FOR TRUTH AND SERVICE

ST. ALBERT'S COLLEGE (AUTONOMOUS) ERNAKULAM

Affiliated to Mahatma Gandhi University, Kottayam, Kerala

SYLLABUS FOR UNDERGRADUATE PROGRAMME

BACHELOR OF SCIENCE (HONOURS) ZOOLGY

SACA – UGP
(WITH EFFECT FROM 2024 ADMISSION)

FOR TRUTH AND SERVICE

Syllabus of B.Sc. (Honours) Zoology

Proposed by the Board of Studies on …….

Ms. Nimila P. J.
Chairman, Board of Studies

Approved by the Academic Council on 16th August 2024

DR. Joseph Justin Rebello
Chairman, Academic Council

Adopted by the Governing Council on..

Fr. Antony Thoppil

Chairman, Governing Council

FOR TRUTH AND SERVICE

BOARD OF STUDIES AND EXPERTS

(As per UGC Regulations 2018)

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12	Dr. Sunish K.S.	Assistant Professor Department of Zoology, Maharajas College, Ernakulam
13	Dr. Elizabeth V Mathew	Assistant Professor, Department of Zoology, UC College, Aluva

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Preface

The introduction of the Four-Year Undergraduate programme (FYUGP) marks a significant advancement in higher education, aligning with the objectives of the National Educational Policy. This comprehensive programme is designed to equip students with a profound understanding, nurturing their abilities in research, development, and value-added applications.

The Undergraduate programme in Zoology offers a wide-ranging curriculum that encompasses various aspects of the subject. From foundational courses in Zoology to specialized modules in advanced areas, the programme provides students with a solid foundation and opportunities for in-depth exploration. The inclusion of skill development programme ensures that graduates are well-prepared for the challenges of the modern workforce, while the emphasis on research and value-added initiatives encourages innovation and critical thinking.

The development of the syllabus was a collaborative effort. The expertise and dedication to the field of Zoology have been instrumental in crafting a curriculum that is both rigorous and relevant. While we acknowledge the foundational strength of the curriculum adopted from Mahatma Gandhi University, the incorporation of signature courses represents a significant step forward in tailoring the programme to the specific needs and aspirations of our students. We believe that this blend of established knowledge and innovative approaches will foster a dynamic and stimulating learning environment.

We extend our sincere gratitude to all those involved in the development and implementation of this syllabus. We look forward to the continued success of the programme and the bright future it holds for our students.

THE ST. ALBERTS COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024

SACA-UGP (Honours)

PREAMBLE

The University Grants Commission (UGC) has issued the Curriculum and Credit Framework for Undergraduate Programmes 2023 (CCFUP) which would provide a flexible choice-based credit system, multidisciplinary approach, multiple entry and exit options, and establish three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and 4-year UG Degree (Honours with Research).

The Kerala Higher Education Reforms Commission has recommended a comprehensive reform in the undergraduate curriculum for the 2023-24 academic year, adopting 4-year undergraduate programmes to bring Kerala's undergraduate education at par with well acclaimed universities across the globe.

The Kerala State Curriculum Committee for Higher Education has been constituted and have proposed a model Kerala State Higher Education Curriculum Framework (KSHECF) for Undergraduate Education. Further, an Executive Committee and various sub committees were constituted for the implementation of the Regulations. Further, MGU has framed the Rules and Regulations based on this namely: THE MAHATMA GANDHI UNIVERSITY UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {MGU-UGP (Honours)} under the New Curriculum and Credit Framework, 2024. Being an Autonomous college affiliated to MG University, St. Albert's College is adopting all the major components of MGU UGP (Honours) 2024 in the title SACA-UGP (Honours) to our UG curriculum from the academic year (2024-25) onwards.

1. **Short Title and Commencement**

i. The Regulations will be called as "THE ST. ALBERT'S COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {SACA-UGP (Honours)}" under the New Curriculum and Credit Framework 2024.

ii. These Regulations will come into effect from the academic year 2024-2025 and will have prospective effect.

2. **Scope, Application**

These Regulations shall apply to all undergraduate programmes (except B. Voc.) of ST.ALBERT'S COLLEGE (AUTONOMOUS) for the Admissions commencing in the academic year 2024-2025.

Every programme conducted under the SACA-UGP shall be monitored by the SACA-UGP Academic Committee (Academic Council)

3. Definitions

Unless context otherwise required,

i. FYUGP means Four Year Undergraduate Programme.

ii. Academic Year: Two consecutive (one odd and one even) semester followed by a vacation in one academic year.

iii. Academic Coordinator/Nodal Officer: Academic Coordinator/Nodal Officer is a faculty nominated by the College Council to co-ordinate the effective conduct of the FYUGP including Continuous Comprehensive Assessment (CCA) undertaken by various departments within the College. She/ he/ they shall be the convenor for the College level Academic Committee.

iv. Academic Week: A unit of five working days in which the distribution of work is organized, with five contact hours of one-hour duration on each day.

v. Academic Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. It is defined both in terms of student efforts and teacher's efforts. A course which includes one hour of lecture or tutorial or minimum 2 hours of lab work/ practical work/ field work per week is given one credit hour. Accordingly, one credit is equivalent to one hour of lecture or tutorial or two hours of lab work/ practical work/ field work/ practicum and learner engagement in terms of course related activities (such as seminar preparation, submitting assignments, group discussion, recognized club-related activities etc.) per week. Generally, a one credit course in a semester should be designed for 15 hours lecture/ tutorials or 30 hours of practical/ fieldwork/ practicum and 30 hours learner engagement.

vi. Academic Bank of Credits (ABC): An academic service mechanism as a digital/ virtual entity established and managed by Government of India to facilitate the learner to become its academic account holders and facilitating seamless learner mobility, between or within degree-granting Higher Education Institutions (HEIs) through a formal system of credit recognition, credit accumulation, credit transfers and credit redemption to promote distributed and flexible process of teaching and learning. This will facilitate the learner to choose their own learning path to attain a Degree/ Diploma/ Certificate, working on the principle of multiple entry and exit, keeping to the doctrine of anytime, anywhere, and any level of learning.

vii. Credit Accumulation: The facility created by ABC in the Academic Credit Bank Account (ABA) opened by the learner across the country in order to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs.

viii. Credit Recognition: The credits earned through eligible/ partnering HEIs and transferred directly to the ABC by the HEIs concerned.

ix. Credit Redemption: The process of commuting the accrued credits in the ABC of the learner for the purpose of fulfilling the credits requirements for the award of various degrees. Total credits necessary to fulfil the criteria to get a degree shall be debited and deleted from the account concerned upon collecting a degree by the learner.

x. Credit Transfer: The mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed credits to individuals registered with ABA in adherence to the UGC credit norms for the course(s) registered by the learner in any HEIs within India.

xi. Credit Cap: Maximum number of credits that a student can take per semester, which is restricted to 30.

xii. Continuous Comprehensive Assessment (CCA): The mechanism of evaluating the learner by the course faculty at the institutional level.

xiii. End Semester Evaluation (ESE): The mechanism of evaluating the learner at the end of each semester.

xiv. Audit Course: A course that the learner can register without earning credits and is not mandatory for completing the SACA-UGP. The student has the option not to take part in the CCA and ESE of the Audit Course. If the student has 75% attendance in an Audit Course, he/ she/ they are eligible for a pass in that course, without any credit (zero-credit).

xv. Courses: Refer to the papers which are taught and evaluated within a programme, which include lectures, tutorials, laboratory work, studio activity, fieldwork, project work, vocational training, viva, seminars, term papers, presentations, assignments, self-study, group discussion, internship, etc., or a combination of some of these elements.

xvi. Choice Based Credit System (CBCS) means the system wherein students have the option to select courses from the prescribed list of courses.

xvii. College-level Academic Committee: Is a committee constituted for the FYUGP at the College level comprising the Principal as the Chairperson, the Academic Co-ordinator/ Nodal Officer as its convenor.

xviii. Academic Co-ordinator/ Nodal Officer: A senior faculty member nominated by the College Council.

xix. Course Faculty: A faculty member nominated by the Head of the Department shall be in charge of offering a particular course in a particular semester of FYUGP.

xx. Department means any teaching department in a college offering a course of study approved by the Governing body and statutory bodies of the College.

xxi. Senior Faculty Advisor (SFA) is a faculty nominated by a Department Council to coordinate all the necessary work related to FYUGP undertaken in that department, including the Continuous

Comprehensive Assessment.

xxii. Department Council means the body of all teachers of a department in a college.

xxiii. Faculty Advisor (FA) means a teacher from the parent department nominated by the Department Council to advise students in academic matters.

xxiv. Graduate Attributes means the qualities and characteristics to be obtained by the graduates of a programme of study at the College, which include the learning outcomes related to the disciplinary areas in the chosen field of learning and generic learning outcomes. The graduate attributes for its programmes will be specified.

xxv. Programme means the entire duration of the educational process including the evaluation leading to the award of a degree.

xxvi. Programme Pathway: Combination of courses that can be chosen by a student that give options to pursue interesting and unconventional combinations of courses drawn from different disciplinary areas, like the sciences and the social sciences/ humanities. The pathways could be in terms of major- minor options with different complementary/allied disciplines.

xxvii. Regulatory Body means University Grants Commission (UGC), All India Council for Technical Education (AICTE), National Council for Teacher Education (NCTE), Medical Council of India (MCI), Pharmacy Council of India (PCI), Indian Council for Agricultural Research (ICAR), Bar Council of India, Council of Architecture, National Assessment and Accreditation Council (NAAC) and National Board of Accreditation (NBA) etc.

xxviii. Signature Courses: Signature courses are the specialized Discipline Specific Elective courses or skill enhancement/value addition courses offered by the regular/ ad hoc/visiting/ emeritus/ adjunct faculty member of a particular Department with the prior recommendation of the BoS and the approval of Academic Council of the College.

xxix. Letter Grade or simply 'Grade' in a course is a letter symbol (O, A+, A, B+, B, C, P, F, and Ab). Grade shall mean the prescribed alphabetical grade awarded to a student based on their performance in various examinations. The Letter grade that corresponds to a range of CGPA.

xxx. Grade Point: Each letter grade is assigned a 'Grade point' (G) which is an integer indicating the numerical equivalent of the broad level of performance of a student in each course. Grade Point means point given to a letter grade on 10-pointscale.

xxxi. Semester Grade Point Average (SGPA) is the value obtained by dividing the sum of credit points obtained by a student in the various courses taken in a semester by the total number of credits in that semester. SGPA shall be rounded off to two decimal places. SGPA determines the overall performance of a student at the end of a semester.

xxxii. Credit Point (P) of a course is the value obtained by multiplying the grade point (G) by the credit (C) of the course: $P = G \times C$

xxxiii. Cumulative Grade Point Average (CGPA) is the value obtained by dividing the sum of credit points in all the semesters earned by the student for the entire programme by the total number of credits in the entire programme and shall be rounded off to two decimal places

xxxiv. Grade Card means the printed record of students' performance, awarded to them.

xxxv. Words and expressions used and not defined in this regulation but defined in the M. G. University Act and Statutes, and College handbook shall have the meaning assigned to them in the Act and Statutes and handbook

4. Features and Objectives of SACA-UGP 2024

The features and objectives of the SACA-UGP 2024 shall be:

i. The features, meaning, and purpose of FYUGP shall be as stipulated by the UGC and as adapted by the Kerala State Higher Education Curriculum Framework (KSHECF) and MGU-UGP (Honours) for undergraduate education.

ii. 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.

iii. 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).

iv. 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.

v. A 4-year UG Degree (Honours) in the Discipline/ Disciplines shall be awarded to those who complete the SACA-UGP with a specific number of Courses with 177 credits including 12 credits from a capstone level graduate project/dissertation. Those students who are not doing capstone project shall do three courses at the level 400 or above or three vocational training courses or internships for 12 credits.

vi. 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 University and College Regulations time to time.

vii. 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.

viii. The recognized research departments or departments with at least two faculty members having PhD shall offer the Honours with Research programme. Minimum 2 students

(mentees) should be allotted to a faculty member

ix. Students who have chosen the honours with research stream shall do their entire fourth year under the mentorship of a mentor.

x. 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. Students shall also be allowed to pursue these three courses of 12 credits from suitable interdisciplinary/ transdisciplinary/ multidisciplinary/ vocational areas of their choice.

xi. 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 successfully defend the research project to obtain 12 credits under a faculty member of the University/ College/Recognized Research Institute. The research shall be in the Major/ allied discipline.

xii. The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.

xiii. The proposed FYUGP curriculum comprises three broad parts: a) Foundation Components, b) Discipline Specific Pathway components (Major/ Minor), and c) Discipline Specific Capstone Components

xiv. The Foundation component of the FYUGP shall consist of a Set of General Foundation Courses and a Set of Discipline Specific Foundation Courses.

xv. 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).

xvi. 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.

xvii. 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.

xviii. 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 Plus Two. Third semester MDC can be Kerala specific content. Each BoS can prepare basket of courses under MDC.

xix. Skill Enhancement Courses (SEC) shall be designed to enhance 21st century workplace skills such as creativity, critical thinking, communication, and collaboration.

xx. Discipline Specific Courses shall include Discipline Specific Pathway Courses, both Major and Minor streams, enabling students to gain basic knowledge in the chosen discipline.

xxi. 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.

xxii. 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).

xxiii. Value Addition Courses (VAC) shall be so designed as to empower the students with personality development, perspective building, and self-awareness.

xxiv. 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.

xxv. Major components consist of three types: Discipline Specific Core or the Discipline Specific Elective Courses, and the research/laboratory/fieldwork.

xxvi. Minor Courses can be selected from any discipline. A student who completes 12 credits in a particular stream will be eligible for a minor.

xxvii. 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.

xxviii. 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.

xxix. 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.

xxx. 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 can also opt for a change of Major at the end of the second semester to any MDC.

xxxi. Students should opt their 5th and 6th semester VAC and SEC from their Major disciplines only.

xxxii. Course cum Credits Certificate: After the successful completion of a semester, this certificate is essential as proof for re-entry to another institution. This will help the learner for preserving the credits in the Academic Bank of Credits.

xxxiii. 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.

xxxiv. 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.

xxxv. 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.

xxxvi. 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. A separate guideline for Internship Programmes will be published.

xxxvii. 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 improve their employability.

xxxviii. The College will assist in providing 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 assist in providing the students with opportunities for Community engagement and services, exposing them to socio-economic issues to facilitate theoretical learning in real-life contexts.

xxxix. Additional Credits will be awarded for those who actively participate in Social Activities, which may include participation in National Service Scheme (NSS), Sports and Games, Arts, participation in University/ 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

College.

xl. 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. The Academic Council will decide from time to time the eligibility and other rules of awarding the grace marks.

xli. 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 from time to time.

xlii. Students shall be entitled to gain credits from courses offered by other recognized institutions directly as well as through distance learning.

xliii. For the effective operation of the FYUGP, a system of flexible academic transaction timings shall be implemented for the students and teachers.

xliv. Specialization: Student will have the option to achieve specialization within their Major by securing 12 credits from a disciplinary/interdisciplinary area. By choosing atleast 3 courses from discipline specific elective basket under a chosen field (preferably one from 200 level course and two 300 level courses) student will be awarded specialization in that particular area of study. Each student will have the option to achieve two specializations at a time from the institution

5. Eligibility for Admission and Reservation of Seats

i. The eligibility for admissions and reservation of seats for various FYUG Degree Programmes shall be in accordance with the norms/ rules made by the Government/University/College from time to time.

ii. No student shall be eligible for admission to FYUG Degree Programmes in any of the disciplines unless he/she/they have successfully completed the examination conducted by a Board/University at the Plus Two level of schooling or its equivalent.

iii. Students shall be admitted and enrolled in the respective programmes solely based on the availability of the academic and physical facilities within the institution. The College shall provide all students with a brochure detailing the Courses offered by the various departments under the various Programmes and the number of seats sanctioned for each Programme.

iv. During the time of admission each student may be provided with a unique higher education student ID which may be linked with the Aadhar number of the students so that his ID can be transferred if required to other higher education institutions as well.

v. The students at the end of second semester may be permitted to change their major programme of study to any course/ institution/ university across the state. Based on the availability of seats and other facilities, the students may be permitted to opt any discipline which he/she/they had studied during the

first two semesters as Discipline Specific Foundation courses/ Multidisciplinary Foundation courses. If ranking is required, it will be in the order of the highest-grade points secured in the discipline to which the switching of Major is sought.

vi. Students shall be allowed to change their major programmes, if required, to a maximum of 10% of the sanctioned strength of that particular programmes depending upon the academic and infrastructural facilities available in the Institution.

vii. Depending upon the availability of academic and infrastructural facilities, the Institution may also admit a certain number of students who are registered for particular programmes in each semester by transfer method, if required, from other Institutions subject to conditions as may be issued by the University.

viii. A student who has already successfully completed a First-Degree Programme and is desirous of and academically capable of pursuing another First-Degree Programme may also be admitted with the prior approval of the University as per the conditions regarding programme requirements specified by the University.

ix. A Student can also be admitted for an additional major/ second major/ additional minor and on completion of the required credits he/she/they can be awarded a second major/ additional major/ minor. He/she/they may be exempted from minor pathway and general foundation course requirement.

x. The HEIs can also enrol students in certain courses as per their choice depending upon the availability of infrastructure and other academic facilities from other recognized HEIs who are already registered for a particular programme there either through regular/online/distance mode irrespective of the nature of programme (Govt/ Aided/ Self- finance/ Autonomous). On successful completion of the course the credits may be transferred through the Academic Bank of Credit (ABC), against the unique higher education ID provided by the College at the time of admission

6. Academic Monitoring and student Support

The academic monitoring and student support shall be in the following manner, namely

i. College should appoint a Senior Faculty member as Academic Co-ordinator/Nodal officer for the smooth conduct of FYUGP.

ii. Advisory System: There shall be one Senior Faculty Advisor (SFA) for each department and one Faculty Advisor (FA) for 20 to 30 students of the class to provide advice in all relevant matters. The Head of the Department, in consultation with the SFA, shall assign FA for each student.

iii. The documents regarding all academic activities of students in a class shall be kept under the custody of the FA/SFA.

iv. All requests / applications from a student or parent to higher offices are to be forwarded / recommended by FA / SFA.

v. Students shall first approach their FA/ SFA for all kinds of advice, clarifications, and permissions on academic matters.

vi. It is the official responsibility of the institution to provide the required guidance, clarifications, and advice to the students and parents strictly based on the prevailing academic regulations.

vii. The SFA shall arrange separate or combined meetings with FA, faculty members, parents, and students as and when required and discuss the academic progress of students.

viii. The FA/SFA shall also offer guidance and help to solve the issues on academic and non-academic matters, including personal issues of the students.

ix. Regular advisory meetings shall be convened immediately after the commencement of the semester and immediately after announcing the marks of the Continuous Comprehensive Assessment (CCA).

x. The CCA related results shall be uploaded on the College portal only after displaying the same on the department notice board/other official digital platforms of the college at least for two working days.

    i. Any concern raised by the students regarding CCA shall be looked into in the combined meetings of advisors, HoD, course faculty, and the students concerned.

    ii. If the concerns are not resolved at the advisor's level, the same can be referred to the properly constituted department-level grievance redressal committees

    iii. The HOD shall ensure the proper redressal of the concerns raised by the students regarding CCA.

    iv. If the students raise further concerns about the issue, the Principal shall refer the issue to the College-level grievance committee with proper documents and minutes of all the committees.

xi. The FA/SFA shall be the custodian of the minutes and action taken reports of the advisory meetings. The SFA shall get the minutes and action taken reports of advisory meetings approved by the Head of Department and the Principal. It shall be the duty of the HoD and the Principal to produce them before the Governing body of the College as and when required.

xii. The Principal shall inform/forward all regulations, guidelines, communications, announcements, etc. issued by the University regarding student academic and other matters to the HODs/ SFA for information and timely action.

xiii. It shall be the official responsibility of the Principal to extend the required administrative and financial support to the HODs, SFAs and FAs to arrange necessary orientation programmes for students regarding student counselling, the prevailing College norms, regulations, guidelines and procedures on all academic and other College related matters.

xiv. An integrated educational planning and administration software will be made available by the College to manage the academic information of all students. Which include student admissions and registration, managing student personal and academic information, course registrations, attendance management, all process related to assessments including regular & online examinations, grading, publishing of results, supplementary examinations, LMS, stakeholders' feedback, etc.

xv. Faculty, staff, students, and parents shall be allowed to access this software system over a highly secure authenticated mechanism from within the campus and outside the campus

7. Course Registration

i. Each department shall publish well in advance the relevant details of courses offered, such as the name, academic level, expected outcomes, time slot, and course faculty members.

ii. Students shall be allowed to visit and interact with respective faculty members during the first week of each semester, to gather more information about the courses and the availability of seats.

iii. Based on consultations and advice from the faculty adviser, each student shall complete course registration within one week from the commencement of each semester.

iv. The number of credits that a student can take in a semester is governed by the provisions in these Regulations, subject to a minimum of 16 and a maximum of 30 Credits.

v. A student can opt out of a Course or Courses registered, subject to the minimum Credit/ Course requirement, if he/she/they feel that he/she/they has registered for more Courses than he/she/they can handle, within 30 days from the commencement of the semester. An option can be given to the student to convert this course as audit course if he/she/they wishes to do so.

vi. The college shall publish a list of the students registered for each course including audit course, if any, along with the chosen Programmes, repeat/reappearance courses, if any, and shall forward the same to the university.

vii. The higher education institutions shall admit candidates not only for programmes, but also for courses.

8. Re-admission and Scheme Migration

i. Students who opt out before the completion of the third year shall be provided with a 'Course cum Credits Certificate' after the successful completion of a semester as proof for re-entry to another institution.

ii. Students who have successfully completed a particular programme pathway maybe permitted to take an additional minor or second major.

iii. Those students who are opting for a second major are eligible for getting certain credit transfer/ credit exemption from their previous minor programs of study, subject to the prior recommendation of the BoS that, those credits are relevant for the present major programme of study.

9. Duration of Programmes, Credits Requirements and Options

i. Students will be offered the opportunity to take breaks during the programme and resume after the break, but the total duration for completing the FYUG programme shall not exceed 7 years.

ii. Students who wish to complete the undergraduate programmes faster may do so by completing different courses equivalent to the required number of credits and fulfilling all other requirements in N-1 semesters, where N is the number of semesters in the FYUGP.

iii. Provided further that the students may complete the undergraduate programme in slower pace, they may pursue the three years or six semester programme in 4 to 5 years (8 to 10 semesters), and four

years, or eight semester programme in 5 to 6 years (10 to 12 semesters) without obtaining readmission.

iv. For students who crossed 6 semesters at a slower space, the requirement of 16 credits per semester from the institutions where they enrolled may be relaxed.

10. Credit Structure

The proposed number of credits per course and the credit distribution of them for the FYUG Programmes are given below-

i. An academic year shall consist of 200 working days; one semester consists of 90 working days; and an academic year consists of two semesters.

ii. Ten working days in a semester shall be used for extracurricular activities. One semester consists of 18 weeks with 5 working days per week. In each semester, 15 days (3 weeks) should be kept aside for End Semester Evaluation (ESE) and CCA.

iii. The maximum number of available weeks for curriculum transactions should be fixed at 15 in each semester. A minimum of 5 teaching or tutorial hours could be made available for a day in a 5-day week.

iv. A course that includes one hour of lecture/ tutorial or two hours of lab work/practical work/fieldwork/practicum per week is given one credit hour.

v. One credit in a semester should be designed for 15 hours of lectures/ tutorials or 30 hours of lab work/ practical work/ field work/ practicum and 30 hours of learner engagement in terms of course-related activities such as seminar preparation, assignment submission, etc.

vi. A one-credit seminar or internship or studio activities or field work/ projects or community engagement and service will have two-hour engagements per week (30 hours of engagement per semester).

vii. A course can have a combination of Lecture (L)/ Tutorial (T)/ Practicum or Practical (P)/ & Others (O) credits.

viii. Minimum credit for one Course should be 2 (Two), and the maximum credit should be 4 (Four).

ix. All Discipline Specific Major/Minor Courses shall be of 4 (Four) credits.

x. For all Discipline Specific Major/Minor Courses, there may be practical/ practicum.

xi. All Courses under the Multi-Disciplinary, Ability Enhancement, Value Addition and Skill Enhancement categories are of 3 credits. Practical/Practicum credits can also be included in this category.

xii. Summer Internship, Apprenticeship, Community Outreach activities, etc. may require sixty hours (or as appropriate) of engagement for acquiring one credit.

xiii. A student shall be able to opt for a certain number of extra credits over and above the requirements for the award of a degree.

xiv. Maximum number of credits that a student can earn per semester shall be restricted to 30. Hence, a student shall have the option of acquiring credits to a maximum of 180 credits for a 3-year (6-semester) UG programmes and 240 credits for a 4-year (8-semester) programmes.

xv. Each faculty member shall offer a maximum of 16 credits per semester. However, those who are offering both practical and theory courses shall offer a maximum of 12-16 credits per semester.

xvi. For a four-credit theory course, 60 hours of lecture/ tutorial class shall be assured as a mandatory requirement for the completion of that course.

