
	1.2	Motivation, Fixed Action Patterns, Learning, Types of learning with examples - Habituation, Sensitization, Associative and Cognitive learning, Imprinting.	6	1
	1.3	Mammalian nervous system and Behaviour, Forebrain, Midbrain, Hindbrain, Reticular Activating System, Reticular Formation	5	1
Module II: Biological clocks, migration and communication			(20 Hrs)	
2	2.1	Biological clocks, Types of rhythms - Circannual, Circatidal, Circalunar, Semilunar, Circadian Clocks	4	2
	2.2	Bird migration, types, causes, Advantages, Methods to study migration and navigation	3	2
	2.3	Fish Migration, homing, Types of migratory fishes, Causes of migration - gametic, Alimental, Climatic, Osmoregulatory, Factors influencing migration, hibernation, aestivation	4	2
	2.4	Communication - Types, Sensory mechanisms: electrical, chemical, olfactory, auditory and visual. Dance language of honey bees.	5	2
	2.5	Pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and parental behavior).	4	2
Module III: Sociobiology, parental behavior			(11 Hrs)	
3	3.1	Sociobiology - Basic Social Behaviours, Altruism, Hamilton's theory, Cooperation, Reciprocation, Selfishness, Eusociality.	4	3
	3.2	Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies.	4	3
	3.3	Parental Behaviour - Care before birth, Care after birth, Early Parental care, Factors affecting parental care, Types, Parent Offspring Conflict	3	3
Module IV: Human Ethology			(15 Hrs)	
4	4.1	Introduction, Ethological concepts and Human Behaviour, Concept of Sign Stimulus, Concept of Imprinting, Kinship and Human Social Systems.	4	4
	4.2	Human Pheromones, Human Beings and Territorial Behaviour, Human Aggressive Behaviour.	5	4
	4.3	Development of Human Behaviour.	6	4, 5

		Measuring Human Behaviour - Psychological test (Definition). Characteristics of a good psychological test. Difference between Testing and Assessment. Classification of test (Briefly) Ethical issues in psychological testing.		
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References:

1. Agarwal. V. K. (2009). Animal Behaviour. S. Chand and Company Pvt. Ltd., NewDelhi.
2. Alcock, J. (2009). Animal behavior: An evolutionary approach. Sinauer Associates.
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4. Bonner, J.T. (1980). The Evolution of Culture in Animals. Princeton University Press. NJ,
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18. Scott, G. (2009). Essential animal behavior. John Wiley and Sons.
19. Wilson, E. O. (2000). Sociobiology: The new synthesis. Harvard University Press.

Suggested Readings:

1. Hussain, A. (2012). Psychological Testing. New Delhi: Pearson Edition.
2. Singh, A. K. (2010). Tests, measurements and Research Methods in Behavioural Sciences. New Delhi: Bharathi Bhawan.



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
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Programme	B.Sc. (Hons.) Zoology					
Course Name	ANIMAL-DERIVED VALUE-ADDED PRODUCTS					
Type of Course	MAJOR					
Course Code	ZO3DSEA02B24					
Course Level	200-299					
Course Summary	<p>Raises student's awareness of procedures for preventing raw produce from spoiling and provides them with an idea of the range of easily prepared, ready-to-eat products that can meet the needs of modern consumers at a fair price. It also gives interested parties the opportunity to process during periods of excess production and decreased sales of fresh perishable livestock produce in order to add value to less perishable products, store them, and sell them later in larger quantities. Encourage the growth of entrepreneurship and jobs.</p>					
Semester	III	Credits			4	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		4				
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
After the successful completion of the course the student should be able to:			
1	Describe products and value-added products of bee keeping.	I, U	1,2
2	Explain fishery products, by-products and value-added products.	I, U	1,2
3	Explain Meat and Poultry Products.	U	1,2,9,10
4	Describe testing and grading of raw milk, preparation of cultured milks and milk products.	U	1,2,9,10
5	Examine employment and entrepreneurship opportunities in value-added animal products.	A	1,2,9,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Unit	Course description	Hrs	CO No.
Module I: Products and value added products of bee keeping			(15 Hrs)	
1	1.1	Honey - bee wax, bee venom - Honey Production, chemical composition - Economic importance of Honey bee wax.	6	1, 5
	1.2	Value added products of honey- Fermented honey (mead), honey paste for dressing wounds, honey jelly, honey caramels, creamed honey, comb honey, honey beer, honey fruit syrup, honey with fruits and nuts and honey gums and their manufacture.	9	1, 5
Module II: Fishery products, by-products and value added products			(15 Hrs)	
2	2.1	Fish protein concentrate, fish oils- fish liver oil and body oil, squalene from shark liver oil, fish gelatin, fish glue, fish maws and isinglass, fish wafers, fish silage, fish skin leather, shark cartilage, fertilizer from fish waste, chitin and chitosan, surimi, roe, ambergris, ready to cook and ready to eat products.	12	2, 5
	2.2	Additives and classes of additives.	3	2, 5
Module III: Meat and Poultry Products			(15 Hrs)	
3	3.1	Meat Products: Canned meat, Frozen meat, Cooked and Refrigerated meat, Dried and preserved meat, Cured meat, Prepared meat products, Production methods for Intermediate moisture and dried meat products, Different kinds of goat meat products - Curried goat, Goat Sausage, Goat Hamburger. Organ products for food and pharmaceuticals.	8	3, 5
	3.2	Poultry Products: Poultry meat processing operations in detail along with equipment used -Packaging of poultry products, refrigerated storage of poultry meat, by products - eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.	7	3, 5
Module IV: Milk Products			(15 Hrs)	
4	4.1	Testing and grading of raw milk. Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined, flavoured milks. Kulfi, butter milk, lactose, casein.	7	4, 5
	4.2	Preparation of cultured milks, cultures and their management, yoghurt, Dahi, Lassi and Srikh. Milk products such as Cream, Butter, Peda, Paneer, Burfi,	8	4, 5


		Ghee, Khoa, Cheese, rasagolla mix, condensed, evaporated, dried milk and baby food, Ice cream.		
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References:

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2. Aneja, R.P., Vyas, M.N., Nanda, K. and Thareja, V.K. (1977). Development of an Industrial process for the manufacture of shrikhand. J. Food Sci. Technology.14:159-163.
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 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	APPLIED ZOOLOGY
Type of Course	MINOR
Course Code	ZO3DSCB101B24
Course Level	200-299
Course Summary	The course equips students with self employment capabilities and acquaints them with various rearing techniques in Poultry, Apiculture, Sericulture and Aquaculture. It provides them with the scientific knowledge of profitable farming of Bees, Silkworms and Fishes. Students gain knowledge and skills in poultry, fish, silkworm, and honey bee farming through this course. It also promotes student entrepreneurship.
Semester	III
Course Details	Credits
	4
	Total Hours
	75
Pre-requisites, if any	NIL

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Distinguish different breeds of poultry, duck, quail, and cultivable fish and shell fish species.	Ap, U	1,2,3,10
2	Explain common diseases of poultry and fish.	A	1,2,3,10
3	Identify economically important insects, castes of honey bees, bee products, pollen basket and cocoon.	I, U	1,2,3,10
4	Compare different aquaculture methods.	I, U	1,2,3,10
5	Explain management of quail, ducks, and poultry.	I, A	1,2,3,10
<i>*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Poultry farming			(9 Hrs)	
1	1.1	Introduction, Poultry breeds in India, Broilers and layers, Poultry Housing and Equipment, Poultry feed and its composition, Importance of egg production, Nutritive value of eggs and meat, Diseases and their management.	5	1,5
	1.2	Husbandry of quail - Breeds in India, Advantages of quail rearing - Housing, feeding and management of quail.	2	1,5
	1.3	Husbandry of ducks - Breeds in India, Advantages of duck rearing - Housing, feeding and management of ducks	2	1,5
Module II: Economically important insects			(21 Hrs)	
2	2.1	Useful Insects: Honey bee, silk worm, Black soldier fly. Apiculture, Sericulture	15	3
	2.2	Pests of paddy <i>Leptocorisa acuta</i> (Rice bug)]; Pests of coconut <i>Oryctes rhinoceros</i> (Rhinoceros beetle), Pests of stored products <i>Sitophilus oryzae</i> (Rice weevil).	3	3
	2.3	Vectors of public health importance - Mosquitoes- elephantiasis, malaria, chikun guinea, dengue, zika and Housefly - typhoid, dysentery	3	3
Module III: Aquaculture			(15 Hrs)	
3	3.1	Introduction and scope, Advantages and salient features, Types of aquaculture, Biotic and abiotic factors affecting aquaculture.	4	4
	3.2	Pond culture, Brief Description of common cultural fishes of Kerala, Composite fish culture. Integrated Fish Culture, Induced breeding in fishes, Mussel culture, Prawn culture. Important Fish Diseases. Fish preservation and processing.	8	2, 4,5
	3.3	Aquarium management: Setting up of an Aquarium.	3	4
Module IV: Applied Zoology - PRACTICAL			(30 Hrs)	
	4.1	• Poultry breeds (picture identification)	6	1, 5
	4.2	• Study of Pests of paddy <i>Leptocorisa acuta</i> (Rice bug), Pests of coconut <i>Oryctes rhinoceros</i> (Rhinoceros beetle) Pests of stored products	16	3, 5

4		<p>[<i>Sitophilus oryzae</i> (Rice weevil) through damaged plant parts /photographs.</p> <ul style="list-style-type: none"> • Identification different species and castes of honey bees and bee products. Identification of pollen basket and mouth parts of Honey bee using picture/ photograph. • Bee keeping equipments • Identification of Silk worm moth, cocoon. Identification of black soldier fly–Preparation of black soldier fly unit. 		
	4.3	<ul style="list-style-type: none"> • General Identification, scientific names and common names of the following a. cultivable fish species (Catla, Rohu, Mrigal, Etroplus, Tilapia) and b. shellfish species (Any 3: <i>Fenneropenaeus indicus</i> / <i>F.monodon</i> / <i>Macrobrachium</i>, <i>Perna viridis</i> / <i>P. indicus</i>) 	8	1, 4


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Suggested Readings:

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 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	HUMAN DISEASES AND ITS MANAGEMENT					
Type of Course	MDC					
Course Code	ZO3MDC01B24					
Course Level	200-299					
Course Summary	Familiarizing various causative organisms and factors for human diseases, how and what preventive and therapeutic measures can be adopted against these diseases, the need to keep away/manage communicable diseases and life style diseases, thereby creating a healthy society and the need for maintaining vectors below damage threshold levels.					
Semester	III	Credits			3	Total
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Hours
		3				
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe epidemiology, pathogenicity, mode of transmission, symptoms, diagnosis, treatment and preventive measures of common airborne, waterborne, foodborne, and microbial infectious diseases.	U	1,2,3
2	Distinguish infectious zoonotic diseases and its preventive measures	U	1,2,3
3	Differentiate the symptoms, diagnosis, treatment and preventive measures of disorders of the central nervous system, immune system, and blood vascular system, as well as genetic, lifestyle, and nutritional deficiency diseases.	A	1,2,3
4	Explain the causes and types of cancer, the characteristics of cancer cells, and theories of carcinogenesis.	U	1,2,3
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Infectious diseases			(15 Hrs)	
1	1.1	Introduction, health: - Need for being healthy. Classification of diseases: - infectious and non - infectious.	2	1,2
	1.2	Infectious diseases: -Description of disease, epidemiology, pathogenicity, mode of transmission, symptoms, diagnosis, treatment and preventive measures required for 2 diseases each from a category. 1. Air borne (Diphtheria, measles) 2. Water borne (typhoid, hepatitis A) 3. Food borne (Botulism, Salmonellosis) 4. Microbial - bacterial (TB, Tetanus) 5. Viral, (Nipah, chickenpox) 6. Fungal (Candidiasis, Aspergillosis), 7. Protozoan (Malaria, leishmaniasis), 8. Helminthic (Schistosomiasis, ascariasis). 9. Zoonotic diseases- Leptospirosis, Rabies, Nipah - Kerala context.	13	1,2
Module II: Non infectious diseases - 1			(15 Hrs)	
2	2.1	Non infectious diseases - Description of disease, symptoms, diagnosis, treatment and preventive measures required for 2 diseases each from a category.	5	3
	2.2	Genetic disorders (Klinefelter's syndrome, Down syndrome) Life style diseases (Diabetes, obesity).	5	3
	2.3	Nutritional deficiency diseases- Scurvy, Marasmus	5	3
Module III: Non infectious diseases - 2			(15 Hrs)	
3	3.1	Non infectious diseases Disorders of blood vascular system (Atherosclerosis, Stroke) Disorders of immune system - Immune deficiency disorders (AIDS, SCID), Autoimmune disorders (Rheumatoid arthritis, SLE)	10	3
	3.2	Disorders of central nervous system (Parkinson's disease, Alzheimer's disease)	2	4
	3.3	Cancer - causes, types, characteristics of cancer cells, theories of carcinogenesis	3	4

References:

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 3. Emily Reisner and Howard Reisner (2004) Crowley's An introduction to human diseases: Pathology and Pathophysiology Correlations (2004). 11th edition, Jones and Bartlett Learning
 4. Margaret Schell Frazier and Tracie Fuqua (2020) Essentials of human diseases and conditions. 7th edition. Published by Elsevier Health sciences.
 5. Marianne Neighbors, Ruth Tannehill Jones (2018) Human diseases 5th edition, Delmar Cengage Learning.

Suggested Readings:

1. Bhattacharya and Chakraborty (1999) Hand Book of Clinical Pathology. Amer Society of Clinical; 2nd edition.



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
Affiliated to Mahatma Gandhi University, Kottayam

Programme	B.Sc. (Hons.) Zoology					
Course Name	WELLNESS SCIENCE AND HUMAN RIGHTS					
Type of Course	VAC					
Course Code	ZO3VAC01B24					
Course Level	200-299					
Course Summary	Facilitates the development of a life-saving stress-reduction skill in students by helping them to synthesize the insights gained by Anthropologists, Psychologists, and human development experts regarding the experience of happiness. And also to cultivate an understanding of human rights in all of its forms and conceptions.					
Semester	III		Credits		3	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		3				45
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Identify the factors contributing to happiness in the personal, familial and community life of an individual.	U	1,2,3,6
2	Describe different theories of Happiness.	U	1,2,3
3	Distinguish potential sources and consequences of stress.	U	1,3,5
4	Explain individual approaches of Managing stress.	A	1,3,5
5	Describe the fundamental concepts of human rights, the human rights provisions stipulated in the Indian Constitution, and the UN's involvement in these areas.	A	3,6,7,8,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Unit	Course description	Hrs	CO No.
Module I: Science of happiness			(15 Hrs)	
1	1.1	Human Ecology and Happiness. Definitions/Factors of Happiness: Environmental and Social. Physical, emotional and psychological well-being for happiness. Physiological and hormonal basis of happiness.	5	1
	1.2	Theories of Happiness: - Need/ goal satisfaction theory, Process/ activity theory, Genetic/ personality theories. Idea of Self and other, Hierarchy and stages of happiness. New ways of thinking and rewiring the brains and be happy: 1. Be authentic 2. Change your perspective 3. Grow positive feelings 4. Cultivate mindfulness 5. Develop and foster healthy relationships 6. Create meaning Happiness: Cross-cultural Contexts: Culture and Happiness, Interpersonal Relationship: Comparative Perspective, Towards Self-Actualization. Local and Global Perspective of Happiness, Measuring happiness: Key indicators, Happiness Index, India in Global Happiness Indices	10	2
Module II: Stress management			(15 Hrs)	
2	2.1	Coping with Stress- A life-saving skill: Stress can be bad and good as well. Potential sources of stress - Environmental factors, organizational factors, personal factors.	3	3,4
	2.2	Consequences of stress- Physiological -headache, high blood pressure, heart disease; Psychological- anxiety, depression, decrease in job satisfaction; Behavioural- changes in productivity, absenteeism, sleeping disorders, changes in eating habits etc.	5	3, 4
	2.3	Approaches of Managing stress- a) implementing time management techniques - (1) making daily lists of activities to be accomplished; (2) prioritizing activities by importance and urgency; (3) scheduling activities according to the priorities set; and (4) knowing your daily cycle and handling the most demanding parts of your job during the high part of your cycle when you are most alert	7	3, 4

		and productive; b) increasing physical exercise - such as aerobics, walking, jogging, swimming, and riding a bicycle;c) relaxation training- meditation, hypnosis, biofeedback; d) expanding social support network -have friends, family and colleagues as an outlet of stress.		
Module III: Human rights			(15 Hrs)	
3	3.1	An Introduction to Human Rights, Meaning, concept and development. Universality of Human Rights- Basic International Human Rights Documents - UDHR, ICCPR, ICESCR.	5	5
	3.2	Human Rights and United Nations Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.	5	5
	3.3	Human Rights National Perspective Human Rights in Indian Constitution - Fundamental Rights- The Constitutional Context of Human Rights- directive Principles of State Policy and Human Rights- Human Rights of Women-children -minorities- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.	5	5

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Suggested Readings:

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SEMESTER 4



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
Affiliated to Mahatma Gandhi University, Kottayam

Programme	B.Sc. (Hons.) Zoology				
Course Name	ANIMAL DIVERSITY - CHORDATA I				
Type of Course	MAJOR				
Course Code	ZO4DSCA01B24				
Course Level	200-299				
Course Summary	The course provides a general overview of chordate classification and emphasizes the distinctions among the many classes of chordates, up to Class Reptilia. It also clarifies the evolutionary relevance of some organisms that serve as the intermediaries between two groups. Additionally, it aids in distinguishing between deadly and non-poisonous snakes. The training provides opportunities for skill development in comprehending chordates' diversity, systematic position, and economic significance.				
Semester	IV	Credits			4
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others
		3		1	
Pre-requisites, if any	Basic knowledge on animal diversity.				
					Total Hours 75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
After the successful completion of the course the student should be able to:			
1	Classify Chordata up to class.	U	1,2
2	Compare the general characters of Protochordates, Agnatha, Pisces, Amphibians and Reptiles.	U	1,2
3	Explain Parental care, Scales, Migration and Accessory respiratory organs in fishes.	I, U	1,2
4	Distinguish different Orders coming under Class amphibia and Reptilia.	U	1,2
5	Explain the different organ systems of Amphibia.	A	1,2,10
6	Differentiate the poisonous and non-poisonous snakes.	I, A	1,2,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Classification of chordata			(13 Hrs)	
1	1.1	Introduction General Characters and outline classification of Chordata up to class.	2	1
	1.2	Protochordates: General characters and Classification	1	2
	1.3	Sub phylum: Urochordata: General characters and Classification Class 1 Larvacea Eg. <i>Oikopleura</i> (mention paedogenesis and Oikopleuran house) Class 2 Ascidiacea Eg: <i>Ascidia</i> (Mention Retrogressive Metamorphosis) Class 3 Thaliacea Eg: <i>Doliolum</i>	4	2
	1.4	Sub phylum: Cephalochordata Example - <i>Amphioxus</i> (Structure and affinities)	3	2
	1.5	Sub phylum: Vertebrata General characters and Classification Division 1- Agnatha Class I Ostracodermi Eg: <i>Cephalaspis</i> Class II Cyclostomata Eg: <i>Petromyzon</i> Division 2 - Gnathostomata	3	2
Module II: Superclass Pisces			(13 Hrs)	
2	2.1	Super class Pisces General Characters and Classification	1	2
	2.2	Class: Chondrichthyes - General Characters Sub class - Elasmobranchii Eg: Shark Sub class - Holocephali Eg: <i>Chimaera</i>	2	2
	2.3	Class: Osteichthyes - General Characters Sub class - Choanichthyes Order 1 Crossopterigii (Coelocanths) Eg: <i>Latimeria</i> (Evolutionary Significance) Order 2 Dipnoi Eg: <i>Lepidosiren</i> Sub class: - Actinopterygii Super order 1. Chondrostei Eg: <i>Acipenser</i> Super order 2. Holostei Eg: <i>Amia</i> Super order 3. Teleostei Eg: Sardine	4	2
	2.4	General topics 1. Accessory respiratory organs in fishes. 2. Parental care in fishes.	6	3

		3. Scales in fishes. 4. Migration in fishes		
Module III: Super class: Tetrapoda			(19 Hrs)	
3	3.1	General characters	1	4
	3.2	Class Amphibia - General characters, Classification up to Orders. Mention the extinct orders. Order 1 Anura Eg: <i>Hyla</i> Order 2 Urodela Eg: <i>Ambystoma</i> (mention axolotl larva and Paedomorphosis /neoteny) Order 3 Apoda Eg: <i>Ichthyophis</i> . Mention <i>Nasikabatrachus sahyadranis</i>	3	4
	3.3	Class Amphibia - Type Frog (<i>Euphlyctis hexadactylus</i>)	10	5
	3.4	Class Reptilia - General characters, Classification up to Orders Sub class I: Anapsida Order Chelonia Eg: <i>Chelone</i> Sub class II: Parapsida Eg: <i>Ichthyosaurus</i> Sub class III: Diapsida Order 1 Rhynchocephalia Eg: <i>Sphenodon</i> Order 2 Squamata Eg: <i>Chamaeleon</i> Order 3. Crocodilia Eg: <i>Crocodylus</i> Sub class IV: Synapsida Eg: <i>Cynognathus</i>	2	4
	3.5	General topics 1. Identification of venomous and non- venomous snakes 2. Common venomous and non- venomous snakes of Kerala 3. Biting mechanism of snakes	3	6
Module IV: Animal diversity - Chordata I - PRACTICAL			(30 Hrs)	
4	4.1	Scientific Drawing Make scientific drawing of 3 locally available vertebrate specimens belonging to different Classes	3	2
	4.2	Dissections Frog: Photographs/diagrams/one dissected and preserved specimen each/models /virtual Dissections may be used for study 1. Frog Viscera 2. Frog Digestive System 3. Frog Arterial System 4. Frog 9 thand 1st Spinal nerve 5. Frog Sciatic Plexus 6. Frog Brain	6	5

4.3	Mounting of placoid scales; study of cycloid and ctenoid scales	4	3
4.4	Osteology Frog vertebrae - typical, atlas, 8th and 9th Pectoral and pelvic girdles of Frog Turtle/Tortoise - plastron and carapace	4	5
4.5	Study of sections. <i>Amphioxus</i> T. S. through pharynx/T.S. through intestine	1	2
4.6	Identification: General identification Identify, classify and describe the following animals by their scientific names. Protochordata-1, Pisces-5, Amphibia-5, Reptilia- 5 A. Taxonomic identification with key: i) Identification of fishes up to the level of order (Any 4 different orders). ii) Identification of snakes up to family (Any 2 venomous and 2 nonvenomous snakes). B. Identification of different types of caudal fins	9	1, 6
4.7	Group activity- Report presentation of homestead/campus biodiversity of Amphibia and Reptilia/fish diversity of the locality	3	2


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Suggested Readings:

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4. Marshall, A.J. (1995), Textbook of Zoology: Vertebrates, The McMillan Press Ltd.
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6. Pough H. (2009) Vertebrate life, (8 th Ed.), Pearson International.

		ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam				
Programme	B.Sc. (Hons.) Zoology					
Course Name	BIOCHEMISTRY					
Type of Course	MAJOR					
Course Code	ZO4DSCA02B24					
Course Level	200-299					
Course Summary	An extensive investigation of bioenergetics, enzymology, biomolecules, and metabolism is offered in this course. Students will comprehend the chemical basis of life.					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Basic knowledge on body functions.					

COURSE OUTCOMES

CO No.	Expected Course Outcome	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Discuss how energy is released into high-energy compounds capable of driving biochemical reactions and various primary metabolic pathways.	U	1
2	Explain the role of enzymes in catalyzing biochemical reactions.	U	1,2
3	Describe the structure and function of the building blocks of life - carbohydrates, proteins, lipids, and nucleic acids.	U	1,2
4	Explain the metabolic profile of organs, metabolic responses, and disorders.	U	1,3
5	Prepare standard solutions to analyse biomolecules in various samples.	A	1,2,10
6	Illustrate molecular structures of carbohydrates, proteins and nucleic acids	A	1,4
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Biomolecules			(17 Hrs)	
1	1.1	Carbohydrates: Biological function. Classification- Monosaccharides- Fischer's and Haworth's structure of Glucose, Fructose, Galactose, Mannose. Oligosaccharides - Maltose, Lactose and Sucrose. Polysaccharides- Glycogen, Chitin, Hyaluronic acid. Enantiomers, Anomers, and Epimers.	5	3
	1.2	Proteins: Biological function. Amino acids- Basic structure. Zwitterions. Isoelectric point. Essential and non-essential amino acids. Ketogenic and Glucogenic amino acids (egs.). Levels of organization of proteins - primary (Insulin), secondary (Collagen), tertiary (Myoglobin) and quaternary structure (Haemoglobin). Mention Ramachandran plot. Chaperons.	4	3
	1.3	Lipids: Biological function. Basic structure- Triglycerides. Fats, oils and waxes. Saturated and unsaturated fatty acids, Cis and trans fatty acids. Reactions- Saponification, Rancidity. Generation of free radicals and role of antioxidants. Cholesterol and its importance. Physiological functions of Sphingolipids and Phospholipids.	5	3
	1.4	Nucleic acids: Biological function. Basic structure- Purines and Pyrimidines, Nucleosides and nucleotides. RNA (m-RNA, t-RNA, r-RNA) and DNA (A, B and Z model).	3	3
Module II: Enzymology			(9 Hrs)	
2	2.1	Enzyme Chemistry Chemical nature of enzymes. Holoenzyme, Apoenzyme, Non-proteinaceous enzymes: ribozymes, DNA enzymes, Abzymes. Coenzyme, Cofactor. Classification (I.U.B. system).	2	2
	2.2	Enzyme Kinetics Mode of action of enzymes- lowering of Activation energy, Michaelis-Menten Curve. Km and its significance. Factors affecting enzyme-catalyzed reaction.	4	2
	2.3	Enzyme Inhibition Reversible inhibition (Mention competitive, uncompetitive and non competitive) (eg: methanol inhibition of ADH), irreversible inhibition (eg: Iodoacetate inhibition of SDH),	3	2

		and feedback enzyme inhibition (eg: citrate inhibition of glycolysis). Isoenzymes (eg: LDH) and Allosteric enzymes (eg: PFK-1).		
Module III: Bioenergetics and Metabolism			(19 Hrs)	
3	3.1	Free energy changes, coupled reactions, redox reactions. High energy compounds.	2	1
	3.2	Overview of Metabolic pathways- Anabolic and Catabolic pathways Carbohydrate - Cellular respiration - Glycolysis - aerobic and anaerobic (alcohol and lactic acid fermentation), Krebs cycle, Oxidative phosphorylation. Glycogen metabolism- Glycogenesis, Glycogenolysis. Gluconeogenesis, HMP shunt	7	1
	3.3	Amino acid - Transamination, Deamination, Urea cycle	2	1
	3.4	Lipid - Fatty acid activation, Carnitine Shuttle, and Beta Oxidation of fatty acids.	5	1
	3.5	Metabolic disorders - Diabetes, Keto acidosis, Lactose intolerance, Hyperlipidemia, Atherosclerosis.	3	4
Module IV: Biochemistry - PRACTICAL			(30 Hrs)	
4		Calculation of Molarity and normality of solutions. Preparation of standard solutions.	6	5
		Study of the structure of Carbohydrates - Glucose and Fructose using Ball and stick model	2	6
		Study of the structure of Nucleic acids- DNA, RNA and Protein using software tools	6	6
		Qualitative analysis of Carbohydrates, Proteins and lipids	6	5
		Qualitative analysis of Urease	4	5
		Saponification test	6	5


References:

1. Berg, J. M., and Tymoczko, J. L. (2018). *Stryer biochemie* (Vol. 8). Heidelberg: Springer Spektrum.
2. Chatterjee, M. N., and Shinde, R. (2000). *Textbook of medical biochemistry. Metabolism of Carbohydrates*. Jaypee Brothers Medical Publishers, New Delhi, India, 421.
3. Ferrier, D. R. (2014). *Lippincott's illustrated reviews*.
4. Nelson, D. L., and Cox, M. M. (2013). *Lehninger Principles of Biochemistry* 6th Edition.
5. Reed, R., Weyers, J., and Jones, A. (2016). *Practical Skills in Biomolecular Science 5th Edn*. Pearson Education Limited.
6. Rodwell, V. W., Bender, D., and Botham, K. M. (2018). *Harper's illustrated biochemistry*. McGraw-Hill.

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7. Vasudevan, D. M., Sreekumari, S., and Vaidyanathan, K. (2019). *Textbook of biochemistry for medical students*. Jaypee brothers Medical publishers.
 8. Voet, D., Voet, J. G., and Pratt, C. W. (2018). *Voet's principles of biochemistry*. John Wiley and Sons.
 9. Wilson, K., Hofmann, A., Walker, J. M., and Clokie, S. (Eds.). (2018). *Wilson and Walker's principles and techniques of biochemistry and molecular biology*. Cambridge university press.

Suggested Readings

1. "<https://openstax.org/books/concepts-biology/pages/2-3-biological-molecules>"
2. "<https://en.wikibooks.org/wiki/Biochemistry>"
3. <https://biochem.oregonstate.edu/undergraduate/educational-resources>"
4. "<https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch450-and-ch451-biochemistry-defining-life-at-the-molecular-level/ch450-biochemistry-i-student-and-teacher-resources/>"
5. "<https://www.abpishools.org.uk/topics/chemistry-of-life/the-importance-of-chemistry-in-biology/>"
6. "<https://home.csulb.edu/~cohlberg/songbook.html>"

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
CourseName	HEALTH, NUTRITION AND WELLNESS
Type of Course	MAJOR
Course Code	ZO4DSEA01B24
Course Level	200-299
Course Summary	The course explores the fundamental principles of nutrition, emphasizing the role of a balanced diet in promoting health and wellness. Topics include macronutrients, micronutrients, dietary guidelines, and their impact on various aspects of physical and mental well-being. Additionally, the course delves into lifestyle factors, such as exercise and stress management, contributing to overall health.
Semester	IV
Course Details	Credits
	4
Learning Approach	Total Hours
	60
Pre-requisites, if any	NIL

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the fundamental concepts of nutrition and their role in maintaining health and well-being.	U	1,6
2	Employ healthy habits in daily life.	A	1,2,8
3	Distinguish healthy life style choices.	U	1,10
4	Explain the role of nutrition in disease prevention and management	A	1,3
5	Describe the impact of dietary choices and exercise on health	U	1,2,3
6	Explain Nutritional management for various age groups.	A	1,6,8,10
*Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Nutrition and Health			(15 Hrs)	
1	1.1	Overview of nutrition. Basic nutrients - Macronutrients-sources and functions (Carbohydrates, Proteins and Fats), Micronutrients (vitamins, minerals- Ca, Fe, I, Na and K) their functions and sources. Vitamin toxicity (brief account only). Activity - Observe and interpret the nutritional information on the labels of food packets /tin, Assignment on Common myths and facts related to nutrition.	9	1
	1.2	Dietary antioxidants. Importance of dietary fibers and water in the diet. Balanced diet and its importance. Basal Metabolic Rate and BMI.	3	1, 3, 5
	1.3	Common nutrition-related diseases and their prevention. (Obesity, Protein Energy Malnutrition-Kwashiorkor and Marasmus, Vitamin deficiency disorders etc.)	3	4
Module II: Health and well being			(15 Hrs)	
2	2.1	Health- concept and dimensions. Benefits of regular physical activity.	2	3, 5
	2.2	Stress management and relaxation techniques. Importance of quality sleep for mental and emotional health, sleep deprivation. Sleep hygiene practices for improved sleep quality	3	2, 3
	2.3	Types of exercises and their benefits - Aerobic and anerobic. Brief account on yoga and its health benefits Activity - Short videos - Practice 3 yoga asanas or zumba or any other physical activity	10	5
Module III: Nutritional needs and Healthy dietary practices			(16 Hrs)	
3	3.1	Nutritional needs during different Life stages Nutrition for different stages - Childhood, adolescence and adulthood.	4	6
	3.2	Special nutritional requirements during Pregnancy each trimester and lactation, The importance of breastfeeding. Composition and benefits of breast milk.	4	6, 3
	3.3	Healthy dietary practices The role of nutrition in prevention and management of cardiac problems. The role of nutrition in prevention and management of diabetes.	4	4, 5

		Dietary strategies for addressing obesity. Dietary management of hypertension and lactose intolerance.		
	3.4	Overview of different dietary practices: Gluten-free, Vegan and Keto diet	2	4, 5
	3.5	Food adulteration: Impact on health, addressing concerns. Fast food culture and health implications)	2	4, 5
Module IV: Geriatric Nutrition			(14 Hrs)	
4	4.1	Overview of ageing (changes in metabolism, digestion, and absorption in aged people) and the changes in nutritional requirements. The impact of common chronic conditions (eg., Diabetes, Hypertension) on dietary requirements	6	6
	4.2	Common nutritional issues in the elderly population. Importance of adequate hydration and practical approaches to ensure adequate hydration. Activity - Meal Planning for adolescence or pregnancy or geriatrics	8	6


References:

1. Forshaw, M. (2003). Advanced psychology: Health psychology. London: Hodder and Stoughton.
2. Greenberg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health and Fitness , London Allyn and Bacon Inc.
3. Gupta P and Thakhar R, (2003): Nutritional Disorder and Community Health, Pointer Publishers, Jaipur.
4. Hick, J.W. (2005). Fifty signs of Mental Health. A Guide to understanding mental health. Yale University Press.
5. Mudambi, SR and Rajagopal, MV. (2007) Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; New Age International Publishers
6. Raheena Begum(1989) A Test Book of Foods, Nutrition and Dietetics, Sterling Publishers, New Delhi.
7. Shills, M.E, Oslon, J.A, Shike, M and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition.
8. Shubhangini A. Joshi,(1992)' "Nutrition and Dietetics"TataMc Grow- Hill publishing Company Ltd, New Delhi.
9. Snyder, C.R., and Lopez, S.J.(2007). Positive psychology: The scientific and practical explorations of human strengths. Thousand Oaks, CA: Sage.
10. Srilakshmi. B.; (2021) "Nutrition Science", VIIEdn., New Age International (P) Ltd, Publishers, Chennai
11. Swaminathan J (1995): "Food and Nutrition", The Bangalore Printing and publishing co ltd., Vol I, Second Edition, Bangalore.

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12. Swaminathan M (1986) Handbook of Foods and Nutrition; Fifth Ed, The Bangalore Printing and Publishing.
 13. Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor and Francis Publishers Ane Book
 14. Williams S.R. (1993): Nutrition and Diet Therapy, 7th Ed. Times Mirror / Mosby College Publishing, St. Louis.
 15. Williams, R.(2002):Medications and older adults .FDA Consumer magazine.

Suggested Readings:

1. Carr, A. (2004). Positive Psychology: The science of happiness and human strength. UK: Routledge.
2. National Institute of Nutrition, (2005): Dietary Guidelines for Indians - A Manual, Hyderabad
3. Neiman N. Catherine, (1990), "Nutrition", Wm.C. Brown Publishers. USA.
4. Passmore R. and Eastwood M.A,(1986), "Human Nutrition and Dietetics", English language book Society/Churchill Livingstone, Eighth edition, Hong Kong.
5. Whitney, E. N. and Rolfes, S.R. (2005): Understanding Nutrition, 10th edition, Thomson/Wadsworth Publishing company, Belmont. CA
6. Wilson, K.J.W and Waugh, A. (1996): Ross and Wilson, Anatomy and Physiology in Health and Illness, 8th Edition, Churchill Livingstone.

	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	TOXICOLOGICAL SCIENCE					
Type of Course	MAJOR					
Course Code	ZO4DSEA02B24					
Course Level	200- 299					
Course Summary	Toxicology is the scientific study of adverse effects that occur in living organisms due to exposure to toxic substances. This course provides a comprehensive understanding of the principles, practices, and applications of toxicology in various fields, from environmental and occupational health to pharmaceutical development and public policy.					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Basic knowledge on ecosystem and its pollutants.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Describe the basic principles and concepts of toxicology.	U	1
2	Explain the impacts of environmental contaminants on biodiversity, ecological processes, and ecosystem services.	A	1,4
3	Compare various chemical contaminants that can occur in food, including natural toxins, environmental contaminants, and food additives.	U	1,6
4	Describe various aspects of Veterinary toxicology	U	1,8
5	Explain the diagnosis, treatment, and management of poisoning and overdose cases in clinical settings, including the use of antidotes and supportive care.	U	1,6
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Toxicology			(13 Hrs)	
1	1.1	Introduction, definition, brief history, scope and subdivisions of toxicology, Classification of toxins, natural toxins, animal toxins, plant toxins, food toxins, genetic poisons and chemical toxins; Categorization of toxicology based on pollution.	2	1
	1.2	Dose-Response Relationships, Sources of Toxic Compounds, Movement of Toxicants in the Environment	1	1
	1.3	factors affecting toxicity- Species and strain, age, sex, nutritional status, hormones, circadian rhythms and environmental factor	10	1
Module II: Environmental toxicology			(10 Hrs)	
2	2.1	Ecotoxicological episodes, entry, fate, movement of pollutants in ecosystems, scientific approach to ecotoxicology	3	2
	2.2	Air pollution- Classification and properties of air pollutants, Behaviour and fate of air pollutants, photochemical smog, acid rain, health effects of air pollution in man. Water pollution- Origin of Waste water, Types of water pollution (domestic, Industrial, agricultural, solid waste, thermal and oil II pollution) Toxic water pollutants and their health effects, ground water pollution, health effects of marine pollution, case studies	4	2
	2.3	Occupational Toxicants- Regulation of Exposure Levels, Routes of Exposure, Examples of Industrial Toxicants	3	2
Module III: Food toxicology			(26 Hrs)	
3	3.1	Define the terms and scope of food and nutritional toxicology, toxicants in food, nutrients, naturally occurring toxicants, food additives and contaminants, impact of diet on the effect of toxicants. Cause of food poisoning, bacterial toxins, toxicants found in foods, bacteria that cause food borne illness	9	3
	3.2	Phases of toxicological effects, exposure phase, toxicokinetics phase, toxicodynamic phase	10	3

		Dose- response relationship, frequency response, potency and toxicity.		
	3.3	Fungal mycotoxins- introduction, adverse effects of mycotoxins, processes for reducing mycotoxins, Alfatoxins, trichothecens, patulin, yellow rice toxins, other mycotoxins.	7	3
Module IV: Applied toxicology			(11 Hrs)	
4	4.1	Cosmetic toxicology- Toxicity of shampoos, conditioners, bleachers, dyes, allergic and respiratory disorders.	4	5
	4.2	Veterinary toxicology- Common causes of toxicity in dogs, cats, horses and poultry, by herbicides, house hold chemical, heavy metals, mycotoxins, blue green algae and toxic plants.	5	4
	4.3	Medical toxicology- Mission of medical toxicology, Comparative toxicology, Human risk assessment, Toxicological database.	2	5

References:

1. Principles of Biochemical toxicology By John Timbrell, Taylor and Francis
2. Environmental Pollution health Toxicology by Rana S.Y.S., Narosa. New Delhi
3. General and applied Toxicology by Ballantyne T. Marrs, T. Syverscn (Volume-1II), Macmillan, UK
4. Fundamental of industrial hygiene by H. Plogg A. Barhara et al. National safety council

Suggested Readings:

1. *A Textbook of Modern Toxicology, Fourth Edition.* Edited by Ernest Hodgson
2. e-Krishi Shiksha

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Nutrition, Respiration and Circulation			(13 Hrs)	
1	1.1	Nutrition: Introduction and Types, Nutritional requirements, nutritional disorders. Antioxidants. Balanced diet, Recommended Dietary Allowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition (PEM).	4	1
	1.2	Respiration: Transport of respiratory gases, Respiratory disturbances- Hypoxia, Hypercapnia, Physiological effect of smoking, carbon monoxide poisoning	4	3
	1.3	Circulation: Composition and function of blood, Mechanism of blood clotting, ECG, Blood pressure, Arteriosclerosis, Haemophilia	5	3
Module II: Excretion, Neuro physiology and Muscle physiology			(17 Hrs)	
2	1.4	Excretion: Structure of nephron, Urine formation and concentration, Kidney stone, dialysis	5	2
	1.5	Neuro physiology: Structure of neuron, Nerve impulse production and propagation, synapse and synaptic transmission, Neurotransmitters, EEG, Neural disorder: Parkinson's and Alzheimer's diseases	6	2
	1.6	Muscle Physiology: Types of muscles, Structure of striated muscle, Mechanism of muscle contraction, Cori cycle, Muscle fatigue, Oxygen debt, Rigor mortis	6	2
Module III: Endocrinology			(15 Hrs)	
3	2.1	Endocrinology: Introduction to Endocrine system, Mechanism of hormone action, Endocrine glands, Hormonal disorders (brief account only).	15	4
Module IV: Human Physiology - PRACTICAL			(30 Hrs)	
4	4.1	Preparation of blood smear and identification of leukocytes Identification of human blood groups	12	5
	4.2	Demonstration of effect of tonicity on RBC Estimation of haemoglobin (Demonstration)	8	5
	4.3	Effect of temperature on opercular movement of fish.	8	5


	4.4	Instruments (Principle and Use) Sphygmomanometer, Stethoscope (Students are expected to learn how to monitor blood pressure and heart rate)	2	5
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References:

1. Khonsary, S. A. (2017). "Guyton and Hall: Textbook of Medical Physiology." *Surgical Neurology International*, 8.
2. Kleine, B., and Rossmann, W. G. (2016). *Hormones and the Endocrine System*. Cham: Springer International Publishing.
3. Larsen, P. R., et al. (2003). *Williams Textbook of Endocrinology*. Philadelphia: Saunders.
4. Loukas, M., et al. (2019). *Gray's Clinical Photographic Dissector of the Human Body* (2nd ed.). Elsevier Health Sciences.
5. Parslow, T. G., Stites, D. P., Terr, A. I., and Imboden, J. B. (2001). *Medical immunology*. McGraw-Hill.
6. Pommerville, J. C. (2012). *Alcamo's Fundamentals of Microbiology: Body Systems*. Jones and Bartlett Publishers.

Suggested Readings:

1. Ananthanarayan, R., and Jayaram Paniker, C. K. (2020). *Textbook of Microbiology*. Orient Longman Private Ltd.
2. Alberts, B. (2017). *Molecular biology of the cell*. Garland science.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	FIRST AID AND MEDICAL CARE					
Type of Course	SEC					
Course Code	ZO4SEC01B24					
Course Level	200-299					
Course Summary	The course gives the student the skills necessary to respond to situations with confidence by teaching them the principles of first aid, safety procedures, and life-saving strategies.					
Semester	IV	Credits			3	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		3				
Pre-requisites, if any	Basic knowledge on body systems and its functions.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the basics of First Aid.	U	1,2,3
2	Apply CPR and safety principles in various scenarios.	S, A	1,2,3,6,10
3	Illustrate the management of fractures, sprain and wounds.	S, A	1,2,3,6,10
4	Differentiate various types of burns, bites, and stings and implement tailored treatments for each condition.	S, An	1,2,3,6
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Unit	Course description	Hrs	CO No.
Module I: First Aid Essentials			(8 Hrs)	
1	1.1	First aid - Definition, Importance of first aid, Rules of first aid, contents of an ideal first aid kit.	4	1
	1.2	Emergency management Crisis management and emotional support including effective communication with casualties and bystanders, responses in casualties- AVPU (Alert, Voice, Pain, Unresponsive). Stroke symptom management - FAST (Face, Arms, Speech, Time)	4	1
Module II: First aids for frequently encountered emergency situations			(20 Hrs)	
2	2.1	Initial care for falls, fractures, dislocations, sprains, and strains, including immobilization techniques.	5	3
	2.2	Different Types of wounds Small cuts and abrasions, Head injury, nose bleed, bleeding gums, bleeding from varicose veins.	4	3
	2.3	Burns Types, danger of burns, first aid in dry burns and scalds, electrical burns, chemical burns, sunburn, heatstroke.	4	4
	2.4	Bites, Stings and Poisoning Snake bite, bed bug/ spider/ animal bite, wasp/ bee/ fire-ant/scorpion sting and poisoning- poisoning by swallowing, gases, injections, skin absorption.	5	4
	2.5	Drowning - Rescue from water, First aid measures- Position(supine) Observe, alert medical service	2	4
Module III: Basic Life Support care and Safety Education			(17 Hrs)	
3	3.1	Cardiopulmonary Resuscitation Airway, Breathing and Circulation (ABC), Cardiopulmonary Resuscitation (CPR) in adults, children and infants, automated external defibrillators (AED).	4	2
	3.2	Choking Relief Techniques Techniques in adults and children, recovery position.	4	2
	3.3	Safety education: Fundamental principles Accident prevention, hazard identification, risk assessment, and mitigation strategies, Safety at home and different workplaces like laboratories, construction sites, healthcare facilities, schools. Safety in sports.	3	2
	3.4	Safety management	3	2


		An overview on safety technologies, including sensors, alarms, personal protective equipment (PPE), and software tools for risk assessment and management.		
	3.5	ACTIVITY: <ul style="list-style-type: none"> • Preparation of First aid kit • Role play (group) on given hypothetical situations/ Pamphlet preparation on emergency care and distribution in community. • Demonstration class on CPR/ recovery position and reporting (Any one) 	3	1, 2

References:

1. Austin, M., Crawford, R. (2016). First Aid Manual: The Authorised Manual of St John Ambulance, St Andrews First Aid and the British Red Cross. United Kingdom: Dorling Kindersley.
2. First Aid Manual 11th Edition: Written and Authorised by the UK's Leading First Aid Providers. (2021). United Kingdom: Dorling Kindersley Limited.
3. First Aid -medical First Responder, Published by: District Disaster Management Authority, East Khasi hill District , Shillong Meghalaya
4. First Responder Manual , GVK Emergency Management and Research Institute, Secunderabad -500014, AP, India
5. Hunt, G. (2018). Health and Safety Pocket Book. United Kingdom: Taylor and Francis.
6. Keech, P. (2022). Practical First Aid: What to Do in an Emergency. United Kingdom: Anness Publishing.
7. Michael Stachim, Chris Bauer (Ed.) (2014) First Aid Guide Edition. BanarasidassBhenot Publication
8. Sharman, A. (2016). From Accidents to Zero: A Practical Guide to Improving Your Workplace Safety Culture. United Kingdom: Taylor and Francis.
9. Staywell. (2012). Responding to Emergencies: Comprehensive First Aid/CPR/AED. United States: American National Red Cross.

Suggested Readings:

1. Park, K (2008) Park's Text Book of Preventive and Social Mediine 18th.
2. <https://www.redcross.org/take-a-class/cpr>

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	FITNESS SCIENCE					
Type of Course	VAC					
Course Code	ZO4VAC01B24					
Course Level	200-299					
Course Summary	This course is designed in an integrated approach that blends mental resilience, and physical vigour to create an overall well-being. It investigates the interrelated facets of health, encouraging harmony and balance in the body and mind.					
Semester	IV	Credits			3	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		3				45
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
After the successful completion of the course the student should be able to:			
1	Describe basic aspects of exercise and its physiology	I, U	1,2,4,6
2	Explain the effects of exercise on the body systems.	A	1,2,3
3	Describe the relevance of psychological well being in life.	U	1,2,3,6,10
4	Explain concepts of yoga.	Ap, U	1,2,3,4,5
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT


Module	Unit	Course description	Hrs	CO No.
Module I: Basic aspects of exercise and its physiology			(19Hrs)	
1	1.1	Importance of health and wellness education. Differentiate health and wellness. Five dimensions of health. Local, demographic, societal issues and factors affecting health and wellness. Role of diet, exercise and sleep.	4	1
	1.2	Health benefits of exercise Definition. Health benefits- overview, Recovery, Regeneration	3	2
	1.3	Basics of exercise Moderate exercises for body fitness, right postures of sitting and standing, stretching, walking, aerobic and flexibility exercises.	6	2
	1.4	Effects of exercise Effect on the blood vascular system, effect on the muscular system, effect on the respiration and metabolism, effect on the endocrine system, effect on the skeletal system, body's adaptations.	6	2
Module II: Mental health			(14 Hrs)	
2	2.1	Psychological health Importance of mental health. Stress, anxiety, and depression. Factors affecting mental health. Mental health promotion activities/sessions. Counselling, Agencies supporting Mental health	6	3
	2.2	Substance abuse Substance abuse (Synthetic Drugs, tobacco products, Alcohol), de-addiction, counselling and rehabilitation.	8	3
Module III: Concepts of yoga			(12 Hrs)	
3	3.1	Yoga and its types Origin. Breathing Exercise, Meditation - Types. Asanas - Differences between Asanas and Physical exercises.	6	4
	3.2	Yoga for holistic wellness Yogic concept of health, wellness and illness, holistic health and importance in management of diseases and stress and its management.	6	4

References:

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3. Coulter, H D. (2001) Anatomy and Hatha Yoga, USA: Body and Breath Ic.
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10. Robin, M., Nagendra, HR and Ford-Kohne, N. Yoga for Common Ailments Simon and Schuster, UK, 1990
11. The AI's Guide to Psychological Well-Being. (2023). (n.p.): Cevdet Acarsoy.
12. The Sadhaks. Yoga Therapy, The Yoga Institute, Santacruz, 2002
13. Waln Brown (1995) Drugs and the Brain. York, PA: Gladden Press

Suggested Readings:

1. Key Concepts in Public Health. (2008). United Kingdom: SAGE Publications.
2. Waln Brown, Alcohol Addiction and Alcoholism: Drug Abuse Briefs for Kids and Teens (Drug Addiction and Drug Prevention Book 42) Kindle Edition

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) ZOOLOGY					
Course Name	INTERNSHIP					
Type of Course	INTERNSHIP					
Course Code	ZO4IB24					
Course Level	200-299					
Course Summary	<p>During the internship period, students will have the option to work with a diverse range of organizations, including local industries, research institutions, government agencies, and non-profit organizations. This hands-on experience allows students to apply their academic knowledge in real-world settings, gaining insight into the practical applications of zoological concepts. Additionally, students will have the opportunity to participate in training sessions conducted by faculty members and researchers in our own laboratories or in collaboration with other Higher Education Institutions (HEIs) and research institutions. These sessions provide specialized skills and techniques relevant to their field of study, enhancing their employability in the competitive job market.</p>					
Semester	IV	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Students need to have basic knowledge about the related subjects of study.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Apply theoretical knowledge of Zoology to real-world contexts by effectively implementing concepts and principles in diverse organizational settings, including industries, research institutions, government agencies, and non-profit organizations.	A	1,2,9,10
2	Employ proficiency in practical skills and techniques relevant to zoological research and fieldwork through active participation in internship experiences and training sessions conducted by faculty members and researchers.	S,A	1,2,3,5,9,10


3	Develop employability by acquiring specialized skills and knowledge through experiential learning opportunities, including participation in field-based projects, community engagement activities, and collaborative research initiatives	S,A	5,9,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
INTERNSHIP			(60 Hrs)	
1	1.1	<p>All students shall undergo Summer Internship or Apprenticeship in a Firm, Industry or Organization; or Training in labs with faculty and researchers or other Higher Education Institutions (HEIs) or Research Institutions.</p> <p>The internship can be done individually or as a group of maximum 5 students. However, a report of the internship should be submitted to the department to attain 2 credits as per the curriculum.</p> <p>The Internship offers students a multifaceted approach to practical learning in Zoology. Through summer internships, apprenticeships, and laboratory training, students immerse themselves in real-world applications of their academic knowledge.</p> <p>Internship opportunities span a wide range of sectors, including local industries, agricultural enterprises, healthcare institutions, and government agencies. Additionally, partnerships with research institutions and laboratories provide avenues for students to engage in cutting-edge scientific inquiry and contribute to ongoing research projects.</p> <p>Students gain firsthand experience in field-based learning and minor projects, allowing them to explore socio-economic and developmental issues within both rural and urban environments. Community engagement initiatives further enrich their understanding by providing opportunities to address real-world challenges and apply theoretical concepts in practical</p>		1,2,3

	<p>contexts.</p> <p>For those interested in research, specialized internships within research institutions and labs offer invaluable experiences in data collection, analysis, and scientific inquiry. Students have the chance to collaborate with faculty and researchers on diverse projects spanning topics such as conservation biology, ecology, animal behavior, and biodiversity studies.</p> <p>By participating in the Internship, students not only enhance their employability but also develop a holistic understanding of Zoology and its relevance in addressing contemporary societal and environmental issues. Through hands-on experiences and community engagement, they emerge as well-rounded professionals poised to make meaningful contributions to the field of Zoology and beyond.</p>		
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SEMESTER 5

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) Zoology				
Course	ANIMAL DIVERSITY - CHORDATA II					
Type of Course	MAJOR -DSC A					
Course Code	ZO5DSCA01B24					
Course Level	300-399					
Course Summary	The course is designed to give an overall idea on the characteristics and basic classification of Aves and Mammals. It also throws light on the systems of Pigeon and Rabbit.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Basic knowledge on animal diversity.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Classify Aves and Mammals.	A	1
2	Identify the organisms in Class Aves and Mammalia.	U	1,2
3	Explain the salient features of Aves and Mammals.	I, U	1,2
4	Describe different systems of Pigeon and Rabbit.	I, U	1,2
5	Cite the local fauna of Aves and Mammals.	Ap, U	1,2,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Class Aves			(9 Hrs)	
1	1.1	General characters - Aves Subclass Archaeornithes: Eg: <i>Archaeopteryx</i> Subclass Neornithes Super order Paleognathae: Eg: <i>Struthio</i> Super order Neognathae: Eg: Brahminy Kite	3	1, 3
	1.3	General Topics. Flight adaptations in Birds. Common birds of Kerala (brief mention only)	6	3
Module II: Type Study - Pigeon			(13 Hrs)	
2	2.1	Type: Pigeon (<i>Columba livia</i>) External characters, Skeletal System, Respiratory System, Digestive system, Circulatory system, Excretory system, Reproductive system, Nervous system and sense organs	13	4
Module III: Class Mammalia			(11 Hrs)	
3	3.1	General characters and Classification of Mammals. Subclass Prototheria Order Tachyglossa. Eg: Echidna Order Platypoda. Eg: Platypus Subclass Theria. Infra class - Metatheria Eg: Macropus Infra class - Eutheria Order Rodentia. Eg: <i>Funambulus</i> Order Chiroptera. Eg: <i>Pteropus</i> Order Soricomorpha Eg: Mole Order Afrosoricida. Eg: Tenrec Order Erinaceomorpha. Eg: Hedgehog Order Primates Eg: Lion tailed Macaque Order Artiodactyla. Eg: Camel Order Perissodactyla. Eg: Rhinoceros Order Cetacea. Eg: <i>Delphinus</i> Order Hyracoidea. Eg: Procavia Order Sirenia. Eg: Dugong Order Proboscidea. Eg: Elephas Order Tubulidentata. Eg: Aardvark Order Carnivora. Eg: <i>Panthera tigris</i> Order Lagomorpha. Eg: Rabbit Order Xenarthra. Eg: Armadillo Order Scandentia. Eg: Tree shrews Order Macroscelidea. Eg: Elephant Shrews	8	1, 3

		Order Pholidota. Eg: Pangolin		
	3.2	General Topic Adaptations of aquatic mammals with representative examples from Sirenia and Cetacea	3	3
Module IV: Type Study - Rabbit			(12 Hrs)	
4	4.1	Type: Rabbit External Characters, Integumentary system and Glands, Axial and Appendicular Skeleton, Digestive System (Mention Dentition and Secondary digestion), Respiratory System, Circulatory system, Urinogenital system, Nervous system and sense organs	12	4
Module V: Animal Diversity - Chordata II - PRACTICAL			(30 Hrs)	
5	5.1	Study of specimens (5 Birds and 5 Mammals)	4	2
	5.2	Prepare the list of the common names, scientific names and characteristics of animals from Class Aves and Mammalia.	6	5
	5.3	Study of Skeletal Structures: Bird- Heterocoelous vertebra, Synsacrum, pygostyle, keel and sternum Mammals: Skull with special reference to dentition (Diastema / Carnassial teeth), vertebrae, pectoral girdle, pelvic girdle	10	3
	5.4	Study of arterial system of bird and mammal using pictures	4	4
	5.5	Study of different parts of Heart and Kidney of rabbit from photograph/picture	6	4


References:

1. Ali, S. (1969). Birds of Kerala. Oxford University Press, Kerala
2. Ekambaranatha Iyer (2000), A Manual of Zoology Vol. II .S. Viswanathan and Co.
3. Hoar, W. S. (1983). General and comparative physiology. United Kingdom: Prentice-Hall.
4. Jhingran (1977), Fish and Fisheries of India, Hindustan Publishing Co.
5. Jordan E L and P.S. Verma, (2002), Chordate Zoology, S. Chand and Co. New Delhi
6. Joy P.J., George Abraham K., Aloysius M. Sebastian (1998). Animal Diversity. Zoological Society of Kerala, Kottayam
7. Neelakantan, K. K. (1986). Keralathile pakshikal. (n.p.): Kerala Sahitya Akademi.
8. Kotpal R.L. (2000), Modern Text Book of Zoology, Vertebrates, Rastogi Publications, Meerut - 250 002.
9. Nigam, H. C. (1983). Zoology of Chordates, Vishal Publications, Jalandhar - 1440036
10. Nigam, H.C. and Sobti (2000), Functional Organization of Chordates, Shoban Lal Nagin Chand and Co., New Delhi.
11. Parker and Hanswell, (2004), Text Book of Zoology, Vol II (Chordata), A. Z. T, B. S. Publishers and Distributors, New Delhi - 110 051
12. Pough H. (2009) Vertebrate life, VIII Edition, Pearson International

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13. Prema A.K., Terrence V.R. and Mini K.D. (Eds.) (2011). Chordate Diversity of Kerala, Zoological Society of Kerala, Kottayam.
 14. Rema. L. P, Mammals, MJP Publishers Chennai 2012, ISBN 978 81 8094 100 9
 15. Praveen, J. (2015). A checklist of birds of Kerala, India. *Journal of Threatened Taxa* 7(13): 7983-8009.
 16. Thomas A. P. (Editor) (2010) Chordata. Green leaf publications Kottayam
 17. Young J.Z. (2004), The life of Vertebrates, Oxford University Press (Third Ed.) India Ed.