11. Course Structure of the SACA-UGP Programmes

The SACA-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-yearUG	4-yearUG
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**
	Total Credits	133	177

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

** The students pursuing the 4-year honours with research have to complete a capstone project with 12 credits and for the 4-year honours degree students have to complete a project with 12 credits. Those honours students who are not doing capstone project shall do three courses at the level 400 or above or three vocational training courses or internships for 12 credits.

i. 20% syllabus of each course will be prepared by the teacher as 'Teacher Specific Content' and will be evaluated under CCA.

ii. In case of MDC, SEC, VAC courses coming under 3rd & 4th semester, college should

make necessary arrangements to give adequate preference to courses designed by language departments. MDC in the 3rd semester can be Kerala Specific Content

12. Academic Levels of Pathway Courses

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

13. Signature Courses

i. With a prior recommendation of BoS and the approval of academic council, each faculty member can design and offer at least one signature course in every semester, which may be offered as DSE/SEC/VAC.

ii. College may publish a list of their signature courses in DSE/ SEC/ VAC offered by their faculty members with a prior recommendation of BoS and the approval of Academic Council.

iii. College may empanel distinguished individuals who have excelled in their field of specialization like science and technology, industry, commerce, social research, media, literature, fine arts, civil services etc. as adjunct faculty as per the UGC guidelines with the approval of the University/College. With a prior recommendation of BoS and the approval of academic council, the adjunct faculty can offer SEC/VAC as signature course.

iv. Adhoc/ Guest faculty/ Visiting faculty/ Visiting Scholars can also offer DSE/SEC/ VAC as signature courses with a prior recommendation of BoS and the approval of academic council.

v. The faculty concerned may design the particular course and it should be forwarded to the BoS after the approval of department council.

vi. The examinations and evaluation of the signature courses designed by the faculty shall be conducted by the faculty themselves and an external expert faculty chosen by the college from a panel of experts submitted by the faculty and recommend by the BoS concerned.

14. Programme Pathways and Curriculum Structure

Students who have joined for any programme under these regulations shall have the option to choose the following pathways for their UG degree and Honours programme.

i. **Degree with single Major**: A student pursuing the FYUG programme in a specific discipline shall be awarded a Major degree if he secures at least 50% of the total credits in the specific discipline required for the award of the Degree in that Discipline. Example: Physics Major/Economics Major/Commerce Major

ii. **Degree Major with Minor**: If a student pursuing the FYUG Programme is awarded a Major Degree in a particular discipline, he/she/they are eligible to be awarded a Minor in another discipline of his choice, if he earns a minimum of 32 credits (approximately 25% of credit required for the three-year programme) from 8 pathway courses in that discipline.
Example: Physics Major with Chemistry Minor/ Chemistry Major with English Minor/ Commerce Major with Economics Minor/ English Major with Functional English Minor/Hindi Major with Malayalam Minor etc.

iii. **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.

iv. **Interdisciplinary Major**: For these programme pathways, the credits for the major and minor pathways shall be distributed among the constituent disciplines/subjects to attain core competence in the inter disciplinary programme.
Example: Econometrics Major, Global Studies Major, Biostatistics Major.

v. **Multi-Disciplinary Major**: For multidisciplinary major pathways, the credits for the major and minor pathways will be distributed among the broad disciplines such as Life Sciences, Physical Sciences, Mathematical and Computer Sciences, Data Analysis, Social Sciences, Humanities, etc.
Example: Life Science, Data Science, Nano Science.

vi. **Degree with Double Major**: A student who secures a minimum of 50% credits from the first major will be awarded a second major in another discipline if he could secure 40% of credit from that discipline for the 3-year/ 4-year UG degree to be awarded a double major degree.
Example: Physics and Chemistry Major, Economics and History Major, Economics and History Major, Commerce and Management Major

Pathway Option1-Degree Major or Major with Multiple Disciplines of Study

Course Components	No. of Courses											
	Semester 1	Semester2	Semester3	Semester4		Semester5#	Semester6#	Total	Remarks	Semester 7	Semester 8	Total
DSCA (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
DSCB&C (4 Credit /Course)	2(P)	2(P)	1(P) (BorC)	1(P) (CorB)				6		3		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 DSCA **From DSCA only			3
Value Addition Courses (VAC) (3 Credit/ Course)			1*	1*			1**	3	*Cannot opt from DSCA **From DSCA only			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours											**12 (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**	

Internship of 2 Credits

Pathway Option 2 – Major with Minor

Course Components	No. of Courses											
	Semester 1	Semester 2	Semester 3	Semester 4		Semester 5#	Semester 6#	Total	Remarks	Semester7	Semester8	Total
DSCA (4Credit/ Course)	1(P)	1(P)	3 (2P)	3 (2P)		4	3	15	7 Out of 15 can be opted as DSE	3	2	22
DSCB (4Credit/ Course)	2(P)	2(P)	1(P)	1(P)		1	1	8	1 Out of 8 can be opted as DSE	3		11
Multidisciplinary Courses (MDC)/ (3Credit/ Course)	1(P)	1(P)	1*					3	*Cannot opt from DSC			3
Ability Enhancement Courses (AEC) (3Credit/ Course)	1 (English)1 (OL)	1 (English) 1 (OL)						4				4
Skill Enhancement Courses (SEC) (3Credit/ Course)				1*		1**	1**	3	*Cannot opt from DSCA **From DSCA only			3
Value Addition Courses (VAC) (3 Credit/ Course)			1*	1*			1**	3	*Cannot opt from DSCA **From DSCA only			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours											**12 (1DSC/ 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**	

Internship of 2 Credits

Pathway Option 3 – Double Major

Course Components	No. of Courses											Total
	Semester 1	Semester 2	Semester 3	Semester 4		Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8	
DSC A (4 Credit/ Course)	1(P)	1(P)	2(2P)	2(1P)		4	3	13	7 Out of 13 can be opted as DSE	3	2	18
DSC B (4 Credit/ Course)	2(P)	2(P)	2(1P)	2(2P)		1	1	10	2 Out of 10 can be opted as DSE	3		13
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				3
Value addition Courses (VAC) (3 Credit/ Course)			1	1			1	3				3
Project/Dissertation 12 credits for Honours with Research & 8 for Honours											**12 (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**		**TotalCredits133**	**24**	**20**	**Total Credits 177**
Total Hours per Week	**25**	**25**	**25**	**25**		**25**	**25**		**Exit option available**	**25**	**25**	

Internship of 2 Credits

15. Guidelines for Acquiring Credit from Other Institutions/Online/Distance Mode

i. A student shall register to a minimum of 16 credit per semester from the college/ department where he/ she/ they is officially admitted for a particular programme. However, students enrolled for a particular programme in one institution can simultaneously enrol for additional credits from other HEIs within the University or outside the University subject to a maximum of 30 credits per semester including the 16 institutional credits.

ii. The College shall publish a list of courses that are open for admission for students from other institutions well in advance before the commencement of each semester.

iii. Each BoS shall prepare and publish a list of online courses at different levels before the commencement of each semester offered in various online educational platforms recognized by the academic council of the College, which can be opted by the students for acquiring additional credits.

iv. Each BoS shall prepare and publish a list of allied/relevant pathway courses before the commencement of each semester offered by other Board of Studies that can be considered as pathway courses for major/minor for their disciplines at different levels.

v. At the end of each, the semester College will include the credit acquired by the student through online courses in their semester grade cards subject to a maximum of 30 credits.

16 Attendance

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

ii. A student is eligible for attendance as per the existing university and government orders which includes participation in a meeting, or events organized by the college or the university, a regularly scheduled curricular or extracurricular activity prescribed by the college or the university. Due to unavoidable or other legitimate circumstances such as illness, injury, family emergency, care-related responsibilities, bad or severe weather conditions, academic or career-related interviews, students are eligible for authorized absence. Apart from this, all other eligible leave such as maternity leave, and menstrual leave shall also be treated as authorized absences.

iii. The condonation facility can be availed as per the College norms

17. Workload

i. The workload of a faculty who offers only lecture courses during an academic year shall be

32 credits.

ii. The workload of a faculty offering both practical courses and theory courses may be between 24-32 credits per academic year.

iii. An academic year shall consist of two semesters.

iv. To protect the existing language workload, college should make necessary arrangements to give adequate preference to those courses designed by language departments coming under MDC, SEC and VAC of 3rd & 4th semester.

v. Programme wise workload calculation will be as per the FYUGP workload ordinance 2024.

vi. The teachers given the administrative responsibilities in the department and college level may give a relaxation in their workload as specified in the UGC regulations 2018.

18. Credit Transfer and Credit Accumulation

i. College will establish a digital storage (DIGILOCKER) of academic credits for the credit accumulation and transfer in line with ABC.

ii. The validity of credits earned shall be for a maximum period of seven (7) years or as specified in the university/UGC regulations.

iii. The students shall be required to earn at least 50% of the credits from the College.

iv. Students shall be required to earn the required number of credits as per any of the pathway structure specified in this regulation for the award of the degree

19. Outcome Based Approach

The curriculum will be designed based on Outcome Based Education (OBE) practices. The Graduate Attributes (GA) and Programme Outcomes (PO) are provided in appendix-1. The OBE based syllabus template is provided in appendix-2.

20. Assessment and Evaluation

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 must 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. FA is to encourage students to build on their strengths rather than fixate or dwell on their deficits. FA can help to clarify and calibrate learning expectations of students. FA will help students become more aware of their learning needs, strengths, and interests so they can take greater responsibility for their educational growth. FA will be the prerogative of the course faculty/course coordinator based on specific requirement of the student.

vi. Suggested methods of FA are as follows: (any one or in combination could be followed as decided by the course faculty/course coordinator)

   a. Practical assignment
   b. Observation of practical skills
   c. Viva voce
   d. Quiz
   e. Interview
   f. Oral presentations
   g. Computerized adaptive testing
   h. In-class discussions
   i. Group tutorial work
   j. Reflection writing assignments
   k. Home assignments
   l. Self and peer Assessments
   m. Any other method as may be required for specific course/student by the Course faculty/course coordinator

vii. 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. SA may be class tests, assignments, or project, used to determine whether students have learned what they were expected to learn. It will be based on evidence, collected using single or multiple ways of assessment. The systematically collected evidence should be kept in record by course faculty/course coordinator and the marks should be displayed on the college notice board/ other official digital platforms of the college before the end semester examinations

viii. The method of SA will be as follows: (any one as decided by the course faculty/course coordinator)

   a. Written test
   b. Open book test

c. Laboratory report
d. Problem based assignments
e. Individual project report
f. Case study report
g. Team project report
h. Literature survey
i. Standardized test
j. Any other pedagogic approach specifically designed for a particular course by the course faculty/course coordinator.

ix. A student may repeat SA only if there are any compulsive reasons due to which the student could not attend the assessment

x. The prerogative of arranging a CCA lies with the course faculty/course coordinator with the approval of SACA-UGP Academic Committee based on justified reasons

xi. The course faculty/ course coordinator shall be responsible for evaluating all the components of CCA. However, the university may involve any other person (External or Internal) for evaluation of any or all the components as decided by the Vice-Chancellor/Pro-Vice Chancellor from time to time in case any grievances are raised.

xii. Written tests shall be precisely designed using a variety of tools and processes (e.g., constructed responses, open-ended items, multiple-choice), and the students should be informed about the evaluation modalities before the commencement of the course.

xiii. The course faculty may provide options for students to improve their performance through continuous assessment mechanism.

xiv. There shall be theory and practical examinations at the end of each semester.

xv. Regarding evaluation, one credit may be evaluated for 25 marks in a semester; thus, a 4-credit course will be evaluated for 100 marks; and 2-credit courses for 50 marks. However, for tabulation purpose course with 1-credit will be evaluated for 50 marks and will be converted to 25 marks

xvi. Odd semester examinations will be conducted by the institution and will be evaluated at the institution level. However, even semester examinations will be conducted and evaluated by internal and external faculty.

xvii. Individual Learning Plans (ILPs) and/ or specific assessment arrangements may be put in place for differently abled students. Suitable evaluation strategies including technology assisted examinations/alternate examination strategies will be designed and implemented for differently abled students.

xviii. Distribution of CCA & ESE will be as given below

Credit	CCA	ESE
4	30	70
3	25	50
2	15	35

21. Practical Examination

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

ii. There shall be a CCA of practical courses conducted by the course faculty course coordinator.

iii. 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%

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

v. For grievance redressal purposes, the university shall have the right to call for all the records of CCA.

vi. 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 & M) flexibility for all External Examinations. BoS can recommend the T&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

22. 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 Marks**	**CCA**	**ESE**
Research Project of Honours with Research (12 credits)	200	60	140
Project of Honours (8 credits)	100	30	70

23. 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 / 50Marks
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

24. Letter Grades and Grade Points

A Mark system is followed for evaluating each question. For each course in the semester, letter grades and grade points are introduced in a 10-point indirect grading system as per the guidelines given below,

i. 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.

ii. 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 & 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

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

25. 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 undertaken by a student in the semester, i.e.

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

Where S_i is the SGPA in the ith semester, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course.

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

Illustration–Computation of SGPA

Semester	**Course**	**Credit**	**Letter Grade**	**Grade point**	**Credit Point** (Credit Grade)
I	DSC A	4	A	8	4x8=32
I	DSC B	4	B+	7	4x7=28
I	DSC C	4	B	6	4x6=24
I	MDC	3	B	6	3x6=18
I	AEC 1	3	O	10	3x10=30
I	AEC 2	3	C	5	3x5=15
	Total	21			147
	SGPA				147/21=7

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

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

Where S_i is the SGPA in the ith semester, C_i is the total number of credits in the ith semester.

$$CGPA = \frac{Sum\ of\ the\ credits\ of\ all\ the\ courses\ in\ six/eight\ semesters}{Total\ Credits\ in\ Six(133)/Eight(177)\ semesters}$$

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

26. Committees to be Constituted for the Implementation and Monitoring of SACA-UGP

i. There shall be a college level SACA-UGP Academic Co-ordinator/Nodal Officer, academic committee and SACA-UGP department committee in each department.

ii. The tenure of the college level committees will be 4 years

SACA-UGP Academic Committee

i. The Principal (Chairman)

ii. Academic Co-ordinator/Nodal Officer (Convenor)

iii. All the Heads of Departments in the college

iv. Four teachers of the college representing different discipline nominated by the college council by rotation

v. Not less than four experts/academicians from outside the college representing areas such as Industry, Commerce, Education, Sciences etc., to be nominated by the college council preferably from the alumni of the college

vi. Three nominees of the affiliating University (not less than the designation of associate professor in a college/university department)

Functions of SACA-UGP Academic Committee

i. Scrutinize, approve, and recommend to the University all the proposals submitted by the department committee with regard to the SACA-UGP such as, academic pathway, allowed syllabi enrichment/updation, details of elective courses, Online courses, blended teaching, courses offering to the students of other HEIs, panel of examiners, summative and formative evaluation tools proposed by the concerned course faculty, new courses

and syllabus proposed by the faculty members as signature courses etc. The Academic Committee can differ on any proposal, and it shall have the right to return the matter for reconsideration to the concerned Department committee or reject it, after giving sufficient reasons to do so.

ii. Scrutiny of all documents related to Teacher Specific Content.

iii. Recommend to the College Governing Body for starting innovative programmes using the flexibility and holistic nature of the SACA-UGP curriculum framework

SACA-UGP Department Committee

i. Head of the Department concerned (Chairman)

ii. The entire faculties of the Department

iii. Two subject experts from outside the college to be nominated by the MGU-UGP Academic Committee

iv. One representative from industry/ corporate sector/ allied area relating to placement

v. One meritorious alumnus of the department to be nominated by the department council

vi. The department council of the SACA-UGP, may with the approval of the principal of the college, co-opt:

(a) Experts from outside the college whenever special courses of studies are to be formulated.

(b) Other faculty members of the same Faculty within the college

Functions of SACA-UGP Department Committee

i. Prepare teacher specific content of syllabi for various courses keeping in view the objectives of the SACA-UGP and submit the same for the approval of the academic committee

ii. Scrutinize the signature course content and its evaluation techniques.

iii. Suggest methodologies for innovative teaching and evaluation techniques.

iv. Suggest panel of examiners to the academic committee.

v. Coordinate research, teaching, extension and other academic activities in the department/college.

vi.

27. Proposed Options for Higher Studies for the Students of SACA-UGP

The following higher studies options at the level of post-graduation/research was described by UGC in the national higher education qualification framework;

i. The two-year master programme will continue (with an option of having the second year devoted entirely to research) for those who have completed a 3-year UG programme under the SACA-UGP regulations.

ii. For students who have completed a 4-year honours degree could complete their master programme within one year by acquiring the required credits as per the Post Graduate curriculum framework requirement.

iii. For enrolling in a PhD programme the candidate should have acquired a master degree or a 4-year honours degree with research.

28. Power to Remove Difficulties

If any difficulty arises in giving effect to the provisions of these Regulations, the Principal may by order make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, which appears to him to be necessary or expedient for removing the difficulty. Every order made under this rule shall be subject to ratification by the Governing body.

29. Modifications to the Regulations

Not with standing anything contained in these Regulations, any amendments or modifications issued or notified by the University Grants Commission or the State Government, from time to time, shall be deemed to have been incorporated into these Regulations and shall constitute an integral part thereof.

Appendix-1

Graduate Attributes (GA) of St. Albert's College (Autonomous)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that, higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected. The expected learning outcomes are used as reference points that would help formulate graduate attributes, qualification descriptors, programme outcomes and course outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. The graduate attributes of St. Albert's College (Autonomous) are:

GA1: Critical thinking and Analytical reasoning

Capability to analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories to develop knowledge and understanding; critical sensibility to lived experiences, with self-awareness and reflexivity of

both self and society.

GA2: Scientific reasoning and Problem solving

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

GA3: Multidisciplinary / interdisciplinary / trans disciplinary Approach

Acquire interdisciplinary / multidisciplinary / transdisciplinary knowledge base as a consequence of the learning they engage with their programme of study; develop a collaborative – multidisciplinary / interdisciplinary / transdisciplinary-approach to formulate constructive arguments and rational analysis for achieving common goals and objectives.

GA4: Intra and Interpersonal skills

Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team; lead the team to guide people to the right destination, in a smooth and efficient way.

GA5: Digital literacy

Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

GA6: Global citizenship

Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

GA7: Social Competency

Ability to contemplate on the impact of research findings on conventional practices, and a clear understanding of responsibility towards societal needs, and reaching the targets for attaining inclusive and sustainable development.

GA8: Equity, Inclusiveness and Sustainability

Appreciate equity, inclusiveness and sustainability and diversity; acquire ethical and moral reasoning and values of unity, secularism and national integration to enable to act as dignified citizens; able to understand and appreciate diversity (caste, ethnicity, gender and marginalization), managing diversity and use of an inclusive approach to the extent possible.

GA9: Lifelong Learning

Ability to acquire knowledge and skills, including learning how to gain knowledge, that are

necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of workplace through knowledge / skill development/ reskilling.

Programme Outcomes (PO)

PO1: Critical thinking and Analytical reasoning

Capability to analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories to develop knowledge and understanding; critical sensibility to lived experiences, with self-awareness and reflexivity of both the self and the society.

PO2: Scientific reasoning and Problem solving

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO3: Multi-disciplinary/interdisciplinary/transdisciplinary Approach

Acquire interdisciplinary/multidisciplinary/transdisciplinary knowledge base, as a result of the learning they engage within their programme of study; develop a collaborative-multidisciplinary/interdisciplinary/transdisciplinary-approach to formulate constructive arguments and rational analysis for achieving common goals and objectives.

PO4: Communication Skills

Ability to express thoughts and ideas effectively in writing and in speech; communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO5: Leadership Skills

Ability to work effectively and lead respectfully with diverse teams; setting direction, formulating an inspiring vision, building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO6: Social Consciousness and Responsibility

Ability to contemplate on the impact of research findings on conventional practices, and a clear understanding of responsibility towards societal needs and reaching the targets for attaining inclusive and sustainable development.

PO7: Equity, Inclusiveness and Sustainability

Appreciate equity, inclusiveness and sustainability and diversity; acquire ethical and moral reasoning and values of unity, secularism and national integration to enable to act as dignified citizens; able to understand and appreciate diversity (caste, ethnicity, gender and marginalization), managing diversity and use of an inclusive approach to the extent possible.

PO8: Moral and Ethical Reasoning

Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour.

PO9: Networking and Collaboration

Acquire skills to be able to collaborate and network with educational institutions, research organisations and industrial units in India and abroad.