Suggested Readings:

1. Bentley, P. J. (1998): Comparative Vertebrate Endocrinology (3rd edition) Cambridge University; Physiology. Italy: Wiley Press.
2. Prosser C. L. (1991) Comparative Animal Physiology, Environmental and Metabolic Animal
3. The Book of Indian Animals by S H Prater BNHS Oxford University Press.
4. William S. Hoar, General and Comparative Physiology.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam				
Programme	B.Sc. (Hons.) Zoology				
Course Name	CELL AND MOLECULAR BIOLOGY				
Type of Course	MAJOR -DSC A				
Course Code	ZO5DSCA02B24				
Course Level	300-399				
Course Summary	This course provides in-depth knowledge on the structure and function of cell organelles, cell division and cell communication. It covers DNA structure and replication, prokaryotic gene expression and regulation and the fundamentals of cancer biology. The course also emphasizes the practical applications of cellular and molecular biology.				
Semester	V		Credits		4
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others
		3		1	75
Pre-requisites, if any	Basic knowledge on Animal Cell.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Describe the cell theory, Prokaryotes, Eukaryotes, plasma membrane, cell permeability, transport and cell communication	I, U	1,2
2	Distinguish the stages of mitosis and meiosis.	U	1,2
3	Compare the structure and functions of cell organelles.	Ap, U	1,2
4	Explain the nature of genetic material, the principles of prokaryotic gene expression, and its regulatory mechanisms.	I, U	1,2,3
5	Illustrate experiments in Cell Biology and Molecular Biology.	A,S	1,2,3,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Overview of cells			(15 Hrs)	
1	1.1	Introduction of cell and Diversity of cells: History, Cell theory, Prokaryotes, Eukaryotes, Origin of Eukaryotic cell-Endosymbiotic theory, Mycoplasmas, Virions and Viroids, Prions.	5	1
	1.2	Cell membrane and Permeability: Molecular models of cell membrane (Sandwich model, Unit membrane model, Fluid mosaic model).	5	1
	1.3	Cell properties - permeability, Transport (Diffusion, Osmosis, Passive transport, Active transport, bulk transport), Modifications of plasma membrane - Cell junctions - Tight junctions, Desmosomes, Gap junctions. Cell coat and Cell recognition.	5	1
Module II: Cell Organelles, Cell cycle and cell communication.			(15 Hrs)	
2	2.1	Cell Organelles: Structure and functions of following cell organelles: Cytoskeleton, Endoplasmic reticulum, Ribosomes (Prokaryotic and Eukaryotic), Golgi complex, Lysosomes, Mitochondria	6	3
	2.2	Interphase nucleus, Nuclear membrane, pore complex, nucleolus (in detail), Chromatin	3	3
	2.3	Cell cycle - Interphase, Mitosis, meiosis. Difference between Mitosis and Meiosis.	4	4
	2.4	Cell Communication: Basic principles of cell communications, Cell signaling (in brief), Types of signaling, Mention signaling molecules (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and D derivatives), Role of cyclic AMP	2	1
Module III: Nature of Genetic material and Expression of Gene			(15 Hrs)	
3	3.1	Structure and types of DNA and RNA.	2	4
	3.2	Modern concept of gene (Cistron, muton, recon), Brief account of the following - Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons	3	4
	3.3	Prokaryotic Gene expression and regulation:	10	4

		Central Dogma of molecular biology and characteristics of genetic code; DNA replication (theta and rolling circle) Gene Expression: Transcription, Translation and Reverse transcription. Prokaryotic Gene regulation: (inducible and repressible systems) Operon concept - Lac operon and Tryptophan operon.		
Module IV: Cell and Molecular Biology - Practicals			(30 Hrs)	
4	4.1	Squash preparation of onion root tip for mitotic stages.	6	2
	4.2	Squash preparation of grasshopper testes for meiotic stages (Demonstration).	4	2
	4.3	Identification of cell organelles (using models, pictures).	2	1
	4.4	Preparation of temporary whole mount.	2	5
	4.5	Preparation of human blood smear and identification of leucocytes.	6	5
	4.6	Study and interpretation of electron micrographs/ photograph of DNA, DNA replication, RNA different types.	2	4
	4.7	Mounting of polytene chromosome (<i>Drosophila/Chironomous</i>) Demonstration	4	4
	4.8	Extraction of DNA from plant/ tissue samples.	4	5

References:

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2014). Molecular Biology of the Cell (6th ed.). Garland Science.
2. Becker, W. M., Kleinsmith, L. J., Hardin, J., and Bertoni, G. P. (2019). The World of the Cell (8th ed.). Benjamin Cummings.
3. Cooper, G. M., and Hausman, R. E. (2019). The Cell: A Molecular Approach (8th ed.). Sinauer Associates.
4. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
5. Karp, G. (2013). Cell and Molecular Biology: Concepts and Experiments (7th ed.). Wiley.
6. Koshy Thomas and Joe Prasad Mathew (Editors) (2011) Cell Biology and Molecular Biology.
7. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D., and Darnell, J. (2000). Molecular Cell Biology (4th ed.). W. H. Freeman.
8. Powar C.B. (1983) Cell Biology (Himalaya Pub.Company)
9. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., and Losick, R. (2014). Molecular Biology of the Gene (7th ed.). Pearson.

Suggested readings

1. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2019). *Essential Cell Biology*. Garland Science.
2. Berg, J. M., Tymoczko, J. L., and Gatto, G. J. (2018). *Biochemistry*. W. H. Freeman.
3. Lewin, B. (2020). *Genes IX*. Jones and Bartlett Learning.
4. Weaver, R. F. (2020). *Molecular Biology (6th ed.)*. McGraw-Hill Education.

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Principles of Transmission Genetics			(22 Hrs)	
1	1.1	Mendelian inheritance and Chromosome Theory: Mendel's Experiments- Monohybrid cross, dihybrid cross, test cross, back cross, reciprocal cross (Genetic problems to be included). Principles of inheritance, Chromosome theory of heredity. ACTIVITY Practice problems on Genetics	8	1
	1.2	Extension of Mendelism: Interaction of genes: (Brief account with one example each) Incomplete dominance, Co-dominance, Complementary, Supplementary, Dominant and Recessive epistasis, Polygenes, Pleiotropism, Modifying genes, Lethal genes. Multiple allelism - ABO Blood group system, Rh group and its inheritance in human, Erythroblastosis fetalis. Pseudo autosomal genes, sex-limited, sex-influenced, sex-linked genes and holandric genes. Mitochondrial inheritance (Brief account only).	10	1
	1.3	Linkage and Recombination: Linkage and recombination of genes based on Morgan's work in Drosophila (Complete and incomplete linkage). Recombination mapping using two-point test cross.	4	2
Module II: Sex determination			(10 Hrs)	
2	2.1	Basics of sex determination: Chromosome theory of sex determination (sex chromosomes and autosomes), Chromosomal mechanism (XX-XO, XX-XY, ZW-ZZ). Genic balance theory.	3	2
	2.2	Sex determination in Honey bees, Drosophila (Intersex) and Man. Role of SRY genes and gonad development. Hormonal and Environmental influence on sex determination.	4	2
	2.3	Barr bodies, Dosage compensation, Lyon hypothesis, gynandromorphs, sex mosaics, Hermaphroditism- Free martin.	3	2
Module III: Mutations			(10 Hrs)	
3	3.1	Types of Mutations: Germinal and Somatic, Spontaneous and Induced mutations. Chromosomal mutation - structural and numerical aberrations.	3	3
	3.2	Molecular basis of gene mutation - tautomerism, addition, deletion, substitution, frame shift mutation.	3	3
	3.3	Factors affecting mutation, mutagens and their mode of	4	3


		action. Detection of mutation - CIB method.		
Module IV: Cytogenetics and Genetic disorders			(18 Hrs)	
4	4.1	Cytogenetics Nucleus and Chromosome structure: Chromatin (euchromatin, heterochromatin), Chromosome - structure, types, different levels of organization (Nucleosomes, Solenoid, Chromosome loop), Giant chromosomes (Polytene and Lampbrush chromosomes), Karyotyping - Normal human chromosome complement.	5	4
	4.2	Genetic disorders Human chromosomal anomalies: Autosomal (Down syndrome, Edward's syndrome and Cri du chat syndrome). Sex chromosomal anomalies (Klinefelter syndrome, and Turners syndrome), Single gene disorders - Sickle cell anemia, cystic fibrosis, Tay Sachs disease. Inborn errors of metabolism: Genetic basis of Phenyl ketonuria, Alkaptonuria, Albinism. Multifactorial disorders - Cleft lip and cleft palate. Pedigree Analysis (Brief account only) - Pedigree symbols and construction of Pedigree. Human Genome Project (Brief account only), Genetic counselling- Eugenics and Euthenics.	11	5
	4.3	ACTIVITY Study of syndromes and karyotypes using photograph	2	5

References:

1. Gupta, P.K. (2010). Cytogenetics. Rastogi Publications, Meerut, India
2. Hartl, L.D. and E.W.Jones. (2009). Genetics: Analysis of Genes and Genomes (7th edn) Jones and Barlett Publishers Inc, USA.
3. Klug, W.S and Cummings, M.R. (2011). Concepts of Genetics (7th edn). Pearson Education Inc.India.
4. Roberts, K., Alberts, B., Johnson, A., Walter, P., and Hunt, T. (2002). Molecular biology of the cell. New York: Garland Science.
5. Singh, B. D. (2022). Fundamentals of Genetics (6th edn). Kalyani Publishers, New Delhi.
6. Snustad, D. P., and Simmons, M. J. (2015). Principles of genetics. John Wiley and Sons
7. Thomas, A. P (Editor), (2012). Genetics and Biotechnology- The Fundamentals. Green Leaf Publications, TIES, Kottayam.
8. Vijayakumaran, N. K. (2017). Cell Biology, Genetics and Molecular Biology. Academica, Trivandrum.

Suggested Readings:

1. Benjamin, L. (2004). Gene VIII. Oxford University Press.
2. Pierce, B. A. (2012). Genetics: a conceptual approach. Macmillan publication.
3. Shirly, A.O., Sampath Kumar S., and Jinsu Varghese (Editors). (2012). Gene to Genome. Zoological Society of Kerala, Kottayam.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	CLIMATE CHANGE AND DISASTER MANAGEMENT					
Type of Course	MAJOR -DSE					
Course Code	ZO5DSEA02B24					
Course Level	300-399					
Course Summary	Climate change is known to increase disaster intensities and frequency by aggravating hazards and the factors determining vulnerability of environment, inhabiting communities and their resources. There has been a paradigm shift in approach to disaster management from response and relief centric to risk management centric, and thus, calling integration of climate change adaptation and sustainability concerns along DRR into developmental process. This course introduces the concepts, causes and consequences of Ozone layer depletion, international efforts on climate change and Disaster management.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Basic knowledge on environment and climate.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain the structure and composition of atmosphere.	Ap, U	1,2
2	Explain the causes and effects of depletion of stratospheric ozone layer.	I, U	1,2,6
3	Describe the climate change and its effect on living beings.	U	1,2
4	Describe different types of disaster.	U	1,2
5	Compare mitigation and management techniques of Disaster.	A	1,2,6
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT


Module	Units	Course description	Hrs	CO No.
Module I: An overview of earth system			(4 Hrs)	
1	1.1	The Earth System: Atmosphere: Structure and Composition	4	1
Module II : Causes and consequences of Ozone layer depletion			(20 Hrs)	
2	2.1	Greenhouse gases and their sources; Greenhouse effects; Causes of depletion of ozone layer and consequences; Climate change: Effects of enhanced UV-B on plants, microbes, animals, human health and materials; global energy infrastructure and GHG emissions.	10	2
	2.2	Other adverse impacts on climate Atmospheric deposition: Past and present scenario; Acid rain and its effects on plants, animals, microbes and ecosystems. Eutrophication, Consequences on climate, oceans, agriculture, natural vegetation and humans Clouds, Storms and Climate -Cloud Formation and Climate, El Niño and Southern Oscillation -El Niño and its effects.	10	2
Module III : International summits and agreements			(12 Hrs)	
3	3.1	International efforts on climate change issues. Global efforts for mitigating ozone layer depletion. International Agreements: the United Nations Framework Convention on Climate Change, Kyoto Protocol, Paris Agreement.	10	3
	3.2	Carbon trading, carbon credit; Carbon sequestration	2	3
Module IV: Definition and types of disaster			(24 Hrs)	
4	4.1	Disaster- Types of Disaster- Natural and anthropogenic, earthquakes, floods, drought, landslide, cyclones, volcanoes, tsunami, avalanches, Cloud bursting, global climate extremes. Man-made disasters: Gas and radiations leaks, toxic waste disposal, oil spills, forest fires.	10	4
	4.2	Study of Important disasters: Earthquakes and its types, magnitude and intensity, seismic zones of India, flood types and its management, drought types and its management, landside and its managements. Case studies of disasters in Kerala, Eg: Landslide. Environmental impact of disasters.	10	4
	4.3	Mitigation and Management techniques of Disaster Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warning Systems, Regulation/guidelines for disaster tolerance building structures.	4	5

References:

1. Adger, N.; Brown, K. and Conway, D. (2012). Global Environmental Change: Understanding the Human Dimensions. The National Academic Press.
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gautam Ashutosh (1994). Earthquake: A Natural Disaster, Ashok Publishing House, New Delhi.
4. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
5. Hester, R.E. and Harrison, R.M. (2002). Global Environmental Change. Royal Society of Chemistry
6. Matthew, R.A.; Barnett, J. and McDonald, B. (2009). Global Environmental Change and Human Security. MIT Press., USA.
7. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD, Inc. 2008.
8. Sahni, P.and Malagola M. (Eds.). (2003) Disaster Risk Reduction in South Asia, Prentice-Hall of India, New Delhi.
9. Singh T. (2006) Disaster management Approaches and Strategies, Akansha Publishing House, New Delhi.
10. Sinha, D. K. Towards Basics of Natural Disaster Reduction, Research Book Centre, New Delhi. 2006
11. Smith, K. (2001). Environmental Health, Assessing Risk and Reduction Disaster, 3rd Edition, Routledge, London.
12. Turekian, K.K. (1996). Global Environmental Change-Past, Present, and Future. Prentice Hall.

Suggested Readings:

1. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
2. Sharma, V.K. (Ed.).(1995). Disaster Management, IIPA, New Delhi.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) Zoology				
Course Name	BIOTECHNOLOGY					
Type of Course	MAJOR -DSE					
Course Code	ZO5DSEA03B24					
Course Level	300-399					
Course Summary	This course gives students a strong foundation in genetic engineering theory and a deeper understanding of the revolutionary applications that are reshaping the frontiers of contemporary science and industry.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Basic knowledge in Cell biology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the principles and techniques of rDNA Technology.	U	1, 2
2	Summarise the techniques in cell culture and genetic engineering.	U	1, 2, 3
3	Explain the biotechnological applications in various fields.	A	1, 2, 3, 6, 8
4	Describe biosafety concerns in biotechnology.	U	1, 2, 6, 8
5	Explain the provisions for the protection of intellectual property.	U	1, 6, 8
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Fundamentals of Recombinant DNA Technology			(20 Hrs)	
1	1.1	Introduction to Biotechnology Historical background, Prospects of biotechnology	2	1
	1.2	Tools and Techniques Enzymes- restriction enzymes, ligases, polymerases. Vectors - Plasmids, Bacteriophage - derived vectors, artificial chromosomes. Techniques - DNA Extraction (Brief account of RNA and plasmid extraction), Electrophoresis- Agarose Gel, PAGE. PCR-Principle and application. Hybridization of nucleic acid- Southern and Northern blotting. DNA sequencing-Sanger sequencing, Next Generation Sequencing (NGS) (Brief account only) Brief account of protein/proteome identification/sequencing (using a flowchart/ schematic representation only)	10	1
	1.3	rDNA technology Gene isolation, integration of the desired gene into Vector, Insertion of rDNA into host cell. Screening methods of recombinants. Gene transfer- Transformation, Transduction, Transfection, Retro-virus, Gene gun, Microinjection, Electroporation, Ultrasonication. Genomic and cDNA library. (Brief description only)	8	1
Module II: Cell culture and Genetic Engineering			(13 Hrs)	
2	2.1	Cell culture Animal cell culture-Media-Natural and Synthetic media (one example each). Stem cell- type and uses	3	2
	2.2	Genetic Engineering Organismal cloning by nuclear transfer, transgenic technology: development of transgenic animals- Transgenic mice- knock-in, knock - out models, Transgenic <i>C. elegans</i> . Cell line transfections. Gene silencing - RNA interference, gene editing - CRISPR Cas (brief account only).	10	2


Module III: Biotechnology and Human welfare			(17 Hrs)	
3	3.1	<p>Medical Biotechnology and Forensics Gene therapy (SCID). Stem cell therapy -regenerative medicine, personalized medicine. Development of Pharmaceuticals- biopharmaceuticals of immune system -(interferons, IL), hormones (insulin, stomatostatin), antibiotics, monoclonal antibodies, vaccines. DNA finger printing and its applications. ACTIVITY Case studies, report submission and presentation of: any criminal case, disputed paternity etc. based on DNA fingerprinting, from Newspapers [any one]</p>	7	3
	3.2	<p>Agricultural and Environmental Biotechnology Agriculture: Transgenic plants -Pest resistant (Bt-cotton), herbicide resistant, disease resistant varieties. Microbial pesticides. Qualitative improvement of livestock-Milk production in cows Environment: Bioremediation of soil and water contaminated with oil spills, heavy metals and detergents. Bio-fertilizers: Algal and fungal biofertilizers (VAM), Bioleaching. Development of Biodegradable polymers-PHB.</p>	6	3
	3.3	<p>Fermentation: Principles and applications Enzymes- Amylase, Invertase, Zymase, general overview of synthesis of vitamins, food and beverages Single Cell Proteins.</p>	4	3
Module IV: Biosafety concerns and Intellectual Property Protection			(10 Hrs)	
4	4.1	<p>Biosafety concerns Levels of Biosafety. Risks associated with Genetically Modified Organisms (terminators seeds, impact on biodiversity, transferring transgenes from food to intestinal microbes, toxins/allergens in foods). Biological warfare and biopiracy. Ethics in Cloning</p>	5	4
	4.2	<p>Intellectual Property Protection Intellectual Property Rights (IPR)- Patents, Indian Patent law (overview). Copyright- TRIPS agreement, Trade secret, trademark, Plant breeder's right, Geographical indication (GI)</p>	5	5

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2. Brown, T.A. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
3. Curell, B.R. *et al.*, (2004) Techniques for Engineering Genes.
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5. Glick, B.R. and Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
6. Jackson, I.J. and Abott, C.M. (1999) Mouse Genetics and Transgenics: A Practical Approach- Oxford
7. Jördening, H. J. and Winter, J. *eds.* (2005) Environmental Biotechnology: Concepts and Applications. Wiley-VCH Verlag GmbH and Co. KGaA
8. Mohapatra, P.K. (2013). Environmental Biotechnology. I K International Publishing House Pvt. Ltd.
9. Nicholl. (2006), Introduction to Genetic Engineering - Cambridge Low Price Edition.
10. Primrose, S.B. and Twyman, R.M. (2008) Principles of gene manipulation and Genomics, Blackwell Scientific Publications.
11. Rema.L.P.(2006) Applied Biotechnology, MJP Publishers Chennai, ISBN 81 8094 012 8
12. Riddle, D.L., Blumenthal, T., Meyer, B.J., Priess, J.R. (1997) C. elegans II,- Cold Spring Harbor Press
13. Sambrook. J, Fritsch, E.F. and Maniatis, T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
14. Smith, R. H. (2012). Plant tissue culture: techniques and experiments. Academic Press.
15. Stephenson, F. H. (2016) Calculations for Molecular Biology and Biotechnology. Academic Press
16. Wainwright, M. (2012). Introduction to Environmental Biotechnology. Springer, NY.

Suggested readings:

1. Lewis, B. (2008) Genes IX - Oxford University and Cell Press.
2. Strickberger, M.W. (2004) Genetics, - Garland

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	WILDLIFE CONSERVATION
Type of Course	MAJOR -DSE
Course Code	ZO5DSEA04B24
Course Level	300-399
Course Summary	To impart fundamental knowledge about animals, forests, conflicts between humans and wildlife, and wildlife conservation.
Semester	V
Course Details	Credits
	4
Learning Approach	Total Hours
	60
Pre-requisites, if any	Basic knowledge on ecosystems and its interactions.

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Explain biodiversity hotspots, forest ecosystems, and species richness-diversity indices.	I, U	1,2,10
2	Describe primate biology, ecology, and behaviour; animal barriers; and wildlife, with special reference to mammals, birds, and reptiles.	Ap, U	1,2,6
3	Explain the consequences of the man-wildlife conflict.	U	1,2,6
4	Explain the threats faced by wildlife, protected areas, research institutes, and types of wildlife conservation.	I, A	1,2
5	Summarise advances in wildlife conservation.	I, U	1,2,3,6
*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Forest ecosystems			(14 Hrs)	
1	1.1	Introduction to Forest ecosystems. Structure and functioning, forest succession. Keystone species, flagship species, Umbrella species	5	1
	1.2	Types of Forests - classification, distribution, composition and structure. Estimation of volume of individual tree and forest stands. Species richness-diversity indices (Shannon Weiner; Simpson).	5	1
	1.3	Biodiversity hotspots with special reference to Western Ghats.	4	1
Module II: Introduction to wildlife and Man wildlife conflict			(18 Hrs)	
2	2.1	Wild life - with special reference to Mammals, Birds and reptiles in international, national and local perspective	4	2
	2.2	Introduction to Biology, ecology and behaviour of Primates (Bonnet macaque), Carnivora (Tiger, Leopard) and Elephants.	5	2
	2.3	Man wildlife conflict- Case studies (one each) Elephant, Monkey (Bonnet macaque), Large carnivores (Tiger/leopard) and Wild boar.	6	3
	2.4	Animal barriers: Mechanical and electrical.	1	2
	2.5	ACTIVITY: Compilation of newspaper reports and seminar presentation of Wildlife/ Man- Wildlife conflict.	2	
Module III: Wildlife Conservation			(15 Hrs)	
3	4.1	Threats faced by wildlife. Conservation of wildlife- Ex-situ conservation and in-situ conservation. Management of Protected Areas.	6	4
	4.2	National Park, Sanctuaries, Tiger reserves, Biosphere Reserves, Community reserves. Ramsar Sites. Protected areas of Kerala.	4	4
	4.3	Research institutes of Wildlife in India. Special projects for wildlife conservation- Project Tiger, Project Elephant, Crocodile Conservation Initiative. Wildlife (Protection) Act, 1972 and 2022 amendments. CITES, TRAFFIC. IUCN red list categories, Red Data Book.	5	4
Module IV: Advances in Wildlife Conservation			(13 Hrs)	


4	4.1	Remote sensing (RS): Introduction, definition, brief history, fundamental principle of RS, Stages of RS, Classification of RS: Active and Passive RS- based on source of energy and wavelength; Aerial and space remote sensing, Merits and limitations of RS. Recent developments.	10	5
	4.2	GIS; GPS; Radio collaring.	3	5

References:

1. Grimmett, R., Inskipp, C., and Inskipp, T. (2016). *Birds of the Indian Subcontinent: India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives*. Bloomsbury Publishing.
2. Hunter Jr, M.L., and Gibbs, J.P. (2006). *Fundamentals of Conservation Biology*. John Wiley and Sons.
3. Johnsingh, A.J.T., and Manjrekar, N. (Eds.). (2013 and 2015). *Mammals of South Asia*. Universities Press.
4. Kothari, A. (1989). *Management of National Parks and Sanctuaries in India: A Status Report*. Environmental Studies Division, Indian Institute of Public Administration.
5. Mathur, R. (2000). *Animal Behavior*. Rastogi Publication.
6. Menon, V. (2014). *Indian Mammals: A Field Guide*. Hachette Book Publishing India.
7. Mills, L.S. (2013). *Conservation of Wildlife Populations: Demography, Genetics and Management (2nd ed.)*. Wiley-Blackwell.
8. Nameer, P.O., et al. (2015). A checklist of vertebrates of the Kerala State. *Journal of Threatened Taxa*, 7(13), 7961-7970. doi.org/10.11609/jott.1999.7.13.7961-7970.
9. Prater, S.H. (1971). *The Book of Indian Animals*. Oxford University Press.
10. Rasmussen, P.C., and Anderton, J.C. (2005). *Birds of South Asia: The Ripley Guide (Vol. 2)*.
11. Van Dyke, F. (2008). *Conservation Biology: Foundations, Concepts, Applications*. Springer Science and Business Media.
12. Whitaker, R., and Captain, A. (2008). *Indian Snakes: A Field Guide*. Draco Books

Suggested Readings:

1. Bharucha, E. (2002). *The Biodiversity of India (Vol. 1)*. Mapin Publishing Pvt Ltd.
2. Das, I. (2015). *Field Guide to the Reptiles of South-East Asia*. Bloomsbury Publishing.