PO10: Lifelong Learning

Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of workplace through knowledge/skill development/reskilling

Syllabus Index

Name of the Major: **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
24SACZOO1DA101 (MAJOR) 24SACZOO1DB101 (MINOR)	Introduction to Zoology	DSC A	**4**	**5**	**3**	**---**	**2**	**---**
24SACZOO1MD101	Ornamental Fish Farming and Aquarium Keeping	MDC	**3**	**4**	**2**	**----**	**2**	**----**

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
24SACZOO2DA101 (MAJOR) 24SACZOO2DB101 (MINOR)	Environmental Biology	DSC A	**4**	**5**	**3**	**---**	**2**	**---**
24SACZOO2MD101	Pet Care and Management	MDC	**3**	**4**	**2**	**---**	**2**	**----**

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
24SACZOO3DA201	Protistan Diversity and Animal Diversity Non Chordata- I		DSC A	**4**	**5**	**3**	---	**2**	---
24SACZOO3DA202	Animal Diversity Non Chordata- II		DSC A	**4**	**5**	**3**	---	**2**	----
24SACZOO3DE201	Ethology	Any 1	DSE	**4**	**4**	**4**	---	---	--
24SACZOO3DE202	Value Added Products of Animals								
24SACZOO3DB201	Applied Zoology		DSC B	**4**	**5**	**3**	---	**2**	---
24SACZOO3MD201	Human Diseases and Their Management		MDC	**3**	**3**	**3**	---	---	---
24SACZOO3VA201	Science of Happiness & Human Rights		VAC	**3**	**3**	**3**	---	---	---

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
24SACZOO4DA201	Animal Diversity Chordata-I		DSC A	**4**	**5**	**3**	--	**2**	--
24SACZOO4DA202	Biological Chemistry		DSC A	**4**	**5**	**3**	---	**2**	---
24SACZOO4DE201	General Toxicology	Any 1	DSE	**4**	**4**	**4**	--	---	--
24SACZOO4DE202	Health, Nutrition and Wellness								
24SACZOO4DB201	Functional Zoology		DSC B	**4**	**5**	**3**	---	**2**	--
24SACZOO4SE201	Emergency Life Support and First Aid		SEC	**3**	**3**	**3**	--	---	--
24SACZOO4VA201	Comprehensive Fitness		VAC	**3**	**3**	**3**	--	---	--
	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
24SACZOO5DA301	Animal Diversity Chordata -II		DSC	**4**	**5**	**3**	**---**	**2**	**---**
24SACZOO5DA302	Cell Biology and Molecular Biology		DSC	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO5DA303	Fundamentals of Genetics		DSC	**4**	**4**	**4**	**---**	**--**	**----**
24SACZOO5DE301	Biotechnology - Principles and Practices		DSE	**4**	**4**	**4**	**---**	**---**	**---**
24SACZOO5DE302	Wildlife Management	Any 1	DSE	**4**	**4**	**4**	**---**	**---**	**---**
24SACZOO5DE303	Climate Change and Disaster Risk Reduction								
24SACZOO5SE301	Food and Water Quality Management		SEC	**3**	**3**	**3**	**---**	**---**	**----**

Semester: 6

Course Code	Title of the Course		Type of Course DSC/ MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
						L	T	P	O
24SACZOO6DA301	Microbiology and Basic Immunology		DSC	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO6DA302	Physiology and Endocrinology		DSC	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO6DE301	Reproductive Biology and Teratology		DSE	**4**	**5**	**3**	**---**	**2**	**---**
24SACZOO6DE302	Zoogeography and Evolutionary Biology	Any 1	DSE	**4**	**4**	**4**	**---**	**---**	
24SACZOO6DE303	Fundamentals of Parasitology								
24SACZOO6SE301	Responsible Tourism		SEC	**3**	**3**				
24SACZOO6DA301	Reproductive Health and Sex Education		VAC	**3**	**3**				

Semester: 7

Course Code	Title of the Course		Type of Course DSC, DCC, MDC, SEC	Credit	Hours / week	Hour Distribution /week			
						L	T	P	O
24SACZOO7CC401	Biophysics, Instrumentation and Diagnostic Imaging Techniques		DCC	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO7CC402	Biostatistics and Research Methodology		DCC	**4**	**4**	**4**	**---**	**--**	**---**
24SACZOO7CC403	Advanced Genetics		DCC	**4**	**4**	**4**	**---**	**--**	**---**
24SACZOO7DE401	Economic Entomology	Any 1	DCE	**4**	**4**	**4**	**---**	**---**	**----**
24SACZOO7DE402	Aquafarming								
24SACZOO7DE403	Estuarine Ecology and Planktonology								
24SACZOO7DE404	LiveStock and Poultry Management		DCE	**4**	**4**	**4**	**---**	**---**	**----**
24SACZOO7DE405	Solid Waste Management		DCE	**4**	**4**	**4**	**---**	**---**	**----**

Semester: 8

Course Code	Title of the Course	Type of Course DSC, DCC, MDC, SEC	Credit	Hours / week	Hour Distribution /week			
					L	T	P	O
24SACZOO8CC401	Advanced Immunology	DCC	**4**	**5**	**3**	**---**	**2**	**---**
24SACZOO8CC402	Animal Systematics	DCC	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO8DE401	Pandemic Science	Any 1 DCE	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO8DE402	Developmental Biology							
24SACZOO8DE403	Advanced Toxicology							
24SACZOO8DE405	Aquatic Biology	Any 1 DCE	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO8DE406	Fishing and Fish Processing Technologies							
24SACZOO8DE407	Applied Microbiology							
24SACZOO8DE408	Biological Specimen Preparation Techniques	Any 1 DCE	**4**	**5**	**3**	**---**	**2**	**----**
24SACZOO8DE409	Bioinformatics and Computational Biology							
24SACZOO8PR401	Project		**12**					

Semester- I

Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**INTRODUCTION TO ZOOLOGY**					
Type of course	**DSC A**					
Course Code	**24SACZOO1DA101(MAJOR) / 24SACZOO1DB101 (MINOR)**					
Course Level	**100**					
Course Summary	The course includes several marvellous facts about the animal world which can foster a sense of interest¸ connection, empathy and caring towards the animals. They feel responsible and enthusiastic to learn more about the animal world.					
Semester	I	Credits			4	Total Hours Lecture
Course Details	Learning Approach	Lecture	Tutorial	Practical	Learning Approach	
		3	---	1		3
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify the wonders of the animal world and the facts behind the phenomena.	U	2,3
2	Explain Coloration, Mimicry & Parental care.	U	2,3
3	Discover the research avenues & career opportunities in Zoology	U	2,3
4	Predict the Entrepreneurial Possibilities in the field of Zoology	E	1,2,3
5.	Prepare detailed report of field visits to environmentally important places¸ research institutions and career orientation centers	A	2,3

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Wonders of Animal world**	**15**	
	1.1	**Incredible Animal Architects** Introduction to Animal Societies	7	1
	1.2	Honeybees – Skilled Engineers of Nature Comb building in Honey bees		
	1.3	Architectural secret of Termite hills		
	1.4	Weaver Bird-Wonderful Architect		
	1.5	**Glowing Wonders** Bioluminescence – Mechanism Noctiluca – Sparkle of the sea Firefly- Stars on earth Octopus – Wild Glowing Wonder Angler fish – the glowing monster	8	1
	1.6	Story of Pearl , Types of Pearl, Pearl Formation, Process of Picking best Pearl		
2		**Coloration, Mimicry & parental care**	15	
	2.1	**Coloration & Mimicry** Fakers of Nature- Secret behind Coloration & Mimicry Beautiful Butterflies, Colourful Earthworms, Painted Starfish Blue beauty Frog , Lovely Chameleon , Handsome Peacock Magnificent Owl Butterfly Leaf insect – The Walking leaves	7	2

	2.2	P**arental care** Animal Parenting – Facts & examples Who will take care? Father or Mother. Mother – Velvet Spider - Epitome of sacrifice Father – Water bug - Model father Pregnant Father – Sea Horse Father Brooder – Male Darwin frog. Sophisticated parents – Python parenting Supermom – Humming Bird Aggressive Mother – Otter	8	
3		**Major Research Areas & Careers in Zoology**	15	
	3.1	**Exciting avenues for research** Bioinformatics, Molecular biology, Biostatistics, Wildlife Biology, Toxicology & Pharmacology, Forensic biology, Physiology, Genetics, Microbiology, Immunology, Developmental Biology, Ethology, Biotechnology, Environmental Biology, Animal Systematics, Marine biology Fisheries, Cell biology, Entomology, Biochemistry, Parasitology, **brief description only**	5	3
	3.2	**Attractive career opportunities** **General**- All general UPSC jobs especially IFS (Indian Forest Service), Kerala PSC (all general degree based jobs), jobs in Kerala Forest and wildlife department (Range Forest Officer and Beat Forest officer),Scientists, Research assistants, Lab technicians, Animal house keepers in reputed research centers like ZSI, CSIR, ICAR, RGCB, KFRI, NCBS TIFR, SACON, BARC, ICZN etc. Jobs in NGOs like WWF, ATREE, Wildlife SOS, Wildlife Trust of India, Center for Wildlife Studies, Nature Conservation Foundations etc. **Specific**- Entomologist in Vector control board and in research institutes like KFRI; Teaching; Biologist and Curato		

		in Museum and Zoological Parks; Fisheries officer in Fisheries department, Junior scientific assistant in pollution control board, District Malaria Officer, forensic assistant in police department and health department; ecologist, conservation biologist and nature education officers in various wildlife sanctuaries and protected areas; jobs in Pharmaceutical companies. Embryologist, Cytological specimen preparation, Cytogeneticist in diagnostic labs and hospitals. Medical coding		
	3.3	**Lucrative Entrepreneurial Possibilities** Products, byproducts & value added products of: Apiculture, Sericulture, Dairy Farming, Poultry Farming, Pets and their management, Aqua culture (Edible and ornamental) and Vermiculture		
		Practical	**0**	
3		**Major Research Areas & Careers in Zoology**	15	
	3.1	**Exciting avenues for research** Bioinformatics, Molecular biology, Biostatistics, Wildlife Biology, Toxicology & Pharmacology, Forensic biology, Physiology, Genetics, Microbiology, Immunology, Developmental Biology, Ethology, Biotechnology, Environmental Biology, Animal Systematics, Marine biology Fisheries, Cell biology, Entomology, Biochemistry, Parasitology, **brief description only**	5	3
4	4.1	Identification of any 10 specimens coming under the following categories 1. Animal architects, 2. Glowing animals, 3. Animal mimicry 4 Animal coloration, 5. Parental care.		
	4.2	Search wonders of animal world and make short		

		videos/reports/photos: 1. Animal architects, 2. Glowing animals, 3. Animal mimicry, 4 Animal coloration, 5. Parental care.		
	4.3	1. Field visit - Nature camp, butterfly garden, museum, pearl culture farm.(any 2) 2. Visit to any 2 research institutes 3. Visit and interact with any two entrepreneurs from different fields and submit the report 4. Career Orientation class by experts	17	
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, group interaction, seminar, presentations **Note:** Only a brief description of the focal topic is required. Teaching aids like photographs, models, videos,short films, documentaries related to the topic may be used
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks)** **Duration- 1 hrs**

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SUGGESTED READING

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Department of Zoology
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Programme	**ZOOLOGY - MDC**					
Course Name	**ORNAMENTAL FISH FARMING AND AQUARIUM KEEPING**					
Type of course	**MDC**					
Course Code	**24SACZOO1MD101**					
Course Level	**100**					
Course Summary	The course 'Ornamental fish breeding, culture and aquarium keeping' provides a comprehensive understanding of the varieties of ornamental fishes, management aspects of ornamental fish farming, fish transportation, breeding and rearing of ornamental fishes and construction and maintenance of aquarium.					
Semester	I	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	--	1	--	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify various commercially important freshwater ornamental fishes, aquarium accessories, aquarium fish diseases.	U, An, A	1
2	Understand and apply fish transportation techniques while transporting brooders and fish seeds.	U, A	1
3	Employ skills for breeding and rearing of egg-layers and live bearers and aquarium setting.	A, S	1
4	Apply the knowledge in aquascaping, water quality management and feed administration.	A	10

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Ornamental fish farming- Management aspects**	**15**	
	1.1	Introduction to ornamental fish farming**.** Common freshwater ornamental fishes; Live bearers (Guppy, Platy, Molly, Sword tail), Egg layers (Varieties of Goldfish, Gourami, *Betta*, Tetra, Angel Fish, *Puntius* sp.).	2	1
	1.2	Study of Two examples each of Indigenous, Endemic and Exotic ornamental fishes of Kerala	2	1
	1.3	**Food and feeding**: Nutritional requirements of fishes. Types of Feed: Dry feeds, Non -Dry feeds (Moist feeds, Wet or paste feeds), Feeds for colour enhancement. Live feed and live feed culture. Preparation and composition of formulated fish feeds. Feeding rate and management.	4	1, 5
	1.4	**Water quality management** (pH, hardness, salinity, oxygen, carbon dioxide, chlorine, ammonia, nitrites, temperature); Water filtration systems – biological, physical; types of filters. Aerators, Aquarium Plants.	3	5
	1.5	**Common diseases of aquarium fishes** Parasitic (protistan, helminthic, arthropodan), microbial (Bacterial, Fungal, Viral) (Any two from parasitic and microbial) and nutritional deficiency diseases.	3	3
	1.6	Conditioning, packing, transport and quarantine methods.	1	2
2		**Breeding and rearing of ornamental fishes & Construction and maintenance of aquarium**	**15**	

	2.1	Breeding of Live bearers (Guppy, Molly, Sword tail) and Egg layers (Gold Fish, Gourami, *Betta*).-any one from each group. Sex identification, brooder selection and conditioning, induced spawning, hatching and rearing of frys.	10	3
	2.2	Types of aquaria, Setting up of a freshwater aquarium. **ACTIVITY:** Visit ornamental fish farm & submit a report	5	3,4
3		**Practicals**	**30**	
	1	Identification of aquarium fishes-Egg layers and live bearers, both indigenous, exotic and endemic.		1,3, 4
	2	Identification of fish diseases - symptom, causative organism and control measures.		
	3	Study of aquarium accessories		
	4	Determination of pH of water sample		
	5	Demonstration of construction and setting up of an aquarium		
	6	Study of breeding behaviour of any one ornamental fish.		
	7	Identification of live fish feeds and culturing of any one.		
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Demonstration, ICT Enabled learning, Experiential Learning Tutorial
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA):** **Theory Total - 15 Marks** Submission of report on ornamental fish farm visit, Test paper, Viva, Seminar **Practical Total - 10 Marks** Lab performance/Record/Lab test

	B. End Semester Examination **Theory Total = 35 Marks; Duration - 1 hr** Multiple Choice Questions -1 x 15 = 15 marks Short Essays - 4 out of 6, 4 x 5 =20 marks **Practicals Total = 15 Marks – (Record 3 marks, Viva 2 marks, Skill 10 marks) Duration - 1 hr**

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Semester- II

Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**ENVIRONMENTAL BIOLOGY**					
Type of Course	**DSC A**					
Course Code	**24SACZOO2DA101 (MAJOR)/ 24SACZOO2DB101 (MINOR)**					
Course Level	**100**					
Course Summary	This comprehensive course covers the fundamental principles of ecosystems, populations, and communities, emphasizing biodiversity & its threats. It explores biogeochemical cycles, renewable and non-renewable resources, and ecological interactions. The module on biodiversity delves into its types, significance, and threats, including climate change & habitat destruction. Conservation efforts, both international & national, are detailed, along with key environmental laws. It concludes with a focus on managing environmental issues, addressing solid waste, watershed management, carbon-related concepts, and eco friendly initiatives.					
Semester	**II**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1.	Explain the dynamics of Ecosystem and renewable resources.	A	1,2, 7
2.	Describe the attributes of Population, community and animal interaction.	U	1,2, 7
3.	Distinguish concepts of biodiversity, threats to biodiversity and measures to conserve Biodiversity.	A	1,2,6,7

4.	Employ strategies to manage environmental issues.	A	1,2,6,7
5.	Administer experiments in Environmental Biology.	A	2,6,10
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Dynamics of Ecosystem**	**10**	
	1.1	Introduction to Environmental Biology; Scope and History.	1	1
	1.2	**Basic concept and structure of ecosystem**: Definition; Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers)	2	1,2
	1.3	**Functions of ecosystem**: Productivity-Food chain Food web- Energy flow-Laws of Thermodynamics	2	1
	1.4	**Types of Ecosystem**: **Terrestria**l (Forest-Grassland Desert) and **Aquatic**-(Marine, Fresh water, Wetland); Biome; Ecological pyramids (number, biomass, energy)	2	1,2
	1.5	**Biogeochemical cycles:** Concept, gaseous (Carbon cycle, Nitrogen cycle) and sedimentary cycles (phosphorous cycle).	1	1,3
	1.6	**Renewable resources (**solar, wind, wave, hydroelectric, biomass and geothermal) **and Non renewable resources** (mineral and metal ore, fossil fuels)	2	1,3
2		**Population and Community**	**8**	
	2.1	**Concept of population**: Population attributes Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves.	1	2,3
	2.2	**Animal interactions**: **Positive**- Commensalism Mutualism-Proto-cooperation, **Negative**-Predation Parasitism-Competition-Antibiosis.	3	2,3

	2.3	**Characteristics of a community**: Species diversity richness, evenness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Flagship species¸Umbrella species. Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax.	4	2,3
3		**Biodiversity Conservation and Disaster Management**	**27**	
	3.1	**Introduction to Biodiversity:** Types of biodiversity Alpha, Beta and Gamma diversity. **Concept and importance of Biodiversity**: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity (in brief); Biodiversity indices (Shannon-Wiener index, Simpson's index); Basic sampling techniques (Quadrat and Transect methods). **Significance of Biodiversity** - Ecosystem productivity (Ecosystem services, Biological resources, Social benefits), Ecosystem stability; India as a mega-diversity nation, Biodiversity hotspots. **Threats to Biodiversity:** 1. Climate change and global warming (details of greenhouse effect and Ozone depletion to be included here), 2. Habitat destruction, 3.Pollution (air, water, noise and plastic pollution) - causes, effects and control measures in brief, Invasive species, Over-exploitation of natural resources.	7	1,2, 3
	3.2	**Conservation of Biodiversity** **Protected area concept:** Wildlife Sanctuary, National Park, Biosphere Reserve, Conservation Reserve, Community Reserve	1	3,4
	3.3	**International Efforts in Biodiversity Conservation**: WWF, Convention on Biological Diversity (CBD), International Union for the Conservation of Nature and Natural Resources (IUCN), United Nations Environment Program-World Conservation Monitoring Centre (UNEP-WCMC), Red Data Book, Green Data Book, Blue Data Book; IUCN's Post 2020 Global Biodiversity Framework (GBF) Strategy Initiative, UN's Sustainable Developmental Goal 15 of 2030 Agenda. Overview of	3	4

		G20 Summit 2023 in terms of Biodiversity Conservation and Sustainable development .		
	3.4	**National level initiatives** National Biodiversity Strategy and Action Plan; People's Biodiversity Register. **Regional level initiatives**: The Chipko movement, Narmada Bachao Andolan, The Silent Valley Episode.	4	4
	3.5	**Environmental disasters:** Natural disasters (Earthquakes, Cyclones, Floods, Tsunamis and Landslides) and Man-made disasters-case studies (Global level- Chernobyl nuclear power plant explosion, National level - Bhopal gas tragedy and Regional level- Endosulfan issue). PRRP for disaster management.	5	2,3
	3.5	**Environmental disasters:** Natural disasters (Earthquakes, Cyclones, Floods, Tsunamis and Landslides) and Man-made disasters-case studies (Global level- Chernobyl nuclear power plant explosion, National level - Bhopal gas tragedy and Regional level- Endosulfan issue). PRRP for disaster management.	5	2,3
	3.6	**Management oF Environmental Issues**	7	3,5
		Solid Waste Management; Watershed Management; Rainwater Harvesting; **International agreements:** Montreal Protocol, Kyoto Protocol, Inter-government Panel on Climate Change (IPCC), Overview of UN Climate Change Conferences (COP 2023 to be included); Ramsar Convention. Carbon Credit; Carbon Trading (Emission trading); Carbon Sequestration; Carbon Footprint; Ecological Footprint **Environmental Laws (Brief accounts only):** The Wildlife Protection Act, 1972; The Water (Prevention		

		and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act,1981; Indian Forest Act (Revised) 1982; The Environment Protection Act, 1986; The Biodiversity Act, 2002; National Green Tribunal Act, 2010; Environment (Protection) Amendment Rule, 2022.		
4		**Practicals**	**30**	
	1.	Estimation of Dissolved Oxygen.	2	4, 5
	2.	Estimation of Carbon-di-oxide	2	
	3.	Analyze the pH and texture (sandy/silty/clayey) of any 2 soil samples.	2	
	4.	Preparation of Temporary mount of any one plankton	2	
	5.	Counting of plankton using plankton counting chamber	2	
	6	Spotters:Plankton counting chamber, Secchi disc & Plankton net	2	
	7.	Individual visit to any polluted site and preparation of a detailed report (it should include observation and remedial measures)	8	
	8.	Present a report on the environmental challenges identified in your Locality and its mitigation measures.(group project of 5 members each)	8	
	9.	Identify five influential personalities (from India) who have contributed towards the conservation of the environment and comment on their contributions (eg. Vandana Shiva,Sundarlal Bahuguna, ,Daya Bhai, Sugathakumari, M.K.Prasad, Prof.Sitaraman, Sankaranarayana, Kallen Pokkudan)	2	
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Field Visit to Ecologically significant areas
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) Zoology**					
Course Name	**PET CARE AND MANAGEMENT**					
Type of course	**MDC**					
Course Code	**24SACZOO2MD101**					
Course Level	**100**					
Course Summary	Pet care and management course provides a sound introduction to caring for a wide variety of different pets including dogs, cats, birds and some other pets like rabbits, and rodents. This course covers the aspects like diets & nutrition, breeding health and hygiene, care of litters and young animals and more. Pet Care is designed as an introductory course for those seeking to work with animals in positions such as vet nurses, animal welfare and animal rescue.					
Semester	**II**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	**---**	**1**	**----**	**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the legal and safety measures in keeping pets	***K***	1
2	Explain different breeds of dog¸cat and bird, pet nutrition¸ grooming¸ reproductive biology & healthcare management.	***U***	2
3	Apply management techniques of pet care in starting and running a pet-related business, marketing, and customer service.	E	1
4	Identify different breeds of pets and pet diseases.	K	7

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Pet care sector -- Legal and safety measures**	**9**	
	1.1	**Introduction to Pet animals** – Relevance of Pet animals – for leisure, revenue. Common pet animals. Cat, dog, birds, rabbits, hamsters, guinea pigs.	2	1
	1.2	Career Opportunities Associated with pet Animals Pet breeding & marketing & pet food business.	1	1, 2
	1.3	Laws (animal & bird act regulations) & licenses	2	6
	1.4	Animal charities & societies - Animal Welfare Board of India:(AWBI); 'National Institute of Animal Welfare' (NIAW); NGOs - Federation of Indian Animal Protection organisations (FIAPO); 'Blue Cross of India'- Chennai (BCI-Chennai) 'People for Ethical Treatment of Animals'- India (PETA'-India)	2	6
	1.5	Zoonotic diseases (rabies, capnocytophagosis, Swine flu, avian flu, toxoplasmosis and ecto-parasitic infections)	2	5
2		**Pet Cats, Dogs, birds and their care**	**21**	
	2.1	**Common cat breeds for Indian climate** - Small cat breeds (Bombay cat, Siamese cat & Oriental Shorthair) Large cat breeds (Persian Cats, Bengal Cat, & British Shorthair)	2	1
	2.2	**General Habits, nutrition and feeding, breeding and management** of Pet cats. Newborn Kittens - Behaviour and grooming. Feed and nutrition.	3	2
	2.3	**Common diseases** of cats-their diagnosis, treatment and control. Care for a sick cat. Cattery design and management.	3	7
	2.4	**Common dog breeds -** Labrador, German Shepherd, Pug, Beagle, Indian Spitz & Doberman. Selection of dog	3	7

		breeds - Purebred and mix-breeds. Behaviour and Grooming. General habits, Feeding and nutrition. Detection of oestrus and Breeding of dogs. Desexing.		
	2.5	**Common diseases** Microbial, parasitic, fungal and nutritional deficiency disorders. Clinical manifestations, diagnosis, treatment and control. Vaccination/ deworming schedules.	3	7
	2.6	**Pet Birds : Selection of Breeds** (eg. Canaries, Finches, Budgerigars, Small Parrots)	2	1,2
	2.7	**Sexing, Desexing, Containment (Aviaries –** selection, design, size, management). Feed and Feeding methods, Grooming (Wing trim, Beak Trim, Nail Trim), Hygiene	3	2
	2.8	**Common diseases -** diagnosis, treatment and control. Caring for the Sick Bird, Supportive therapy.	2	7
		Practicals	**30**	
	1	Breed identification – dog¸cat and bird.	6	3,4
	2	Identification of ecto & endoparasites of dog¸cat and bird	3	
	3	Composition of balanced diet for the pets; dog, cat & bird.	3	
	4	Visit to near by Veterinary hospital & report submission on different pet diseases	6	
	5	Collaborate with veterinarians to organize joint workshops or informational sessions, combining medical advice with practical care tips.	6	
	6	Analyse incidence of different diseases on specific pets and submit the report (any two pets).	6	
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** 1. Lecture, Videos 2. Demonstrations: Conduct live demonstrations, either in person or through videos, showcasing proper grooming techniques, training methods, or other aspects of pet care.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA):** **Theory Total - 15 Marks** Submission of report on ornamental fish farm visit, Test paper, Viva, Seminar **Practical Total - 10 Marks** Lab performance/Record/Lab test
	B. End Semester Examination **Theory Total = 35 Marks; Duration - 1 hr** Multiple Choice Questions -1 x 15 = 15 marks Short Essays - 4 out of 6, 4 x 5 =20 marks **Practicals Total = 15 Marks – (Record 3 marks, Viva 2 marks, Skill 10 marks) Duration - 1 hr**

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Semester- III

Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) ZOOLOGY**
Course Name	**PROTISTAN DIVERSITY AND ANIMAL DIVERSITY - NON CHORDATA- I**
Type of Course	**DSC A**
Course Code	**24SACZOO3DA201**
Course Level	**200**
Course Summary	This course aims to provide a thorough understanding of various animal phyla, including Kingdom Protista, Phylum Orthonectida, Phylum Placozoa, Phylum Coelenterata, Phylum Ctenophora, Phylum Platyhelminthes, Phylum Aschelminthes and Phylum Annelida. The course structure focuses on the key features, classification, and special characteristics of representative examples within each phylum. Additionally, it explores topics such as economic importance, unique features, and adaptations. The course places a strong emphasis on practical knowledge in the area of invertebrate zoology, with a particular focus on developing students' hands-on skills, observational abilities, and collaborative work.

Semester	**III**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	**-**	**1**	**----**	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Classify the Kingdom Protista, Phylum - Orthonectida, Placozoa, Coelenterata, Ctenophora, Platyhelminthes, Aschelminthes and Annelida.	**U**	**1**
2	Compare salient features of different phyla from Orthonectida to Annelida.	**U**	**1**

3	Describe the canal systems in Sponges¸ Parasitic Protists¸ Life cycle of *Plasmodium*¸ Coral and coral reefs and its conservation¸ Polymorphism in Coelenterates¸ Pathogenic nematodes in man.	**U**	**1**
4	Distinguish different parasitic/pathogenic Protists¸ Platyhelminthes, Nematodes and Annelids	**U**	**2**
	Practical		
1	Identification of specimens from Protista¸ Porifera¸ Cnidaria¸Platyhelminthes¸ Nematoda & Annelida	**U**	**1**
2	Apply culture techniques of protists and prepare temporary whole mounts of specimens	**A**	**1, 2**
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Kingdom Protista**	**15**	
	1.1	Kingdoms of classification: Two-kingdom, Three Kingdom, Five kingdom and Eight kingdom classifications, Levels of animal organization. (Mention only)	1	1
	1.2	**Animal -like protists** 1. Phylum Rhizopoda Eg.: *Amoeba* 2. Phylum Actinopoda Eg.: *Actinophrys* 3. Phylum Foraminifera Eg.: *Elphidium* 4. Phylum Ciliophora Eg.: *Balantidium* 5. Phylum Opalinata Eg.: *Opalina* 6. Phylum Kinetoplasta Eg.: *Trypanosoma* 7. Phylum Metamonada Eg.: *Giardia* 8. Phylum Choanoflagellata Eg.: *Proterospongia* 9. Phylum Parabasalia Eg.: *Trychonympha*	7	1

		10. Phylum Sporozoa Eg.: *Toxoplasma* **Plant -like protists** 11. Phylum Euglenophyta Eg. : *Euglena* 12. Phylum Cryptophyta Eg. : *Cryptomonas* 13. Phylum Bacillariophyta Eg.: Diatoms 14. Phylum Chlorophyta Eg.: *Volvox* 15. Phylum Rhodophyta Eg. : Red Algae 16. Phylum Dinoflagellata Eg. :*Noctiluca* **Fungus -like protists** 17. Phylum Mycetozoa Eg.: Slime moulds 18. Phylum Microsporidia Eg.: *Nosema* (Brief description only)		
	1.3	**Type: - *Paramecium* –** Morphology (Mention - cyclosis, respiration, osmoregulation and excretion), asexual reproduction (Binary fission) and sexual reproduction (Conjugation). **General topics**: 1. Parasitic Protists (*Entamoeba* and *Leishmania*) 2. Lifecycle of *Plasmodium*	7	1
2		**Kingdom Animalia** **Classification, Phylum Porifera and Cnidaria**	**15**	
	2.1	**Basis of classification** Germ layers: diploblastic, and triploblastic Symmetry – Asymmetry, Spherical, Radial, Biradial and Bilateral Coelom – Acoelomates, Pseudocoelomates and Eucoelomates -Schizocoelom, Enterocoelom, Protostomia and Deuterostomia Metamerism Outline classification of Kingdom Animalia Three branches – Mesozoa, Parazoa and Eumetazoa **Mesozoa**: **Phylum Orthonectida** - Eg. *Rhopalura* **Parazoa**: **Phylum Placozoa** – Eg. *Trycoplax adherens*	5	1
	2.2	**Phylum Porifera** – Classification up to classes. Salient	4	1, 2

		features of phylum and classes. Class I – Calcarea Eg. *Sycon* Class II – Hexactinellida Eg. *Euplectella* Class III – Demospongia Eg. *Cliona* **General topic:** 1. Canal system in Sponges.		
	2.3	**Eumetazoa** **Phylum Cnidaria** Classification up to classes. Salient features of phylum and classes. Class I- Hydrozoa Eg. *Obelia* (Mention metagenesis) Class II- Scyphozoa Eg. *Rhizostoma* Class III- Anthozoa Eg. *Metridium* **General topics**: 1. Coral and coral reefs and its conservation. 2. Polymorphism in Coelenterates	5	1, 3
	2.4	**Phylum Ctenophora** - Salient features Eg. *Pleurobrachia*	1	1
3		**Phylum Platyhelminthes, Nematoda and Annelida**	**15**	
	3.1	**Phylum Platyhelminthes** – Classification up to classes. Salient features of phylum and classes. Class I- Turbellaria Eg. *Planaria* Class II- Trematoda Eg. *Fasciola hepatica* Class III- Cestoda Eg. *Taenia solium* **General topics**: 1. Life history of *Fasciola hepatica*. 2. Platyhelminth parasites of Man and Dog (*Schistosoma*, *Taenia solium*, *Echinococcus*)	5	1, 4
	3.2	**Phylum Nematoda** - Classification up to classes. Salient features of phylum and classes. Class- Phasmidia Eg. *Enterobius*, *Ascaris* Class - Aphasmidia Eg. *Trichinella*	5	1, 5

		General topics: Pathogenic nematodes in man. (*Wuchereria bancrofti*, *Ancylostoma duodenale*, *Enterobius vermicularis*, *Ascaris lumbricoides*)		
	3.3	Classification up to classes. Salient features of phylum and classes. Class I- Archiannelida Eg. *Polygordius* Class II -Polychaeta Eg. *Chaetopterus* Class III- Oligochaeta Eg. *Megascolex.* Class IV- Hirudinea Eg. *Hirudinaria* **General topic:** 1. Ecological and parasitic Adaptations with reference to the above examples.	5	1
4		**Practicals**	**30**	
		1. General identification and classification (Phylum, Class, Genus and Species) a) Protista (any 6) b) Porifera- 1 c) Cnidaria - 3 d) Platyhelminthes- 2 e) Nematoda – 1 f) Annelida – 2	10	1
		2. Identification of any four economically important parasitic protists (Slides/ photographs may be used)	2	1
		3. Identification of Protistans from pond water (any 2).	4	2
		4. Mounting of earthworm setae.	2	3
		5. Study of sections (Any Two) a. T.S. of *Hydra* b. T.S. of *Ascaris* c. T.S. of *Fasciola* d. T.S. of Earthworm	4	1
		6. Identification of larval stages. (Any two, Slides or photographs may be used) (miracidium, sporocyst, redia, cercaria, metacercaria)	4	1
		ACTIVITY 1. Poster making as a group project on parasitic protists infesting humans and presentation by a group representative	4	4
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Tutorial, ICT enabled learning, Group activity, Assignment, Seminar
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**ANIMAL DIVERSITY- NON CHORDATA II**					
Type of Course	**DSC A**					
Course Code	**24SACZOO3DA202**					
Course Level	**200**					
Course Summary	This course aims to provide a thorough understanding of various animal phyla, including Phylum Onychophora, Phylum Arthropoda, Phylum Mollusca, Phylum Echinodermata, Hemichordata, and Minor Phyla.					
Semester	**III**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Differentiate salient features of Phylum Onychophora, Arthropoda, Mollusca, Echinodermata, Hemichordata, and Minor Phyla.	An	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, S	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
4.	Sketch invertebrates scientifically.	A, S	1,2

5	Classify species belonging to the minor phyla and phylum Arthropoda, Mollusca, and Echinodermata.	An, S	1,2

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

COURSE CONTENT

Content for Classroom transaction (Units)

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

3		**Phylum Mollusca and Echinodermata**	**15**	
	3.1	**Phylum Mollusca** Classification up to classes. Salient features of phylum and classes. (Brief mention only) Class I- Aplacophora Eg. *Neomenia* Class II- Monoplacophora Eg. *Neopilina* Class III Amphineura Eg. *Chiton* Class IV Gastropoda Eg. *Aplysia* Class V Scaphopoda Eg. *Dentalium* Class VI Pelecypoda (Bivalvia) Eg. *Pinctada* Class VII Cephalopoda Eg. *Sepia* **General Topics** 1. Pearl culture 2. Edible molluscs	7	1, 2
	3.2	**Phylum Echinodermata** Classification up to classes. Salient features of phylum and classes. Class I- Asteroidea Eg. *Astropecten* Class II- Ophiuroidea Eg. *Ophiothrix* Class III- Echinoidea Eg. *Echinus* Class IV- Holothuroidea Eg. *Holothuria* Class V – Crinoidea Eg.*Antedon* **General Topics** 1. Water vascular system in Echinodermata	6	
	3.3	**Phylum Hemichordata** Salient features and affinities Eg. Balanoglossus	1	1,5
	3.4	**Minor Phyla** Salient features of 1. Phylum Chaetognatha Eg. *Sagitta* 2. Phylum Sipunculida Eg. *Sipunculus*	1	
		Practicals	**30**	
	1	**Scientific Drawing:** Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.	5	4

	2	General identification and classification (Phylum, Class, Genus and Species) a). Arthropoda - 6 b). Mollusca - 4 c). Echinodermata – 3 d) Minor Phyla – 2	2	5
	3	**Dissections** 1. Prawn - Nervous system 2. Cockroach - Nervous system	8	3
	4	**Mounting:-** 1. Prawn appendages. 2. Mouth parts - Cockroach/ Plant bug/ Mosquito. (Any Two)	6	3
		Taxonomic identification with key Identification of insects up to the level of order (Any Three).		
		Larval identification (Any Two). (Nauplius, Zoea, metazoea, Mysis)		
		Group activity on 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		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Tutorial, ICT enabled learning, Individual/Group activity, Assignment, Seminar
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report

	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**ETHOLOGY**					
Type of Course	**DSE**					
Course Code	**24SACZOO3DE201**					
Course Level	**200**					
Course Summary	This course is designed to unravel the intricate connections between animal behavior and cognitive processes and the fascinating dynamics of how organisms learn, evolve, and exhibit behavioral plasticity in response to their environment.					
Semester	**III**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	---	---	---	60
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the basics and advances in ethology.	U	1,2,6
2	Describe the role of neural plasticity in learning, memory and behavior.	U	1,2,3, 10
3	Analyze the different patterns & mechanisms of animal behavior.	An	1,2,4, 10

4	Distinguish the nature and characteristics of social behaviour.	U	1,2,3
5	Interpret different animal communications.	A	1,2,8, 10
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction to Ethology**	**3**	
	1.1	Historical background and Scope of ethology, Branches of Ethology, Significance of ethology during animal conservation., animal welfare and human society, Ethogram. Contributions of Pavlov, Frisch and Lorenz		1
2		**Learning, Memory and Neural mechanisms**	17	
	2.1	**Neurobiology and Neuroplasticity** Structure of brain-overview. Describe briefly Hypothalamus, Hippocampus and Amygdala; Learning centers in brain- Broca's areas, Wernicke's area and angular gyrus; Motor areas. Physiological changes during learning. Neural Mechanisms of Behavior	6	2
	2.2	**Motivation & Learning** Innate and learned behavior, motivation- learning model- Lorenz's Psycho-Hydraulic Model of Motivation Types of learning: Habituation, Sensitization, Associative learning – Classical Conditioning, Operant Conditioning, Taste Aversion, Cognitive learning Latent learning, Trial and error learning, Insight learning, Imitation, learning set learning, Imprinting, Instinct	9	2
	2.3	**Memory** Short term & long term memory., Consolidation of memory. Role of sleep in memory consolidation.	2	2
3		**Patterns & Mechanisms of Animal Behaviour**	**22**	

	3.1	**Reproductive behavior & Parental care** Reproductive strategies, Types of Mating systems, Sexual selection, Courtship behavior in invertebrates (Scorpion) & vertebrates (Stickle back fish), Parental care & investment. Influence of hormones on sexual behavior, maternal behavior and parental behavior.	7	1,3
	3.2	**Complex behavior** Orientation, Navigation, Migration (birds), Homing instinct, Hibernation, Aestivation, Biological rhythms – Circadian, Circannual, lunar periodicity, tidal rhythm, Biological clock, Physiological concepts of wakefulness and sleep. Physiological basis for emotionality and stress	9	1, 3
	3.3	**Defensive behavior and biomimicry** Camouflage, Cryptic coloration, Disruptive coloration, Aposematic coloration, Mimicry – Batesian, Mullerian and Aggressive Mimicry, Biomimicry.		, 3
4		**Social Behavior**	**8**	
	4.1	Socio – biology (brief account), Cost and benefits of group living, Group selection, Kin selection, Altruism, Reciprocal altruism, Alarm call		
	4.2	**Social organization** Territoriality- territory marking in animals, Aggressive behavior, Foraging behavior, Aggregation – schooling in fish. Social organization in insects (ants, honeybees), Mammals (Primates) Activity –Behavioral study/ behavioral conditioning of any one organism based on observation		
	4.3	**Animal Communication** Components of Communication, Types of Communication – Visual, Auditory, Olfactory, Tactile, Chemical – Pheromones, Types of pheromones, Pheromonal communication in ants and mammals. Bee Dance in honeybees.		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ICT Enabled Learning, Experiential learning, Tutorial, Lecturing,
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**VALUE ADDED PRODUCTS OF ANIMALS**					
Type of Course DSE	**VAC**					
Course Code	**24SACZOO3DE202**					
Course Level	**200**					
Course Summary	Makes students aware of processes to prevent the risk of spoilage of raw produce, gives an idea about a variety of convenient, ready to prepare and ready to eat products which can satisfy the need of the present-day consumers at reasonable price, enable those who are interested to process during period of excess production and reduced selling of fresh perishable livestock produce, for value addition to less perishable products, store them, and sell them later in greater quantities. Promote employment and entrepreneurship development.					
Semester	III	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	**--**	**--**		**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Describe products and value-added products of bee keeping.	U, S	1,2
2	Explain Fishery products, by-products and value-added products.	A, S	1,2
3	Explain Meat and Poultry Products	A, S	2,9.10
4	Describe testing and grading of raw milk, preparation of cultured milks and milk products.	U, S	1,2,9, 10

5	Deduce employment and entrepreneurship opportunities in value-added animal products.	An, S	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

Content for Classroom transaction (Units)

Module	Course description	Hrs	CO
1	**Products and value added products of bee keeping**	**15**	
	Honey – bee wax, bee venom – Honey Production, chemical composition – Economic importance of Honey bee wax. 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 their manufacture,		1,5
2	**Fishery products, by-products and value added products**	15	
	Fish protein concentrate, fish oils- fishliver 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 - Additives and classes of additives.		2,5
3	**Meat & Poultry Products**	15	
	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. 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.		3,5
4	**Milk Products**	15	

	Testing and grading of raw milk. Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined and flavoured milks. Preparation of cultured milks, cultures and their management, yoghurt, Dahi, Lassi and Srikhand. Milk products such as Cream, Butter, Peda, Paneer, Burfi, Ghee, Khoa, Cheese, rasagolla mix, condensed, evaporated, dried milk and baby food, Ice cream and Kulfi, butter milk, lactose and casein.		4,5
	ACTIVITY: 1. Assignment and submission of various preparations. 2. Survey or refer sources and list out other value-added products of animals. 3. Organizing of food fest. 4. Exhibition of value added products (any 2)		
	Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction):** Lectures, demonstrations using videos
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

REFERENCES

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**APPLIED ZOOLOGY**					
Type of Course DSC B	**DSC**					
Course Code	**24SACZOO3DB201**					
Course Level	**200**					
Course Summary	To understand experiential learning on the methodology of Poultry Farming, Dairy Farming, Aquaculture, Vermiculture And Entomology					
Course Code						
Semester	**III**	**Credits**			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	1	---	75
Pre- requisite, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Distinguish different breeds of cattle, poultry, duck, quail, and cultivable fish and shellfish species.	An, S	1,2, 3. 10
2	Explain common diseases of cattle, poultry, and fish.	A, S	1,2, 3,10
3	Identify economically important insects, castes of honey bees, bee products, pollen basket and cocoon.	R, S	1,2, 3,10
4	Explain different aquaculture methods as well as the management of dairy, quail, ducks, and poultry.	An, S	1,2, 3,10

5	Explain milk, milk by-products, Biogas production and test the purity of milk.	An, S	1,2, 3,10
Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Poultry and Dairy Farming**	**15**	
	1.1	**Poultry Farming** 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, 3, 4
	1.2	Husbandry of quail - Breeds in India, Advantages of quail rearing - Housing, feeding and management of quail.	2	1, 4
	1.3	Husbandry of ducks - Breeds in India, Advantages of duck rearing - Housing, feeding and management of ducks	2	1, 4
	1.4	**Dairy Farming** Importance, Scope and management of farm animals. Breeds of cattle, housing system, nutrition requirements. Importance of artificial insemination	3	1, 4
	1.5	Milk, milk by-products. Biogas production.	1	5
	1.6	Common Cattle diseases: Anthrax, Foot and Mouth disease, Rinderpest	2	3
2		**Economically Important Insects**	**15**	
	2.1	Useful Insects: Honey bee, silk worm, Black soldier fly. Apiculture	9	3
	2.2	Pests of paddy - *Leptocorisa acuta* (Rice bug)]; Pests of coconut - *Oryctes rhinoceros* (Rhinoceros beetle), Pests of stored products - *Sitophilus oryzae* (Rice weevil).	3	3

	2.3	Vectors of public health importance – Mosquitoes elephantiasis, malaria, chikun guinea, dengue, zika & Housefly – typhoid, dysentery	3	3
3		**Aquaculture**	**15**	
	3.1	Introduction & 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	4, 2
	3.3	Aquarium management: Setting up of an Aquarium.	3	4
		Practicals	**30**	
	4.1	Poultry breeds (picture identification)	6	1
	4.2	Cattle breeds (picture identification), Purity analysis of milk	8	1
	4.3	Study of Pests of paddy *Leptocorisa acuta* (Rice bug), Pests of coconut *Oryctes rhinoceros* (Rhinoceros beetle) Pests of stored products [*Sitophilus oryzae* (Rice weevil) through damaged plant parts /photographs. Identification different species and castes of honey bees and bee products. Identification of pollen basket using picture, photograph. Identification of Silk worm moth, cocoon. Identification of black soldier fly.	8	3
	4.4	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: *Fenneropenaeus indicus / F.monodon / Macrobrachium, Perna viridis / P. indicus*)	8	1
		ACTIVITY - Visit to any 2 units (Poultry, Dairy, Apiculture or Aquaculture) and submit report		4
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Tutorial, Videos, Visit to any 2 units (Poultry, Dairy, Vermiculture or Aquaculture).
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks)** **Duration- 1 hrs**

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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**HUMAN DISEASES & THEIR MANAGEMENT**					
Type of Course	**MDC**					
Course Code	**24SACZOO3MD201**					
Course Level	**200**					
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, the need for maintaining vectors below damage threshold levels.					
Semester	**III**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	---	---	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain the aetiology, 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 diseases spread by mosquito vectors.	U	1,2, 3

3	Differentiate the aetiology, 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.	An	1,2, 3
4	Explain the causes and types of cancer, the characteristics of cancer cells, and theories of carcinogenesis.	U	1,2, 3
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT Content for Classroom transaction (Units)

EVALUATION AND ASSESSMENT

Module	Units	Course description	Hrs	CO No.
1		**Infectious diseases**	**15**	
	1.1	Introduction, health:- Need for being healthy. Classification of diseases:- infectious and non - infectious	5	1, 2
	1.2	Infectious diseases :-Description of disease, etiology, symptoms, diagnosis, treatment and preventive measures required for 2 disease each from a category. Air borne (Covid 19, measles), water borne (typhoid, hepatitis A), food borne (Botulism, shigellosis), Microbial — bacterial (TB, whooping cough), viral, (Covid 19, chickenpox) fungal (Candidiasis, Aspergillosis), protozoan (Malaria, leishmaniasis), helminthic (Schistosomiasis, ascariasis) Mosquito the terrible vectors – Dengue, Zika, chikunguinea. Bats- Nipah Zoonotic diseases- plague, rabies	10	
2		**Non infectious diseases - 1**	**15**	
	2.1	Non infectious diseases ---Description of disease, etiology, symptoms, diagnosis, treatment and preventive measures required for 2 diseases each from a category. 1. Genetic disorders (autism, sickle cell anaemia, haemophilia) Life style diseases (Diabetes, obesity). 2. Nutritional Deficiency diseases- Kwashiorkar, Night Blindness, Hypovitaminosis, Pernicious Anaemia.	15	3, 4

3		**Non infectious diseases - 2**	**15**	
	3.1	Non infectious diseases 3. Disorders of blood vascular system (Atherosclerosis, myocardial infarction), disorders of immune system:-Immune deficiency disorders (AIDS, SCID), Autoimmune disorders (Rheumatoid arthritis, SLE), Allergy. Disorders of central nervous system (Parkinson's disease, Alzheimer's disease)	8	3, 4
	3.2	4. Cancer: causes, types, characteristics of cancer cells, theories of carcinogenesis	7	
4		**Teacher Specific module**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Presentation of report of the activity.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

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Department of Zoology
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**SCIENCE OF HAPPINESS & HUMAN RIGHTS**					
Type of Course	**VAC**					
Course Code	**24SACZOO3VA201**					
Course Level	**200**					
Course Summary	Helps the students to synthesize the insights developed by Human Development experts, Psychologists, Anthropologists towards the experience of happiness, to illustrate various factors that determine the subjective experience of happiness in a cross cultural context, to achieve a life-saving skill to cope with the stress. To develop the real sense of Human rights – its concepts & manifestations					
Semester	**III**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture		Tutorial Practical	Others	
		3	--	---	---	45
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify the factors contributing to happiness in the personal, familial and community life of an individual.	U	1,2,6
2	Describe different theories of Happiness.	U	1,2
3	Distinguish potential sources and consequences of stress.	An	1,5

4	Integrate individual approaches of Managing stress.	C	1,5
5	Explain the fundamental concepts of human rights, the human rights provisions stipulated in the Indian Constitution, and the UN's involvement in these areas.	A	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

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1.		**Science of Happiness**	**15**	
	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 Perspectives of happiness-Hedonic (Subjective Well being) Eudaimonic (Psychological well-being). Happiness pie-chart" of Lyubomirsky.	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
2		**Stress management**	**15**	

	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	
	2.3	**Individual approaches of Managing stress** a) implementing time management techniques - ✔making daily lists of activities to be accomplished; ✔prioritizing activities by importance and urgency; ✔scheduling activities according to the priorities set; and	7	
		✔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 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.		
		Human Rights	**15**	
	3.1	An Introduction to Human Rights, Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR, ICCPR, ICESCR. -Value dimensions of Human Rights	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	

	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 Prisoners- Science Technology and Human Rights National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.	5	
		ACTIVITY - Any two 1. Workshops/ Sessions for the actualization of innate creative potential-(Music, Drawing, Calligraphy, Dramatics) 2. Hands-on Happiness: Gardening, Cleaning, Cooking, etc. 3. Extending help and social service by visiting old age homes/hospitals/slum areas or any other disadvantaged groups. 4. Community surveys on the facilities promoting positive mental health practices such as Yoga and Meditation Centres, Recreation clubs, and Parks for youth and senior citizens 5. Survey on various factors that determine the subjective experience of happiness in various populations and its reporting, distributing questionnaires. 6. Collection of newspaper reports on Global Human rights violations. **(Any two)**		
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, presentations, videos
Assessment types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

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Semester- IV

Department of Zoology
St. Albert's College (Autonomous)
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**ANIMAL DIVERSITY - CHORDATA I**					
Type of Course	**DSC A**					
Course Code	**24SACZOO4DA201**					
Course Level	**200**					
Course Summary	The course gives an overall idea of the classification of chordates and highlights the differences between different classes of chordates up to Class Reptilia. It also sheds light on the evolutionary significance of certain animals, which form the connecting links between two groups. It also helps in the identification of poisonous and non-poisonous snakes. The course enables skill development in understanding the diversity, systematic position, and economic importance of chordates.					
Semester	**IV**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	----	1	---	75
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Classify Chordata up to class and Class amphibia and Reptilia up to order.	An	2
2	Examine the general characters of protochordates, agnatha, pisces, amphibia, and reptilia.	A	2
3	Describe fish migration, scales, parental care, and accessory respiratory organs.	U	2

4	Describe the different organ systems of frogs and the key characteristics of both poisonous and non-poisonous snakes.	U	2
5	Demonstrate expertise in the laboratory in mounting scales and identifying specimens.	A, S	2
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Classification of Chordata**	**13**	
	1.1	**Introduction** General Characters and outline **classification** of Chordata up to class	2	1,2
	1.2	**Protochordates**: General characters and Classification	1	1,2
	1.3	**Sub phylum: Urochordata** Class I Larvacea Eg. *Oikopleura* (mention paedogenesis and Oikopleuran house) Class II Ascidiacea Eg: *Ascidia* (Mention Retrogressive Metamorphosis) Class III Thaliacea Eg: *Doliolum*	4	1,2
	1.4	**Sub phylum: Cephalochordata** Example - *Amphioxus* (Structure and affinities)	3	1,2
	1.5	**Sub phylum: Vertebrata** General characters and Classification **Division 1– Agnatha** Class I Ostracodermi Eg: *Cephalaspis* Class II Cyclostomata Eg: *Petromyzon* **Division 2 – Gnathostomata**	3	1,2
2		**Superclass Pisces**	**13**	
	2.1	Super class Pisces General Characters and Classification	1	1,2
	2.2	**Class: Chondrichthyes** - General Characters Sub class – Elasmobranchii Eg: Shark Sub class - Holocephali Eg: *Chimaera*	2	1,2