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	FORENSIC BIOLOGY
Type of Course	MAJOR - DSE
Course Code	ZO5DSEA05B24
Course Level	300-399
Course Summary	Forensic Biology explores biological and serological evidence's significance in investigations. It covers wildlife forensics, forensic entomology, toxicological studies, and poison classification. Students learn to analyze evidence and understand its role in solving crimes, conservation efforts, and toxicology assessments.
Semester	V
Course Details	Credits
	4
Pre-requisites, if any	Total Hours
	60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain the significance of biological and serological evidence.	U	1,2
2	Describe the importance of wildlife forensics and forensic entomology in conserving natural resources.	I, U	1,2
3	Describe the significance of toxicological studies in forensic science	U	1,2
4	Explain the classification of poisons and their modes of actions.	U	1, 2,6
5	Interpret the effects of Narcotics, Drugs and Psychotropic Substances	S. A	1,2,6,8
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Nature and importance of biological evidence			(15Hrs)	
1	1.1	Nature and importance of biological evidence. Significance of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair. Comparison of hair samples. Morphology and biochemistry of human hair. Comparison of human and animal hair.	10	1
	1.2	Types and identification of microbial organisms of forensic significance.	3	1
	1.3	Diatoms and their forensic significance.	2	1
Module II: Wildlife Forensics			(15Hrs)	
2	2.1	Fundamentals of wildlife forensic. Significance of wildlife forensic. Protected and endangered species of animals and plants. Illegal trading in wildlife items, such as skin, fur, bone, horn, teeth, flowers and plants. Identification of physical evidence pertaining to wildlife forensics. Identification of pug marks of various animals.	9	2
	2.2	Forensic Entomology Basics of forensic entomology. Insects of forensic importance. Order Diptera- Calliphoridae, Sarcophagidae and Muscidae. Order Coleoptera - Staphylinidae, Histeridae, Silphidae, Dermestidae and Cleridae Collection of entomological evidence during death investigations. Forensic Entomology Procedures - Collection of entomological evidence during a death investigation, Temperature and climatic records, Collection, preservation and handling of insects/maggots from the crime scene, Analysis of entomological evidence and estimating PMI (Post Mortem Index) using Maggot age and Insect succession.	6	2
Module III: Significance of toxicological findings			(15 Hrs)	
	3.1	Basics of Toxicology Significance of toxicological findings. Techniques used in toxicology. Toxicological analysis and chemical intoxication tests	4	3
	3.2	Poisons	8	4


3		Classification of poisons. Physico-chemical characteristics and mode of action of poisons. Accidental, suicidal and homicidal poisonings. Signs and symptoms of common poisoning and their antidotes. Collection and preservation of viscera, blood and urine for various poison cases. Identification of biocides and metal salts in body fluids. Metabolism and excretion of poisons.		
	3.3	Animal poisons. Snake venom. Mode of action.	1	4
	3.4	Carbon monoxide poisoning.	1	4
	3.5	Application of immunoassays in forensic work	1	4
Module IV: Narcotics, Drugs and Psychotropic Substances			(15 Hrs)	
4	4.1	Definition of narcotics, drugs and psychotropic substances. Broad classification - Narcotics, Stimulants, depressants and hallucinogens. Designer drugs.	5	5
	4.2	General characteristics and common example of each classification. Natural, synthetic and semi-synthetic narcotics, drugs and psychotropic substances.	5	5
	4.3	Tolerance, addiction and withdrawal symptoms of narcotics, drugs and psychotropic substances Drugs and driving. Dope tests.	5	5

References:

1. Chowdhuri, S. 1971. Forensic Biology, BPRD, New Delhi.
2. Duncan G.T. and M.I. Tracey, 1997, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton.
3. Hofmann, F.G., 1983, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York.
4. Jones, A.W., 1988, Enforcement of drink-driving laws by use of per se legal alcohol limits: Blood and/or breath concentration as evidence of impairment, Alcohol, Drug and Driving, 4, 99.
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6. Poklis, A., 1997, Forensic toxicology in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton.
7. Saferstein, R. Criminalistics, 2004, 8th Edition, Prentice Hall, New Jersey.
8. Tilstone, W.J., M.L. Hastrup and C. Hald, Fisher's, 2013, Techniques of Crime Scene Investigation, CRC Press, Boca Raton.

Suggested Readings:

1. Saferstein, R. 1993. Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey.
2. Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell, 1993. Harper's Biochemistry, APPLETON and Lange, Norwalk.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>						
Programme	B.Sc. (Hons.) Zoology					
Course Name	MAN AND NATURE					
Type of Course	MAJOR - DSE					
Course Code	ZO5DSEA06B24					
Course Level	300-399					
Course Summary	The course provides an overview on the evolution of man in nature, the various natural resources and their importance. It also deals with various global environmental issues, conservation and sustainable development strategies.					
Semester	V	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Basic knowledge on ecosystems and its interactions.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain the evolution of man in nature.	I, U	1,2
2	Describe the structure and importance of the biosphere.	Ap, U	1,2
3	Examine various global environmental issues.	I, A	1,2,6,10
4	Report various global strategies for conservation.	A	1,2,6,7
5	Explain the global strategies for sustainable development.	I, A	1,2,6,7
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Man in Nature			(17 Hrs)	
1	1.1	Introduction. Evolution of Man, Out of Africa and Candelabra Model, The Fossils and the Molecular Evidences Hunter, Gatherer and the Agriculturist. Speech and Languages. Cultural Evolution. Altruism and Morality.	10	1
	1.2	Industrial Revolution Human Population Growth Resource Utilization, Environmental Consequences Modern Agriculture and Green Revolution Environmental Impacts Imperialism and its Ecological Root.	7	1
Module II: The Biosphere			(17 Hrs)	
2	2.1	Earth-Continents and Continental drift. Freshwater. Concept of Landscapes and Habitats. Lithosphere- Forest (Tropical and Temperate) Grasslands, Deserts and Montane, Biomes of the World. Hydrosphere- Oceans, Estuaries, Water the Elixir of Life. Atmosphere - Structure and stratification.	10	2
	2.2	Renewable and Non-renewable. Biodiversity Importance of Biodiversity - the 6 Hotspots of Biodiversity; Biotic Richness of India; Monoculture and loss of Genetic Diversity Extinction Crisis, IUCN and Red Data Book.	7	2
Module III: Global Environmental Issues			(12 Hrs)	
3	3.1	Global Environmental Issues, Natural Resources and Human Life, Deforestation, Landscape alterations, Soil erosion, Flood and Drought, Desertification, Overexploitation, Pollution (Air, Water and Soil- Pollutants and Consequences only), Acid rain, Ozone depletion, Greenhouse effect and Global Warming. Waste disposal (Biodegradable and Non-degradable eg. Plastic and E- waste), Oil spill Energy - Production, Consumption and its Impact on Environment Quality of the Environment and Human Health.	10	3
	3.2	ACTIVITY Collect reports of case studies of any two global environmental issues.	2	3
Module IV: Global Strategies for Conservation and Sustainable Development			(14 Hrs)	
4	4.1	UN conference on Man and Environment-1972 UNEP and its Contributions. The World Conservation Strategy-1980, World Commission on Environment and Development. The Earth Summit -1992. The UNFCCC and IPCC, Conservation Strategies in India-MoEF. People's Participation in Conservation: Chipko Movement, Narmada Bachao Andolan, and Silent Valley Movement.	8	4
	4.2	Sustainable development - Definition and Concept, Principles	6	5

		and Goals. Environment versus Development Debate. Johannesburg Conference -2002. Sustainable Development in the era of Globalization Gandhian Environmentalism Education for Sustainable Development (UNESCO-ESD).		
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1. Conroy, G.C. 1997. *Reconstructing Human Evolution: A Modern Synthesis*. Norton, NY, USA.
2. Harrison, Lawrence E. and Samuel P. Huntington. 2000. *Culture Matters: How Values Shape Human Progress*. Basic Books. Perseus.
3. Strickberger, M.W. 2000. *Evolution*. Jones and Bartlett, Boston.
4. Forman, R.T and M. Gordaon. 1986. *Landscape Ecology*. John Wiley and Sons, NY, USA.
5. Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.
6. Khanna, G.N. 1993. *Global Environmental Crisis and Management*. Ashish Publishing House, New Delhi.
7. Ramesh, B. R and Rajan Gurukkal., 2007. *Forest Landscapes of the Southern Western Ghats, India Biodiversity, Human Ecology and management Strategies*. French Institute of Pondicherry, India
8. Richard T. Wright and Bernard J. Nebel. 2002. *Environmental Science-Toward a Sustainable future*. Pearson Education Inc. NY, USA.
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12. Alfred W. Crosby. 1995. *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*. Cambridge University Press, MA. USA.
13. Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.
14. Barnes, C.W. 1988. *Earth, Time and Life*. John Wiley and Sons, New York.
15. Bickerton, D. 1995. *Language and Human Behaviour*. University of Washington Press, Seattle.
16. Carlos Hernandez and Rashmi Mayur. 1999. *Pedagogy of the Earth: Education for a Sustainable Future*. Bharatiya Vidya Bhavan, Mumbai, India.
17. Chandran, Subash M.D. 1997. On the ecological history of the Western Ghats. *Current Science*, Vol.73, No.2. 146-155.
18. Chattopadhyay Sajib. 2002. *Life Origin, Evolution and Adaptation*. Books and Allied (P) Ltd. Kolkata, India.
19. Conroy, G.C. 1997. *Reconstructing Human Evolution: A Modern Synthesis*. Norton, NY, USA.
20. Khanna, G.N. 1993. *Global Environmental Crisis and Management*. Ashish Publishing House, New Delhi.
21. Ramesh, B. R and Rajan Gurukkal., 2007. *Forest Landscapes of the Southern Western Ghats, India Biodiversity, Human Ecology and management Strategies*. French Institute of Pondicherry, India

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20. Richard T. Wright and Bernard J. Nebel. 2002. Environmental Science-Toward a Sustainable future. Pearson Education Inc.NY, USA.

Suggested Readings:

1. Gandhi, M. K.-Writings on Ecology
2. Sharma P.D.1994. Ecology and Environment.Rastogi Publications, Meerut-2.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	FOOD AND WATER QUALITY ASSESSMENT					
Type of Course	SEC					
Course Code	ZO5SEC01B24					
Course Level	300-399					
Course Summary	<p>The skill enhanced course on food and water quality management encompasses various topics aimed at ensuring the safety and quality of both food and water. The course discusses issues like food adulteration and the indiscriminate use of food additives. The course delves into the identification and management of spoilage bacteria, along with methods for monitoring and assessing microbial quality. It also explores the regulatory frameworks at both national and international levels that oversee food and water quality, highlighting the responsible agencies entrusted with enforcing these regulations.</p>					
Semester	V	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Basic interest in environmental quality assessments.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify various food adulterants and additives and their health implications	S, U	1,2
2	Describe the causes and consequences of quality deterioration of food and water	S, U	1,2
3	Apply skills in food and water quality analysis.	S, A	1,6,10
4	Explain the laws and regulations pertaining to food safety and consumer protection and quality management systems operating at national and international levels.	U	1,2
5	Test the chemical and microbial quality of different categories of food and water	An,S	1,2,6,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate I, Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Food adulterants and food additives			(16 Hrs)	
1	1.1	Food adulteration Definition; types-intentional, incidental. Poisonous substances, cheap substitutes, metallic and packaging hazard. Common adulterants and detection methods. General impact on human health.	3	1
	1.2	Food additives Definition, classification: Preservatives, colourants, 142igger enhancers, anti-oxidants, artificial sweeteners and stabilizers, thickening agents, leavening agents, emulsifiers, anti-caking agents and humectants. Food additives generally recognized as safe (GRAS); toxicology and safety evaluation of food additives.	4	1
	1.3	Food laws and regulations: Food Safety and Standards Act 2006, Role of Food Safety and Standard Authority of India (FSSAI). FSS Regulations 2011: Regulations on Contaminants, toxins and residues, FSS Regulations on Food products standards and food additives, FSS Regulations on Packaging and Labeling, Consumer protection act 2019.	4	4
	1.4	Quality management: Introduction, Scope, significance and objectives of quality management systems. Good Manufacturing Practices. Hazard Analysis and Critical Control Point (HACCP). Management and certification systems: Role of FDA, FAO, Codex Alimentarius Commission, ISO 2000, FSSC 22000, Agmark, BIS, QCI, NABCB.	5	4
Module II: Food and water quality Analysis			(14 Hrs)	
2	2.1	Food Spoilage: Introduction, definition, types of spoilage – Physical, chemical and microbial. Chemical spoilage – Oxidation of fat, Physical spoilage – Browning of fruits and vegetables.	2	5
	2.2	Microbial spoilage of food Factors affecting microbial spoilage of food. Contamination and spoilage of fish and shell fishes, dairy products, fruits and vegetables, meat and meat products. Control measures.	4	5
	2.3	Analysis of spoiled foods	2	3

		Microbiological analysis of spoiled foods: isolation, total plate count and biochemical tests for the identification of spoilage bacteria (Brief account)		
	2.4	Physico-chemical parameters of water (Brief account) Turbidity, colour, odour, taste, conductivity, pH, acidity, alkalinity, TDS, total hardness, nitrate, phosphate, residual chlorine.	2	2
	2.5	Microbiological quality of water Etiology of water borne diseases (Eg: Typhoid and Cholera). Microbial water quality analysis – most probable number, total coliforms, faecal coliforms, <i>E. coli</i> . BIS specifications for drinking water.	4	2,3
Module III: Hands on training			(15 Hrs)	
3	3.1	Detection of adulterants in honey (143iggery, sugar syrup), in milk – tests for urea and starch, in chilli powder, turmeric powder and coriander powder	5	1
	3.2	Detection of castor oil, cotton seed oil and argemone oil in edible oils and detection of adulteration in ghee	3	1
	3.3	Determination of alkalinity, hardness and residual chlorine in water, Microbial analysis of water	6	3
	3.4	Sensory/organoleptic evaluation of fish	1	5


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1. Branen, A.L., Davidson, P.M., Salminen, S. (2001). Food Additives. CRC Book Press. USA.
2. Harrigan, F.W, (2013). Laboratory Methods in Food Microbiology. Elsevier
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2. Frazier, J., Westhoff D.C. (1988). Food Microbiology. MC Graw Hill, New York

SEMESTER 6

	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam						
Programme	B.Sc. (Hons.) Zoology						
Course Name	REPRODUCTIVE BIOLOGY AND TERATOLOGY						
Type of Course	MAJOR-DSC A						
Course Code	ZO6DSCA01B24						
Course Level	300-399						
Course Summary	The process of development, anomalies in development, experimental embryology, prenatal diagnostics, and assisted reproduction are covered in this course.						
Semester	VI			Credits		4	Total Hours
Course Details	Learning Approach	Lecture 3	Tutorial	Practical 1	Others	75	
Pre-requisites, if any	Basic knowledge in human physiology.						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain concepts and theories in Reproductive biology.	U	1
2	Compare techniques in prenatal diagnostics and assisted reproduction.	I, U	1, 3
3	Describe the concepts of experimental embryology.	U	1
4	Examine teratogens, their effects and other common developmental defects.	A	1, 2
5	Administer experiments in Reproductive biology.	A, S	1, 2, 10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Reproductive Biology			(25 Hrs)	
1	1.1	Introduction, Definition, Scope of reproductive biology Theories of development- Preformation theory, Theory of Epigenesis, Recapitulation theory, Germplasm theory, Mosaic theory and Regulative theory.	2	1
	1.2	Reproductive Physiology.	1	1
	1.3	Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg.	6	1
	1.4	Early Embryonic development Patterns of development - Oviparity, Ovo-viviparity and Viviparity Egg types: Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs. Polarity and symmetry of egg. Fertilization: Mechanism of fertilization- (Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, capacitation of sperm, Activation of Ovum, Migration of Pronuclei and Amphimixis), Significance of fertilization, Polyspermy. Parthenogenesis- Different types and significance. (Natural and artificial. Arrhenotoky, Thelytoky, Obligatory and Facultative)	5	1
	1.5	Developmental patterns Cleavage: Types (Holoblastic (equal, unequal) and Meroblastic cleavage (discoidal and Superficial), planes Meridional, Vertical, Equatorial, Latitudinal and patterns (Radial and Spiral, bilateral and rotational with examples) Determinate, Indeterminate cleavage, Cell lineage of Planocera. Influence of yolk on cleavage. Blastulation: Morula, blastula formation, types of blastula with examples. Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.	11	1

		<p>Gastrulation: Major events in gastrulation. Morphogenetic cell movements. (Epiboly, Emboly - invagination, involution, delamination, convergence, divergence infiltration) Influence of yolk on gastrulation. Concept of germ layers and derivatives. (Brief account).</p> <p>Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour chick embryo.</p> <p>Extra embryonic membranes in chick.</p> <p>Human development: Fertilization, cleavage, blastocyst, Gestation, parturition and lactation.</p> <p>Classification and functions of placenta in mammals.</p>		
Module II: Prenatal diagnosis and Assisted Reproductive Techniques (8 Hrs)				
2	2.1	Invasive techniques: Amniocentesis, Chorionic villi sampling, Alfa fetoprotein test, cordocentesis, Foetoscopy, fetal tissue biopsy, Maternal serum beta-HCG. Non-invasive techniques: Ultra sound scanning	4	2
	2.2	Assisted Reproductive Techniques: In vitro fertilization (IVF) and Embryo transfer (ET), ZIFT, GIFT, ICSI	4	2
Module III: Experimental embryology and Teratology (10 Hrs)				
3	3.1	Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology and cloning.	3	3
	3.2	Significance of model organisms (<i>Caenorhabditis elegans</i> , <i>Danio rerio</i> and <i>Mus musculus</i>) in embryological studies (brief account).	2	3
	3.3	Teratology: Teratogenic agents [Physical (Radiations), Chemical (Environmental toxins and drugs), Biological (infectious agents)], Teratogenesis, Teratogenic mechanisms- Genetic mutations, cellular processes and physiological disruptions).	3	4
	3.4	Developmental defects: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).	2	4
Module IV: Reproductive Biology and Teratology - PRACTICAL (30 Hrs)				
4	4.1	Calculation of gonado-somatic index of fish.	4	5
	4.2	Male and female reproductive organs in a teleost fish	6	5
	4.3	Study of placenta - pig and man.	2	5
	4.4	Study of permanent slides of blastula of frog and chick	3	5
	4.5	Study of permanent slides of gastrula of frog and chick	3	5
	4.6	Study of permanent slides of 18 hour, 24 hour, 33 hour and 48 hour chick embryo.	8	5


	4.7	Candling of eggs	1	5
	4.8	Study of chick development using live eggs - Vital staining-Window method (Demonstration)	3	5

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1. Anthony S. Fauci, Eugene Braunwald, Dennis L. Kasper, Stephen L. Hauser, Dan L. Longo, J. Larry Jameson and Joseph Loscalzo; 2008; Harrison's Principles of Internal Medicine; Churchill Livingstone 17th Ed.
2. Balinsky B.I.; 1981 An Introduction to Embryology, W.B. Saunders and Co.
3. Berril, N.J. and Karp, G.; 1986. Developmental biology, McGraw-Hill
4. Dutta 2007 Obstetrics, Churchill Livingstone 17 Ed
5. Melissa A Gibbs, 2006; A Practical Guide to Developmental Biology, Oxford University Press (Int. student edition)
6. Taylor D J, Green NPO and G W Stout. (2008) Biological Science 3rd edition. Cambridge University Press.
7. Vijayakumaran Nair, K. and George, P. V. 2002. A Manual of Developmental Biology, Continental Publications, Trivandrum

Suggested Readings:

1. Majumdar N. N (1985) Vertebrate Embryology; Tata McGraw-Hill, New Delhi
2. Scott F. Gilbert; 2003; Developmental biology; Sinauer Associates Inc., U.S.; 7th Revised edition.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam				
Programme	B.Sc. (Hons.) Zoology				
Course Name	HUMAN PHYSIOLOGY AND ENDOCRINOLOGY				
Type of Course	MAJOR-DSC A				
Course Code	ZO6DSCA02B24				
Course Level	300-399				
Course Summary	The course provides an in-depth knowledge on various organ systems, their functioning and related disorders. It also throws light on the hormonal regulation of various systems of the body and the role played by various hormones in regulating the homeostasis is elaborated.				
Semester	VI	Credits			Total Hours
Course Details	Learning Approach	Lecture 3	Tutorial	Practical 1	
Pre-requisites, if any	Basic knowledge in human physiology.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain the structure, function, and disorders of the organ systems in man.	Ap, U	1,2
2	Describe the nutritional requirements and digestion.	U	1,2
3	Distinguish different endocrine glands, hormones and its role in homeostasis.	Ap, U	1,2
4	Explain the mechanisms governing muscle contractions and nerve impulse production.	Ap, U	1,2
5	Practice experiments in physiology.	S, A	1, 2
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Physiology of Circulation and Respiration			(12 Hrs)	
1	1.1	Composition of Blood, (Brief account, self study) Haemopoiesis. Haemostasis (blood coagulation) - clotting factors, intrinsic and extrinsic pathways, anticoagulants and its mechanism of action.	3	1
	1.2	Cardiovascular diseases (Jaundice, Atherosclerosis, Myocardial infarction, Thrombus, Stroke). ESR, blood pressure, ECG, Angiogram and Angioplasty.	2	2
	1.3	Phases of respiration (external respiration, gas transport and internal respiration). Respiratory pigments: Haemoglobin, Myoglobin (Structure and Function). Transport of respiratory gases - transport of oxygen, oxyhaemoglobin curve, factors affecting oxyhaemoglobin curve, Bohr Effect, transport of carbon dioxide, (chloride shift). Control of respiration.	4	1
	1.4	Respiratory disturbances: Hypoxia, Hypercapnia, Hypocapnia, Asphyxia). Dysbarism, Oxygen toxicity, Physiological effect of smoking, carbon monoxide poisoning, Oxygen therapy and artificial respiration.	3	1,2
Module II: Nerve and Muscle Physiology and Nutrition			(17 Hrs)	
2	2.1	Nutrition: Nutritional requirements - carbohydrates, proteins, lipids, minerals (Ca, P, Fe, I), vitamins (sources and deficiency disorders). Importance of dietary fibre and antioxidants. Balanced diet, Recommended Dietary Allowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition (PEM).	2	3
	2.2	Digestion: Anatomy and histology of digestive glands (liver, pancreas, salivary, gastric and intestinal). Digestion and absorption of carbohydrates, proteins and fats. Nervous and hormonal control of digestion.	4	3
	2.3	Nerve physiology: Ultra structure of neuron. Nerve impulse production (resting membrane potential, action potential), transmission of impulse along the nerve fiber, interneuron (synaptic) transmission, neuromuscular junction and transmission of impulses. Neurotransmitters (acetyl choline, adrenalin, dopamine). EEG. Memory.	5	4

		Neural disorders (brief account on Dyslexia, Parkinson's disease, Alzheimer's disease and Epilepsy).		
	2.4	Muscle physiology: Ultra structure of striated muscle, muscle proteins (myosin, actin, tropomyosin, troponin), Muscle contraction and relaxation-Sliding Filament Theory, cross bridge cycle, biochemical changes and ATP production in muscle, Cori cycle. Kymograph, Simple muscle twitch, muscle fatigue, tetanus, rigor mortis.	6	4
Module III: Renal Physiology and Endocrinology			(16 Hrs)	
3	3.1	Renal Physiology: Structure of nephron, Urine formation - glomerular filtration, tubular reabsorption, tubular secretion. Urine concentration - counter current mechanism. Role of Kidney in Acid - base balance, hormonal regulation of kidney function.	3	3
	3.2	Kidney disorders: Kidney stone, acute and chronic renal failure, Nephritis, Nephrotic syndrome and dialysis	3	2
	3.3	Homeostasis: Definition, Concept and importance in biological system. Thermal regulation and physiological adaptations to heat and cold in homeotherms.	1	3
	3.4	Endocrinology: Hormone - classification and mechanism of hormone action	1	1
	3.5	Major endocrine glands their hormones, functions and disorders (hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, islets of Langerhans, adrenal gland, Placenta).	7	1
	3.6	Homeostasis and feedback mechanisms	1	1
Module IV: Human Physiology and Endocrinology - PRACTICAL			(30 Hrs)	
4	4.1	Estimation of the RBC count of blood using Haemocytometer.	4	5
	4.2	Estimation of the WBC Count of blood using Haemocytometer.	4	5
	4.3	Estimation of hemoglobin content of blood.	4	5
	4.4	Estimation of microhaematocrit	4	5
	4.5	Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.	4	5
	4.6	Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use)	2	5


	4.7	Determination of heart rate, pulse rate and blood pressure using sphygmomanometer	4	5
	4.8	Cockroach - Corpora cardiaca and Corpora allata (Demonstration)	2	5
	4.9	Effect of adrenalin on heart beat of Cockroach (Demonstration)	2	5

References:

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2. Barrington, E. J. W. (1975). General and Comparative Endocrinology. Oxford, Clarendon Press.
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6. Eckert, R., and Randall, D. (2020). Animal Physiology: Mechanism and Adaptations. CBS Publications.
7. Ganong, W. F. (2005). Review of Medical Physiology. McGraw-Hill.
8. Guyton. (2006). Textbook of Medical Physiology. Saunders.
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10. John Wiley and Toy, E. C., Cleary, L. J., Papasakelariou, C., and Ross, L. M. (2008). Case Files: Anatomy. EBSCO eBook.
11. Joshi. (1992). Nutrition and Dietetics. Tata McGraw-Hill.
12. Knut Schmidt Nilesen. (2007). Animal Physiology - Adaptation and Environment (5th ed.). Cambridge University Press.
13. Mackenna, B. R., and Callander, R. (1997). Illustrated physiology. Churchill Livingstone.
14. Martin, C. R. (1985). Endocrine Physiology. Oxford University Press.
15. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
16. Prosser and Brown.(1962) Comparative Animal Physiology:, W. B. Saunders Co., West Washington Square, Philadelphia 5.
17. Sarada Subramanyam, and K. Madhavankutty. (2014). Textbook of Human Physiology. S. Chand and Co Ltd.
18. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
19. Williams, R. H. (2003). Textbook of Endocrinology. W.B. Saunders.

Suggested readings:

1. Prema A. K, Editor: 2022, Ecophysiology of Man, Zoological Society of Kerala.

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	MICROBIOLOGY AND BASIC IMMUNOLOGY
Type of Course	MAJOR- DSE
Course Code	ZO6DSEA01B24
Course Level	300-399
Course Summary	The course covers microscopic life and the body's defenses, preparing students for careers in biology. It includes microbiology, focusing on microorganisms, and basic immunology, studying the body's defense mechanisms.
Semester	VI
Course Details	Credits
	4
Learning Approach	Total Hours
	75
Pre-requisites, if any	Basic knowledge about Microbes.

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Summarize the structure, growth, reproduction and classification of bacteria and viruses.	I, U	1
2	Differentiate various techniques of sterilization, staining and culture techniques in microbiology	U	1, 2
3	Describe viral cultivation.	U	1
4	Explain the basic concepts of immunology.	Ap, U	1, 2
5	Practice experiments in Microbiology and immunology	A, S	1, 2, 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction, classification and techniques in Microbiology (16 Hrs)				
1	1.1	Introduction: History and scope of microbiology.	1	1
	1.2	Outline classification of microbes. A brief note on microbes: Bacteria, Fungi, and Viruses.	2	1
	1.3	Methods in Microbiology: Sterilization and disinfection - physical and chemical methods. Culture media - selective media, enrichment media, differential media. Plating techniques and isolation of pure colony. Culture preservation techniques: Refrigeration, Deep freezing, Freezing under liquid nitrogen, lyophilization. Staining techniques-Gram staining	8	2
	1.4	Nutritional requirements for bacterial growth. Microbial growth - Growth curve, Measurement of microbial growth-Direct method (viable count) and indirect method (turbidometry). synchronous growth, batch culture, continuous culture.	5	1
Module II: Morphology of Bacteria and Virus and Viral Cultivation (18 Hrs)				
2	2.1	Morphology of Bacteria- Size, Shape and Ultra structure of bacteria. Morphology of virus- shape, size and structure. Bacteriophages- T4 Phages and life cycle (Lytic and Lysogenic cycle), virions, viroids, prions. Viral cultivation-Chick embryo method and cell culture methods.	18	1
Module III: Basic Immunology (11 Hrs)				
3	3.1	Immune system: Organs of Immune system. Immune cells- (B Cells, T cells, memory cells, Macrophages, Dendritic cells, Natural Killer cells)	3	4
	3.2	Immunity and types of Immunity (Innate and Acquired, Passive and Active, Humoral and Cell Mediated)	3	4
	3.3	Antigens. Types of antigens, Haptens, Adjuvants, Epitopes (T cell and B cell Epitopes), Immunoglobulins- structure (basic only), classes and functions of immunoglobulins. Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Mention Hypersensitivity. Vaccines Introduction. Types of vaccines, Current Vaccines, Recent trends in vaccine preparation.	5	4

Module IV: Microbiology and Basic Immunology - PRACTICAL (30 Hrs)				
4	4.1	Instruments - Autoclave, Hot air oven, Bacteriological incubator - Laminar air flow	4	5
	4.2	Preparation of solid and liquid media for microbial cultures. (Ingredients, pH and method of preparation) (Demonstration) (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar (b) Liquid Media (1) Nutrient broth (2) Peptone water.	2	5
	4.3	Culture methods (Demonstration) (a) Streak plate technique and isolation of pure colonies. (b) Lawn culture (c) Pour plate culture (d) Liquid culture	4	5
	4.4	Streak plating (individual performance)	4	5
	4.5	Gram staining - preparation, procedure, identification of Gram + ve and Gram -ve bacteria.	5	5
	4.6	Examination of microbes in living condition: Hanging drop method for demonstrating motility of bacteria.	2	5
	4.7	Preparation of a fungal smear - Lactophenol cotton blue staining and mounting	4	5
	4.8	Antibiotic sensitivity test. (Demonstration)	2	5
	4.9	Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in rat/Man.	2	5
	4.10	Determination of ABO blood groups and Rh factor (Antigen - antibody Reaction)	1	5


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- Chakraborty, P. (2005). *A textbook of microbiology*. New Central Book Agency
- Chander, J. (2017). *Textbook of medical mycology*. JP Medical Ltd.
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- Delves, P. J., Martin, S. J., Burton, D. R., and Roitt, I. M. (2017). *Roitt's Essential Immunology*. John Wiley and Sons.
- Dubey, R. C., and Maheshwari, D. K. (2023). *A textbook of microbiology*. S. Chand Publishing Education.