	2.3	**Class: Osteichthyes** - General Characters Sub class – Choanichthyes Order 1 Crossopterigii (Coelocanths) Eg: *Latimeria* (Evolutionary Significance) Order 2 Dipnoi Eg: *Lepidosiren* Sub class: - Actinopterygii Super order 1. Chondrostei Eg: *Acipencer* Super order 2. Holostei Eg: *Amia* Super order 3. Teleostei Eg: Sardine	4	1,2
	2.4	**General topics** 1. Accessory respiratory organs in fishes. 2. Parental care in fishes. 3. Scales in fishes. 4. Migration in fishes	6	3
3		**Super class: Tetrapoda**	19	
	3.1	General characters	1	2
	3.2	**Class Amphibia** – General characters, Classification up to Orders. Mention the extinct orders. Order I Anura Eg: *Hyla* Order II Urodela Eg: *Ambystoma* (mention axolotl larva and Paedomorphosis /neoteny) Order III Apoda Eg: *Ichthyophis.* Mention Nasikabatrachus sahyadransis	3	1,2
	3.3	Class Amphibia - **Type Frog** (*Euphlyctis hexadactylus*	10	4
	3.4	**Class Reptilia** - General characters, Classification up to Orders Sub class I: Anapsida Order Chelonia Eg: *Chelone* Sub class II: Parapsida Eg: *Ichthyosaurus* Sub class III: Diapsida Order I Rhynchocephalia Eg: *Sphenodon* Order II Squamata Eg: *Chamaeleon* Order III. Crocodilia Eg:*Crocodylus* Sub class IV: Synapsida Eg: *Cynognathus*	2	1,2
	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	4

4		**Practicals**	**30**	
	1	**Scientific Drawing** Make scientific drawing of 3 locally available vertebrate specimens belonging to different Classes	3	5
	2	**Dissections** Frog: Photographs/diagrams/one dissected & 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 th & 1st Spinal nerve 5. Frog Sciatic Plexus 6. Frog Brain	6	
	3	Mounting of placoid scales; study of cycloid and ctenoid scales	4	
	4	**Osteology** Frog vertebrae - typical, atlas, 8th and 9th Pectoral and pelvic girdles of Frog Turtle/Tortoise - plastron and carapace	4	
		Study of sections. *Amphioxus* T. S. through pharynx/T.S. through intestine	1	
		Identification: **A**,**General identification;** Identify, classify and describe the following animals by their scientific names. Protochordata-1, Pisces-5, Amphibia-5, Reptilia- 5 **B. 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). **C.** Identification of different types of caudal fins	4 4 1	
		Group activity- Report presentation of homestead /campus biodiversity of Amphibia and Reptilia/ fish diversity of the locality	3	
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Videos, PPT, Field trips, Zoo Visit, Fish landing centre visit
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**BIOLOGICAL CHEMISTRY**					
Type of Course	**DSC A**					
Course Code	**24SACZOO4DA202**					
Course Level	**200**					
Course Summary	This course provides a comprehensive exploration of bioenergetics, enzymology, biomolecules and metabolism. Students will have a deep understanding of the chemical foundations of life.					
Semester	**IV**	Credits		4		Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre-requisites if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain how energy is released into high-energy compounds capable of driving biochemical reactions.	U	1
2	Describe the role of enzymes in catalyzing reactions.	U	2
3	Illustrate the structure and function of the chemical building blocks of life -carbohydrates, proteins, lipids, and nucleic acids	U	2
4	Explain the primary metabolic pathways that power cells and metabolic disorders.	U	2,3

5	Prepare standard solutions and test the presence or absence of biomolecules in various samples.	A, S	1,2
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description (Theory)	Hrs	CO No.
1		**Biomolecules**	**17**	
	1.1	**Carbohydrates:** Biological function. Classification Monosaccharides- Fischer 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 (examples). 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
2		**Enzymology**	9	
	2.1	**Enzyme Chemistry** Chemical nature of enzymes. Holoenzyme, Apoenzyme,	2	2

		Non-proteinaceous enzymes: ribozymes, DNA enzymes, Abzymes. Coenzyme, Cofactor. Classification (I.U.B. system).		
	2.2	**Enzyme Kinetics** Mode of action of enzymes- lowering of Activation energy, Michaelis-Menten Curve. Km and its significance. Factors affecting enzyme-catalysed reaction.	4	2
	2.3	**Enzyme Inhibition** Reversible inhibition (Mention competitive, uncompetitive and noncompetitive) (eg: methanol inhibition of ADH), irreversible inhibition (eg: Iodoacetate inhibition of SDH), and feedback enzyme inhibition (eg: citrate inhibition of glycolysis). Isoenzymes (eg: LDH) and Allosteric enzymes (eg: PFK-1).		
3.		**Bioenergetics** & **Metabolism** (structural details not expected)	**9**	
	3.1	Free energy changes, coupled reactions, redox reactions. High energy compounds.		
	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		
	3.3	**Amino acid** - Transamination, Deamination, Urea cycle		
	3.4	**Lipid** - Fatty acid activation, Carnitine Shuttle, and Beta Oxidation of fatty acids.		
	3.5	**Metabolic disorders**- Diabetes, Keto acidosis, Lactose intolerance, Hyperlipidemia, Atherosclerosis.		
4		**Practicals**	**0**	
		Calculation of Molarity and normality of solutions.		

		Preparation of standard solutions.		
		Study of the structure of Carbohydrates – Glucose and Fructose using Ball and stick model		
		Study of the structure of Nucleic acids- DNA, RNA and Protein using software tools		
		Qualitative analysis of Carbohydrates, Proteins and lipids		
		Qualitative analysis of Urease		
		Saponification test		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures and presentations Case studies, Visual aids- charts, animations etc. Interactive lectures, group discussions, Laboratory simulations, hands-on activities, Technology Integrating Laboratory Sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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5. https://www.abpischools.org.uk/topics/chemistry-of-life/the-importance-of chemistry-in-biology/
6. https://home.csulb.edu/~cohlberg/songbook.htm

Department of Zoology
St. Albert's College (Autonomous)
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**GENERAL TOXICOLOGY**					
Type of Course	**DSE**					
Course Code	**24SACZOO4DE201**					
Course Level	**200**					
Course Summary	Provides an overview of the principles and practices of toxicology, focusing on the adverse effects of chemicals on living organisms. Students will explore the fundamental concepts of toxicology, including the mechanisms of toxicity, routes of exposure, dose-response relationships, risk assessment, and regulatory aspects.					
Semester	IV	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1.	Distinguish different toxicants, their impacts on human health and environment and the principles of toxicity evaluation	E	1,2,6, 8, 10
2	Describe the toxicants of biological origin and various food additives & their impacts.	U	1,2,10
3	Analyze the toxicity of various products used in day today life.	A	1,2, 6
4	Identify the branches of Applied Toxicology	U	1,2,10

5	Identify the occupational hazards, occupational diseases and their control measures	U	1,2,6, 10
Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Basic Concept of Toxicology**	**18**	
	1.1	Introduction of toxicology, history of toxicology, definition of toxicology, definition of poison, definition of toxicity and classification of toxicants occurrence/source. Mode of action of toxic agents.	9	1
	1.2	**Evaluation of toxicity** Principles, Acute, sub-acute and chronic assays LD50, LC50, NOEL. Maintenance and general handling of animals for toxicological laboratories.	3	1
	1.3	Toxicants of biological origin:- aflatoxin, botulinum toxin	3	2
	1.4	Food additives	3	2
2		**Xenobiotics**	**17**	
	2.1	Introduction, Importance of xenobiotics concerned to Human health, absorption of xenobiotics, distribution of xenobiotics, accumulation of xenobiotics, elimination, biotransformation and excretion.	3	3
	2.2	Adverse effects of xenobiotics through Biological Magnification and Biotransformation, mechanism of Xenobiotic Translocation, Membrane permeability and mechanism of chemical transfer	8	3
	2.3	**Pesticides and Heavy Metal Toxicity** Pesticides and their toxicological effects. Classification of Pesticides, Insecticides, Mode of action of Insecticide. Heavy Metal Toxicity:	6	2,3

		Introduction, dispersion, general principal of metal toxicity, sources, toxic metals and their toxicity. Arsenic, Aluminium, Cadmium (ItaiItai disaster), Chromium Lead, Mercury, Manganese, Zinc and Nickel		
3		**Applied Toxicology**	**13**	
	3.1	**Cosmetic toxicology**- Toxicity of shampoos, conditioners, bleachers, dyes, allergic and respiratory disorders.	2	4
	3.2	**Wildlife toxicology**- Susceptibility of wildlife to chemicals, Acute ecological hazards, Toxicology of chemicals in birds and mammals, Integrated approach to wildlife toxicology	3	4
	3.3	**Medical toxicology**- acute drug poisoning, adverse drug effects, drug abuse, chemicals and hazardous materials	2	4
	3.4	**Toxicology of chemical warfare agents**- Chemical weapons, classification of chemical warfare agents, mustard gas, lewisite, nerve agents, hydrogen cyanide, management of chemical warfare agents		1,4
	3.5	**Veterinary toxicology**- Common toxicity in dogs, cats, horses and poultry, by herbicides, household chemicals, heavy metals, mycotoxins, blue green algae and toxic plants .		1
		Occupational toxicology	**2**	
	4.1	Occupational hazards- Physical hazards, Chemical hazards, Biological hazards, Mechanical hazards, Psychosocial hazards		5
	4.2	Occupational diseases- Pneumoconiosis, silicosis, asbestosis, anthracosis, byssinosis, bagassosis, Farmers' lung Occupational Cancer- Skin cancer, Lung cancer, Bladder cancer, Leukaemia		
	4.3	Prevention of occupational diseases- Medical measures, Engineering measures, Legislative measures, Occupational health in India		
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Report on activities, Videos, Group discussions and presentation
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**HEALTH, NUTRITION AND WELLNESS.**					
Type of Course	**DSE**					
Course Code	**24SACZOO4DE202**					
Course Level	**200**					
Course Summary	This 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**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the fundamental concepts of nutrition and their role in maintaining health and well-being.	U	1,6
2	Employ healthy dietary practices to prevent disease.	A, S	2,6
3	Describe healthy lifestyle choices.	A	1,10
4	Explain how exercise, diet, and nutrition affect health.	A	1,3
5	Create dietary plans for different age groups.	C, S	1,2,6

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction to Nutrition and Health**	**15**	
	1.1	Overview of nutrition. Basic nutrients, Macronutrients, sources and functions (Carbohydrates, Proteins & Fats), Micronutrients (vitamins, minerals-Ca, Fe, I, Na & 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	2
2		**Health and well being**	**15**	
	2.1	Health- concept and dimensions. Benefits of regular physical activity.	2	4
	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	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	4
3		**Nutritional needs during different Life stages and Healthy dietary practices**	**16**	
	3.1	**Nutritional needs during different Life stages** Nutrition for different stages – Childhood, adolescence and adulthood.	4	5
	3.2	Special nutritional requirements during Pregnancy each trimester and lactation, The importance of breastfeeding. Composition and benefits of breast milk.	4	5
	3.3	**Healthy dietary practices** The role of nutrition in prevention and management of cardiac problems.	4	2

		The role of nutrition in prevention and management of diabetes 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	2
	3.5	Food adulteration: Impact on health, addressing concerns. Fast food culture and health implications)	2	2
4		**Geriatric Nutrition**	**14**	
	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	5
	4.2	Common nutritional issues in the elderly population. Importance of adequate hydration & practical approaches to ensure adequate hydration. **ACTIVITY** - Meal Planning for adolescence or pregnancy or geriatrics	8	5
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Report on activities, Videos Group discussions and presentation
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

REFERENCES

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**FUNCTIONAL ZOOLOGY**					
Type of Course	**DSC B**					
Course Code	**24SACZOO4DB201**					
Course Level	**200**					
Course Summary	To impart deep knowledge in physiology, endocrinology and immunology					
Semester	**IV**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre-requisite, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No
1	Explain the physiology of nutrition, respiration, circulation, excretion, and disorders.	A	1,2,3, 10
2	Describe Muscle and Neuro physiology and neural disorders.	A	1,2,3, 10
3	Explain Endocrine system and Hormonal disorders	U	1,2,3, 10
4	Distinguish types of immunity, lymphoid organs, antigen-antibody reactions, auto-immune diseases, immunodeficiency diseases, hypersensitivity, and vaccines.	An	1,2,3, 10
5	Test human blood groups, leukocytes, tonicity, lymphoid organs, estimate haemoglobin, monitor blood pressure, heart rate, and opercular movement in fish.	An, S	1,2, 3, 10

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Physiology**	**16**	
	1.1	Nutrition: Introduction & Types, Nutritional requirements, nutritional disorders	1	1
	1.2	Respiration: Transport of respiratory gases, Respiratory disturbances- Hypoxia, Hypercapnia, Physiological effect of smoking, carbon monoxide poisoning	3	1
	1.3	Circulation: Composition and function of blood, Mechanism of blood clotting, ECG, Blood pressure, Arteriosclerosis, Haemophilia	3	1
	1.4	Excretion: Structure of nephron, Urine formation and concentration, Kidney stone, dialysis	3	1
	1.5	Neuro physiology: Structure of neuron, Nerve impulse production and propagation, synapse and synaptic transmission, Neurotransmitters, EEG, Neural disorder: Parkinson's & Alzheimer's diseases	3	2
	1.6	Muscle Physiology: Types of muscles, Structure of striated muscle, Mechanism of muscle contraction, Cori cycle, Muscle fatigue, Oxygen debt, Rigor mortis	3	2
2		**Endocrinology**	**15**	
	2.1	Endocrinology: Introduction to Endocrine system, Mechanism of hormone action, Endocrine glands, Hormonal disorders (brief account only).	15	3
3.		**Immunology**	**14**	
	3.1	Introduction to immunology, types of immunity (innate & acquired immunity, Humoral & Cell mediated)	2	4
	3.2	Structure of immunoglobulins, Classes of immunoglobulins, Types of antigen.	3	4
	3.3	Lymphoid organs, T cells, B cells and other cells of immune system.	2	4
	3.4	Antigen-Antibody reactions (Precipitation test, agglutination test, WIDAL, VDRL, ELISA), monoclonal antibodies	3	4
	3.5	Auto immune diseases (Rheumatoid arthritis), Immune	2	4

		deficiency diseases (AIDS), Hypersensitivity		
	3.6	Vaccines (BCG, DPT, Polio, recombinant vaccines, DNA & mRNA vaccine)	2	4
4		**Practicals**	**30**	
		Preparation of blood smear and identification of leukocytes		
		Identification of human blood groups		
		Study of lymphoid organs		
		Demonstration of effect of tonicity on RBC		
		Estimation of haemoglobin (Demonstration)		
		Effect of temperature on opercular movement of fish		
		Instruments-(Principle and Use) - Sphygmomanometer, Stethoscope (Students are expected to learn how to monitor blood pressure and heart rate)		
		Teacher Specific Module		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Tutorial, Videos
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**EMERGENCY LIFE SUPPORT AND FIRST AID**					
Type of course	**SEC**					
Course Code	**24SACZOO4SE201**					
Course Level	**200**					
Course Summary	Equips the learner with life-saving techniques and knowledge about the fundamentals of first aid and safety protocols to respond confidently to emergencies					
Semester	**IV**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	--	--	45
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Apply the basics of first aid and crisis management.	A,S	1,2, 3
2	Demonstrate CPR	A,S	1,2,5, 6
3	Apply first aid for fractures, sprains, wounds, and drowning.	A,S	1,2, 3, 6
4	Employ tailored treatments for various types of burns, bites, and stings.	A,S	1,2, 3, 6
5	Demonstrate basic life support care and safety measures.	A,S	1,2, 3, 8

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**First Aid Essentials**	**8**	
	1.1	**First aid -** Definition, Importance of first aid, Rules of first aid, contents of an ideal first aid kit.	4	1
	1.2	**Crisis management** Dealing with an emergency- crisis management and emotional support including effective communication with casualities and bystanders, responses in casualities- AVPU (Alert, Voice, Pain, Unresponsive). Stroke symptom management-FAST(Face, Arms, Speech, Time)	4	1
2		**First aids for frequently encountered emergency situations**	**20**	
	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, nosebleed, 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	3
3		**Basic Life Support care & Safety Education**	**17**	
	3.1	**Cardiopulmonary Resuscitation** Airway, Breathing and Circulation (ABC), Cardiopulmonary Resuscitation (CPR) in adults, children and infants, automated external defibrillators (AED).	4	2, 5
	3.2	**Choking Relief Techniques** Techniques in adults and children, recovery position.	5	5
	3.3	**Safety education: Fundamental principles** Accident	4	5

		prevention, hazard identification, risk assessment, and mitigation strategies, Safety at home and different workplaces like laboratories, construction sites, healthcare facilities, schools. Safety in sports.		
	3.4	**Safety management** An overview on safety technologies, including sensors, alarms, personal protective equipment (PPE), and software tools for risk assessment and management.	4	5
		ACTIVITY: (Anyone) **1.** Preparation of First aid kit 2. Role play (group) on given hypothetical situations/ Pamphlet preparation on emergency care & distribution in community. 3. Survey on safety management, its assessment and evaluation, if required conduct of awareness sessions in the area of concern in the survey (group) 4. Demonstration class on CPR/ recovery position & reporting **(Anyone)**		
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Participatory learning, Experiential learning, ICT enabled discussion. Tutorial, Focus group discussions,
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

REFERENCES

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**COMPREHENSIVE FITNESS**					
Type of Course	**VAC**					
Course Code	**24SACZOO4VA201**					
Course Level	**200**					
Course Summary	This course is designed to foster an overall well-being through an integrated approach that combines mental resilience, physical vitality, and the enriching practice of yoga. It explores the interconnected dimensions of health, promoting balance and harmony in both mind and body.					
Semester	**IV**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	--	--	45
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain the factors affecting health and wellness.	U	1,2,3,4,6
2	Describe different types of fitness exercises.	U	1,3,6
3	Describe the effect of exercise on the body's systems.	A	1,2,3
4	Explain the importance of mental health.	A	1,2,3,6, 10
5	Analyze the holistic role of yoga.	An	1,2,3, 4,5

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Fitness exercises & Physiology**	**19**	
	1.1	Definition. Differentiate health and wellness. Importance of health and wellness education. Five dimensions of health. Local, demographic, societal issues and factors affecting health and wellness. Role of diet, exercise & sleep.	4	1
	1.2	**Exercise & health** Definition. Health benefits- overview, Recovery, Regeneration	3	3
	1.3	**Fitness exercises** Moderate exercises for body fitness, right postures of sitting & standing, stretching, walking, aerobic & flexibility exercises.	6	2
	1.4	**Effect of exercise on the body systems** Effect on the blood vascular system, effect on the muscular system, effect on respiration & metabolism, effect on the endocrine system, effect on the skeletal system, body's adaptations.	6	3
2		**Mental Health**	**14**	
	2.1	**Psychological well being** Importance of mental health. Stress, anxiety, and depression. Factors affecting mental health. Mental health promotion activities/sessions. Counselling, Agencies supporting Mental health	6	4
	2.2	**Substance abuse** Substance abuse (Synthetic Drugs, tobacco products, Alcohol), de-addiction, counselling and rehabilitation.	8	4
3		**Concept of Yoga**	**12**	
	3.1	**Yoga and its types** Origin. Breathing- Exercise- Meditation Types. Asanas — Differences between Asanas and Physical exercises.	6	5

	3.2	**Yoga for holistic wellness** Yogic concept of health, wellness and illness, holistic health and importance in management of diseases & stress and its management. **ACTIVITY**: (Any one) 1. Local, demographic, societal issues and factors affecting health and wellness- Focus group discussion & report submission 2. Drug awareness campaigns and its outcome assessment (local level survey & reporting) 3. Group presentation of the different asanas and reporting with geotagged photos of students doing Asanas	6	5
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Participatory learning,, ICT Enabled Learning, Experiential Learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

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Semester-V

Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) ZOOLOGY**					
Course	**ANIMAL DIVERSITY CHORDATA - II**					
Type of Course	**DSC**					
Course Code	**24SACZOO5DA301**					
Course Level	**300**					
Course Summary	The course is designed to understand the characteristics and basic classification of Aves and Mammals along with an attempt to provide an insight on the concepts of comparative anatomy					
Semester	**V**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Describe the classification and general characters of Aves and mammals.	U	1,2
2	Compare different systems of Euphlyctis, Pigeon, and Rabbit.	A	1,2
3	Identify the avian and mammalian fauna and their peculiarities.	U, I	1,2,3
4	Explain flight adaptations in birds, endemic birds of the Western Ghats, and aquatic mammals.	U	2
5	Dissect the pecten and hyoid of a bird.	A, I	2

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

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Units	Course description Theory (45 Hrs)	Hrs	CO.No.
1		**Class Aves**	**16**	
	1.1	General characters - Aves **Subclass Archaeornithes** Eg.: *Archaeopteryx* **Subclass Neornithes.** Super order Paleognathae: eg: *Struthio* Super order Neognathae: Brahminy Kite	3	1,3
	1.2	**Type: Pigeon** (*Columba livia*) External characters, Skeletal System (Skull may be excluded), Respiratory System, Digestive system, Circulatory system, Excretory system, Reproductive system, Nervous system and sense organs	10	2
	1.3	**General Topics**. Flight adaptations in Birds. Endemic birds of Western Ghats with special reference to Kerala (Nilgiri - Wood Pigeon, Malabar Grey Hornbill, Malabar Barbet, Malabar Parakeet, Malabar Wood shrike, White-bellied Tree pie, Nilgiri Flowerpecker, Crimson-backed Sunbird, Broad tailed Grass bird, Flame-throated Bulbul, Grey headed Bulbul, Rufous Babbler, Wynand Laughing thrush, White-bellied Blue Flycatcher, Nilgiri Flycatcher, Malabar Starling , Black-and-orange Flycatcher, Palani Laughing thrush White-bellied Blue Robin) (brief mention only)	3	4
2		**Class Mammalia**	**15**	
	2.1	General characters and Classification of Mammals. (Modified version of McKenna and Bells Classification - Updated in 2005 with contributions from Don E. Wilson and DeeAnn M Reeder) **Subclass Prototheria** - Order Tachyglossa. Eg: Echidna Order Platypoda. Eg: Platypus **Subclass Theria.** Infra class- Metatheria Eg: *Macropus* Infra class - Eutheria Order Rodentia. Eg :*Funambulus* Order Chiroptera. Eg : *Pteropus* Order Soricomorpha Eg : Mole	5	1,3

		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. *Delphinus* Order Hyracoidea. Eg. Procavia Order Sirenia. Eg .Dugong Order Proboscidea. Eg : Elephas Order Tubulidentata. Eg : Aardvark Order Carnivora. Eg: *Panthera tigris* Order Lagomorpha. Eg : Rabbit Order Xenarthra. Eg: Armadillo Order Scandentia. Eg: Tree shrews Order Macroscelidea. Eg : Elephant Shrews Order Pholidota. Eg: Pangolin		
	2.2	**Type: Rabbit** External Characters, Integumentary system and Glands, Axial and Appendicular Skeleton (Skull bones may be avoided), Digestive System (Mention Dentition and Secondary digestion), Respiratory System, Circulatory system, Urinogenital system, Nervous system and sense organs	8	2
	2.3	**General Topic** Adaptations of aquatic mammals with representative examples from Sirenia and Cetacea	2	4
3		**Comparative Anatomy of Selected Vertebrates**	**14**	
	3.1	**Type Specimens (***Euphlyctis*, Pigeon and Rabbit - Brief study only) Integumentary System, Locomotor organs, Skeletal System: Axial Skeleton (skull excluded), Appendicular skeleton, Digestive System, Circulatory System, Respiratory system, Sense organs, Urinogenital system	14	2
4		**Practical**	**30**	
	1	Dissection of pecten and hyoid of a bird	6	5
	2	Study of specimens (5 Birds and 5 Mammals)	3	3
	3	Prepare and write in the record, the list of the common names and scientific names of smallest/ biggest/tallest/ heaviest/ other peculiarities/ animals of different states /national animal etc. from all classes of animals.	1	3
	4	Study of Skeletal Structures: Bird- Heterocoelous vertebra, Synsacrum, pygostyle, keel and sternum	8	2
		Mammals: Skull with special reference to dentition		