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 - 13 Mossel, D. A. A., Corry, J. E., Struijk, C. B., and Baird, R. M. (1995). *Essentials of the Microbiology of Foods: A Textbook for Advanced Studies John Wiley and Sons*.
 - 14 Parija, S. C. (2023). *Textbook of microbiology and immunology*. Springer.Pearson.
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 - 19 Tortora G J., Funke B.R. and Case C.L. (2019) Microbiology: an introduction.13th Ed.
 - 20 Vasanthakumari, R. (2016). *Textbook of microbiology*. Wolters kluwer india Pvt Ltd.
 - 21 Willey, J. M., Sherwood, L. M., and Woolverton, C. J. (2014). Prescott's Microbiology.

Suggested readings:

1. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's Text Book of microbiology*. Orient Blackswan.
2. Mini, K.D. (2020). Microbiology. Zoological Society of Kerala.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	FISHING AND FISH PROCESSING					
Type of Course	MAJOR-DSE					
Course Code	ZO6DSEA02B24					
Course Level	300-399					
Course Summary	<p>This course offers a comprehensive overview of fishing and fish processing techniques. Students will explore the various fishing methods and strategies. The course also covers different fish preservation techniques including curing, smoking and freezing. Emphasis will be placed on quality control, food safety standards, and quality certification in seafood industry.</p>					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		The student should have an understanding on fish as a resource.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the concept of fishing crafts and gears.	U	1, 2, 3
2	Explain the various aspects of seafood microbiology	S, A	1, 2, 3
3	Practice various fish preservation techniques.	S, A	1, 2, 3, 6
4	Explain fishing methods and fish processing procedures.	I, U	1, 2, 3, 6, 10
5	Prepare field survey report of fish processing plants	A	1, 2, 3, 6
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Fishing techniques			(15 Hrs)	
1	1.1	Fishing crafts and gears, fishing techniques and strategies: bait selection & casting.	5	1
	1.2	Handling of fish onboard fishing vessels, Unit operations and unloading of fish, Post harvest fishery losses, Handling fish in Landing centres.	5	1
	1.3	Basics of onboard processing, Cold shock, Physical, chemical, and sensory changes during chill storage. Principle of freezing and refrigeration.	5	1
Module II: Seafood microbiology			(15 Hrs)	
2	2.1	Importance of seafood microbiology in food safety and quality assurance. Types of microbial pathogens and toxins in seafood. Sources of microbial contamination during harvesting, processing, and distribution.	5	2
	2.2	Microbial Spoilage of Seafood, metabolic activities of spoilage organisms in seafood. Factors influencing microbial spoilage (temperature, pH, water activity). Quality indicators and sensory evaluation of spoiled seafood products	5	2
	2.3	Basic Microbiological techniques. Collection of specimen and identification of various diseases of fish and shell fish, Isolation and cultivation of pathogenic bacteria.	5	2
Module III: Preservation techniques			(15 Hrs)	
3	3.1	Different methods of fish preservation: freeze drying, curing, salting, brining, canning, smoking. Freeze drying: principles, accelerated freeze drying (AFD), shelf life and specialties of AFD products. definition of canning, Selection and preparation of foods for canning. Canning process, steps involved, process flow.	5	3
	3.2	Role of salt in preservation Dry salting vs. brining, Salt concentration and its effects on preservation. Smoking: Principles of smoking as a preservation method, Types of smoking (cold smoking, hot smoking), Equipment and materials used for smoking	5	3

		Brining Techniques: Principles of brining and osmosis, Types of brining solutions (wet brining, dry brining), Brining equipment and procedure		
	3.3	Fermented products: different methods of fermentation, indigenous products and their principles of preservation	5	3
Module IV: Fishing and Fish Processing - PRACTICAL			(30 Hrs)	
4	4.1	Identification of various fishing gears	10	4
	4.2	Isolation and identification of spoilage and pathogenic microorganisms from fish and shellfish	10	4
	4.3	Field report on visiting any fish processing plants.	10	5

References:

1. Alasavar .C Taylor. T. (2002), Seafood -quality, Technology and Nutraceutical applications, Springer Verlag Berlin.
2. Davies. R (1982) Developments in Food Microbiology, Applied Set. London.
3. Hall G.M (1997), Fish Processing Technology, Blackie Academic & Professional New York.
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5. J.J. Connel, 1980. Advances in Fishery Science and Technology, Fishing News Books Ltd., England
6. Joan K. Loken (1995), The HACCP Food Safety Manual, John Wiley and Sons.
7. Joe, M. R. and Carrie, E. R. 1984. Food protein chemistry. Academic press Inc. New York. K.
8. Wheaton F.W and Lawson T.B (1985) Processing of Aquatic Food Products, John Wiley & Sons, New York.

Suggested Readings:

1. Connel J.J (1980), Control of Fish quality. Fishing News Books Ltd., England. Quality Assurance in Seafood Processing, (2000) Society of Fisheries Technologists, (India) Cochin.
2. Gopakumar. Text Book of Fish Processing Technology. ICAR, New Delhi 12.



ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM
Affiliated to Mahatma Gandhi University, Kottayam

Programme	B.Sc. (Hons.) Zoology					
Course Name	EVOLUTION AND ZOOGEOGRAPHY					
Type of Course	MAJOR-DSE					
Course Code	ZO6DSEA03B24					
Course Level	300-399					
Course Summary	This course helps the student gain an understanding on the origin of life and evolution of various organisms. The course also critically analyses the various theories of organic evolution. It also visualises the patterns of distribution of life on earth. It defines the processes that cause evolutionary changes and explains how it can cause deviation from Hardy Weinberg Equilibrium.					
Semester	VI	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Basic knowledge on evolution.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Explain the Origin of life and theories of organic evolution.	Ap, U	1,2
2	Explain the patterns and factors affecting the distribution of animals on earth.	I, U	1, 2
3	Describe the types of isolating mechanisms and speciation.	I, U	1, 2,3
4	Compare evolution of man and horse.	Ap, An	1, 2
5	Illustrate Zoogeographical realms.	I, A	1,2, 3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Origin of life and theories of organic evolution			(20Hrs)	
1	1.1	<p>Origin of life and theories of organic evolution Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation (Abiogenesis or Autogenesis), Special creation, Biogenesis, Endosymbiosis. Chemical evolution - Haldane and Oparin theory, Miller-Urey experiment. Direct evidences of evolution - Recapitulation Theory of Haeckel, Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous organs. Lamarckism and its Criticism, Weismann's Germplasm theory, Darwinism and its Criticism, NeoDarwinism, Theory of DeVries.</p>	14	1
	1.2	<p>Population genetics and evolution Hardy-Weinberg Equilibrium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on population: Bottleneck effect and founder effect.</p>	6	1
Module II: Speciation			(12 Hrs)	
2	2.1	<p>Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme); Speciation: Types of speciation, Phyletic speciation (autogenous and allogeous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation</p>	5	3
	2.2	<p>Isolation: Types of isolating mechanisms - Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution</p>	7	3
Module III: Nature of Evolution			(10 Hrs)	
3	3.1	<p>Nature of Evolution Microevolution, Macroevolution (Adaptive radiation - Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass extinction (brief account only). Evolution of Horse. Evolution of man.</p>	10	4
Module IV: ZOOGEOGRAPHY			(18 Hrs)	
	4.1	Dispersal and Migration	8	2


4		Continental drift theory, Types and means of animal distribution, Factors affecting animal distribution. Types of animal distribution, Insular fauna - oceanic islands and continental islands with examples		
	4.2	Zoogeographical realms Palaeartic region, Nearctic region, Neotropical region, Ethiopian region, Oriental region, Australian region (brief account with physical features and fauna, Wallace's line, Weber's line.	7	5
	4.3	Biogeography of India Biogeography of India with special reference to Western Ghats.	3	5

References:

1. Bell, G. (1996). Selection: The Mechanism of Evolution. Chapman and Hall
2. Bernal, J.D. (1969). The Origin of Life. Weidenfeld and Nicolson, London
3. Briggs, J.C. (1996). Global Biogeography. Elsevier Publishers.
4. Chandran Subash M.D. (1997). On the ecological history of the Western Ghats. Current Science, Vol.73, No.2. 146-155.
5. Daniels, R.J.R and Vencatesan J. (2008), Western Ghats Biodiversity. People Conservation; Rupa and Co. New Delhi. India.
6. Darlington, P.J. The Zoogeography: The geographical distribution of animals. Wiley Publication, New York.
7. Hall, B.K. and Hallgrimson, B. (2008). Evolution IV Edition. Jones and Barlett Publishers.
8. Hobbs, C.L. Zoogeography. Ayer co pub; Reprint Edition.
9. Mani, M.S. (1974). Ecology and Biogeography of India; The Hague: .Dr. W. Junk b.v. Publishers.
10. Nair, C.S. (1991). The Southern Western Ghats: A Biodiversity Conservation Plan. INTACH, New Delhi.
11. Ramesh, B.R and R Gurukkal (2007), Forest Landscapes of the Southern Western Ghats, India- Biodiversity, Human Ecology and management Strategies. (French Institute of Pondicherry) India.
12. Stearus, S. and Hoeksra, R. (2000). Evolution: An Introduction. OUP, USA
13. Strickberger, M.W.2000. Evolution. Jones and Bartlett, Boston.
14. Tiwari, S. Readings in Indian Zoogeography (vol.1) Today and Tomorrow printers and Publishers

Suggested reading:

1. Dr. Seema K, Editor: 2019, Evolution, Zoological Society of Kerala.

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	ENTOMOLOGY
Type of Course	MAJOR - DSE
Course Code	ZO6DSEA04B24
Course Level	300-399
Course Summary	This entomology course covers insect pests and their control, emphasizing integrated pest management (IPM). It explores the significance of insects in various industries and distinguishes between pests affecting humans and domestic animals, offering management strategies.
Semester	VI
Course Details	Credits
	4
Pre-requisites, if any	Total Hours
	60
Pre-requisites, if any	Basic knowledge on insects.

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Explain the effect and control of insect pests.	S, A	1, 2
2	Describe the principles and practices of integrated pest management.	I, U	1, 2
3	Explain the significance of insects in industry	A	1, 2, 3
4	Explain the pests of man and their management.	Ap, U	1, 2, 6, 7
5	Describe the pests of domestic animals and their management.	I, U	1, 2, 6, 7
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Insects as pests			(14 Hrs)	
1	1.1	Types of insect pests - major, minor, sporadic, endemic, exotic, seasonal, occasional, regular and persistent. Causes of pest outbreak- deforestation, natural enemy destruction, pest resurgence, secondary outbreak, intensive and extensive cultivation, crop introduction, hybrid varieties, new pests introduction.	4	1
	1.2	Effect and control of insect pests: Pests of Crops: Coconut (<i>Oryctes rhinoceros</i> and <i>Rhyncophorus ferrugineus</i>), Paddy (<i>Leptocorisa acuta</i> and <i>Spodoptera mauritia</i>). Pests of Stored grain: <i>Trogoderma granarium</i> and <i>Tribolium castaneum</i> . Pests of vegetables: Brinjal (<i>Leucinodes orbonalis</i> and <i>Euzophera perticella</i>), Gourds (<i>Bactrocera cucurbitae</i> and <i>Anadevidia peponis</i>). Pests of fruits: Citrus fruits (<i>Phyllocnistis citrella</i> and <i>Diaphorina citri</i>), Banana - <i>Cosmopolites sordidus</i> and <i>Pentalonia nigronervosa</i>) Mango (<i>Batocera rufomaculata</i> , <i>Chloropulvinaria polygonata</i> ,).	10	1
Module II: Insect pest control			(13 Hrs)	
2	2.1	Integrated pest management (IPM) IPM- Definition, Planning, techniques used, examples and advantages.	3	2
	2.2	Chemical Control: Classification. Inorganic insecticides (Arsenicals, Lime Sulphur, Fumigants (Para dichlorobenzene, Methyl bromide). Organics insecticides - oils, insecticides of plant origin (Pyrethrins, Nicotine, Azadiractin) Synthetic Organics - Chlorinated Hydrocarbons (BHC, Methoxychlor) Organophosphate (Malathion, Parathion,) Carbamates (Carbaryl, Propoxur) and Pyrethroids (Allethrin, Cypermethrin). Advantages and disadvantages of chemical control	5	2
	2.3	Biological control - predators, parasites and microbes, Nematodes. Biological control Strategies - Introduction, Augmentation and Conservation. Use of Hormones and Pheromones. Autocidal control - Sterile	5	2

		male technique, male confusion technique, genetic technique.		
Module III: Beneficial Insects			(21 Hrs)	
3	3.1	<p>Apiculture Definition, Uses of bees, species of bees cultured, organization of honey bee colony, bee keeping methods and equipments, management and maintenance of an apiary- growth period, dividing the colony, uniting two colonies, replacing old queen with new queen, honey flow period, Bee pasturage, Dearth period, Enemies of bees, Bee diseases, uses of honey and wax, Apitherapy, Propolis, Royal jelly, Agencies supporting apiculture.</p> <p>Sericulture Four species of silkworms, life history of silkworm, silk worm rearing techniques, mounting of silkworm - Chandrika, defective cocoons, harvesting and stifling of coccons. Silkworm diseases and pest, preventive and control measures.</p> <p>Black Soldier Flies. BSF life cycle, BSF rearing unit, Black Soldier Fly Biowaste Processing.</p>	17	3
	3.2	Forensic Entomology: Brief mention of common insects of Forensic importance - Order Diptera and Order Coleoptera	4	3
Module IV: Pests of man and domestic animals			(12 Hrs)	
4	4.1	Pests of man, diseases caused and their management: mosquitoes - houseflies, bed bugs, head lice, house dust mites.	7	4
	4.2	Pests of domestic animals, diseases caused and their management: cattle, poultry, pet animals (bird louse, <i>Hypoderma</i> , screwworms, <i>Gasterophilus</i>).	5	5


References:

1. Amrul N F et.al. A Review of Organic Waste Treatment Using Black Soldier Fly (*Hermetia illucens*), *Sustainability* 2022, 14 (8), 4565.
2. Beutel, R. G., and Leschen, R. A. B. (2005). *Insect Morphology and Systematics*. Walter de Gruyter.
3. Chapman R. F. Simpson S. J. and Douglas A. E. (2013). *The insects: structure and function* (Fifth). Cambridge University Press.
4. Deepak Kumar Verma (1999). *Applied Entomology*. Mittal Publications.

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5. Joly, G., and Nikiema, J. (2019). Global experiences on waste processing with black soldier fly (*Hermetia illucens*): From technology to business. *Resource Recovery and Reuse*.
 6. Lalander, C.; Diener, S.; Zurbrügg, C.; Vinnerås, B. Effects of feed stock on larval development and process efficiency in waste treatment with black soldier fly (*Hermetia illucens*). *J. Clean. Prod.* 2019, 208, 211-219.
 7. Liu, C.; Wang, C.; Yao, H. (2019) Comprehensive resource utilization of waste using the black soldier fly (*Hermetia illucens* (L.))(Diptera: Stratiomyidae). *Animals* , 9, 349
 8. Liu, T., Awasthi, M. K., Awasthi, S. K., Duan, Y., and amp; Zhang, Z. (2020). Effects of black soldier fly larvae (Diptera: Stratiomyidae) on food waste and sewage sludge composting. *Journal of Environmental Management*, 256.
 9. Marshall, S. A. (2006). *Insects: Their Natural History and Diversity*. Firefly Books.
 10. Mentari, P. D., Nurulalia, L., Permana, I. G., andamp; Yuwono, A. S. (2020). Decomposition characteristics of organic solid waste from traditional market by black soldier fly larvae (*Hermetia illucens* L.). *International Journal of Applied Engineering Research*, 15(7), 639-647.
 11. Myers, H.M.; Tomberlin, J.K.; Lambert, B.D.; Kattes, D. (2014) Development of black soldier fly (Diptera: Stratiomyidae) larvae fed dairy manure. *Environ. Entomol.* , 37, 11-15.
 12. Pedigo, L. P., and Rice, M. E. (2009). *Entomology and Pest Management*. Pearson.
 13. Singh, A.; Kumari, K. (2019) An inclusive approach for organic waste treatment and valorisation using black soldier fly larvae: A review. *J. Environ. Manag.*, 251.
 14. Tembhare, D.B. (2000). *Modern Entomology*. Himalaya Publishing House.
 15. Vasantharaj David and Kumaraswami, T (2000). *Elements of Economic Entomology*. Popular Book Depot.
 16. Wang, G.; Peng, K.; Hu, J.; Yi, C.; Chen, X.; Wu, H.; Huang, Y. Evaluation of de-fatted black soldier fly (*Hermetia illucens* L.) larvae meal as an alternative protein ingredient for juvenile Japanese seabass (*Lateolabrax japonicus*) diets. *Aquaculture* 2019, 507, 144-154.

Suggested Readings:

1. Nalina Sundari, M.S and Santhi, R (2006) *Entomology*. MJP Publishers
2. NPCS Board of Consultants and Engineers, Chennai. (2015) *The complete book on Beekeeping and honey processing*, 2nd Edition, NIIR Project consultancy services, 106- E kamala Nagar Delhi - 110007.
3. Vijayakumaran Nair, K, Manju, K.G. and Minimol, K. C. (2015) *Applied Zoology*, Academia press, Thiruvananthapuram.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam						
	Programme	B.Sc. (Hons.) Zoology					
Course Name	ECO TOURISM AND SUSTAINABLE PRACTICES						
Type of Course	SEC						
Course Code	ZO6SEC01B24						
Course Level	300-399						
Course Summary	This course focuses on responsible tourism ideas and methods, including local inclusion, poverty reduction, job creation, cultural heritage preservation, and natural resource conservation.						
Semester	VI			Credits		3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	45	
		3					
Pre-requisites, if any	Basic knowledge on ecosystems.						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No
After the successful completion of the course the student should be able to:			
1	Describe fundamentals of Eco Tourism.	U	1,6,7,8
2	Explain Eco tourism trends, issues and challenges.	I, U	1,5,6,7
3	Compare emerging trends in eco-tourism.	Ap, U	1,5,6,7
4	Examine policies to promote sustainable tourism.	A	1,6,7,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction			(12 Hrs)	
1	1.1	Introduction - Fundamentals of Ecology - Basic Laws and ideas in Ecology. Function and Management of Ecosystem. Biodiversity and its Conservation-Pollution. Ecological Foot Prints. Relationship between Tourism and Ecology.	6	1
	1.2	Eco Tourism - Evolution, Principles, Trends and Functions of Ecotourism, Mass Tourism Vs Eco tourist, Typology of Eco-tourists, Ecotourism Activities and Impacts.	5	3
Module II: Eco Tourism Trends, Issues and Challenges			(18 Hrs)	
2	2.1	Alternative and Reponsible Tourism Ecotourism development - Sustainable Ecotourism. Resource Management, Socio-economic Development. Ecotourism Policies, Planning and Implementation. Eco-friendly Facilities and Amenities. Carrying Capacity, Alternative Tourism and Responsible ecotourism- Ecotourism Programming	10	2
	2.2	Eco Tourism Trends, Issues and Challenges Conservation of Ecotourism Protected Area Management through Ecotourism - Community Participation - Types of Participation, Issues and Challenges - Ecotourism Projects - Case Studies on Periyar National Park, Thenmala Eco-Project, Similipal Ecotourism Project, Sunderbans Eco tourism Project, Kaziranga National Park, Nandadevi Biosphere Reserve, Corbett National Park, Gulf of Manar, Kruger National Park, SouthAfrica.	8	3
Module III: Emerging trends in eco-tourism			(10 Hrs)	
3	3.1	Major areas of eco-tourism Concepts, practices and case studies for each: Marine	6	3


		tourism ,Wildlife tourism, Adventure tourism		
	3.2	Emerging trends in eco-tourism Cultural tourism, Pilgrimage tourism, Farm tourism, Backwater tourism, Health tourism	4	2
Module IV: Policies and Ecotourism Development Agencies (6 Hrs)				
4	4.1	National policies for: Sustainable tourism, Ecotourism, National Tourism Policy, Swadesh Darsan Scheme Policies for States, Kerala Tourism Policy	3	4
	4.2	Ecotourism Development Agencies- Role of the International Ecotourism Society - the UNWTO, UNDP,WWF - Department of Forest and Environment - Government of India, ATREE, EQUATIONS..	3	3

References:

1. Fennell, D., and Malloy, D., (2007). Codes of Ethics in Tourism. Practice, Theory, Synthesis. Clevedon: Channel View Publications.
2. Goodwin, H. (2011). Taking responsibility for tourism. Oxford: Goodfellow Publishers Ltd.
3. Parikshat Singh Manhas 2010. Sustainable and Responsible tourism.PHI Publishers.
4. Ralf Buckley (204), Environment Impacts of Ecotourism, Cabi, London.
5. Ramesh Chawla (206), Ecology and Tourism Development, Sumit International, New Delhi.
6. Sukanta K Chaudhury, Cultural, Ecology and Sustainable Development, Mital, New Delhi.
7. Weaver, D. (2001), The Encyclopedia Of Ecotourism, Cabi Publication.

Suggested readings:

1. Anukrati S. (2019). Sustainable Tourism and Development, Apple Academic Press.
2. Fenel, D. A. (2002), Ecotourism Policy and Planning, Cabi Publishing, USA

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	SEX EDUCATION					
Type of Course	VAC					
Course Code	ZO6VAC01B24					
Course Level	300-399					
Course Summary	<p>The course covers biological, psychological, and sociological facets of sex education and reproductive health. The goal of the course is to provide students with the knowledge needed to make informed sexual health decisions, nurture healthy relationships, and contribute to the promotion of sexual well-being in diverse communities.</p>					
Semester	VI	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Basic knowledge on reproductory system.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Explain primary and secondary sexual characters.	U	1,2,7,6
2	Describe causes of infertility and Sexual orientation.	U	1,2
3	Examine contraceptives and sexually transmitted infectious diseases.	A	1,2,6
4	Examine ethical aspects of sex.	A	1,6,7,8
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction			(11 Hrs)	
1	1.1	Definition; Reproductive health - problems and strategies, reproductive rights, importance of sex education	3	1
	1.2	Primary and secondary sexual characters and puberty, Physical and emotional changes during puberty. Role of hormones in the development of secondary sexual characters.	5	2
	1.3	Personal hygiene and self-care during adolescence, Emotional well-being, self-esteem, and body image.	3	2
Module II: Infertility and Sexual orientation			(14 Hrs)	
2	2.1	Infertility and assisted reproductive technologies Infertility: Causes and problems in male and female. Infertility management: semen collection, preservation and storage, artificial insemination, surrogacy. Cryopreservation and embryo transfer: Collection, care and preservation of embryos. In vitro fertilization (IVF) and embryo transfer: Major steps; Test tube babies. Assisted Reproductive Techniques (ART): GIFT, ZIFT, ICSI, oocyte donation and embryo donation.	8	3
	2.2	Sexual orientation, sexual abuse and myths Homosexuality and bisexuality (mention LGBT), sexual abuse, premarital and extramarital sex, sexual perversions, paraphilia, child abuse, prostitution, sexual hygiene, protection of children from sexual offences (POCSO) Act, 2012 (brief account only), sexual myths.	6	3
Module III: Contraceptives and Sexually transmitted infectious diseases			(14 Hrs)	
3	3.1	Contraceptives Importance of safe sex practices, Natural methods; artificial methods; chemical methods; hormonal methods; contraceptive devices (condoms, birth control pills, IUDs, Emergency contraception and its availability etc.) surgical contraception (Vasectomy and Tubectomy); abortion, legal termination of pregnancy.	7	4
	3.2	Sexually transmitted infectious diseases	7	4

		Symptoms, mode of transmission, diagnosis, treatment and prophylaxis of AIDS, syphilis, gonorrhoea, herpes (genital), human papilloma virus and genital warts, Hepatitis, gonococcal vulvo vaginitis, Trichomonal vaginitis.		
Module IV: Ethical aspects of sex			(6 Hrs)	
4	4.1	Options for reproductive choices (parenting, adoption, abortion, surrogacy), Postpartum care and mental health.	3	5
	4.2	Responsible parenthood and family planning, Healthy relationship with opposite sex, role of counseling, gender discrimination in family and society.	3	5


References:

1. Brian Walker Nicki R Colledge Stuart Ralston and Ian Penman (2014): Davidson's Principles and Practice of Medicine, 22nd edition; Elsevier
2. Czerwinski, B. S. (1992). Relationship between feminine hygiene practices, body image, and self-esteem. Texas Woman's University.
3. Frankowski, B. L., and Committee on Adolescence. (2004). Sexual orientation and adolescents. *Pediatrics*, 113(6), 1827-1832.
4. Goldberg, A. E. (Ed.). (2016). *The SAGE encyclopedia of LGBTQ studies*. SAGE publications.
5. Leon, I. (2008). *Psychology of reproduction: Pregnancy, parenthood, and parental ties*. Global Library of Women's Medicine.
6. Lynn L. Long, Judith A. Burnett, R. Valorie Thomas (2005): *Sexuality counseling an integrated approach*, 1st Edition, ISBN-10: 0131710524, Pearson
7. Owen, R. R., and Matthews, D. (1982). Developmental and acquired disabilities in adolescence. In *Adolescent Health Care* (pp. 131-141). Academic Press.

Suggested Readings:

1. Prakash Kothari (1995): *Common sexual problems and solutions*, 2nd Edition, ISBN10: 8185674086, UBS Publ. and Distributors Ltd., 173 pages
2. Tortora, G. J. and Derrickson, B. H. (2018). *Principles of Anatomy and Physiology*. John Wiley and Sons.

SEMESTER 7

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	BIOPHYSICAL TECHNIQUES
Type of Course	MAJOR
Course Code	ZO7DCCA01B24
Course Level	400-499
Course Summary	Biophysics is an interdisciplinary field that applies principles and methods of physics to understand biological systems at various levels, from molecules to organisms. This course provides an overview of the physical principles underlying biological phenomena, including molecular structure, dynamics and interactions, as well as the application of biophysical techniques in research and technology.
Semester	VII
Course Details	Credits
	4
	Total Hours
	75
Pre-requisites, if any	An introductory knowledge in Physics, Chemistry and Biology.

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Explain principles and applications of different microscopic and histological techniques.	S, A	1,2,3
2	Describe the various types of separation techniques.	U	1,2, 3
3	Compare the principles and applications of different analytical techniques	U	1,2,3
4	Explain different spectroscopy.	S, A	1,2,3,10
5	Practice Biophysical techniques.	S, A	1,2, 3,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Microscopy and histological techniques			(10 Hrs)	
1	1.1	Microscopy- Differential, Interference, contrast (Nomarsky) microscopy, Fluorescence microscopy, Confocal microscope, Scanning, Tunnelling, Electron microscope - TEM, SEM, Specimen preparation, Shadow casting, Freeze fracturing, Freeze etching, Negative staining. Microphotography, Atomic force microscope.	5	1
	1.2	Histological Techniques Types of microtomes and microtomy. Fixation, preparation of temporary and permanent slides, whole mounts, smears, squashes and sections. Cytochemical and histological method, Histochemistry of nucleic acids, detection of carbohydrates, proteins and lipids.	3	1
	1.3	Ocular and stage micrometres; Hemocytometer; Camera lucida.	2	1
Module II: Separation techniques			(20 Hrs)	
2	2.1	Centrifugation: Basic principle and applications. Differential, density and ultracentrifugation.	3	2
	2.2	Chromatography: Basic principles, working and applications of Thin-layer chromatography, Ion - exchange and Affinity chromatography; High performance liquid chromatography (HPLC), Fast protein liquid chromatography (FPLC), Gel permeation chromatography.	9	2
	2.3	Electrophoresis: Basic principle and applications. Gel electrophoresis- Agarose, PAGE, SDS and non SDS, 2D Gel electrophoresis, Isoelectric focusing, Density gradient gel electrophoresis, Disc electrophoresis, High voltage electrophoresis, Capillary gel electrophoresis, Electrophoretic mobility shift assay (EMSA).	8	2
Module III: Analytical techniques			(15 Hrs)	
3	3.1	Colorimetry, Spectrophotometry: Principle and applications, Beer Lambert law.	2	3
	3.2	Spectroscopy: Fourier-Transform infrared spectroscopy (FTIR), Raman spectroscopy, Circular dichroism spectroscopy, Flame emission	10	3, 4

		spectroscopy, Atomic absorption spectroscopy, Nuclear Magnetic Resonance spectroscopy (NMR) and Electron Spin Resonance (ESR) spectroscopy, Mass spectroscopy- Different types and applications: MALDI-TOF, LCMS, Tandem Mass Spectrometry, Flow cytometry, pH meter.		
	3.3	Radioisotope Detection and Measurement, Dosimetry: Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography, PET (Positron electron transmission).	3	3
Module IV: Biophysical techniques - PRACTICAL			(30 Hrs)	
4	4.1	Measurement of microscopic objects using micrometer.	6	5
	4.2	Diagrammatic representation of specimen using camera lucida.	5	5
	4.3	Principle and working of phase contrast microscope, Micro-photographic equipment.	5	5
	4.4	Identification of absorption maxima of any sample by spectrophotometer.	6	5
	4.5	TLC using amino acids and calculation of R _f values.	6	5
	4.6	Determination of pH of 2 prepared buffer samples.	2	5


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- Ackerman, E. (1979). Biophysical science. New Jersey, USA: Prentice Hall Inc.
- Alonso, A. & Arrondo, J.L.R. (2006). Advanced Techniques in Biophysics.UK: Springer.
- Arora, M.P. (2007). Biophysics. New Delhi: Himalaya Publishing House.
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 19. Weesner, F.M. (1968). *General Zoological Microtechniques*. Baltimore, USA: The Williams & Wilknins Company.

Suggested Readings:

1. <https://doi.org/10.1146/annurev-biophys-120121-074034>
2. <https://doi.org/10.1146/annurev-bioeng-081622-025405>

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) Zoology				
Course Name	BIostatistics and Research Methodology					
Type of Course	MAJOR					
Course Code	ZO7DCCA02B24					
Course Level	400-499					
Course Summary	This course covers research methodology and biostatistics, introducing students to key concepts in designing and conducting scientific studies. Students delve into descriptive and inferential statistics, with a focus on applying these principles in biology-related research. Practical skills are enhanced through hands-on experience with statistical software.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Basic knowledge in mathematical calculations and statistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Explain the basic concepts of Biostatistics and descriptive statistics.	U	1,2,3
2	Analyse biological data using appropriate statistical softwares.	S, An	1,2,3
3	Describe the different types, designs, literature review and ethics in Research.	U	1,2,8
4	Explain strategies for research documentation and scientific communication.	S, A	1,2,4
5	Apply biostatistical methods to interpret biological data.	S, A	1,2,3
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Biostatistics and Descriptive Statistics			(15 Hrs)	
1	1.1	Biostatistics - Role and applications in life sciences. Steps in Statistical Investigation. Meta-analysis. Data and Variable (Types, Sources). Data collection methods: Census and Sampling techniques, Sampling Errors. Organization of Data - tabulation, types and characteristics of a frequency table. Data presentation - Graphs and Diagrams. ACTIVITY: <ul style="list-style-type: none"> Preparation of frequency distribution table from raw data. Construction of bar diagrams, pie diagrams, line graphs, frequency polygon, frequency curve, histogram and ogives. 	4	1,5
	1.2	Measures of central tendency: mean, median, mode. Corrected mean. ACTIVITY: <ul style="list-style-type: none"> Problems related to mean, median and mode (Individual, discrete and continuous series). 	5	1,5
	1.3	Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation. Corrected standard deviation. Skewness and kurtosis. ACTIVITY: <ul style="list-style-type: none"> Problems related to range, Quartile deviation, mean deviation and standard deviation (Individual, discrete and continuous series). 	6	1,5
Module II: Biostatistics - Analysis and Softwares			(25 Hrs)	
	2.1	Correlation Analysis: Types and methods of correlation analysis, Karl Pearson's correlation coefficient. ACTIVITY: <ul style="list-style-type: none"> Calculation and interpretation of Pearson correlation coefficient. 	6	2, 5
	2.2	Regression analysis: Graphic methods - Scatter method, Line of best fit; Algebraic method- Regression equations. Relationship between correlation and	6	2, 5

2		regression. ACTIVITY: <ul style="list-style-type: none"> • Calculation and interpretation of regression equation (x on y & y on x) 		
	2.3	Definition of probability. Addition and multiplication theorems. Probability distributions: Binomial and Normal distribution.	4	2
	2.4	Testing of hypothesis - null and alternative hypothesis, test statistic, type-I and type-II errors, critical region, level of significance, p-value. Parametric Tests: t-test, Z test, ANOVA (one way). Non-parametric Test - Chi-square test. ACTIVITY: <ul style="list-style-type: none"> • Calculation and interpretation of Chi-square test (2×2 table only), t TEST, one-way ANOVA 	6	2, 5
	2.5	Statistical Software: SPSS, R-Programming, PRIMER (Brief account only)	3	2
Module III: Research: Types, Design, Literature Review and Ethics (8 Hrs)				
3	3.1	Types of Research - Deductive/Inductive, Descriptive/Analytical, Applied/Fundamental, Quantitative/Qualitative, Conceptual/ Empirical.	2	3
	3.2	Research Design - Basic principles, types, Significance and features of good design.	2	3
	3.3	Literature review - Importance of literature review in defining a problem, Critical literature review.	2	3
	3.4	Ethics in research - Plagiarism, Plagiarism check - Turnitin, Viper, Urkund. Citation and Acknowledgement.	2	3
Module IV: Research Documentation and Scientific Communication (12 Hrs)				
4	4.1	Structure and components of Scientific Report. Types of Report - Technical Reports and Thesis/dissertations. ACTIVITY: <ul style="list-style-type: none"> • Review a scientific article in Biology and submit the report. 	4	4, 5
	4.2	Preparation of Project Proposal to Project funding agencies. Preparing Research papers for journals, seminars and conferences. SCOPUS, Web of Science, Impact factor, Citation Index, h-index, DOI., ISBN and ISSN.	4	4

	4.3	<p>Conventions and strategies of authentication - Citation styles, bibliography, referencing and footnotes. Software for managing bibliographies - EndNote, Mendley.</p> <p>Global Information System - BIOSIS, Medline and Medlars, AGRIS, PubMed, Google Scholar.</p> <p>ACTIVITY:</p> <ul style="list-style-type: none"> • Prepare a bibliography in APA format from the given details of a published scientific paper. 	4	4, 5
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References:

BIOSTATISTICS


1. Chap, T. Le. (2003). *Introductory Biostatistics*. John Wiley & Sons, NJ, USA.
2. Daniel, W.W. (2006). *Biostatistics: A Foundation for Analysis in the Health Sciences*. John Wiley & Sons, New York.
3. Freedman, D. F., Pisani, R., & Purves, R. (2011). *Statistics*. Viva Books, New Delhi.
4. Gupta, S. P. (2014). *Statistical methods for CA foundation course*. Sultan Chand & Sons, New Delhi.
5. Potti, L. R. (2021). *A Full Course in Statistics*. Yamuna Publication.
6. Rajathi, A., & Chandran, P. (2010). *SPSS for You*. MJP Publishers, Chennai
7. Samuels, M. L., Witmer, J. A., & Schaffner, A. (2016). *Statistics for Life Sciences*. Pearson Education Inc., New Delhi.
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RESEARCH METHODOLOGY

9. Bordens, K., & Abbott, B. B. (2022). *Research Design and Methods: A Process Approach*. McGraw Hill.
10. Das, A. K. (2015). *Research evaluation metrics*. United Nations Educational, Scientific and Cultural Organization.
11. Davis, M., Davis, K. J., & Dunagan, M. (2012). *Scientific Papers and Presentations*. Elsevier Science.
12. Greener, S., & Greenfield, T. (2016). *Research Methods for Postgraduates*. Wiley.
13. Kothari, C. R. (2023). *Research Methodology: Methods and Techniques*. New Age International Publishers.
14. Kumar, R. (2018). *Research Methodology: A Step-by-Step Guide for Beginners*. SAGE Publications.
15. Marder, M. P. (2011). *Research Methods for Science*. Cambridge University Press.
16. Mishra, S. B., & Alok, S. (2017). *Handbook of Research Methodology*. Educreation Publishing.
17. Ranganatham, M., & Krishnaswamy, O. R. (2022). *Methodology of Research in Social Sciences*. Himalaya Publishing House.

Suggested Readings:

1. P. Ramakrishnan, Biostatistics, Saras Publications.
2. D N Elhance, Fundamentals of Biostatistics, Kitab Mahal Publications.
3. L R Potti, Research Methodology, Yamuna Publications.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	ADVANCED GENETICS					
Type of Course	MAJOR					
Course Code	ZO7DCCA03B24					
Course Level	400-499					
Course Summary	This course provides a comprehensive understanding of the principles and mechanisms underlying inheritance, variation, and gene expression in living organisms. Students will explore the molecular basis of genetics, inheritance patterns, genetic disorders, population genetics, and the ethical implications of genetic research and technology.					
Semester	VII	Credits			4	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		4				
Pre-requisites, if any	Basic knowledge in Genetics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Examine the fundamental concepts of Mendelian genetics, gene interactions, linkage and recombination.	S, A	1, 2
2	Explain the molecular organization of chromosomes, gene fine structure and transposons.	Ap, U	1, 2
3	Interpret DNA replication, mutation and repair	A	1, 2
4	Describe Human Genetics and Epigenetics	U	1, 2
5	Solve Genetics problems.	S, A	1, 2, 10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Principles of genetic transmission			(12 Hrs)	
1	1.1	Basic principles of inheritance: Alleles, Pseudo alleles, Dominance, Segregation, Independent assortment, Test cross and ratios. Extensions of Mendelian Principles: Codominance, Incomplete Dominance, Gene interactions - Epistasis, Pleiotropy. Penetrance and Expressivity, Phenocopy. ACTIVITY: • Solve Genetics practice problems.	3	1, 5
	1.2	Multiple alleles- ABO blood groups in humans, Rh incompatibility, self-sterility alleles in plants, complex loci in Drosophila; inborn errors of metabolism, one gene one enzyme concept; inheritance of polygenic traits with specific example.	3	1
	1.3	Linkage, Recombination, Stern's experiment, crossing over as the physical basis of recombination, Molecular mechanism of crossing over and recombination, Holliday Model. Mechanisms of genetic exchange in Bacteria. Recombination mapping with a three-point test cross in Drosophila, Interference and the Coefficient of Coincidence. Mitotic recombination, Evolutionary significance of recombination. Mapping genes using conjugation data, Fine structure, Mapping of Phage genes: Complementation Mapping, Deletion Mapping.	6	1
Module II: Molecular Organization of Chromosomes, Gene structure and Transposons			(17 Hrs)	
2	2.1	DNA, Histone, Chromatin, Euchromatin and heterochromatin. Genome size and C - value paradox, Chromatin Structure and levels of DNA packaging in Prokaryotic and Eukaryotic chromosomes, Molecular structure of Centromere and Telomere, Telomere shortening and Aging (Werner's syndrome), Repeated DNA sequences in Eukaryotic Genome: Highly repetitive, moderately repetitive, Single copy, Kinetics of renaturation, Cot Curve.	8	2
	2.2	Classical versus Molecular concept of the gene, Cis-Trans test for functional allelism, Fine structure of the	4	2

		phage T4 rII locus, Modern findings on the nature of gene: Interrupted genes in eukaryotes, Exons and introns, Genes within genes in phage ϕ x174, Gene synthesis: in vitro synthesis - Works of Watson and Crick, Khorana, Kornberg and Nirenberg		
	2.3	Barbara McClintock's experiment of maize, Autonomous and non-autonomous transposons, Transposable elements in Bacteria, Cut and Paste transposons in Eukaryotes, Retrotransposons, LINEs, SINEs, Alu family, Transposable elements in Humans. Genetic and evolutionary significance of transposable elements, application of transposons in mutagenesis, genome mapping and evolution	5	2
Module III: DNA Replication, Mutation and Repair			(15 Hrs)	
3	3.1	Meselson and Stahl Experiment, Semiconservative replication. Unidirectional replication, Bidirectional replication, Theta replication, Rolling circle replication, eukaryotic replication. Replication Machineries - prokaryotes and eukaryotes.	4	3
	3.2	Mutagenesis (Somatic or germinal mutation, Spontaneous or induced Mutation, Conditional lethal mutation, Variation in chromosome Number and Structure: Aneuploidy, Deletions and Duplications, Inversions, Translocations (Brief account only) and Molecular Mechanism of Mutation.	8	3
	3.3	Tautomeric shift, DNA Repair Mechanisms, Inherited Human Diseases with defects in DNA repair, Gene conversion, Ames test.	3	3
Module IV: Human Genetics and Epigenetics			(16 Hrs)	
4	4.1	Karyotype, Chromosome banding techniques, Pedigree analysis, anticipation, Lod Score, Complex traits, Quantitative traits, Threshold traits. Analysis of quantitative traits: The Multiple Factor Hypothesis, Broad sense heritability, Narrow sense heritability. Artificial selection, Correlations between Relatives.	4	4
	4.2	Theory of allele frequencies and allelic natural selection. Applications of Molecular Genetics. Identification of human genes and diagnosis of human diseases. Uni parental Disomy, Huntington's disease, Fragile X syndrome, Cystic fibrosis. Gene therapy- SCID-Autosomal disease of immune system, DNA profiling, Micro RNA, Si RNA and their control in Genetic disorders. Mitochondrial gene in Aging and	6	4


		Human Disease.		
	4.3	Epigenetics, Histone code hypothesis. Chromatin modifications and their mechanisms of action: Modification of histone proteins-Acetylation, phosphorylation, methylation, ubiquitylation, sumoylation. Chromatin remodeling, Genomic imprinting, X chromosome inactivation- Lyon hypothesis, genetic control; gene silencing. Epigenetics in Drosophila: Position effect variegation (PEV), Gene silencing - Polycomb Group Genes (PcG) - Yeast and Drosophila models.	6	4

References:

1. Brooker, R.R. (2011). *Genetics: Analysis and Principles*. Addison- Wesley, NY.
2. David, A., & Thomas, J. (2007). *Epigenetics*. Cold Spring Harbor Laboratory Press.
3. Gardner. J.E., Simmons, J., & Snustad, D.P. (2019). *Principles of Genetics* (Asia Edition). John Wiley, India.
4. Gilbert, S. F. (2006). *Developmental Biology* (9th Edition) Sinauer Associates, Inc., Publishers, Massachusetts.
5. Griffiths, et. al., (2015). *Introduction to Genetic Analysis*.(11th Edition). W.H. Freeman, NY, USA
6. Hartl, L. D., & Jones, E.W. (2009). *Genetics: Analysis of Genes and Genomes* (7th Edition). Jones & Bartlett Pub. Inc. MA, USA.
7. Lewin B, (2011). *Genes*. Jones and Barlett Publishers Inc.
8. Klug, W.S. & Michael R. C. (2009). *Concept of Genetics*. Pearson Education. Inc.
9. Russel, J, P. (2010). *Genetics*. Pearson International Edition.
10. Snustard, P. & Simmons, M. J. (2019). *Principles of Genetics*. John Wiley and Sons.
11. Watson et al., (2017). *Molecular Biology of Gene* (7th Edition.). Pearson Education Inc.

Suggested Readings:

1. Benjamin A. Pierce. Genetics 4th Edition, A Conceptual Approach
2. Strickberger, M.W. (2015). *Genetics*. (3rd Edition). Macmillan Publishing Co.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	BIOINFORMATICS AND COMPUTATIONAL BIOLOGY					
Type of Course	MAJOR					
Course Code	ZO7DCEA01B24					
Course Level	400-499					
Course Summary	This course introduces students to the interdisciplinary knowledge that underlies Bioinformatics and Computational Biology. The students will get acquainted with fundamentals of bioinformatics and basic concepts in analyzing biological data. The students will be trained to use computational tools to extract information from different bioinformatics data (gene, protein, disease, etc.) and to analyze them in their area of research work.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Hours
		4				
Pre-requisites, if any	The learner should have a basic knowledge in computer, biostatistics and basic concepts of molecular biology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the basics of bioinformatics.	U	1,2,3
2	Apply various sequence alignment in Bioinformatics.	S, A	1,2,3,9
3	Employ advanced knowledge in genomics, proteomics, phylogenetics and computational biology.	S, A	1,2,3
4	Evaluate biological data using various bioinformatic analysis.	S, E	1,2,3,9
5	Analyze the Bioinformatics resources, biological data and databases.	S, An	1,2,3
6	Employ Molecular visualization tools to analyse the biomolecules.	S, A	1,2,3,9
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Bioinformatics			(15 Hrs)	
1	1.1	History, Definition of Bioinformatics and its relation with molecular biology. Terms related to bioinformatics-redundant, annotated etc. Aim, goals, branches and Applications of Bioinformatics. Role of internet and world wide web in bioinformatics.	2	1
	1.2	Types of Biological data: - Genomic DNA, Complementary DNA, Recombinant DNA, expressed sequence tags, Sequence-Tagged Sites, Genomic survey sequences. Sequence data format- FASTA format, PHYLIP format. File formats- Flat files, relational, object-oriented databases. Bioinformatics resources- Biological Database and its types- primary, secondary and composite databases. Conversion of Sequence Formats Using Readseq. Bioinformatics Resources - NCBI, EBI, ExPASy, RCSB, DDBJ: organization of databases: data contents, purpose, and utility. Open access bibliographic resources and literature databases: PubMed, BioMed Central, Public Library of Sciences (PloS), CiteXplore. Classification of Biological databases- Primary Nucleic acid databases (NCBI, DDBJ, and EMBL). Secondary Protein databases (SWISSPROT, PIR). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structural databases (CATH, SCOP, and PDBsum). ACTIVITY: <ul style="list-style-type: none"> Data base search and data retrieval-using NCBI, SWISS-PROT, PDB, Expasy. 	10	1, 5
	1.3	Eukaryotic genomes with special reference to model organisms: -Yeast (SGD), Drosophila (FlyBase), <i>C. elegans</i> (WormBase), Rat, Mouse, Human (OMIM/OMIA), plants - <i>Arabidopsis thaliana</i> (TAIR), Rice, PlasmodiumDB, etc. Data Retrieval Systems -Search and Retrieval Using Entrez/GQuery, DBGET/LinkDB, Sequence Retrieval	3	1, 5

		System.		
Module II: Sequence Alignments and Visualization			(15 Hrs)	
2	2.1	Evolutionary Basis of Sequence Alignment - Sequence Identity, Sequence Similarity, and Sequence Homology and their Proper Usage. Global Versus Local Alignment, Pairwise and Multiple Alignment. Alignment Algorithms, Gaps and Gap Penalties.	2	2
	2.2	Scoring Matrix, Alignment Score-Statistical Significance of Sequence Alignment-PAM Matrices, PET91 Matrix, BLOSUM, Statistical Significance of Sequence Alignment -P-Value, Z-Score, E-Value and Bit Score.	3	2
	2.3	Database Searching with the Heuristic Versions of the Smith Waterman Algorithm - BLAST and FASTA. BLAST and its Utility, Various BLAST Programs for Analysis - Megablast, Blastn, and Discontinuous Megablast. Searching for Short, Nearly Exact Matches. Suggested BLAST E-Value Cut-Off. Typical Basic BLAST Output. Searching for Distantly Related Proteins—PSI-BLAST Searching for Pattern Hit—PHI-BLAST. Comparison of BLAST and FASTA. Sequence Comparison, Synteny and Molecular Evolution. ACTIVITY: • Methods of sequence alignment- BLAST and ClustalW.	10	2
Module III: Advanced Bioinformatics			(20 Hrs)	
3	3.1	GENOMICS Definition, Types- Structural genomics, functional genomics, comparative genomics. Data mining. Goals of the Human Genome Project. Internet resources for gene identification, detection of functional sites, gene expression.	3	3
	3.2	PROTEOMICS Define proteomics, Microarrays. Protein modeling and drug designing. Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition, Ab-intio Method, Protein folding. Molecular Dynamics of Protein, Molecular Docking of Protein, System Biology - metabolomics, gene network, synthetic biology (Brief Account only).	3	3
	3.3	PHYLOGENETIC ANALYSIS	14	3, 6

		<p>Phylogenetics and the Widespread Use of the Phylogenetic Tree. Phylograms, Cladograms, and Dendrograms. Phylogenetic Analysis Tools. Principles of Phylogenetic Tree Construction-Selection of the Appropriate Molecular Marker. Multiple Sequence Alignment. Selection of a Model of Evolution. Construction of the Phylogenetic Tree-Distance-Based (Distance-Matrix) Methods, Character-Based Method. Assessment of the Reliability of a Phylogenetic Tree and related terms-Monophyly, Polyphyly, and Paraphyly. Species Trees Versus Gene Trees.</p> <p>ACTIVITY:</p> <ul style="list-style-type: none"> • Phylogenetic tree construction using MESQUITE/ MEGA/ PHYLIP. • Gene Prediction using GENSCAN/ GRAI. • Protein structure visualization using RASMOL 		
Module IV: Basics of Computational Biology			(10 Hrs)	
4	4.1	<p>INTRODUCTION TO COMPUTATIONAL BIOLOGY</p> <p>Definition, Nature and scope of Computational Biology, Basic algorithms, and tools in Computational Biology. R for Computational Biology and Bioinformatics; Programming in R.</p>	5	4, 5
	4.2	<p>Transcriptomics: Concept of Transcriptome, transcriptome analysis and Gene Expression. DNA microarray: understanding of microarray data, normalizing microarray data, detecting differential gene expression, correlation of gene expression data to biological process and computational analysis tools. RNA databases RNA structure prediction tools, RNA sequence analysis, RNA regulatory networks; Transcriptome assembly, Comparative transcriptomics.</p>	5	4, 5


References:

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2. Attwood, T.K. & Parry Smith, D. (2006). Introduction to Bioinformatics. Pearson, Education.
 3. Bourne, P. E. & Weissig, H, (2003). Structural Bioinformatics. Wiley-Liss. USA.
 4. David, W. M. (2004). Bioinformatics, Sequence and Genome Analysis (2nd Edition). CSHP, New York.
 5. Krane, D. E. Fundamental concepts of Bioinformatics. Pears & Raymer, M. L. (2006). on Education, New Delhi.
 6. Masaru, T. & Nishioka, T. (2005). Metabolomics. The Frontier of Systems Biology. Springer Japan.
 7. Pengcheng, Fu. & Sven P. (2009). Systems Biology and Synthetic Biology. John Wiley & Sons, Inc. NJ, USA.
 8. Tisdall, J. D. (2001). Beginning Perl for Bioinformatics. O'Reilly Media Inc. CA, USA.

Suggested Readings:

1. Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools 1st Edition - May 9, 2014 Supratim Choudhuri ISBN: 9780124104716 eBook ISBN: 9780124105102
2. Lesk, A. M. (2005). Introduction to Bioinformatics. Oxford Press, New Delhi.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam						
Programme	B.Sc. (Hons.) Zoology						
Course Name	ADVANCED IMMUNOLOGY						
Type of Course	MAJOR						
Course Code	ZO7DCEA02B24						
Course Level	400-499						
Course Summary	<p>The course covers the basics of how our immune system works, how it defends against pathogens and recognizes foreign invaders. Students will learn about different types of immunity, how immune cells develop and function, and how the body responds to infections and diseases. The course also explores topics like allergies, autoimmune diseases, and how vaccines work to protect us from illnesses.</p>						
Semester	VII			Credits		4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	60	
Pre-requisites, if any		Basic understanding of immunology and physiological processes.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the fundamental concepts of innate and acquired immunity	U	1,2
2	Explain immunological mechanisms and associated disorders	S, A	1,2,8
3	Analyse various therapeutic strategies	S, An	1,2,8
4	Describe immunodeficiency diseases and autoimmunity.	U	1,2,4,7,8
5	Explain cellular basis of immune response, Immunogenicity, Antigenicity and Antigenic determinants.	S, A	1, 2
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Fundamentals of immunity			(18 Hrs)	
1	1.1	Innate and Acquired Immunity; Components of Innate Immunity: Physical, Physiological Defenses, Inflammatory Response, Phagocytic System; Types of Acquired Immunity: Natural, Artificial, Active, Passive. Humoral and Cell-Mediated Immunity.	4	1
	1.2	Cellular Basis of Immune Response: Hematopoiesis and Differentiation of B-cells and T-cells, Haematopoietic Growth Factors; Receptors Involved: B-cell Receptors, T-cell Receptors, Toll-like Receptors; Primary and Secondary Lymphoid Organs: Thymus, Bone Marrow, Lymph Nodes, Spleen, Tonsils, MALT, GALT.	4	5
	1.3	Immunogenicity and Antigenicity: Factors Influencing Immunogenicity, Types of Antigens: Haptens, Role of Adjuvants Epitopes: B-cell and T-cell Epitopes, Immunoglobulins: Structure, Classes, Functions	4	5
	1.4	Antigenic Determinants: Isotype, Allotype, Idiotype; Immunoglobulin Genes: Multigene Organization; Generation of Antibody Diversity; Monoclonal Antibodies: Production and Clinical Uses; Antibody Engineering	6	5
Module II: Immunological mechanisms and disorders			(24 Hrs)	
2	2.1	Complement System: Complement Activation Pathways: Classical, Alternative, and Lectin. Terminal Sequence of Complement Activation (MAC); Regulation of the Complement System; Biological Consequences of Complement Activation; Complement Deficiencies	6	2
	2.2	Antigen-Antibody Interactions: Strength of Antigen-Antibody Interaction: Affinity and Avidity; Types of Antigen-Antibody Reactions: Cross-reaction, Precipitation, Agglutination, Complement Fixation; Techniques: Immunoprecipitation, immunofluorescence, ELISA, RIA, Western Blotting	6	2
	2.3	Immune Effector Mechanisms: Types of Inflammation: Acute and Chronic; Role of Chemokines and Cytokines in Immune Response; Properties and Functions of Cytokines, Therapeutic Uses of Cytokines	4	2

	2.4	Major Histocompatibility Complex: General Organization and Inheritance of MHC; HLA Complex in Humans; MHC-Peptide Interaction; Expression of MHC Molecules; Biological Significance of MHC	4	2
	2.5	Hypersensitivity: Types of Hypersensitivity: Type I, Type II, Type III, Type IV; Mechanisms and Clinical Manifestations of Each Type of Hypersensitivity	4	2
Module III: Immunodeficiency diseases and autoimmunity			(10 Hrs)	
3	3.1	Immunodeficiency Diseases: Severe Combined Immunodeficiency (SCID), Wiskott-Aldrich Syndrome (WAS), Common Variable Immunodeficiency (CVID), Ataxia-Telangiectasia, Chronic Granulomatous Disease (CGD)	5	4
	3.2	Autoimmunity- Definition and Mechanisms of Autoimmunity, Organ-Specific Autoimmune Diseases, Systemic Autoimmune Diseases	5	4
Module IV: Vaccines and transplantation immunology			(8 Hrs)	
4	4.1	Vaccines: Whole Organism Vaccines, Purified Macromolecules as Vaccines, Recombinant Vector Vaccines, DNA Vaccines	4	3
	4.2	Transplantation Immunology: Immunologic Basis of Graft Rejection, Prevention of Graft Rejection, Clinical Transplantation	4	3


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2. Ashim, K., & Chakravarthy. (1998). Immunology. Tata McGraw-Hill, New Delhi.
3. Chakraborty, A. K. (2006). Immunology and Immunotechnology. Oxford University Press.
4. Coico, R., & Sunshine, G. (2015). Immunology: a short course. John Wiley & Sons.
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10. Owen, J. A., Punt, J., & Stranford, S. A. (2018). Kuby immunology (8th edn). New York: WH Freeman.