		(Diastema/Carnassial teeth), vertebrae, pectoral girdle, pelvic girdle		
	5	Study of arterial system of bird and mammal using pictures	6	2
	6	Study of different parts of Heart and Kidney of rabbit from photograph/picture	4	2
		ACTIVITY 1. Digital photo book / Printed Album of local Avian and Mammalian Fauna 2. Prepare a list of common names, Malayalam names and scientific names of mammals of Kerala. 3. Field visit to Zoo/Protected Area (2 fields) and report submission	2	3
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Verbal Teaching, Video Classes, Documentaries, Seminars, Album making,
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**CELL BIOLOGY AND MOLECULAR BIOLOGY**					
Type of Course	**DSC**					
Course Code	**24SACZOO5DA302**					
Course Level	**300**					
Course Summary	Encompasses the study of cells at the molecular level, exploring topics such as cellular diversity, cell structure, membrane dynamics, cell cycle, DNA structure and replication, prokaryotic gene expression and regulation, and basics of cancer biology. The course emphasizes the practical applications of cellular and molecular biology.					
Semester	**V**	Credits			4	Total Hours
Course Details	Learning Approach		Lecture Tutorial	Practical	Others	
		3	--	1	--	75
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain cell theory, cell structure, cellular diversity, cell communication, and the structure and functions of the cell organelles, nucleus, and plasma membrane.	**U**	1, 2
2	Compare the stages of mitosis and meiosis.	**A**	1, 2
3	Describe the types, diagnosis, and treatment of cancer.	**A**	1,2,3
4	Explain the nature of genetic material, the principles of prokaryotic gene expression, and its regulatory mechanisms.	**A**	1,2,3

5	Prepare blood and buccal smear to identify blood cells and the Barr body and extract DNA.	**C**	1,2,3
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Overview of cells and cellular dynamics**	**16**	
	1.1	Diversity of cells: Brief history, Cell theory	1	1
	1.2	Prokaryotes - Bacteria in detail and Mycoplasma Eukaryotic cell (Brief account) Difference between Prokaryotes and Eukaryotes Virus, Virions and Viroids, Prions	2	1
	1.3	Origin of Eukaryotic cell - Endosymbiotic theory Structure and functions of: Cytoskeleton, Endoplasmic reticulum, Ribosomes (Prokaryotic and Eukaryotic), Golgi complex , Lysosomes, Mitochondria	4	1
	1.4	Interphase nucleus, nuclear membrane, pore complex, nucleolus (in detail), Chromatin	3	1
	1.5	Cell cycle - Interphase, Mitosis, meiosis. Difference between Mitosis and Meiosis Cancer - types, diagnosis and treatment (only brief account)	6	2,3
2		**Plasma membrane**	**14**	
	2.1	Structure of plasma membrane (Sandwich model, Unit membrane and Fluid mosaic model)	2	1
	2.2	Modifications of plasma membrane - Cell junctions - Tight junctions, Desmosomes, Gap junctions. Cell coat and Cell recognition - Basic principles of cell communications	4	1
	2.3	Cell signaling - Types of signaling and signaling molecules - hormones, nitric oxide, neurotransmitters, vitamins A and D derivatives, cytokines. Cell signaling pathways - (cAMP and RTK)	6	1
	2.4	Functions of Plasma membrane: Transport - Diffusion, facilitated diffusion, Osmosis, Passive transport, Active transport, bulk	2	1

		transport, role of cell membrane in cell communication.		
3		**Nature of Genetic material and Expression of Gene**	**15**	
	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:** 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.	10	4
4		**Practicals**	**30**	
		Cell Biology	20	
	1	Squash preparation of onion root tip for mitotic stages.		2
	2	Squash preparation of grasshopper testes for meiotic stages (Demonstration).		2
	3	Identification of cell organelles (using models, pictures).		1
	4	Identification of Barr body from human buccal epithelium.		5
	5	Preparation of human blood smear and identification of leukocyte.		5
		Molecular Biology	10	
	1	Study and interpretation of electron micrographs/ photograph of DNA, DNA replication, RNA different types.		4
	2	Study of Polytene chromosomes from *Chironomus/Drosophila* larvae (Demonstration).		4
	3	Extraction of DNA from plant/ tissue samples.		5
		ACTIVITY 1. Prepare posters on cellular diversity 2. Make models of DNA and RNA		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Flipped classroom, Participative Learning, Interactive Sessions, Seminars, Discussions, Practical based learning, Research based Learning, Technology-embedded Learning, Peer teaching
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks)** **Duration- 1 hrs**

REFERENCES

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SUGGESTED READINGS

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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**FUNDAMENTALS OF GENETICS**					
Type of Course	**DSC**					
Course Code	**24SACZOO5DA303**					
Course Level	**300**					
Course Summary	This course covers the foundational aspects of genetics, offering a comprehensive understanding of inheritance, molecular mechanisms, genetic variation, and their practical applications.					
Semester	**V**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	---	60
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1.	Discuss Mendelian principles of inheritance and gene interactions; apply these to predict the outcome of genetic crosses	U, A, An	1,2
2.	Understand and analyze genetic recombination, linkage and sex determination, and solve problems related to these phenomena.	U, An	1, 2
3.	Evaluate the mechanism of mutation and generate awareness about the impact of various chemicals and drugs used in day-to-day life	E, A	2, 6
4.	Comprehend the organization of genetic material	U, An	2
5.	Familiarize with genetic diseases and analyze their pattern of inheritance	U	1, 6

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Principles of Transmission Genetics**	22	
	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** Problems on Genetics	8	1
	1.2	**Extension of Mendelism:** Interaction of genes: (Brief account with one example each) **I**ncomplete 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
2		**Sex determination**	**10**	
	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 influence & Environmental influence on sex determination.	4	2
	2.3	Barr bodies, Dosage compensation and Lyon hypothesis, gynandromorphs, sex mosaics, Hermaphroditism- Freemartin.	3	2

3		**Mutations**	10	
	3.1	**Types of Mutations**: Germinal & Somatic, Spontaneous & 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 action. Detection of mutation - CIB method	4	3
4		**Cytogenetics and Genetic disorders**	**18**	
	4.1	Nucleus & Chromosome structure: Chromatin (euchromatin, heterochromatin), Chromosome – structure, types, different levels of organisation (Nucleosomes, Solenoid, Chromosome loop), Giant chromosomes (Polytene and Lampbrush chromosomes), Karyotyping - Normal human chromosome complement.	5	4
	4.2	Human chromosomal anomalies: Autosomal (Down syndrome, Edward's syndrome and Cri du chat syndrome). Sex chromosomal anomalies (Klinefelter syndrome, and Turner's syndrome), Single gene disorders - Sickle cell anemia, cystic fibrosis¸Tay Sachs disease. **ACTIVITY:** Study of syndromes and karyotypes using photograph	5	5
	4.3	Inborn errors of metabolism: Genetic basis of Phenyl ketonuria, Alkaptonuria, Albinism.	3	5
	4.4	Multifactorial disorders - Cleft lip and cleft palate.	1	5
	4.5	Pedigree Analysis (Brief account only) – Pedigree symbols and construction of Pedigree.	2	5
	4.6	Human Genome Project (Brief account only), Genetic counselling- Eugenics and Euthenics.	2	5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)**
AssessmentTypes	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

REFERENCES

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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**BIOTECHNOLOGY: PRINCIPLES & PRACTICES**					
Type of Course	**DSE**					
Course Code	**24SACZOO5DE301**					
Course Level	**300**					
Course Summary	This course encourages the students to master the fundamental principles underpinning genetic engineering and provides insight into the transformative applications shaping the forefront of modern science and industry.					
Semester	**V**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the principles and techniques of rDNA Technology	U, S	1, 2, 9, 10
2	Describe techniques in cell culture & genetic engineering.	U	1, 2, 3,10
3	Analyze the biotechnological applications in various fields	An	1, 2, 3, 6,7, 8
4	Describe biosafety concerns in biotechnology	U	1, 2, 4, 5, 6, 8
5	Explain the provisions for the protection of intellectual property.	U, Ap	1, 5, 7, 8, 10

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Fundamentals of Recombinant DNA Technology**	**20**	
	1.1	**Introduction to Biotechnology** Historical background, Prospects of biotechnology	2	1
	1.2	**Tools & Techniques** Enzymes- restriction enzymes, ligases, polymerases. Vectors- Plasmids, Bacteriophage-derived vectors, artificial chromosomes. Techniques- DNA Extraction (Brief account of RNA & plasmid extraction), Electrophoresis- Agarose Gel, PAGE. PCR-Principle & 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
2		**Cell culture and Genetic Engineering**	13	
	2.1	**Cell culture** Animal cell culture-Media-Natural & Synthetic media (one example each) Stem cell- type & 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 *C.elegans*. Cell line transfections. Gene silencing - RNA interference, gene editing - **CRISPR Cas** (brief account only).	10	2
3		**Biotechnology & Human welfare**	17	
	3.1	**Medical Biotechnology & Forensics** Gene therapy (SCID). Stem cell therapy - regenerative medicine, Personalised medicine. Development of Pharmaceuticals- biopharmaceuticals of immune system –**(**interferons, IL) Hormones (insulin, somatostatin), Antibiotics, monoclonal antibodies, vaccines. DNA finger printing and its applications. **ACTIVITY** Case studies and report submission and presentation of: any criminal case, disputed paternity etc. based on DNA fingerprinting, from Newspapers [any one]	7	3
	3.2	**Agricultural & 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 & water contaminated with oil spills, heavy metals and detergents. Bio-fertilizers: Algal and fungal biofertilizers (VAM), Bioleaching. Development of Biodegradable polymers-PHB.	6	3
	3.3	**Fermentation Biotechnology: Principles and applications** Enzymes - Amylase, Invertase, Zymase, General overview of synthesis of vitamins, food and beverages Single Cell Proteins.	4	3
4		**A. Biosafety concerns B. Intellectual Property Protection**	10	
	4.1	**A. 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).	5	4

		Biological warfare & biopiracy. Ethics in Cloning		
	4.2	**B. 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)	5	5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, ICT Enabled Learning, Experiential learning, Participatory learning.Tutorial.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**B.Sc. (Honours) Zoology**					
Course Name	**Wildlife Management**					
Type of Course	**DSE**					
Course Code	**24SACZOO5DE302**					
Course Level	**300**					
Course Summary	To convey basic information in Forests, Wildlife, Man wildlife conflict and Wildlife Conservation.					
Semester	**V**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Prerequisite, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain biodiversity hotspots, forest ecosystems, and species richness-diversity indices.	U	1,2,10
2	Describe primate biology, ecology, and behaviour; animal barriers; and wildlife, with special reference to mammals, birds, and reptiles.	U	1,2,6
3	Describe the consequences of the man-wildlife conflict.	A	1,2,6,7
4	Explain the threats faced by wildlife, protected areas, research institutes, and types of wildlife conservation.	A	1,2,10
5	Summarise the advances in wildlife conservation.	U	1,2,3,6, 7,10

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Forest ecosystems**	**14**	
	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
2		**Introduction to wildlife & Man wildlife conflict**	**18**	
	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.	7	2
	2.3	Man wildlife conflict- Case studies-(one each) Elephant, Monkey (Bonnet Macaque), Large carnivores (Tiger/leopard) & Wild boar.	6	3
	2.4	Animal barriers: Mechanical and electrical.	1	2
		ACTIVITY: Compilation of newspaper reports and seminar presentation of Wildlife/ Man- Wildlife conflict.		
3		**Wildlife Conservation**	**15**	
	3.1	Threats faced by wildlife. Conservation of wildlife Ex-situ conservation and in-situ conservation. Management of Protected Areas.	6	4
	3.2	National Park, Sanctuaries, Tiger reserves, Biosphere Reserves, Community reserves. Ramsar Sites. Protected areas of Kerala	4	4
	3.3	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

4		**Advances in Wildlife Conservation**	**13**	
	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
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Tutorial, Videos.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**CLIMATE CHANGE AND DISASTER RISK REDUCTION**					
Type of Course	**DSE**					
Course Code	**24SACZOO5DE303**					
Course Level	**300**					
Course Summary	The course on Climate Change and Disaster Management is designed to provide a comprehensive understanding of the interplay between climate change and the increasing frequency and intensity of natural disasters. Students will explore the scientific foundations of climate change, its impact on the environment, and the resulting challenges in disaster management. The course integrates theoretical knowledge with practical applications to equip participants with the skills necessary for effective mitigation, adaptation, and response strategies.					
Semester	**V**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Develop a comprehensive understanding of climate change and disasters, including the causes and consequences.	A	1,2,6, 10
2	Administer strategies in risk assessments and disaster mitigation preparedness and adaptation.	A	1,2,6
3	Infer Carbon trading, Carbon credit; Carbon footprint; Carbon Sequestration,Green & Energy audit	U	2,6
4	Understand the Policies/treaties to combat Climate change and the	U	3,6,

	challenges and issues of climate change.		10
5	Evaluate the impact of disasters and climate change	E	1,2, 6
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Climate Change & Disasters**	**10**	
	1.1	**Fundamentals of Climate change** : Introduction, Climate change over geological history. Causes & effect of climate change	2	1
	1.2	**Current status** - Greenhouse gases and global warming, acid rain, Ozone layer depletion	3	2
	1.3	**Climatic and meteorological disasters:** Extreme temperature (El Nino & La Nina), drought, fog, wildfire (forest fire and land fire), Cyclone & storms, floods, landslides, earthquake and tsunami	5	1, 2
2		**Disaster Risk Reduction (DRR)**	**20**	
	2.1	**Basic concepts and terminologies:** Hazard, Risk, vulnerability, Disaster, Mitigation, DRR and its evolution, Disaster Risk Management (DRM), Emergency, Response, Relief; Resilience, Reconstruction, Recovery	4	2
	2.2	**Disaster Risk Mitigation** Disaster management journey and paradigm shift; Approaches in disaster management–Engineering centric, Community Based Disaster Preparedness (CBDP), Indent management, Ecosystem-based Disaster Risk Reduction (ecoDRR). Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions - Structural and Non Structural measures of mitigation International and national policy frameworks and guidelines.	5	2

	2.3	**Disaster Risk Management** Tools and Methods in Disaster Risk Management: Hazard, risk and vulnerability analysis; Legislations, Codes & Standards, Risk sensitive land use planning, Safety auditing, Role of Strategic Environmental Assessment (SEA)/ Environmental Impact Assessment (EIA), Situation analysis, Incident response system, Post-Disaster Needs Assessments (PDNA), Environmental economics & DRR, Recovery framework. DM Planning for Government at national/ sub-national, Ministry/ departments, organization/establishments and at local levels.	5	1,2
	2.4	**Applications of science and technology for DRR & Climate Change Adaptation (CCA)** Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination), S&T Institutions for Disaster Management in India.	3	2
	2.5	**Disaster Preparedness** Crisis management, Early warning and communication, Emergency response, Local preparedness, Relief management-Shelter, "water, sanitation and hygiene" (Watsan), environmental health, trauma care; Role of agencies, technology and coordination; Issues of green relief, sustainable recovery, built back better; Climate Change Adaptation - Disaster Risk Reduction (CCA-DRR) and sustainability integration into post-disaster/post-conflict development, International response.	3	2
3		**Adaptation strategies**	**15**	
	3.1	Natural Resource Management-Disaster Risk Management (NRM-DRM) integration, ecosystem based adaptation and eco DRR; Role of Green growth, sustainable NRM – IWRM (Natural Resource Management - Integrated Water Resources Management), Watershed, River basin, Integrated Coastal Zone Management Plan: (ICZM), Socioeconomic resilience, Capacity building,	5	2
	3.2	Carbon trading, carbon credit; Carbon footprint; Carbon Sequestration. Carbon neutral, alternate sources of energy, ecological footprint, Polluter pays principle, 3'R Principle, Green auditing	4	1

		ACTIVITY 1.Energy audit of your house/college 2.Survey in your locality regarding measures adopted for energy utilisation, rain water harvesting etc. and conducting awareness programs		
		Policies/treaties to combat Climate change: International - Montreal protocol, Kyoto Protocol, Earth summit, Paris Agreement 2005, IPCC, & UNFCCC **National** - Disaster Management Act, 2005, NAPCC - National Action Plan on Climate Change Role of government, NGOs, and communities.		
	3.3	**Methods of risk assessment in the Kerala context:** GIS and remote sensing applications for risk mapping Role of local government in disaster management Case studies on policy implementation Early warning systems and their implementation Community-based disaster preparedness Infrastructure planning for disaster resilience Analyzing successful disaster management cases in Kerala Data analytics for predicting and managing disasters **ACTIVITY** 1.Case studies; Field work at areas with a history of natural disasters in Kerala – Report submission and Presentation. 2.Visit to disaster prone areas & report.	6	4
4		**Challenges, issues & impact of Climate change**	**15**	
	4.1	Issues in Urban, Rural and Industrial disaster risks management with respect to climate change. Resilient agriculture, Disaster Resilient - Infrastructure, Industry, Livelihoods, Schools, Hospitals.. Issues of special needs - gender, aged, children, disabled, psycho-social	6	4
	4.2	Impact of climate change in India/Kerala: Extreme Heat, changing rainfall patterns, increased droughts, depletion of ground water, melting of glaciers, rise of sea level, faunal decline	5	1, 2
	4.3	Impact on Agriculture & Food Security, Energy Security, Water Security.	4	1, 2

		Health, Migration & Conflict		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Interactive lecture, Case studies, guest speakers .
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

REFERENCES

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SUGGESTED READINGS

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Department of Zoology
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**FOOD AND WATER QUALITY MANAGEMENT**					
Type of course	**SEC**					
Course Code	**24SACZOO5SE301**					
Course Level	**300**					
Course Summary	Aimed at ensuring the safety & quality of both food & water. Discusses issues like food adulteration and the indiscriminate use of food additives. Delves into the identification & management of spoilage bacteria, along with methods for monitoring & assessing microbial quality. It also explores the regulatory frameworks at both national& international levels that oversee food & water quality, highlighting the responsible agencies entrusted with enforcing these regulations.					
Semester	**V**	Credits			3	Total Hours
Course details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	--	--	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
1	Identify various food adulterants & additives and their health implications	U	1
2	Describe the causes and consequences of quality deterioration of food and water	U	3
3	Apply skills in food and water quality analysis	S	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

5	Analyse the chemical & microbial quality of different categories of food & water	An, S	2, 6

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Food adulterants and food additives**	**16**	
	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, flavour 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 & 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, Regulations on Approval of non-specified food and food ingredients, 2017. Consumer protection act 2019.	4	4
	1.4	**Quality management**: Introduction**,** Scope, significance & objectives of quality management systems. Good Manufacturing Practices. Hazard Analysis and Critical Control Point (HACCP).	5	4

		Management and certification systems: Role of FDA, FAO, Codex Alimentarius Commission, ISO 2000, FSSC 22000, Agmark, BIS, QCI, NABCB.		
2		**Food and water quality analysis**	**14**	
	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** Microbiological analysis of spoiled foods: isolation, total plate count and biochemical tests for the identification of spoilage bacteria (Brief account)	2	3
	2.4	**Physico-chemical parameters of water** 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, *E.coli*. BIS specifications for drinking water.	4	2,3
3		**Hands on training**	**15**	
	3.1	Detection of adulterants in honey (jaggery, 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
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, ICT enabled classes, Group discussions, seminar presentations, case studies and activities.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

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Semester-VI

Department of Zoology
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**MICROBIOLOGY AND BASIC IMMUNOLOGY**					
Type of Course	**DSC**					
Course Code	**24SACZOO6DA301**					
Course Level	**300**					
Course Summary	Equips with a solid understanding of the microscopic world and the body's defence mechanisms, laying the groundwork for various professional paths in the biological sciences. Covers the study of microorganisms. explores their structure, function, classification, & role in various processes. Basic immunology delves into the body's defense mechanisms, examining components like antibodies, antigens, & immune responses.					
Semester	**VI**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Classify major groups of microbes.	U	1
2	Apply skills to isolate, cultivate, and identify microorganisms.	A, S	2

3	Describe the viral replication, viral cultivation, and morphology of bacteria and viruses.	U	1
4	Explain the etiology, symptoms, causative organism, modes of transmission and treatment of specific infections.	A	2
5	Explain the basic concepts of immunology.	A	2
Remember(K), Understand(U),Apply(A),Analyse(An),Evaluate(E), Create (C), Skill S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module Units		Course description	Hrs	CO No.
1		**Introduction and Methods in Microbiology**	**16**	
	1.1	Scope of microbiology-Mention the relevance of Beneficial and harmful microbes.	1	1
	1.2	A brief description of different types of microbes - Bacteria and Archaea, Fungi, Viruses. Outline classification of microbes.	2	1
	1.3	Microbiome –Principles of microbial ecology and interactions within microbial communities. Human microbiomes, Environmental microbiomes. Microbiome research and its applications.	2	1
	1.4	Sterilization methods and disinfection. Culture media, Culture methods, Culture preservation technique. Staining techniques- Gram staining, Capsule staining	6	2
	1.5	Bacterial nutritional requirements. Microbial growth - Growth curve, Measurement of microbial growth Direct method (viable count) & indirect method (turbidometry). synchronous growth, batch culture, continuous culture.	5	2
2		**A. Microbial Morphology and viral cultivation & B. Infections and Diseases**	**18**	
	2.1	**A. Microbial Morphology, Viral Replication and viral cultivation** Bacteria- Size, Shape and arrangement, Ultra structure of bacteria, spheroplast, protoplast. Virus: morphology - size, structure & shape. Bacteriophages -	8	3

		T4 Phages & life cycle (Lytic & Lysogenic cycle). Virions¸viroids, prions. Viral cultivation - Chick embryo and cell culture methods.		
	2.2	**B. Infections and Diseases** Host pathogen interactions. Types of infections Primary, Secondary and nosocomial infections. Contagious diseases- epidemic, endemic and pandemic Routes of infection-inhalation, ingestion, skin (Direct inoculation), iatrogenic and congenital. Modes of transmission-food, water, air, vectors and carriers. STDs (HIV), Emerging diseases (Corona Virus eg: SARS - Cov-2, Zika Virus), Re-emerging infections (Tuberculosis), Zoonoses (Rabies, Avian Influenza)	10	4
3		**Basic Immunology**	**11**	
	3.1	Cells of the Immune system- (B Cells, T cells, Macrophages, Dendritic cells, Natural Killer cells), Organs of Immune system. Mention Toll-like receptors	3	5
	3.2	Types of Immunity (Innate and Acquired, Passive and Active, Humoral and Cell Mediated)	3	5
	3.3	Antigens. Factors that influence immunogenicity. Haptens, Adjuvants, Epitopes (T cell and B cell Epitopes), Vaccines, Immunoglobulins - structure (basic only), classes and functions of immunoglobulins. Mention Hypersensitivity.	5	5
4		**Practicals**	30	
	1	Microbiology lab techniques: Autoclave, Incubator, Oven, Laminar airflow¸ cotton plugging, sterilization Disinfection.	4	2
	2	Preparation of culture media.Nutrient agar, Nutrient broth	2	2
	3	Culture methods: Streak plating, pour plating	4	2
	4	Viable plate count. (Demonstration)	4	2
	5	Gram Staining, Capsule staining, Fungal Staining	5	2
	6	Hanging drop experiment for motility.	2	2
	7	Identification of Bacterial species – IMViC	4	2

	8	Standard plate count SPC (Demonstration only)	2	2
	9	Antibiotic sensitivity test. (Demonstration)	2	2
	10	Blood typing-ABO	1	5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure(Mode of transaction)** Lecture, Tutorial , Videos , Practicals
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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1. **Virtual textbook:** Inglis, T. J., Fu, B., & Kwok-Chan, L. (1995). Teaching microbiology with hypertext: first steps towards a virtual textbook. Medical Education, 29(6), 393-396.

2. **You Tube Channel** Birth of microbiology - :https://youtu.be/uKLrhp4Kw2A?si=D75ytk7SNoLYdgBA

3. Virtual labs:

a) Virtual amrita laboratories

1. https://vlab.amrita.edu/?sub=3&brch=73

2. https://vlab.amrita.edu/index.php?sub=3&brch=76

b) McGraw-Hill Virtual Lab: online simulations covering microbiology experiments.

https://www.mheducation.ca/higher-education/learning-solutions/virtual-labs

4. **Interactive websites** :BioMan Biozone, PhET Interactive simulations

5. **Educational platforms**: Swayam, coursera and edX Platforms offering microbiology courses from reputable universities.

6. **Podcasts:** "This week in microbiology (TWiM) podcasts discussing recent developments in the field of microbiology

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**PHYSIOLOGY & ENDOCRINOLOGY**					
Type of course	**DSC**					
Course Code	**24SACZOO6DA302**					
Course Level	**300**					
Course Summary	Provides an enthralling exploration of human physiology. Learn the mysteries of nutrition, the ways in which food nourishes our bodies, and the multifaceted mechanism of respiration - the inhalation of oxygen that maintains life. Unravel the enigmatic realm of excretion, where the removal of waste preserves the equilibrium of our systems. Uncover the mysteries of movement and feeling by venturing into the realm of muscle and neuron physiology. Know about the secret capabilities of hormones in the endocrine system and how these chemical messengers regulate our physical selves.					
Semester	**VI**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	1	---	75
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Describe the structure, functions, and mechanisms of human systems such as the cardiovascular, endocrine, respiratory, and nervous systems.	An	1,2
2	Analyse the physiological underpinnings, mechanisms, and impacts of prevalent health issues such as diabetes, nutritional disorders, cardiovascular ailments, neural disorders, kidney disorders, endocrine disorders, and respiratory disorders.	A	1,2
3	Explain homeostasis and feedback mechanisms, renal physiology, and basic aspects of nutritional science.	An	1,2

4	Investigate the intricate interactions between the nervous system and muscles, the mechanisms governing muscle contractions, and the impact of neuromuscular complexities on human movement and physiological function.	C	1,2
5	Demonstrate skills in analyzing physiological data and evaluating bodily functions.	A, S	2,10
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	**1**	**Cardiopulmonary Physiology**	**12**	
	1.1	Overview of circulatory system, Cardiac cycle and cardiac output, Haemostasis: Pathways of blood coagulation	3	1
	1.2	Cardiovascular diseases: Atherosclerosis, Myocardial infarction, stroke. ECG (brief) Cardiopulmonary resuscitation (CPR)	2	2
	1.3	Overview of respiratory system, Mechanism of breathing: Inspiration and Expiration, Gas exchange in the alveoli, Oxygen and Carbon Dioxide transport, Oxygen-Hemoglobin dissociation curve; Factors affecting the curve.	3	1
	1.4	Neural and chemical control of respiration, Respiratory problems (Hypoxia, Asphyxia, Hypercapnia, Oxygen toxicity, CO poisoning). Respiration in unusual environments (High Altitude, Diving, foetal).	2	1,2
	1.5	Importance of lung capacity and respiratory efficiency. Breathing exercises: Diaphragmatic Breathing, Pursed lip breathing, and lung expansion techniques, Physical activities and practices to enhance respiratory fitness (very brief account)	2	1

2		**A. Nutritional Science & B. Neuromuscular Physiology**	**17**	
	2.1	**A. Nutritional Science** Introduction to nutrition, balanced diet, RDA, antioxidants, importance of dietary fibre and water. Disorders: Ulcer, Bulimia nervosa, anorexia nervosa, irritable bowel syndrome. obesity. BMI .	2	3
	2.2	Digestion, absorption, and assimilation of carbohydrates, proteins, and lipids	4	3
		B. Neuromuscular Physiology Types of neurons, mechanism of nerve impulse conduction, neuromuscular junction, synaptic transmission, types of neurotransmitters Neural disorders: Dyslexia, Parkinson's, Dementia, Alzheimer's, Schizophrenia	5	4
		Ultrastructure of striated muscle, mechanism of muscle contraction: Sliding filament theory, role of ATP in muscle contraction. Electrophysiology of muscle contraction, Muscle twitch, summation, fatigue, treppe, tetanus. Cori cycle, Rigor mortis.	6	4
3		**A. Renal Physiology & B. Endocrinology**	**16**	
	3.1	**A. Renal Physiology** Structure of nephron, mechanisms of urine formation: glomerular ultrafiltration, tubular re absorption, tubular secretion, countercurrent exchange	3	3
	3.2	Kidney disorders: glomerular nephritis, pyelonephritis, kidney stones, dialysis, kidney transplantation (brief account)	3	2
	3.3	Role of kidney in homoeostasis	1	3
	3.4	**B. Endocrinology** Hormone - classification and mechanism of action	1	1
	3.5	Major endocrine glands, their secretions, functions, and disorders (Hypothalamus, pituitary, pineal gland, thyroid, parathyroid, islets of Langerhans, adrenal gland, gonads)	7	1
	3.6	Homoeostasis and feedback mechanisms	1	1
4		**Practical**	**30**	
	1	Estimation of the RBC count of blood.		5

	2	Estimation of the WBC Count of blood.		5
	3	Estimation of hemoglobin content.		5
	4	Determination of bleeding time.		5
	5	Determination of clotting time.		5
	6	Determination of erythrocyte sedimentation rate (ESR).		5
	7	Determination of heart rate, pulse rate and blood pressure using sphygmomanometer		5
	8	Analyze the effect of different concentrations of NaCl solution on RBC..		5
	9	Study of endocrine glands		5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** lecturing with ICT
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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23. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.

24. Williams, R. H. (2003). Textbook of Endocrinology. W.B. Saunders.

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2. Marshall, P., Gallacher, B., Jolly, J., & Rinomhota, S. (2017). Anatomy and Physiology for Healthcare. EBSCO eBook.
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**REPRODUCTIVE BIOLOGY AND TERATOLOGY**					
Type of Course	**DSE**					
Course Code	**24SACZOO6DE301**					
Course Level	**300**					
Course Summary	This Course aims to give an idea about the development process, defects in development and the techniques applied in reproductive biology to rectify the developmental defects which can be an added milestone to the fertility related medicinal filed.					
Semester	**VI**	Credits			4	Total Hours
Course details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	---	75
Pre-requisites if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the basic concepts and theories in Reproductive biology.	U	1
2	Describe the different developmental stages in animals.	U	3
3	Analyse various techniques in prenatal diagnostics and assisted reproduction.	An, A	3
4	Differentiate the concepts of Experimental embryology	U	1
5	Compare teratogens, their effects and other common developmental defects.	An	2

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description (Theory)	Hrs	CO No.
1		**Reproductive Biology**	**22**	
	1.1	Introduction to Reproductive biology, Definition, Theories of development- Preformation theory, Theory of Epigenesis, Recapitulation theory, Germplasm theory, Mosaic theory and Regulative theory	2	1
	1.2	Patterns of development – Oviparity, Ovo-viviparity and Viviparity	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 (Oestrous cycle, Menstrual cycle). Structure of mammalian sperm and egg, Pregnancy, Types of placenta, parturition and lactation.	7	1
	1.4	**Early Embryonic development** **Egg types:** Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and non-cleidoic 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.	5	2
	1.5	**Developmental patterns with special reference to frog and chick** **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. **Gastrulation:** Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Concept of germ layers and derivatives.	7	2
2		**Prenatal diagnostic techniques Assisted Reproductive Techniques**	10	

	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, MRI, Cell free fetal DNA	4	3
	2.2	Assisted Reproductive Techniques**:** *In vitro* fertilization (IVF) and Embryo transfer (ET), ZIFT, GIFT, ICSI TET in detail	6	3
3		**Experimental embryology & Teratology**	13	
	3.1	Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning.	5	4
	3.2	**Significance of model organisms** (*Caenorhabditis elegans, Danio rerio and Mus musculus)* in embryological studies (brief account).	2	4
	3.3	**Teratology:** Teratogenesis, Teratogenic agents [Physical (Radiations), Chemical (Environmental toxins and drugs), Biological (infectious agents)], Teratogenic mechanisms- Genetic mutations, cellular processes and physiological disruptions).	3	5
	3.4	**Developmental defects**: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).	3	5
4		**Practical**	30	
	1	Calculation of gonado-somatic index of fish.	4	3
	2	Male and female reproductive organs in a teleost fish	3	2
	3	Study of placenta – pig and man.	2	2
	4	Study of permanent slides of blastula of frog and chick	3	2
	5	Study of permanent slides of gastrula of frog and chick	3	2
	6	Study of permanent slides of 18 hour, 24 hour, 33 hour and 48 hour chick embryo.	4	2
	7	Candling of eggs	1	3
	8	Study of chick development using live eggs – Vital staining-Window method (Demonstration)	3	2,3
	9	Blastoderm mounting and age determination of chick embryo (18hr/ 24hr/ 33 hr/ 48 hr/ 72 hr) using vital stains.	7	2,3
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure(Mode of transaction)** Lecture, Tutorial (Videos , Practicals)
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

REFERENCES

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**ZOOGEOGRAPHY AND EVOLUTIONARY BIOLOGY**					
Type of Course	**DSE**					
Course Code	**24SACZOO6DE302**					
CourseLevel	**300**					
Course Summary	Uncover the mysteries of evolution, unravel the geographical distribution of species, and journey through the fossilized record of Earth's evolutionary tapestry.					
Semester	**VI**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	---		----	60
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain the origin of earth and life.	U	1,2,7,10
2	Discuss the patterns and factors affecting the distribution of animals on earth.	U	1, 2,3
3	Describe the concept of evolution.	U	2,3, 10
4	Extrapolate evolutionary mechanisms.	A	1, 2, 10
5	Analyse the central role of fossils in evolution.	An	1,2, 3

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

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Zoogeography**	**20**	
	1.1	**Introduction to Zoogeography** Historical Biogeography Origin of oceans and continents, Plate tectonics – continental drift theory, rift valley, African great rift and its consequences- *(recent trends)*	4	1
	1.2	**Dispersal & Migration** Types and means of animal distribution, Factors affecting animal distribution.; Types of animal distribution,; Insular fauna – oceanic islands and continental islands with examples	8	2
	1.3	**Zoogeographic realms** Different Zoogeographical realms-Palearctic, Nearctic, Neotropical, Ethiopian, Oriental, Australian- with their sub regions - their boundaries, physical characteristics, climatic conditions, vegetation and fauna. Wallacea and its fauna; Zealandia **ACTIVITY:** Locating on the world map, zoogeographical realms and the animals endemic	6	2
	1.4	**Biogeography of India** Topographic features and Zoogeography, Western Ghats and its fauna and conservation measures	2	2
2		**Theories and genetic basis of organic evolution**	**14**	
	2.1	**Evolution of life- origin & theories** Brief account of Origin of Earth, Theory of origin life - biochemical origin- by Oparin and Haldane. Urey Miller experiment Lamarckism - Critical analysis of Lamarck's propositions Weisman's germplasm theory, Mutation theory Darwinism- Critical analysis of Darwinism Neo Darwinism Synthetic Theory of Evolution(brief account only) Neutral theory of molecular evolution by Kimura	9	1,3
	2.2	**Genetic basis of organic evolution** Genetic basis of variation, population genetics Hardy Weinberg	5	3

		law-gene pool, gene frequency, gene flow. Factors affecting gene frequencies		
3		**Mechanism of evolution**	**17**	
	3.1	**Isolating Mechanisms** Types of isolating mechanisms-Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution	3	4
	3.2	**Species and Speciation** Species concept, subdivisions of species- sibling species, deme, cline, semi species, sub-species. Speciation: Types of speciation, Phyletic speciation (autogenous and allogenous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation.	8	4
	3.3	**Nature of Evolution** Microevolution, Macroevolution Mega evolution, Adaptive radiation – process, causes, types (Darwin's finches, adaptive radiation in placental mammals). Punctuated equilibrium vs Gradualism Homologous and analogous structures	6	4
4		**Palaeontology**	**9**	
	4.1	**Fossils & Fossilization** Definition and scope of Palaeontology Types of Fossilization, Types of fossils, microfossils, Index fossils, trace fossils and living fossils, Transitional fossils Dating of fossils	4	5
	4.2	**Trends in Evolution** Convergent evolution. Co-evolution. Mass extinction. Geological Time Scale: Major events in different stages with special reference to connecting links and fossils in human evolution (brief reference to African origin on modern man- Mitochondrial Eve and Y chromosomal Adam).	5	5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Tutorial, ICT Enabled Learning. Experiential learning.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**FUNDAMENTALS OF PARASITOLOGY**					
Type of Course	**DSE**					
Course Code	**24SACZOO6DE303**					
Course Level	**300**					
Course Summary	A broad and multi-disciplinary approach to the complex and dynamic relationships between parasites and their hosts. This course offers an overview of the biological and epidemiological bases of important parasitic diseases and an understanding of the impact of parasitic diseases on endemic communities.					
Semester	**VI**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	---	--	---	60
Pre--requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain the fundamentals of host-parasite interactions, adaptations, and parasitism.	U	1,2
2	Describe the morphology, life cycle, pathogenicity, preventative measures, and control strategies of parasitic protists, nematodes, Platyhelminthes, and arthropods.	A	2
3	Identify parasitic vertebrates.	U	2
4	Demonstrate techniques used in molecular diagnosis and clinical parasitology.		
5	Determine career options in parasite research and the medical sciences.	A	2

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Parasites – An introduction**	**8**	
	1.1	Parasites, parasitoids, host, zoonosis, Origin and evolution of parasites, Basic concept of Parasitism, Symbiosis, Phoresy, commensalisms and mutualism, Host-parasite interactions, and adaptations.		1
2		**Parasitic Protists and Parasitic Platyhelminthes**	19	
	1.2	**Parasitic Protists** Study of morphology, life cycle, pathogenicity, prophylaxis and control measuresof *Entamoeba histolytica, Giardia intestinalis, Leishmania donovani, Toxoplasma gondii*	10	2
	2.2	**Parasitic Platyhelminthes** Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of *Fasciolopsis buski, Diphyllobothrium latum, Hymenolepis nana* ACTIVITY: Isolation, observation and documentation of trematode larval stages.	9	
3		**Parasitic Nematodes, arthropods and vertebrates**	18	
	3.1.	**Parasitic Nematodes** Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of *Ascaris lumbricoides, Ancylostoma duodenale, Brugia malayi, Trichinella spiralis* Nematode plant interaction; Gallformation	10	2,3
	3.2.	**Parasitic Arthropods** Biology, importance and control of Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*), Mites (*Sarcoptes*), Lice (*Pediculus*).Flea (*Xenopsylla*), Bug (*Cimex*), Parasitoid (Wasps)	5	
	3.3	**Parasitic Vertebrates** Cookicutter Shark, Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host	3	
4		**Molecular diagnosis & clinical parasitology**	**15**	

	4.1	General concept of molecular diagnosis for parasitic infection Advantages and disadvantages of moleculardiagnosis Fundamental techniques used in molecular diagnosis of endoparasites Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules (*Giardia intestinalis*, E. *coli, Entamoeba Histolytica, Leishmania donovani).* Malarial parasite using ELISA, RIA, Counter Current Immunoelectrophoresis (CCI), Complement Fixation Test (CFT), PCR, DNA, RNA probe		4
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Tutorial, ICT Enabled Learning. Experiential learning.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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4. Gunn, A. and Pitt, S.J. (2012). Parasitology: An Integrated Approach. Wiley Blackwell.

5. Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
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6. John Hyde (1996) Molecular Parasitology Open University Press.
7. Joseph Marr J and Miklos Muller (1995) Biochemistry and Molecular Biology of Parasites 2nd Edn A P.

Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**RESPONSIBLE TOURISM**					
Type of Course	**SEC**					
Course Code	**24SACZOO6SE301**					
Course Level	**300**					
Course Summary	Responsibility drives sustainability. Responsible Tourism is about making better places for people to live in and better places for people to visit. This course explores the principles and practices essential for responsible tourism including sustainable tourism focusing the inclusiveness of the local people¸ eliminating poverty¸ generating job opportunities¸ preserving cultural heritage and conserving natural resources.					
Semester	**VI**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	---	--	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify and describe the core concept of tourism and its impact on the environment.	**R**	1,3
2	Manage the key factors of responsible tourism and implement strategies to make the tourism sector profitable.	**C**	1,2,3,5, 6
3	Facilitate destination management and responsible tourist behaviour.	**A**	1,2,3,5, 6
4.	Integrate policies to promote responsible tourism.	**An**	1,2,3,6
5.	Choose instruments to implement responsible tourism.	**E**	1,2,3,4

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction to Responsible Tourism(RT) & Responsible Tourism Practices**	**15**	
	1.1	**Introduction** Tourism - Positive & Negative impacts . Types of Tourism	2	1
	1.2	Why Responsible Tourism? Principles & Practices of RT. Benefits- Ecosystem benefits, Tourism industry¸ tourist & host communities of the locality.	3	3
	1.3	Pillars of Responsible Tourism and their roles– environmental, social, economic, cultural.	3	2
	1.4	**Responsible Tourism Practices** Green & Sustainable Tourism Practices - Environment conservation; culture & heritage preservation; Inclusiveness of local community¸ minimize waste production¸ recycle & reuse of waste water¸ Reduce carbon footprint.	7	3
2		**Responsible Tourism Management**	14	
	2.1	Concept of Destination Management-Responsible action to address the social, economic and environmental issues affecting the sustainability that arise in destinations. Destination Management organizations (DMO) –Vision¸ Functions¸ Responsibilities.	4	3
	2.2	Tourist management strategies. Responsible Tourist Guidelines- Responsible behavior including responsible travelling, respecting different cultures, visiting heritage sites with a clear understanding of rules and regulations, and making purchase or usage decisions without generating waste	4	2
	2.3	Implementation of Green tourism in hospitality management	2	2
	2.4	Responsible & Sustainable tourism spots in Kerala: Thenmala¸ Wayanad¸ Thekkady¸ Aymanam¸ Maravanthuruthu.	4	2
3		**A. Policies to promote Responsible Tourism & B. Instruments for RT**	16	

	3.1	**A. Policies to promote Responsible Tourism** National strategies for: Sustainable tourism¸ Ecotourism¸ National Tourism Policy¸ Swadesh Darsan Scheme Policies for States, Kerala Tourism Policy	4	4
	3.2	Strategies for RT promotion: Environmental Sustainability, Biodiversity, Economic Sustainability, Socio-Cultural Sustainability; Criteria for accreditation of Sustainable Tourism: Environmental impact Social policy Capacity Building and Governance.	6	3
	3.3	**Instruments for RT:** Monitoring the Sustainability indicators. Identifying the limits of tourism: Geographic, Economic. Voluntary & Supporting Instruments: Voluntary - Guidelines and codes of conduct; Reporting and auditing; Voluntary certification Supporting - Infrastructure provision and management; Capacity building Implementation instruments for successful RT: Selection of location¸ Land use¸ balance between environmental protection and conservation. **ACTIVITY:** 1. Pick up two responsible tourism practices and present them before the class. 2. Conduct a survey on the award winners in the Responsible Tourism sector locally for the past 2 years and prepare the case study report. 3. Identify an unpopular tourist spot and formulate strategies to revive and turn it to successful 4. Conduct any one field trip to tourist destinations and prepare report on its functioning. **Information to be collected during field trip:** Visit to a hospitality enterprise (hotel, restaurant, travel agency etc) and discussion with the managers and employers about the sustainability innovations, products and technologies used by the company (e.g. renewable energy sources, bio energy, growing own fruits and vegetables, use of natural construction materials or organic household detergents and waste management). (**Minimum 4 days for all the 4**)	6	2, 5
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture¸ group interaction¸ seminar presentations
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

REFERENCES

1. Anukrati S. (2019). Sustainable Tourism & Development¸ Apple Academic Press.
2. Fennell, D., and Malloy, D., (2007). Codes of Ethics in Tourism. Practice, Theory, Synthesis. Clevedon: Channel View Publications.
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7. Harrison, L., and W. Husbands 1996 Practicing Responsible Tourism. New York: Wiley.
8. Husbands, W. & Harrison, C. 1996. Practicing responsible tourism. Toronto: John Wiley & Sons, Inc.
9. J. Policy Res. Tour. Leis. Events, (2012) Responsible tourism and sustainability: the case of Kumarakom in Kerala, India 4 (3) pp. 302-326.
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11. Parikshat Singh Manhas 2010. Sustainable & Responsible tourism.PHI Publishers.
12. Romila Chawla, (2005). Responsible Tourism, Sonali Publications.

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**REPRODUCTIVE HEALTH AND SEX EDUCATION**					
Type of Course	**VAC**					
Course Code	**24SACZOO6VA301**					
Course Level	**300**					
Course Summary	This course is designed to provide students with a thorough understanding of reproductive health & sex education, covering biological, psychological & sociocultural aspects. The course aims to equip students with the knowledge and skills necessary to make informed decisions about their sexual health, foster healthy relationships & contribute to the promotion of sexual well-being in diverse communities.					
Semester	**VI**	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	---	---	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarise the necessity of sex education, primary and secondary sexual characteristics, and reproductive health.	U	1,2,3 ,6
2	Describe teenage pregnancy, sexual harassment, sexual awareness, and policies related to adolescent sexual behaviour.	U	6
3	Appreciate the broad spectrum of sexual orientations and gender identities, equity, inclusivity, and healthy relationships.	U, Ap	7,8
4	Explain sexual health, sexually transmitted infections (STIs) and contraception methods.	U	6

5	Analyse safe sex practices, various options for reproductive choices, responsible parenthood and family planning	U, An	6,8

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction to Sexual and Reproductive Health**	**17**	
	1.1	Definition of reproductive health and sex education, Importance of comprehensive sex education	3	1
	1.2	Cultural and societal perspectives on sexuality, Ethical considerations in sex education	3	1
	1.3	Primary and secondary sexual characters and puberty, Physical and emotional changes during puberty. Neural and hormonal peculiarities of male and female brain. Role of hormones in the development of secondary sexual characters.	5	1
	1.4	Personal hygiene and self-care during adolescence, Emotional well-being, self-esteem, and body image.	3	1
	1.5	Adolescent sexual activity, teenage pregnancy, sexual harassment, sexual awareness and policies (legal aspects)	3	2
2		**Healthy Relationships, Sexual orientations and gender identities**	**14**	
	2.1	Healthy relationships (Five Es-empathy, enthusiasm, empowerment, equality, energetics, Five As-acceptance, accommodation, appreciation, adaptability, agreement, Five Ls love, loyalty, listening, laughter, lust, Five Ts trust, talking, time together, tenderness, thoughtfulness), Consent, boundaries, and respect in relationships, Recognizing and respecting boundaries, sexual assault, harassment, and coercion and supporting survivors.	8	3
	2.2	Sex Determination in Humans, diverse sexual orientations and gender identities (LGBTQ), Addressing stereotypes and prejudices related to sexuality.	6	3
3		**Safe Sex, Reproductive Choices and Parenthood**	**14**	

	3.1	Importance of safe sex practices**,** Types of contraceptives (condoms, birth control pills, IUDs, Emergency contraception and its availability etc.)	3	4
	3.2	STDs and Prevention of sexually transmitted infections (STIs)**,** Testing, treatment, and counseling for STIs	5	4
	3.3	Options for reproductive choices (parenting, adoption, abortion, surrogacy), Postpartum care and mental health.	3	5
	3.4	Responsible parenthood and family planning, Balancing career, education, and parenthood.	3	5
4		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, videos.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 25 marks** Quiz, Test Papers, seminar
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks

REFERENCES

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2. Frankowski, B. L., & Committee on Adolescence. (2004). Sexual orientation and adolescents. Pediatrics, 113(6), 1827-1832.
3. Goldberg, A. E. (Ed.). (2016). The SAGE encyclopedia of LGBTQ studies. SAGE publications.

4. Leon, I. (2008). Psychology of reproduction: Pregnancy, parenthood, and parental ties. Global Library of Women's Medicine.
5. Owen, R. R., & Matthews, D. (1982). Developmental and acquired disabilities in adolescence. In Adolescent Health Care (pp. 131-141). Academic Press.
6. Tortora, G. J., & Derrickson, B. H. (2018). Principles of Anatomy and Physiology. John Wiley & Sons.