Suggested Readings:

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1. Ivan M. Roitt. (2002). *Essential of Immunology*. ELBS, New Delhi. Janeway, C. (2008). *Immunobiology*. New York, NY: Garland Science. Curriculum and Syllabus (2020 admission onwards)
 2. Khan, F. H. (2009). *The elements of immunology*. Pearson Education India.
 3. Kuby J, 2006. *Immunology* (6" edn.). WH Freeman & Co. New York. Press. A Blackwell Science Co, USA.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) Zoology				
Course Name	BIOLOGICAL SPECIMEN PREPARATION TECHNIQUES					
Type of Course	MAJOR					
Course Code	ZO7DCEA03B24					
Course Level	400-499					
Course Summary	Biological specimen preparation techniques are essential for studying living organisms at the cellular and molecular levels. This course provides understanding of various specimen preparation methods used in biological research and clinical diagnostics. Topics include fixation, embedding, sectioning, staining, and taxidermy techniques.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Basic knowledge on cell biology and animal physiology.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Apply the fundamental principles and protocols for specimen collection, fixation, embedding and sectioning.	S, A	1, 2, 8
2	Prepare permanent slides of animals, cells and microorganisms.	S, A	1, 2
3	Explain skeletal specimen preparation.	A	1, 2, 8
4	Prepare whole mount of biological specimens.	S, A	1, 2, 8
5	Employ skill in alizarin preparation and taxidermy.	S, A	1, 2, 8, 10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to biological specimen preparation			(20 Hrs)	
1	1.1	Introduction: importance and applications of the specimen preparation techniques – laboratory/study purpose; museum display; entrepreneurial. Probable application in DNA extraction, Conservation Genetics.	7	1
	1.2	Collection and Fixation techniques Collection techniques for insects, fishes and birds. Principles of fixation and preservation of biological specimen, Display methods - wet & dry. Chemical fixatives and their mechanisms of action, Methods for tissue and cell fixation. Preparation of thick and thin blood smear & its significance ACTIVITY: <ul style="list-style-type: none"> • Whole mount preparation of small animals, tissues and sections of animals. • Preparation of thick and thin blood smear. 	7	1,4
	1.3	Embedding and Sectioning Embedding media and techniques for tissue embedding, Cryosectioning and paraffin sectioning method, Microtome operation and maintenance.	6	1
Module II: Preparation of permanent slides			(20 Hrs)	
2	2.1	Anatomy of animals - organs and tissue (brief account; preparation of sections involving microtome and cryostat; special staining methods, preparation and storage of permanent slides.	8	2
	2.2	Cell division stages: stages of mitosis and meiosis and their importance, use of chemicals to arrest division, Preparation of permanent slides showing stages of division ACTIVITY: <ul style="list-style-type: none"> • Permanent slide preparation of cell division stages. 	7	2
	2.3	Microorganisms: Identification of common microorganisms; their sources and culture techniques; staining and preparation of permanent slides and their storage	5	2
Module III: Skeletal preparation techniques			(10 Hrs)	


3	3.1	Skeletal techniques - Articulated skeleton, general Methods - Clearing- fleshing, maceration, boiling, degreasing, mounting.	8	3
	3.2	Dermostid technique.	2	3
Module IV: Alizarin preparation and Taxidermy			(10 Hrs)	
4	4.1	Alizarin preparation and resin-embedded specimens, ACTIVITY: • Alizarin preparation of small invertebrates and vertebrate skeletal system	5	5
	4.2	Taxidermy ACTIVITY: • Demonstration of taxidermy	5	5

References:

1. Cappuchino, J. G and Sherman N. Microbiology- A Laboratory Manual 3rd ED. The Benjamin/ Cummings Publishing Co.
2. Dubey, R. C and Maheshwari, D. K Practical microbiology 2002 S. Chand and company Ltd.
3. Knudsen, J.W (1966) Biological Techniques Harper International Edition by Harper & Row.

Suggested Readings:

1. Bhaskaran, K.K 1986. Microtechnique and Histochemistry. Evershine Press, Vellangalloor.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) Zoology				
Course Name	NANOBIOTECHNOLOGY					
Type of Course	MAJOR					
Course Code	ZO7DCEA04B24					
Course Level	400-499					
Course Summary	This is an interdisciplinary course that provides a basic overview of nanomaterials and their applications. The course covers synthesis and characterization of nanomaterials. Application of nanomaterials in diverse fields is also discussed.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any	Basic knowledge in biotechnology					60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Discuss the types and synthesis of different nanomaterials.	I, U	1,2,3
2	Describe the nature and properties of nanomaterials.	U	1,2,3
3	Explain the role of Nanobiotechnology in health care and its application.	Ap, U	1,2,3
4	Apply Nanobiotechnology concepts in environment conservation.	S, A	1,2,3,7
5	Describe the significance of nanobiotechnology.	Ap, U	1,2,3,7
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT


Module	Units	Course description	Hrs	CO No.
Module I: Introduction to nanomaterials			(18 Hrs)	
1	1.1	Various types of nanomaterials, Three-dimensional, two-dimensional, one-dimensional and zero-dimensional nanomaterials.	4	1
	1.2	Carbon nanotubes, Graphene, Carbon dots, metal nanoparticles, metal oxide-based nanomaterials, semiconductor nanomaterials, quantum dots, hybrid nanoparticles,	5	1
	1.3	Bio-nanomaterials - DNA nanotechnology, Protein & glyco nanotechnology, Lipid nanotechnology, Bio-nanomachines, Carbon nanotube and its bio-applications.	6	1
	1.4	Synthesis methodologies, Top down and bottom up approaches for nanomaterial synthesis.	3	1
Module II: Properties of nanomaterials			(16 Hrs)	
2	2.1	Structural properties, chemical properties, surface functionalization, physical properties.	6	2
	2.2	Characterization of nanomaterials by various analytical methods, optical characterization and spectroscopy such as FTIR, UV-Vis, DLS, Zetapotential, structural characterization by X-Ray Diffraction, XPS and advanced microscopy (TEM, SEM, AFM).	10	2
Module III: Nanobiotechnology in healthcare			(18 Hrs)	
3	3.1	Role of nanobiotechnology in the area of infectious & non-infectious diseases.	8	3, 5
	3.2	Nanopharmaceuticals. Diagnosis, sensors and biosensors. Delivery vehicles, biomedical applications of nanomaterials. Multimodal nanoparticles, targeted drug delivery, theranostics	10	3, 5
Module IV: Nanobiotechnology in Environment			(8 Hrs)	
4	4.1	Nanotechnology for environment: contamination detection and remediation	4	4, 5
	4.2	Nanobased food preservation and toxicity. Nanopesticides.	4	4, 5

References:

1. Malsch, N.H., “Biomedical Nanotechnology”, CRC Press. (2005).
2. Mirkin, C.A. and Niemeyer, C.M., “Nanobiotechnology II: More Concepts and Applications”, Wiley-VCH. (2007).
3. Kumar, C. S. S. R., Hormes, J. and Leuschner C., “Nanofabrication Towards Biomedical Applications: Techniques, Tools, Applications, and Impact”, WILEY - VCH Verlag GmbH & Co. (2005).
4. Lamprecht, A., “Nanotherapeutics: Drug Delivery Concepts in Nanoscience”, Pan Stanford Publishing Pte. Ltd. (2009).
5. Jain, K.K., “The Handbook of Nanomedicine”, Humana press. (2008).

Suggested Readings:

1. A. L. Rogach, Semiconductor nanocrystal quantum dots synthesis, assembly, spectroscopy and applications (Springer, Wien; London, 2008).
2. E. Gazit, Plenty of room for biology at the bottom: an introduction to bionanotechnology (Imperial College Press; Distributed by World Scientific Pub. in the USA, London: Hackensack, NJ, 2007).
3. G. E. J. Poinern, A laboratory course in nanoscience and nanotechnology (CRC Press, Taylor & Francis Group, Boca Raton, 2015).
4. C. A. Mirkin, C. M. Niemeyer, Eds., More concepts and applications (Wiley-VCH, Weinheim, 2007), Nanobiotechnology.
5. A. K. Mishra, Ed., Application of nanotechnology in water research (Wiley, Scrivener Publishing, Hoboken, New Jersey, 2014).
6. K. R. Nill, Glossary of biotechnology and nanobiotechnology terms (Taylor & Francis, Boca Raton, 4th ed., 2006).
7. J. Kim, Ed., Advances in nanotechnology and the environment (Pan Stanford, Singapore, 2012).
8. P. N. Prasad. Nanophotonics (Wiley, New York, 2003).

		ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam				
Programme	B.Sc. (Hons.) Zoology					
Course Name	AQUACULTURE PRACTICES					
Type of Course	MAJOR					
Course Code	ZO7DCEA05B24					
Course Level	400-499					
Course Summary	The course provides a comprehensive understanding of the diverse methodologies employed in the aquaculture industry, exploring topics ranging from breeding techniques to environmental management strategies.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture 4	Tutorial	Practical	Others	
Pre-requisites, if any	Basic interest fish farming.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Identify the different aquaculture systems.	U	1, 2
2	Explain aquarium management, integrated farming & aquaponics.	S, A	1, 2
3	Examine advanced technologies and health management practices in aquaculture.	S, A	1, 2, 3
4	Explain the effects of aquaculture methods on the environment.	A	1, 2, 3, 8
5	Employ skills in aquarium setting and aquaponics.	S, A	1, 2
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Aquaculture			(18 Hrs)	
1	1.1	Definition, scope and types of Fin fish & shell fish culture. Different aquaculture systems - Pond and embankment pond culture, cage, pen and race ways culture. Extensive, intensive and semi-intensive culture systems, Integrated Multi Trophic Aquaculture (IMTA)	3	1
	1.2	Pond preparation & management. Breeding, Hatchery & nursery management. Prawn culture and Mussel culture.	10	1
	1.3	Nutritional requirements, Probiotics used in Aquafarming, Types of feed, techniques involved in the formulation of fish feed. Processing & preservation of farming products ACTIVITY: <ul style="list-style-type: none"> Identify live fish food organisms & culture any one organism Survey of different feeds used in different hatcheries. 	5	1, 5
Module II: Aquarium management, Integrated farming & Aquaponics			(14 Hrs)	
2	2.1	Aquarium management - water quality, biological filter & aeration. Breeding of ornamental fishes - Angel, Gourami, Fighter and Guppy (live bearer), rearing, brood-stock management & transport.	7	2
	2.2	Integrated farming practices: Fish-cum-livestock/poultry farming, paddy-cum-fish farming, Sewage-fed fish culture	5	2
	2.3	ACTIVITY: <ul style="list-style-type: none"> Construct aquaponics systems at home & report submission (attach Geo-tagged photos) 	2	2, 5
Module III: Advanced technologies and Health management practices in aquaculture			(15 Hrs)	
3	3.1	Sustainable Aquaculture and importance of Recirculating Aquaculture System (RAS)	3	3
	3.2	Monosex culture or Neo-female technology, GIFT	4	3

		(Genetic Improvement of Farmed Tilapia), Biofloc Technology		
	3.3	Biosecurity & quarantine.	2	3
	3.4	Viral, bacterial, fungal & parasitic diseases affecting fin fish & shellfish, treatment & prophylactic measures.	5	3
	3.5	ACTIVITY: • A survey of nearby aquaculture systems and report different diseases/parasites observed from farm.	1	3
Module IV: Environmental impact of Aquaculture			(13 Hrs)	
4	4.1	Positive utilization of waste from other farming systems in aquaculture. Utilization of derelict water bodies for aquaculture. Weed control	3	4
	4.2	Negative environmental impacts due to hyper-nutritification, leaching of chemicals into environment, misuse of productive land. Introduction of pathogens into the environment through indiscriminate movement of fish seeds and its remedial measures	5	4
	4.3	Aquacultural wastes generation and minimization. Enforcement of rules & regulations for sustainable aquaculture	5	4

References:


1. Anand.S. Upadhyaya. (1994). Handbook on design, construction and Equipments in coastal aquaculture Shrimp Farming.Allied Publishers Pvt.Ltd., Bombay.
2. Andrew, C., Excell, A. and Carrington, N., (1988). The Manual of fish Health. Tetra Press, Morris Plains, NJ, USA.
3. Ayyappan.S., Jena.J.K., Gopalakrishnan. A. and Pandey.A.K. (2011) Handbook of Fisheries and Aquaculture. Indian Council of Agricultural Research.
4. Boyd, Claude E and Pillai, V K (1985) Water Quality Management in Aquaculture. CMFRI Special Publication, No. 22. CMFRI. Kochi.
5. Boyd. C.E., and Tucker.C.S.(2012). Pond Aquaculture Water Quality Management. Springer Science and Business Media.
6. Dey, V.K. (1997). A Hand Book on Aquafarming- Ornamental fishes. Manual. MPEDA Cochin.
7. F.A.O. 1995. Regional expert consultation on Aquaculture Health Management in Asia and the Pacific. FAO Fisheries Report 529, 24pp.
8. Jhingran. V. G (1991). Fish and Fisheries of India. 3rd Edn. Hindustan. Pub. Corp. New Delhi.

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 10. Khanna.S.S. (2011). *An introduction to Fishes*. Silver Line Publications.
 11. King, M. (2018). *Fisheries Biology, Assessment, and Management*. Wiley.
 12. Lekang, O. I. (2013). *Aquaculture Engineering*. Wiley.
 13. Lightner, D.V and Redman, R.M., (1998). Shrimp disease diagnostic methods. *Aquaculture*, 164, 201-220.
 14. Lucas, J. S., & Southgate, P. C. (2012). *Aquaculture: Farming Aquatic Animals and Plants*. Wiley-Blackwell.
 15. Marine Products Export Development Authority. (1993). *Handbook on Aquafarming Series. Aquaculture Engineering and Water quality Management*. MPEDA.Kochi.
 16. Mialhe, E., Boulo, V., Bachere, E., Hervio, D., Cousin, K., Noel. T., Ohresser, M., le Deuff, R.M., Despres, B., and Gendreau, S., (1992). Development of new methodologies for diagnosis of infectious disease in molluscs and shrimp aquaculture. *Aquaculture*, 107, 155-164.
 17. Palm, H. W. (2016). *Aquaculture Medicine*. Wiley.
 18. Panday B N, Kamal Jaiswall & Suman Mishra (2017) *Recent advances in Aquaculture* Narendra publishing house
 19. Pandey, K. and Shukla, J. P. (2007): *Fish and fisheries*.
 20. Pillay.T.V. R and Kutty.M.N. (2005). *Aquaculture - Principles and Practices*. 2nd Edn. Wiley- Blackwell.
 21. Plumb, J. A. (2010). *Health Maintenance and Principal Microbial Diseases of Cultured Fishes*. Wiley-Blackwell Publishers
 22. Rechar W Soderberg (2017) *Aquaculture technology*, Tailor & Francis
 23. Ronald J. Roberts. (2012). *Fish Pathology*. 4th Edn. Wiley Blackwell.
 24. Sanil N.K. and K.K. Vijayan (2008) *Diseases in Ornamental Fishes*. In: *Ornamental Fish Breeding, Farming and Trade*. Kurup B.M., (Ed). Dept of Fisheries, Govt. of Kerala.
 25. Santhanam R, N. Ramanathan and B. Jegadeesan. (1990). *Coastal Aquaculture in India*. CBS Publishers & distributors, New Delhi.
 26. Santhanam R, N. Sukumaran & P. Natarajan, (1990). *Manual of Freshwater Aquaculture*. Oxford & IBH Publishing Co. Pvt. Ltd.
 27. Sinderman.C.J.(1990) *Principal diseases of marine fish and shellfish*. Vol 1 & 2. Academic Press.
 28. Smith, J. A. (2018). *Aquaculture and Fisheries: Understanding Environmental Impacts*. Academic Press.
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 38. Woo, P. T. K., & Bruno, D. W. (2006). *Fish Diseases and Disorders: Volume 2: Non-Infectious Disorders*. CABI Publishing; 2nd edition.

Suggested Readings:

1. Anna Mercy, T. V., Gopalakrishnan, A., Kapoor, D. and Lakra, W. S. (2007). *Ornamental Fishes of the Western Ghats of India*. National Bureau of Fish Genetic Resources, Kochi.
2. Sreekanth G. B., Trivesh S. Mayekar, Sudhir Kumar, Purva Rivonkar, Tincy Varghese, Sikendra Kumar, Chakurkar E. B. *Fresh Water Ornamental Fish culture and Management*, Technical Bulletin Number 69, Published by Dr. Eaknath B. Chakurkar, Director ICAR-Central Coastal Agricultural Research Institute, Old Goa.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam						
	Programme	B.Sc. (Hons.) Zoology					
Course Name	POULTRY AND ANIMAL HUSBANDRY						
Type of Course	MINOR						
Course Code	ZO7DSCB101B24						
Course Level	300-399						
Course Summary	This course focuses on the basic techniques for rearing livestock (Cattle, Goat, Pig and Rabbit) and poultry. It emphasizes the sheltering, feeding, breeding and management of livestock and poultry.						
Semester	VII			Credits		4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others		
		4					60
Pre-requisites, if any	Basic interest in Animal Rearing						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe various aspects of poultry care and management.	I, U	1,2
2	Explain dairy farming concepts and management.	I, A	1,2
3	Explain piggery farming and its management.	I, A	1,2
4	Describe rabbit care and handling strategies.	I, U	1,2
5	Prepare health care plans for poultry, quail, duck, Indian cattle, goats, pigs and rabbits.	S, A	1, 2
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Poultry care and management			(15 Hrs)	
1	1.1	Chicken - Introduction, Morphology of chick. Indian breeds, Broilers and layers, Poultry Housing and Equipment. Poultry feed and its composition, mixing of feeds, different mills used (Hammer, mixture, pellet); premix preparation, raw materials, feed mill operation). Importance of egg production, Nutritive value of eggs and meat. Diseases and their control.	7	1, 5
	1.2	Quail - Introduction, care of chicks and adult quails, care of breeding quails, ration for quail, hatching eggs care, Health care, uses of quail egg and meat. Sources of quality chicks.	5	1, 5
	1.3	Duck - Indian breeds, Benefits of duck rearing, Housing, feeding and management of ducks.	3	1, 5
Module II: Dairy farming			(19 Hrs)	
2	2.1	Definition and significance of cattle farming, Breeds of cattle.	3	2, 5
	2.2	Housing for dairy cattle, Management of cross-breed cows, Health management, Milk production.	8	2, 5
	2.3	Introduction and Breeds of Indian Goat. Medicinal importance of goat milk. Prevention of Goat Odor in Milk.	2	2, 5
	2.4	Breeding Management- Assessing Suitability for Initial Breeding - Heat Detection Techniques - Natural Breeding and Artificial Insemination - Pregnancy Care - Breeding Selection - Teaser Utilization - Culling Practices.	3	2, 5
	2.5	Feeding Management- Feeding habits of Goats, Nutritional Needs, Kid Housing and Care.	1	2, 5
	2.6	Health Management - Strategies for Disease Prevention and Control, Deworming, Dipping and Spraying Techniques.	2	2, 5
Module III: Piggery farming			(11 Hrs)	
3	3.1	Piggery development in India, Pig breeds Advantages and disadvantages of swine keeping. Selection of quality adults, Reproduction mechanism and management.	5	3, 5


	3.2	Housing and Feeding, Sanitation and hygiene of Pigs, Nutrition and Digestion in pigs.	4	3, 5
	3.3	Diseases and Prevention.	2	3, 5
Module IV: Cuniculture			(15 Hrs)	
4	4.1	Breeds of Rabbit: Common Breeds of rabbits (For wool production - Angora, for meat/ Fur/ skin production - New Zealand white, White Californian, Soviet Chinchilla, for fancy/hobby purposes - Polish, Palmino, Havana, Beveren, New Zealand Red, English Spot, White Dutch). Importance of rabbit for meat and fur production.	7	4, 5
	4.2	Rabbit production: Housing and Breeding	3	4, 5
	4.3	Care and Maintenance of Young Rabbits, Broiler Rabbit Management, Wool Rabbit Care, Rabbit Feeding Practices.	5	4, 5

References:

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2. Jaiswal, V., & Jaiswal, K. K. (2018). Economic Zoology. New Age International.
3. Sastri, N.S.R., Thomas, C.K., & Singh, R.A. (2007). Livestock Production and Management. New Age International.
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5. Verma, D.N. (1992). A Textbook of Livestock Production Management in Tropics. Kalyani Publishers.

Suggested Reading:

1. Indian Council of Agricultural Research (ICAR). (2022). A Handbook of Animal Husbandry. ICAR.

 <p style="text-align: center;">ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam</p>	
Programme	B.Sc. (Hons.) Zoology
Course Name	PARASITOLOGY
Type of Course	MINOR
Course Code	ZO7DSCB102B24
Course Level	300-399
Course Summary	Parasitology is the study of parasites and their interactions with their hosts. This course provides students with a comprehensive understanding of parasitic organisms, their life cycles, ecological dynamics, the implications for human and animal health and the molecular diagnosis for parasitic infection.
Semester	VII
Course Details	Credits
	4
Learning Approach	Total Hours
	60
Pre-requisites, if any	Basic knowledge on parasites

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Discuss the basic concept of Parasitism	U	1,2,3,6,7
2	Explain the morphology, life cycle, pathogenicity, preventative measures, and control strategies of parasitic protists, nematodes, platyhelminthes and arthropods.	I, A	1,2,3,6,7
3	Identify parasitic vertebrates.	U	1,2,3,6,7
4	Explain techniques used in molecular diagnosis and clinical parasitology.	A	1,2,3
5	Examine Parasite diversity.	S, A	1,2,3,6,7
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT


Module	Units	Course description	Hrs	CO No.
Module I: General Concepts			(8 Hrs)	
1	1.1	Introduction - Parasites, parasitoids, host, zoonosis, Origin and evolution of parasites, Basic concept of Parasitism, Symbiosis, Phoresy, commensalisms and mutualism, Host-parasite interactions and adaptations	6	1
	1.2	Life cycle of human parasites, Occurrence, mode of infection and prophylaxis	2	1
Module II: Parasitic Protists and Parasitic Platyhelminthes			(20 Hrs)	
2	2.1	Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of <i>Entamoeba histolytica</i> , <i>Giardia intestinalis</i> , <i>Plasmodium vivax</i>	10	2,5
	2.2	Parasitic Protists - Morphology, life cycle, pathogenicity, prophylaxis and control measures of <i>Fasciolopsis buski</i> ; <i>Schistosoma haematobium</i> ; <i>Taenia solium</i>	10	2,5
Module III: Parasitic Nematodes, Arthropods and Vertebrates			(17 Hrs)	
3	3.1	Parasitic Nematodes - Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of <i>Ascaris lumbricoides</i> , <i>Ancylostoma duodenale</i> , <i>Wuchereria bancrofti</i>	10	2,5
	3.2	Parasitic Arthropods - Biology, importance and control of Ticks (Soft tick <i>Ornithodoros</i> , Hard tick <i>Ixodes</i>), Mites (<i>Sarcoptes</i>), Lice (<i>Pediculus</i>)	4	2,5
	3.3	Parasitic Vertebrates - Cookicutter Shark, Hood Mocking bird	3	3,5
Module IV: Molecular diagnosis and clinical parasitology			(15 Hrs)	
4	4.1	General concept of molecular diagnosis for parasitic infection, Advantages and disadvantages of molecular diagnosis.	6	4
	4.2	Fundamental techniques used in molecular diagnosis of endoparasites, Immunoassay or serological techniques for laboratory diagnosis of endoparasites like <i>Giardia intestinalis</i> , <i>E. coli</i> , <i>E. histolytica</i> , <i>L. donovani</i> , Malarial parasite on the basis of marker molecules. ELISA, RIA, Counter Current Immuno electrophoresis (CCI), Complement Fixation Test (CFT), PCR, DNA and RNA probe.	9	4

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Suggested Readings:

- 1 Arora, D. R and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications.
- 2 Meyer, Olsen and Schmidt's *Essentials of Parasitology*, Murray, D. Dailey, W.C. Brown Publishers.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) Zoology				
Course Name	SOLID WASTE MANAGEMENT					
Type of Course	MINOR					
Course Code	ZO7DSCB103B24					
Course Level	300-399					
Course Summary	This course provides an overview of the principles, practices, and challenges associated with the management of solid waste. Students learn the importance of adopting sustainable waste management practices to minimize environmental pollution, conserve natural resources, and promote public health.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites		Basic knowledge on environment and conservation.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the categories, sources, components and characteristics of solid waste.	U	1,2,3
2	Explain different types of waste management techniques.	U	1,2,3
3	Examine the environmental impacts of landfill practices.	A	1,2,3
4	Explain composting and thermal conversion methods.	S, A	1,2,3
5	Prepare vermicompost unit.	S, A	1,2,3,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to solid waste			(15 Hrs)	
1	1.1	Solid waste - Definition, overview, types, management, sources, and its properties.	6	1
	1.2	Factors affecting the type and quality of waste, causes of solid waste generation and associated risks, physical and chemical composition of municipal solid waste and hierarchy of waste management options.	9	1
Module II: Solid Waste Management			(15 Hrs)	
2	2.1	Key components of solid waste management - generation, storage (containers), collection, transportation (human-powered, animal-powered and motorized) and disposal (Landfills, composting, incineration and pyrolysis), Recycling and resource recovery. Lay out of routes.	10	2
	2.2	Methods of handling and processing of solid wastes: separation, screening, size reduction, densification, baling, cubing, compaction and pelleting.	5	2
Module III: Landfilling			(15 Hrs)	
3	3.1	Site selection criteria, landfill layout, landfill sections	2	3
	3.2	Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, advantages and disadvantages.	13	3
Module IV: Composting and thermal conversion methods			(15 Hrs)	
4	4.1	Composting (aerobic and anaerobic), vermicomposting, utilisation of black soldier flies for waste decomposition ACTIVITY: • Prepare a vermicomposting unit and submit report along with geo-tagged photos	10	4,5
	4.2	Thermal conversion methods (incineration/combustion, pyrolysis, and gasification)	5	4


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Suggested Readings:

1. <https://ncipm.icar.gov.in/Horticulture/PDF/Pest%20of%20Fruit%20Trees.pdf>
2. <https://directcompostsolutions.com> › composting-with black flies

SEMESTER VIII

		ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam				
Programme	B.Sc. (Hons.) Zoology					
Course Name	ADVANCED ECOLOGY					
Type of Course	MAJOR					
Course Code	ZO8DCCA01B24					
Course Level	400-499					
Course Summary	This course explores ecosystem structure and function, focusing on productivity, energy flow and the impact of various environmental factors. The course also examines population dynamics, including growth models, life history strategies and regulatory mechanisms, alongside resource ecology topics such as deforestation, water conservation and sustainable energy. Additionally, the course addresses animal adaptations to various environments and incorporates modern ecological monitoring techniques like GIS and remote sensing.					
Semester	VIII	Credits			4	Total
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Hours
		3		1		75
Pre-requisites, if any	Basic understanding of environment and its interactions.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Discuss the structure and function of Ecosystem.	U	1, 2
2	Explain processes that shape the distribution and abundance of different populations.	A	1, 2
3	Prepare strategies to utilize resources in a sustainable manner.	A	1, 2, 3, 6, 7, 9
4	Estimate the ecological parameters and plankton diversity of water samples.	S, An	1, 2, 10
5	Analyse soil chloride content and soil arthropods.	S, An	1,2,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Overview of Ecosystem			(15 Hrs)	
1	1.1	Ecosystem concept - structure and function, Productivity, Food chain and food web, Energy flow.	3	1
	1.2	Effect of soil development on nutrient level. Herbivore population and plant nutrient level. Availability of O ₂ and CO ₂ on growth and distribution of organisms. Water availability and abundance of organism. Significance of salt concentration in soil and water. Effect of soil and water pH on distribution of organisms.	6	1
	1.3	Cybernetic nature of ecosystem, homeostasis and feedback systems. Animals and nutrient acquisition - herbivory, carnivory, omnivory, detritus feeding. Animal adaptations to thermal environment - thermal balance, poikilotherms, homeotherms, heterotherms. Animal adaptations to moisture environment - maintenance of water balance, response to drought and flooding. Animal adaptations to light environment.	6	1
Module II: Population Ecology			(15 Hrs)	
2	2.1	Properties - patterns of dispersion, dispersal movements, age structure, sex ratio, life table, survivorship curve, density, population growth-exponential and logistic growth, time lags, carrying capacity. Population growth. Density dependent and density independent influences. Population fluctuations and cycle. Extinction - deterministic extinction and stochastic extinction.	7	2
	2.2	Life history strategies - Reproductive strategies, r and k selection. Human population growth. Concept of ecological foot print.	3	2
	2.3	Population regulation - dispersal, social dominance, territoriality: types of territory, territorial defense, floaters, home range. Aggregation, Allee's principle, Isolation, Metapopulation - Concept, Structure.	5	2
Module III: Resource Ecology			(15 Hrs)	
3	3.1	Currents status of forest resources and deforestation in India. Fresh water sources, water scarcity and	5	3

		water conservation measures. Wet lands -its importance, reclamation and conservation measures. Blue carbon ecosystems. Sand mining and its impacts.		
	3.2	Energy resources - solar, fossil fuels, hydro, tidal, wind, geothermal and nuclear. Recent issues in energy production and utilization. Green technology and sustainable development. Depletion of natural resources and its impacts on life.	5	3
	3.3	Ecosystem monitoring - GIS and its application, Role of remote sensing in ecology. Environmental Impact Assessment (EIA)-Tools and techniques. Ecosystem modelling (Brief account only).	5	3
Module IV: Advanced Ecology - PRACTICAL			(30 Hrs)	
4	4.1	Estimation of salinity, phosphate, nitrate and dissolved oxygen of any water sample.	15	4
	4.2	Estimation of chloride in the soil sample.	5	5
	4.3	Separation and identification of soil arthropods using Berlese funnel.	5	5
	4.4	Qualitative and Quantitative study of marine/freshwater planktons.	5	4


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4. Daniel, C.D. (2014). *Environmental Science*. (10th Ed.). Jones and Bartlett Publishers, Massachusetts, USA.
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11. Tietenberg, T. & Lewis, L. (2018). Environmental and Natural Resource Economics. (11th Ed.). Routledge, New Delhi, India.
 12. Tyler, M. G. & Spoolman, S. E. (2014). Living in the Environment. (18th Ed). Thomson Brooks/cole, New York, USA.

Suggested Readings:

1. Odum, E.P. (2004). Fundamentals of Ecology. (5th Ed.). W.B Saunders College Publishing, Philadelphia, USA.
2. Stiling, P. (2014). Ecology: Global Insights and Investigations. (2nd Ed.). The McGraw-Hill companies, New York, USA.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	ANIMAL SYSTEMATICS					
Type of Course	MAJOR					
Course Code	ZO8DCCA02B24					
Course Level	400-499					
Course Summary	<p>The systematic classification and study of animal diversity is a cornerstone in the understanding of biodiversity conservation and evolutionary relationships. The course explores the principles, methodologies and applications of biological classification in the animal kingdom. The students will understand the development of animal taxonomy, learn about modern methods like molecular techniques and gain insight into the evolutionary relationships among animal groups.</p>					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	<p>Knowledge in biology for grasping the principles and applications of animal systematics.</p>					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the basic principles of biosystematics and animal taxonomy.	U	1,2
2	Compare different kinds of systematic publications and their roles in disseminating taxonomic information.	U	1
3	Examine new trends in taxonomy.	I, A	1,2,3,10
4	Apply knowledge of taxonomic principles and classification systems to effectively collect and identify animal specimens from diverse habitats.	S, A	1,2,4,9,10
5	Analyse evolutionary relationships using molecular techniques.	S, An	1,2,4,10

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction to Animal Systematics			(17 Hrs)	
1	1.1	Definition and basic concepts of Biosystematics and animal taxonomy, Three Domain Concept in Systematics, two, five and six kingdom classification. Scope and significance of biosystematics.	4	1
	1.2	Classical taxonomy to systematics: A historical review; Relationship between experimental, phylogenetical and classical taxonomy; classification and nomenclature; phenon, taxon and category; α , β and γ taxonomy.	5	1
	1.3	Concept of species-taxonomic diversity within species. Molecular Phylogeny-use of Proteins, DNA and RNA. Phylogenetic trees.	4	1
	1.4	Taxonomic Methods and Techniques: Taxonomic characters - Kinds and functions; plesiomorphic and apomorphic characters.	2	1
	1.5	Taxonomic procedures - collection, preservation and process of identification of Species; Classical and modern methods.	2	1
Module II: Taxonomic publications			(11 Hrs)	
2	2.1	Taxonomic publications - keys, types, their merits and demerits, preparation of taxonomic keys, Systematic publication - different kinds of publication.	3	2
	2.2	International Code of Zoological Nomenclature (ICZN), Regulations governing this code and code of ethics; Rules and formation of Scientific names of different taxa. Homonymy and Synonymy.	4	2
	2.3	Ethics in taxonomy- authorship, suppression of data, undesirable practices in taxonomy.	4	2
Module III: New trends in Taxonomy			(17 Hrs)	
3	3.1	Modern concepts and recent trends: chemotaxonomy, cytotaxonomy, serotaxonomy and molecular taxonomy.	6	3
	3.2	Microtaxonomy: species concepts; typological, nominalistic, biological and evolutionary species concept. Polytypic and monotypic species; species	6	3

		category; subspecies, other infra-specific categories and intra-population variants.		
	3.3	Macrotaxonomy: Theories and practice of biological classification: basic principles of classification: The three schools of macrotaxonomy: Phenetics, cladistics and phylogenetics and their comparison. Variations and their importance in Systematics.	5	3
Module IV: Animal Systematics - PRACTICAL			(30 Hrs)	
4	4.1	Study of Museum Specimens: 20 Invertebrates: Including specimens from various phyla such as Arthropoda (e.g. insects, arachnids), Mollusca (e.g. snails, clams), Annelida (e.g. earthworms, leeches). 10 Vertebrates: Including specimens from different classes such as Fish (e.g. bony fish, cartilaginous fish), Amphibians (e.g. frogs, salamanders), Reptiles (e.g. lizards, snakes), Birds (e.g. songbirds, raptors), Mammals (e.g. rodents, carnivores).	5	4
	4.2	Specimen Collection and Field Survey: Arrange a field trip for students to collect animal specimens from different habitats (e.g., freshwater streams, forests, grasslands) and conduct a survey to observe biodiversity patterns and species distributions.	6	4
	4.3	Preparation of Dichotomous Keys: Prepare dichotomous keys up to the family level for specimens from five groups: Insects, Arachnids, Fishes, Amphibians and Reptiles.	3	4
	4.4	Preparation of Cladogram: Based on provided specimens or software programs, construct a cladogram depicting evolutionary relationships among at least five different organisms.	4	4
	4.5	Identification of Mosquito Larval Stages: Collect mosquito larvae specimens from various aquatic habitats and their morphological characteristics. Identify different larval stages, compare and contrast their morphology among different species to infer evolutionary relationships.	4	4
	4.6	Molecular Techniques: Students can analyze downloaded DNA sequences to infer evolutionary relationships among taxa.	8	5


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3. M. H, Craig Moritz and K.M. Barbara.1996. Molecular Systematics. Sinauer Associates, Inc.
4. Hickman Jr., Cleveland, Larry Roberts, Susan Keen, Allan Larson, and David Eisenhour 2011. Animal Diversity. McGraw-Hill Companies, Inc. NY
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6. Margulis, Lynn and M.J.Chapman 2001. Kingdoms and Domains: An Illustrated Guide to the Phyla of Life on Earth (4th edn.). W.H. Freeman & Company, USA
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11. Young, J.Z. (2004). *Life of Vertebrates*. (3rd Ed.). Clarendon Press, Oxford University Press, UK.

Suggested Readings:

1. Anderson, T.A. (2001). *Invertebrate Zoology* (2nd Ed.). Oxford University Press, New Delhi, India.
2. Barnes, R. D. (1982). *Invertebrate Zoology* (6th Ed.). Toppan International Co., New York, USA.
3. Niles, E. (2002). *Life on Earth: an Encyclopedia of Biodiversity, Ecology and Evolution* (Vol. I & II). ABC-CLIO, Inc. CA, USA.
4. Pat, W. (1990). *Invertebrate Relationships: Patterns in Animal Evolution*. (1st Ed.). Cambridge University Press, UK.
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 9. Strickberger, M.W. (2014). *Evolution* (5th Ed). Jones and Bartett Publishers, University Press, Columbia, USA.
 10. Waterman, A.J. (1971). *Chordate Structure and Function*. (1st Ed.). Macmillan Co. London, UK.

 <p>ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925</p>	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
	Programme	B.Sc. (Hons.) ZOOLOGY				
Course Name	ADVANCED BIOCHEMISTRY					
Type of Course	MAJOR					
Course Code	ZO8DCCA03B24					
Course Level	400-499					
Course Summary	This course covers the comprehensive study of carbohydrates, amino acids, proteins, lipids and nucleic acids, focusing on their classification, structure, nomenclature and biological significance. The course also details different metabolic pathways of biomolecules and also explores the area of enzyme kinetics, regulation and inhibition. The student also gains practical skills in quantitative estimation of various biomolecules.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Basic knowledge of different biomolecules.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe classification, structure and biological functions of carbohydrates, proteins and lipids.	U	1,2,3
2	Explain various metabolic reactions of biomolecules.	A	1,2,3
3	Describe the structure and metabolism of nucleic acids.	U	1,2,3
4	Explain the classification, nomenclature and regulation mechanism of various enzymes.	A	1,2,3
5	Apply software tools to study biomolecular structures.	A	1,2,3,9,10
6	Employ skill in quantitative estimation of different	S, A	1,2,3,10

biomolecules.		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)		

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Carbohydrates, Proteins and Lipids			(30 Hrs)	
1	1.1	<p>Carbohydrate: Classification, Structure, nomenclature and Biological functions. Isomerism - structural isomerism and stereoisomerism, optical isomerism, epimerism and anomerism. Mutarotation and inversion of sugars. Glycosidic bond.</p> <p>Metabolic pathways- Glycolysis, Citric acid cycle and its significance, Oxidative and substrate level phosphorylation, Gluconeogenesis, Glycogen metabolism, Pentose Phosphate pathway, Glucuronic acid metabolism, Galactose metabolism.</p>	10	1,2
	1.2	<p>Amino acids: Structure, classification and properties of amino acids. Amphoteric properties of amino acids, pH, Buffer, pK value and iso-electric point of amino acids.</p> <p>Protein: Classification, properties and biological functions of proteins. Primary structure of protein (e.g. insulin). Secondary structure- Alpha helix, Collagen helix, Beta pleated sheet, Ramachandran angles and Ramachandran map. Fibrous proteins- examples (brief account on any two: Keratin, Collagen, Elastin, Resilin, Fibrous muscle proteins). Chaperons. Tertiary structure- e.g. Myoglobin. Quaternary structure - e.g. Haemoglobin.</p> <p>Metabolism: Deamination, Transamination and Trans-deamination. Formation and disposal of ammonia. Urea cycle.</p>	10	1,2
	1.3	<p>Fatty acids: Classification of lipids: simple, compound and derived lipids. Biological importance of lipids. Fatty acids: classification, Genevan system of nomenclature. Simple fats: Triacylglycerol (Triglycerides) - fats, oils and waxes. Physical properties. Reactions-Hydrolysis, Saponification, Rancidity.</p>	10	1,2

		<p>Lipids: Compound lipids: Phospholipids- Lecithin, Phosphatidyl inositol, Cephalins, Plasmalogens. Glycolipids, Sphingolipids. Derived Lipids, Steroids: Biologically important steroids - cholesterol, Bile acids, Ergosterol, Terpenes, Lipoproteins. Prostaglandins-structure, types and functions.</p> <p>Metabolism: Beta oxidation, De novo synthesis of fatty acids, Lipid peroxidation, Free radicals - Scavenger system and antioxidants - Preventive antioxidants and chain breaking antioxidants.</p>		
Module II: Nucleic Acids: Structure and Metabolism			(5 Hrs)	
2	2.1	Structure of nucleic acids: Structural organization of DNA (Watson-Crick model), Characteristic features of A, B, C and Z DNA.	3	3
	2.2	Metabolism: Catabolism of purines and pyrimidines	2	3
Module III: Enzymes			(10 Hrs)	
3	3.1	Classification - (I.U.B. system), co-enzymes, ribozyme. Enzyme specificity. Mode of enzyme action: Concept of Active site, Formation of enzyme substrate complex, Lowering of activation energy. Lock and key theory, induced fit theory, transition state and strain theory. Enzyme kinetics: Michaelis-Menten equation. Km value and its significance. Enzyme velocity and factors influencing enzyme velocity. Kinetics of enzyme inhibition, suicide inhibition, feedback inhibition- sequential, concerted and cumulative feedback control.	6	4
	3.2	Enzyme regulation: Allosteric regulations- Monod-Wyman-Changuex model, Koshland-Nemethy-Filmer model, Key enzymes, Flux analysis. Iso-enzymes and clinical significance.	4	4
Module IV: Advanced Biochemistry - PRACTICAL			(30 Hrs)	
4	4.1	Study of the structure of biomolecules (carbohydrate, aminoacids, cholesterol), Protein and Nucleic acid using software tools.	5	5
	4.2	Preparation of Buffer at specific pH using pH meter.	5	6
	4.3	Calculation of Molality, Normality, percentage W/V, serial dilution and preparation of standard solutions.	5	6


	4.4	Preparation of standard curve for protein, glucose and cholesterol.	15	6
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13. Zubay, G, 1989. Biochemistry. McMillan Publishing Co., New York.

Suggested Readings:

1. Keith Wilson and John Walker. 2008. Principles and Techniques of Biochemistry and Molecular biology (6th edn). Cambridge University Press, UK.
2. Nelson, D. L., & Cox, M. M. (2008). Lehninger: Principles of Biochemistry, Volume Edition 7th. W.H. Freeman & Co, UK.
3. Stryer, L. 2019. Biochemistry. (9th edn). W.H. Freeman & Co. NY.
4. Voet, D., Voet, J. G., & Pratt, C. W. 2018. Principles of Biochemistry: Global Edition (5th Edition). John Wiley & Sons, NY.

	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	EPIDEMIC SCIENCE					
Type of Course	MAJOR					
Course Code	ZO8DCEA01B24					
Course Level	400-499					
Course Summary	This course is a vital research discipline in the field of public health. It covers general introduction to epidemiology, epidemiologic methods for the control of infectious and chronic diseases as well as community and environmental health hazards. This course is designed to expand the awareness and critical understanding of the social, economic, environmental and structural dimensions of epidemics.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess knowledge regarding disease outbreaks.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Examine ecology of health and principles of epidemiology.	A	1,2,3,6,10
2	Explain different modes of transmission of diseases.	S, An	1,2,3,6,10
3	Explain the epidemiology of communicable diseases.	S, An	1,2,3,6,9,10
4	Determine the hazardous effects of biological agents.	S, A	1,2,3,6,9,10
5	Assess various pathogenic agents and their detection procedures.	S, E	1,2,3,6,7,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Ecology of health and Principles of epidemiology			(15 Hrs)	
1	1.1	Responsibility for health: Individual, Community, State, International. Global bodies for prevention and control of diseases.	2	1
	1.2	Natural History of Disease: Prepathogenesis phase; Postpathogenesis phase; Agent factors	2	1
	1.3	Modes of Intervention Flagship Health Programs: Global/ National/ Local/ Kerala context (any two)	3	1
	1.4	Definition; Aim, scope, history and Uses of epidemiology. Population, properties of a population (density, natality, mortality, age distribution, life tables, factors effecting population)	3	1
	1.5	Infectious diseases Epidemiology: selected definitions- Infection, Contamination, Infestation, Host, Infectious, Contagious and communicable diseases, Epidemic, Endemic, Sporadic, Pandemic, Exotic, Zoonoses, Epizootic, Epornothic, Enzootic, Nosocomial infection, Opportunistic infection, Iatrogenic diseases, Surveillance, Eradication.	5	1
Module II: Modes of disease transmission			(15 Hrs)	
2	2.1	Water borne diseases and Prevention-Cholera, Typhoid, Hepatitis A, Gastroenteritis.	3	2
	2.2	Air borne diseases and Prevention - Bronchitis, Lung Disease, Lung Cancer.	2	2
	2.3	Food borne diseases and Prevention -Botulism, Salmonellosis.	2	2
	2.4	Vector borne diseases and Control measures - Chikungunya, Filariasis and Dengue fever.	3	2
	2.5	Zoonotic disease and Control measures - Leptospirosis, Nipah, Rabies, Ebola, Tick Fever. Role of domestic animals in transmission of Zoonosis.	3	2
	2.6	Disease caused by invasive species and Prevention - Zika	2	2

Module III: Communicable diseases			(15 Hrs)	
3	3.1	Emerging diseases - Swine flu (H1N1), bird flu (H5N1), SARS, MERS, Anthrax (Causative agent, mode of transmission, pathogenicity, symptoms, diagnosis, treatment, prevention)	3	3
	3.2	Re-emerging diseases -TB, Malaria (Causative agent, mode of transmission, pathogenicity, symptoms, diagnosis, treatment, prevention)	3	3
	3.3	Sexually transmitted diseases and Prevention - AIDS, Syphilis	3	3
	3.4	Pandemic: Epidemiology and Public Health of COVID-19. Symptoms, strains, risk, impact & mitigation; vaccines and post covid effects.	3	3
	3.5	Biological Warfare Agents - Mustard Gas, Agent Orange, Sarin	3	4
Module IV: Epidemic Science - PRACTICAL			(30 Hrs)	
4	4.1	Mark pandemic outbreaks on the world map and mention the year (Bubonic Plague/ Spanish flu/ Kuru /Nipah) and write an account.	5	5
	4.2	Identification of Pathogenic Bacteria and Parasites - <i>Mycobacterium tuberculi</i> , <i>Leptospira</i> , <i>Wucheraria bancrofti</i> , <i>Trypanosoma</i> , <i>Schistosoma</i>	5	5
	4.3	Insect Vector Studies - <i>Xenopsylla cheopis</i> , <i>Aedes aegypti</i> , Anopheles and Culex mosquito, Phlebotomus	5	5
	4.4	Fungal cultivation on SDA or PDA	5	5
	4.5	Lactophenol cotton blue (LCB) staining of fungi	2	5
	4.6	Principle and procedure for Screening of pulmonary tuberculosis - sputum ZN staining	2	5
	4.7	Principle and procedure for Isolation and identification of pathogenic bacteria (<i>Vibrio cholera</i>)	2	5
	4.8	Principle and procedure for Testing of Bacterial Virulence factors - capsule staining	2	5
	4.9	Principle and procedure of Serological tests to detect viral & bacterial antigens	2	5

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 15. Hall, David J. (1984). The Islamic World Med.J., April 84 p. 22.
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Suggested Readings:

1. Ananthanarayanan, R. and Paniker, Jayaram C. K. 2010. Text book of Microbiology, Hyderabad: Universities Press, Edition: 8th ed, 591p.
2. Park K. 2011. Park's textbook of Preventive and Social Medicine, Banarsidas Bhanot publishers, 868p.
3. Mahabalraja D. K. 2023. Essentials of community medicine, Jaypee Brothers Medical Publishers Pvt.Ltd. ISBN-13 978-9356962910.

4. Jayashree Shetty and Gopal Shetty, 2023. The Blunting Of An Epidemic: A Courageous War On Aids Paperback, Amaryllyis -An Imprint of Manjul Publishing House, ISBN-13978-9355432315

	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) Zoology					
Course Name	DEVELOPMENTAL BIOLOGY					
Type of Course	MAJOR					
Course Code	ZO8DCEA02B24					
Course Level	400-499					
Course Summary	The course provides the students with a solid foundation in the fundamental concepts of developmental biology including early embryonic development. This course details the progression of multicellular organisms from their fertilized egg stage, examining the regulation of gene activity, cellular communication and the emergence of tissue and organs.					
Semester	VIII	Credits		4	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical		Others
		3		1		75
Pre-requisites, if any	Knowledge of basic biology and genetics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Describe the basic concepts of development.	U	1, 2
2	Explain cellular interactions in development.	A	1, 2
3	Describe the development of <i>Caenorhabditis elegans</i> , <i>Drosophila</i> and Amphibian.	U	1, 2
4	Explain the developmental stages of various organisms.	A	1, 2,10
5	Administer experiments in Developmental Biology.	S, A	1,2,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
Module I: Introduction: Basic concepts of development			(10 Hrs)	
1	1.1	Potency of embryonic cells. Stem cells and their applications, ethical issues. Overview of development and cell specifications. Competence, Determination and Differentiation, Morphogenetic gradients.	2	1
	1.2	Cell fate and cell lineages. Genomic equivalence and Cytoplasmic determinants, DNA methylation, Genomic imprinting.	2	1
	1.3	Spermatogenesis, Oogenesis, Fertilization- (biochemical and molecular aspects, cell surface molecules in sperm-egg recognition), Polyspermy.	6	1
Module II: Cellular interactions in development			(15 Hrs)	
2	2.1	Paracrine factors - Hedgehog family, Wnt family, TGF, BMP. Surface receptors and signal transduction pathway - RTK pathway, Smad pathway, Wnt pathway, Hedgehog pathway and cell death pathway.	6	2
	2.2	Metamorphosis of Amphibians and Insects; Hormonal control of metamorphosis. Heterochrony, Neoteny, Progenesis (Brief account).	4	2
	2.3	Regeneration - different types of regeneration; Histological processes during regeneration; Polarity and Metaplasia in regeneration; Lens regeneration in Amphibia.	5	2
Module III: Development of model organism			(20 Hrs)	
3	3.1	<i>Caenorhabditis elegans</i> - Early development and axis specification in <i>Caenorhabditis elegans</i> , Vulval induction in <i>C. elegans</i> . Mechanisms and significance of cleavage.	4	3
	3.2	Drosophila - Early development and axis specification in <i>Drosophila</i> (cleavage, mid-blastula transition, gastrulation). Anterior posterior patterning in <i>Drosophila</i> (Maternal effect genes, zygotic genes, gap genes, pair-rule genes, segment polarity genes; homeotic selector genes, realisator genes), Dorsal-	8	3


		ventral patterning and left-right patterning, Dorsal protein gradient.		
	3.3	Amphibia - Axis formation in Amphibia - Anterior-posterior patterning in Amphibia. Hox code hypothesis. Nieuwkoop centre and mesodermal polarity. Molecular basis of mesoderm induction. Transcription factors induced in the organizer. Neural induction.	8	3
Module IV: Developmental Biology - PRACTICAL			(30 Hrs)	
4	4.1	Study on developmental stages of Drosophila.	5	4
	4.2	Study on the developmental stages of Frog.	5	4
	4.3	Study of serial section of embryo.	5	4
	4.4	Vital staining of early gastrula of chick-window method.	5	5
	4.5	Blastoderm mounting and age determination of chick embryo using vital stains.	5	5
	4.6	Morphological and histological details of different types of mammalian placenta.	5	5

References:

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2. Berril, N.J. 1979. Developmental Biology. Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
3. Hopper, A.F. and Hart, N.H. 1985. Foundations of Animal Development. Oxford University Press, Oxford.
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5. Saunders, J.W. 1982. Developmental Biology-Patterns, Principles and Problems. Macmillan Publishing Co., New York.
6. Snustad, D. P., & Simmons, M. J. (2015). Principles of genetics. John Wiley & Sons.
7. Wolpert, L., Tickle, C., & Arias, A. M. 2015. Principles of development. Oxford university press.

Suggested Readings:

1. Gilbert, S.F. 2013. Developmental Biology (10th edn). Sinauer Associates Inc., Publishers, Massachusetts, USA.
2. Subramanian, T. 2002. Developmental Biology. Alpha Science International Ltd., New Delhi.


	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) ZOOLOGY					
Course Name	PROJECT					
Type of Course	Project (UG Degree-Honours)					
Course Code	ZO8DCCPRB24					
Course Level	400-499					
Course Summary	This course equips students with essential research skills in Zoology, emphasizing employability and career-oriented competencies. Students will learn to select significant research issues, design and conduct experiments, analyze and interpret data, and present their findings effectively. The course emphasizes critical thinking, teamwork, and scientific communication.					
Semester	VIII	Credits			8	Total
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Hours
					8	
Pre-requisites, if any	Basic knowledge of research methodology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Design and implement comprehensive experimental plans to investigate zoological questions.	S, C	1,2,3,9
2	Analyze and interpret data using appropriate statistical tools and methodologies.	S, An	1,2,3,9
3	Communicate research findings effectively through well-structured reports and engaging presentations.	S, A	1,2,3,4,9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
PROJECT			(240 Hrs)	
1	1.1	<p>Students who have opted for the Honours should successfully complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to defend successfully the research project to obtain 8 credits under a faculty member of the College. The research shall be in the Major/ allied discipline.</p> <p>The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.</p> <p>This course equips students with essential research skills in Zoology, focusing on employability and career-oriented competencies. Students will learn to select relevant research issues, plan and conduct experiments, analyze and interpret data, and present their findings effectively. Key components include:</p> <p>Research Issue Selection: Identifying socially and ecologically significant topics.</p> <p>Experimental Planning: Designing robust and ethical experiments.</p> <p>Data Analysis: Using statistical tools and interpreting results.</p> <p>Research Presentation: Writing reports and delivering presentations.</p> <p>Emphasis is placed on critical thinking, teamwork, scientific communication, and real-world application, preparing students for careers in Zoology, ecology, conservation, and related fields.</p>	240	1,2,3

	ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM Affiliated to Mahatma Gandhi University, Kottayam					
Programme	B.Sc. (Hons.) ZOOLOGY					
Course Name	PROJECT					
Type of Course	Project (UG Degree-Honours with research)					
Course Code	ZO8DCCPRRB24					
Course Level	400-499					
Course Summary	This course equips students with essential research skills in Zoology, emphasizing employability and career-oriented competencies. Students will learn to select significant research issues, design and conduct experiments, analyze and interpret data, and present their findings effectively. The course emphasizes critical thinking, teamwork, and scientific communication.					
Semester	VIII	Credits			12	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
					12	360
Pre-requisites, if any	Basic knowledge of research methodology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcomes	Learning Domains *	PO No.
After the successful completion of the course the student should be able to:			
1	Evaluate significant research issues in Zoology, considering both social and ecological perspectives.	S, E	1,2,3,6,9
2	Design and implement comprehensive experimental plans to investigate zoological questions.	S, C	1,2,3,9
3	Analyze and interpret data using appropriate statistical tools and methodologies.	S, An	1,2,3,9
4	Communicate research findings effectively through well-structured reports and engaging presentations.	S, A	1,2,3,4,9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
PROJECT			(360 Hrs)	
1	1.1	<p>Students who have opted for the Honours with research should successfully complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to defend successfully the research project to obtain 12 credits under a faculty member of the College. The research shall be in the Major/ allied discipline.</p> <p>The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.</p> <p>This course equips students with essential research skills in Zoology, focusing on employability and career-oriented competencies. Students will learn to select relevant research issues, plan and conduct experiments, analyze and interpret data, and present their findings effectively. Key components include:</p> <p>Research Issue Selection: Identifying socially and ecologically significant topics.</p> <p>Experimental Planning: Designing robust and ethical experiments.</p> <p>Data Analysis: Using statistical tools and interpreting results.</p> <p>Research Presentation: Writing reports and delivering presentations.</p> <p>Emphasis is placed on critical thinking, teamwork, scientific communication, and real-world application, preparing students for careers in Zoology, ecology, conservation, and related fields.</p>	360	1,2,3,4