SUGGESTED READING

1. SOGIE handbook
2. https://www.lausd.org/cms/lib/CA01000043/Centricity/domain/156/pdfs/SOGIE%20Handbook.pdf
3. https://www.health.ny.gov/prevention/sexual_violence/docs/sogie_handbook.pdf

Semester-VII

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**BIOPHYSICS, INSTRUMENTATION AND DIAGNOSTIC IMAGING TECHNIQUES**					
Type of Course	**DCC**					
Course Code	**24SACZOO7CC401**					
Course Level	**400**					
Course Summary	To understand and interpret the basics of biophysics & facilitate an understanding of the principle, design, working & applications of various instruments & imaging techniques relevant to biology and medicine.					
Semester	**VII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	1	---	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain the theoretical underpinnings of biophysics and bioenergetics.	A	2
2	Describe the concepts of radiation physics, radiation detection, & applications.	A	1
3	Compare the underlying principles, designs, and workings of different separation techniques, microscopes, analytical instruments, diagnostic imaging techniques, and electrophysiological methods.	An	2
4	Explain the utility of bio instruments and their importance in biology.	U	2

5	Apply skills in using the camera Lucida, TLC, micrometry, colorimetry, centrifuge, and pH meter.	A, S	2

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Foundation Concepts in Biophysics and Bioenergetics**	**7**	
	1.1	**Principles of Biophysics** Diffusion- Kinetics of diffusion, Fick's law and diffusion coefficient, Stoke-Einstein's law, Gibb's Donnan equilibrium, Biological importance of diffusion. Applications of diffusion process in Biology. Osmosis - osmotic concentration, osmotic pressure and osmotic gradient, Vant Hoff's laws, Electro-osmosis, Electrolyte and ionic balance in biological fluid. Biological significance of osmosis.	5	1
	1.2	**Bioenergetics** Laws of Thermodynamics, Reversible and Irreversible Thermodynamics, Entropy, Enthalpy, Gibb's Free energy, Carnot cycle, Chemical potential.	2	1
2		**Radiation Biophysics**	12	
	2.1	**Radiation Biology** Nature of radioactivity, Units of radioactivity. Interaction of radiation with matter. Ionising radiations, Cherenkov radiations. Radioactive isotopes. Radiation dosimetry. Biological effects of radiation.	3	2
	2.2	**Radiation detection** Ionization chamber, Liquid scintillation counter, Geiger-Muller (GM) counter, Semiconductor detectors	3	2
	2.3	**Applications :** Diagnosis and Radiotherapy, Radioimmunoassay, Autoradiography, Radio tracer	2	2

		techniques, Nuclear Medicine.		
	2.4	**Radio-Ultrasound Imaging Techniques for diagnosis**: X-ray radiography**,** Angiography, PET, MRI, fMRI, CAT, Ultrasound Imaging.	4	3
3		**Instrumentation**	26	
	3.1	**Microscopy:** Light microscopy, Phase Contrast Microscopy, Fluorescence Microscopy, Confocal Microscopy, Electron Microscopy- Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), STEM, Specimen preparation shadow casting, Freeze fracturing, Freeze etching. Electron Cryo-Microscopy. Micrometry and Camera Lucida	5	3,4
	3.2	**Separation Techniques** Centrifuge- Principle and applications, high-speed centrifuge, Density gradient centrifuge, Ultracentrifuge, Decanter centrifuge. Chromatography-Principle and applications, Column Chromatography, Ion exchange chromatography, HPLC, Gas Chromatography. Electrophoresis- Principle and applications, Gel electrophoresis-SDS PAGE, 2D Gel electrophoresis, Disc electrophoresis, Agarose Electrophoresis, High voltage electrophoresis, Capillary electrophoresis, Electrophoretic mobility shift assay (EMSA), Isoelectric focusing. BRIEF ACCOUNT ONLY	8	3,4
	3.3	**Analytical Instrumentation** Colorimetry & Spectrophotometry. Beer-Lambert's Law Spectroscopy- Raman Spectroscopy, Circular Dichroism, Fourier Transform Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance (NMR) Spectroscopy Electron Spin Resonance (ESR) Spectroscopy, Mass Spectroscopy-MALDI-TOF, LCMS, Tandem Mass pH Meter, Flow Cytometry	10	3,4
	3.4	**Electrophysiological methods** Single neuron recording, Patch-clamp recording, Tread mill	3	3,4

		test, Application of Deep Brain Stimulator and Pacemaker		
4		**PRACTICALS**	30	
		1. Micrometry- Principle and measurement of microscopic objects. 2. Camera Lucida- Drawing of specimens using Camera Lucida 3. TLC using amino acids and calculation of RF values 4. Identification of absorption maxima of given sample by colorimetry 5. Determine the pH of two prepared buffer samples 6. Separation of Casein from milk using centrifugation **7.** Demonstration/Institutional Visit for understanding the instrumentation and working of any three Techniques from Microscopy/ Spectroscopy/ Electrophoresis/Flow Cytometry/ Imaging Techniques and submit the report		5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Group Discussion, Practical
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

REFERENCES

1. Agarwal, L. (2019). *Concise Textbook of Basic Radiography*. Jaipur: JBD Publications.
2. Alonso, A. And Arrondo, J.L.R. (2006). *Advanced techniques in Biophysics*: Heidelberg: Springer Verla.
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7. Gupta, A. (2009). *Instrumentation and Bio-Analytical techniques*. Meerut: Pragati Prakashan.
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9. Levine, I.N. (2009). *Physical Chemistry*. New York: Tata McGraw-Hill.
10. Murugeshan,R. and Sivaprasanth, K. (2008). *Modern Physics*. New Delhi: S. Chand &Company.
11. Nicholis, D.G. and Ferguson, S.J. (1992). *Bioenergetics*. New York: Academic Press.
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13. Powsner, R.A., Palmer, M.R. and Powsner, E.R. (2022). *Essentials of Nuclear Medicine Physics, Instrumentation and Radiation Biology*. Hoboken: John Wiley and Sons, Inc.
14. Puri, B.R., Sharma, L.R. and Puthania, M.S. (2003). *Elements of physical chemistry*. Jalandhar: Vishal Publishing Co.
15. Roy, R.N. (2009). *Text Book of Biophysics*. Howrah: New Central Agency (P) Ltd.
16. Sandhu, G.S. (1990). *Research Techniques in Biological Sciences*. New Delhi: Anmol Publications.
17. Subramanian, M.A. (2005). *Biophysics: Principles and Techniques*. Chennai: MJP Pub.
18. Thayalan, K. (2014). *The Physics of Radiology and Imaging*. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.

SUGGESTED READING

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

Department of Zoology
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**BIOSTATISTICS & RESEARCH METHODOLOGY**					
Type of Course	DCC					
Course Code	**24SACZOO7CC402**					
Course Level	400					
Course Summary	Introduce students to key concepts in designing and conducting scientific studies. Modules include understanding the research process, exploring study designs, and learning data collection techniques. Students delve into descriptive and inferential statistics, with a focus on applying these principles in Biology related research. Practical skills are honed through hands-on experience with statistical software, and the course concludes with sessions on reporting findings & critically appraising research.					
Semester	VII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	---	---	---	60
Pre requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Explain the basic concepts of biostatistics and research methodology.	U	2 ,3
2	Demonstrate skills to collect, organise, and present data for biological research.	S, I	2
3	Analyse biological data using appropriate statistical methods and software.	An	1,2
4	Demonstrate skills in scientific documentation and communication.	A	2,4

5	Test hypotheses in biological research with appropriate statistical tools and interpret the derived information to aid in the decision-making process.	S, C, E	1,2, 3

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Overview of Biostatistics and Descriptive Statistics**	15	
	1.1	Scope and application 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. Presentation of Data - Graphs and Diagrams.	4	1,2
	1.2	Measures of central tendency: mean, median, mode. Corrected mean.	5	3
	1.3	Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation. Corrected standard deviation. Skewness and kurtosis.	6	3
		ACTIVITY: 1. Preparation of frequency distribution table from raw data 2. Problems related to mean, median and mode (Individual, discrete and continuous series) 3. Problems related to range, Quartile deviation, mean deviation and standard deviation (Individual, discrete and continuous series) 4. Preparation of bar diagrams, pie diagram, line graph, frequency polygon, frequency curve, histogram and ogives. Computation of mean, standard deviation, correlation, regression equation, 't' test, ANOVA (Using MS Excel or any other package) **Note:** Use Clinical/Biological data for the problems		
2		**Correlation, Regression, Probability, Statistical Inference & Statistical Software**	25	

	2.1	Correlation Analysis: Types and methods of correlation analysis, Karl Pearson's correlation coefficient.	5	5
	2.2	Regression analysis: Graphic methods - Scatter method, Line of best fit; Algebraic method- Regression equations. Relationship between correlation and regression	6	5
	2.3	Classical definition of probability. Addition and multiplication theorems. Probability distributions: Binomial and Normal distribution.	5	5
	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.	7	5
	2.5	Statistical Software: SPSS, R, PRIMER (Brief account only)	2	3,5
		ACTIVITY: 1. Calculation and interpretation of corrected mean and corrected standard deviation 2. Calculation and interpretation of Pearson correlation coefficient. 3. Calculation and interpretation of regression equation (x on y & y on x) 4. Calculation and interpretation of Chi square test (2×2 table only) 5. Calculation and interpretation of 't' test 6. Calculation and interpretation of one-way ANOVA		
3		**Research: Types, Design , Literature review and Ethics in Research**	8	
	3.1	Types of Research – Deductive/Inductive, Descriptive/Analytical, Applied/Fundamental, Quantitative/Qualitative, Conceptual/Empirical. Defining and formulating the research problem.	2	1
	3.2	Research Design: Basic principles, Significance and features of good design. Types of research designs.	2	1
	3.3	Literature review - Importance of literature review in defining a problem, Critical literature review.	2	1
	3.4	Ethics in research - Plagiarism, Plagiarism checking software - Turnitin, Viper, Urkund. Citation and Acknowledgement	2	1

4		**Scientific Documentation and Communication**	12	
	4.1	Structure and components of Scientific Report. Types of Report – Technical Reports and Thesis/dissertations.	3	4
	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 & ISSN.	5	4
	4.3	Conventions and strategies of authentication – Citation styles, bibliography, referencing and foot notes. Software for managing bibliographies – EndNote, Mendley. Global Information System – BIOSIS, Medline and Medlars, AGRIS, PubMed, Google Scholar.	3	4
		ACTIVITY: 1. Publish a scientific paper in any peer reviewed journal/ publish a book chapter / present a paper (Oral/Poster) in a seminar. (Any one compulsory) 2. Review a scientific article in Biology and submit the report 3. Prepare bibliography in APA format from the given details of a published scientific paper		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing, problem solving, writing a review of any published article. Preparing a sample project proposal.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Department of Zoology
St. Albert's College (Autonomous)
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**ADVANCED GENETICS**					
Type of Course	**DCC**					
Course Code	**24SACZOO7CC403**					
Course Level	**400**					
Course Summary	The course is designed for students with a solid foundation in basic genetics who seek a deeper understanding of advanced topics and their practical applications. The course aims to prepare students for advanced studies or careers in research, healthcare, biotechnology, and related fields by providing a comprehensive understanding of the latest advancements in genetics.					
Semester	**VII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the molecular organization of the chromosome, linkage, recombination, and transposons.	K	2
2	Explain the role of chromatin remodeling complexes in modulating gene expression through epigenetic changes.	U	2
3	Describe the latest developments and advancements in the field of cytogenetics.	U	1
4	Explain the genetic basis of familial cancer and the implications for risk assessment and genetic counselling.	U	3

5	Analyze the ethical implications of HGP, GM crops, personal DNA data, and gene therapy.	An	2,6,8
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Molecular organisation of Chromosome, Linkage, Recombination & Transposons**	**20**	
	1.1	Genome size and c-value Paradox. Molecular structure of centromere and telomere, telomere shortening and aging process, Repetitive nucleotide sequences in eukaryotic genomes - mini and micro satellites.	5	1
	1.2	**Linkage and recombination:** Crossing over as the physical basis of recombination, Molecular mechanisms of recombination (Holliday model), Recombination mapping with two-point and three - point test cross in *Drosophila*, Coincidence and Interference. Mitotic recombination. Genetic recombination in Phage, complementation test, deletion mapping, conjugation mapping.	10	
	1.3	**Transposable genetic elements:** Transposons in prokaryotes (IS elements, composite elements - Tn10, non-composite elements - Tn3) and eukaryotes (DNA transposons, Retrotransposons - SINE and LINE, Ac/Ds elements in maize).	5	
2		**A. Epigenetics & B. Cytogenetic techniques**	**15**	
	2.1	**A. Chromatin modifications and their mechanism of action:** Histone code hypothesis, Modification of histone proteins - acetylation, phosphorylation, methylation, ubiquitylation, SUMOylation, Chromatin remodeling, Genomic imprinting.	6	2, 3
	2.2	**Epigenetics in *Drosophila*:** Position effect variegation (PEV) and Polycomb Group Genes (PcG) in *Drosophila* model	3	
	2.3	**B. Cytogenetic techniques** Karyotyping - G-banding, C-banding, R-banding Sex chromatin analysis (buccal mucosa, hair bud), and COMET assay.	3	
	2.4	FISH (Fluorescent In-situ Hybridization), CGH (Comparative genomic hybridization), aCGH (Array comparative genomic hybridization)	3	

3		**Cancer Genetics**	**15**	
	3.1	Oncogenes, tumour suppressor genes, DNA repair genes and genetic instability, epigenetic & Post translational modifications.	5	4
	3.2	Role of proto-oncogenes in regulating cell growth and survival, mechanisms of activation of oncogenes, Cell cycle and Cancer.	3	
	3.3	**Familial cancers** (Retinoblastoma, Colorectal cancer and Breast cancer), Biomarkers and Cancer therapy: at cellular, gene and protein level. Chemotherapeutics for cancer; Advance therapies in cancer; Monoclonal antibody therapies for cancer.	7	
4		**Genetics and Society**	**10**	
	4.1	**Pedigree:** Analysis of Pedigree charts for different inheritance patterns, Consanguinity and its effects in the pedigree pattern.	2	4,5
	4.2	**Genetic counseling:** Components of genetic counseling - Physical examination, Patterns of inheritance, risk assessment and counseling, Indications for chromosomal testing.	4	
	4.3	**Human Genome Project (HGP):** Sequencing of the Human Genome, promises and achievements, ethical, legal, and social issues of the HGP. Areas of concerns in modern genetics (GM crops, personal DNA data, Gene Therapy)	4	
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing with ICT , Assignments/ Seminar, Group discussion/ Presentation.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)

	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**ECONOMIC ENTOMOLOGY**					
Type of Course	**DCE**					
Course Code	**24SACZOO7DE401**					
Course Level	**400**					
Course Summary	Economic Entomology is a specialised field of study that focuses on the economic impact of insects on agriculture, forestry, and other human activities. This course typically covers a wide range of topics related to insect biology, ecology, and management strategies to mitigate their economic impact.					
Semester	**VII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	--	--	--	60
Pre requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify major insect pests and beneficial insects that are economically significant in agriculture, forestry, and urban settings.	K	1
2	Explain the life cycles, behaviour, and ecology of key insect pests and beneficial insects.	U	2
3	Describe the principles and practices of IPM.	An	3
4	Explain emerging trends and issues in forensic, medical, and industrial entomology.	I	9
5	Demonstrate skills to analyse complex pest management problems and propose practical solutions.	C, S	6,10

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Insects as pests**	**15**	
	1.1	Kinds of insect pests - Major pests, minor pests, sporadic pests, endemic pests, exotic pests, seasonal pests, occasional pests, regular pests, persistent pests. Causes of pest outbreak- deforestation, destruction of natural enemies, pest resurgence, secondary pest outbreak, intensive and extensive cultivation, introduction to new crops, hybrid varieties, introduction to new pests.	5	1
	1.2	Damages caused by selected insect pests and their management. (i) **Pests of Crops:** 1. Coconut Pests - *Oryctes rhinoceros* and *Rhyncophorus ferrugineus* 2. Paddy Pests - *Leptocorisa acuta* and *Spodoptera mauritia*. (ii) **Stored grain pests** - *Trogoderma granarium* and *Tribolium castaneum* (iii) **Pests of vegetables** - 1. Brinjal: *Leucinodes orbonalis* and *Euzophera perticella,* 2. Gourds: *Bactrocera cucurbitae* and *Anadevidia peponis*. (iv) **Pests of fruits:** 1. Citrus fruits - Citrus leaf miner (*Phyllocnistis citrella*) and Citrus psylla (*Diaphorina citri*) *2.* Banana Pests - *Cosmopolites sordidus* and *Pentalonia nigronervosa* 3. Mango Pests - Stem borer (*Batocera rufomaculata*) and Scale insect (*Chloropulvinaria polygonata, Aspidiotus destructor*) **ACTIVITY** 1. Insect collection and preservation: Collection and submission of insect pests of crops and vegetables and prepare an Insect Pest Box. 2. Collect & submit different pests of stored grains from the local provision shops or houses and prepare a power point presentation	10	1, 5
2		**Control of insect pests**	**15**	
	2.1	**Integrated pest management (IPM)** What is IPM? Need for IPM. Planning of IPM, Different techniques used in IPM;, Few examples and advantages of IPM. (Pest surveillance- Forecasting pest outbreaks and	3	3

		surveillance, short term and long term forecasting, legal/Regulatory practices, cultural, physical, Mechanical, genetic, biological and chemical control)		
	2.2	**Chemical Control:** i. Broad classification of insecticides. Inorganic insecticides (Arsenicals, Lime Sulphur, Mercury compounds, Fluorine compounds) , Fumigants (Para dichlorobenzene, Methyl bromide, Hydrogen cyanide) ii. Natural organics – oils, insecticides of plant origin (Pyrethrins, Nicotine, Azadiractin) Synthetic Organics – Chlorinated Hydrocarbons (BHC, Methoxychlor) Organophosphate (Malathion, Parathion, Dicrotophos, clorpyriphos) Carbamates (Carbaryl, Propoxur) and Pyrethroids (Allethrin, Cypermethrin). iii. Advantages and disadvantages of chemical control.	7	5
	2.3	i. **Biological control** by [predators, parasites and microbes (Bacteria, viruses), fungi, Nematodes]; Biological control Strategies - Introduction, Augmentation and Conservation ii. Use of Hormones and Pheromones. iii. Autocidal control - Sterile male technique, male confusion technique, genetic technique	5	5
3		**Beneficial Insects**	**15**	
	3.1	**Industrial Entomology:** Apiculture & Sericulture. Lac insects and Black Soldier Flies **ACTIVITY**: Set up a waste management unit involving Black Soldier Fly and submit report with geotagged photos.	8	4
	3.2	Importance of insect Pollinators with example- honey bee, wasp, butterfly Edible insects & human nutrition	2	4
	3.3	**Forensic Entomology**: Brief mention of Common insects of Forensic importance - Order Diptera Calliphoridae, Sarcophagidae & Muscidae Order Coleoptera - Staphylinidae, Histeridae, Silphidae, Dermestidae & Cleridae	3	4
		Steps involved: i) Collection of entomological evidence during a death investigation. ii) Temperature and climatic records, iii) collection, preservation and handling of insects/maggots from the crime scene. iv) Analysis of entomological evidence and estimating PMI (Post Mortem Index) using Maggot age and Insect succession.		
4		**Medical Entomology**:	**15**	

	4.1	Pests of man and their management: Mosquitoes *Anopheles, Culex, Aedes*, houseflies, bed bugs, head lice, house dust mites. Diseases caused by insects.	8	1,4
	4.2	Pests of domestic animals and their management: cattle, poultry, pet animals:- (bird louse, *Hypoderma*, screwworms, *Gasterophilus*) Diseases caused.	7	1,4
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning approach	**Classroom Procedure (Mode of transaction)** Lectures, virtual tours to observe and identify insect pests.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**AQUAFARMING**					
Type of Course	**DCE**					
Course Code	**24SACZOO7DE402**					
Course Level	**400**					
Course Summary	Course will help the students to understand the various aspects of Aqua farming					
Semester	**VII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	---	-----	-----	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify the different aquaculture systems.	U	2
2	Demonstrate skills in advanced aquaculture technologies, aquarium management, breeding of ornamental fish, seed production of common cultivable species, and aquaponics.	U, S	2
3	Explain nutritional requirements and the processing and preservation of farming products.	A	2
4	Analyse the symptoms, diagnosis, and prevention/control of aquatic animal diseases.	An	2
5	Explain the effects of aquaculture methods on the environment.	A	3,8

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction to Aquaculture**	**18**	
	1.1	Definition, scope, importance & types. Fin fish & shellfish culture. Different aquaculture systems: Pond, embankment pond, cage, pen, running water/race ways, extensive, intensive and semi-intensive culture systems, Integrated Multi trophic Aquaculture (IMTA)	3	1
	1.2	Pond preparation & management (Soil & Water quality management), Breeding & nursery rearing. Hatchery management. Prawn culture. Mussel culture - raft, pole.	10	1,2
	1.3	Nutritional requirements, Probiotics used in aquafarming. Types of feed, Methods and techniques involved in the formulation of fish feed. Processing & preservation of farming products **ACTIVITY** 1. Identify live fish food organisms & culture any one organism. 2. Survey of different feeds used in different hatcheries.	5	3
2		**Aquarium management, Integrated farming & Aquaponics**	**14**	
	2.1	Aquarium - water quality management, 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: Fish-cum-livestock/poultry farming, paddy-cum-fish farming, Sewage-fed fish culture	5	1
	2.3	Aquaponic systems	2	2

		ACTIVITY Construct aquaponics systems at home & report submission (attach Geo-tagged photos)		
3		**Advanced technologies and Health management practices in aquaculture**	**15**	
	3.1	Recirculating Aquaculture System (RAS) for the sustainable development of Aquaculture	3	2
	3.2	Monosex culture or Neo-female technology, GIFT (Genetic Improvement of Farmed Tilapia), Biofloc Technology	4	2
	3.3	Bio security & quarantine.	2	4
	3.4	Diseases (Viral, bacterial, fungal & parasitic) of fin fish & shellfish, treatment & prophylactic measures	5	4
	3.5	Predators **ACTIVITY** A survey of nearby aquaculture systems and report different diseases/parasites observed from farm	1	4
4		**Environmental impact of Aquaculture**	**13**	
	4.1	**Positive**: Utilization of waste from other farming systems in aquaculture Utilization of derelict water bodies for aquaculture. Weed control	3	5
	4.2	**Negative**: Environmental consequences related to hyper-nutrification, leaching of chemicals/ drugs into the environment, misuse of productive land. Introduction of exotic pathogens / diseases into the environment through indiscriminate/clandestine movement of fish seeds Remedial measures	5	5
	4.3	Aquacultural wastes and new developments in waste minimization. Enforcement of rules & regulations for sustainable aquaculture	5	4
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Classroom, videos of reputed farmers/institutions/processing units, success stories of aqua farmers.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Department of Zoology
St. Albert's College (Autonomous)
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Programme	**B.Sc. Zoology**					
Course Name	**Estuarine Ecology and planktonology**					
Type of Course	Core course					
Course Code	**24SACZOO7DE403**					
Course Level	**400**					
Course Summary	This course provides a comprehensive understanding of estuarine ecosystems and its community structure. Estuaries, being the most productive ecosystem, students will explore the distributions and abundance of estuarine species (especially plankton), and the need for conservation of such dynamic environments. The course also delves into topics like role of primary producers; primary and secondary consumers in estuarine ecosystem; collection of phytoplankton and zooplankton; their preservation and identification methods and along with their interrelationships.					
Semester	VII	Credits				Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				75
Prerequisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the Background and Classification of estuaries	U	
2	Analyse the importance of lakes; its classifications and importance of estuarine ecosystems	An	
3	To identify the life forms in estuaries and to apply this knowledge to interpret their interrelations.	Ap	
4	Evaluate the community structure of phytoplankton and zooplankton via qualitative and quantitative studies; and their collection methods	E	
5	Create effectives strategies and measures for conservation of such productive ecosystems with these organisms as indictors.	C, S, I	

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	**Background and Classification of estuaries (7hrs)**			
	1.1	Introduction to estuaries, Classification of estuaries, Major estuaries of international, national and regional importance	3	1, 2
	1.2	Ramsar sites and wetlands, its importance, reclamation and conservation measures.	4	1, 2
2	**Lacustrine; Estuarine and Brackish water Ecology (8hrs)**			
	2.1	Classification and Ecology of lakes; Brief account of the major lakes and reservoirs of India	2	1,2
	2.2	Ecology of estuarine and brackish water systems	2	1,2
	2.3	Estuarine barriers and barrages, their ecological impacts on the ecosystem	2	2
	2.4	Effects of Estuarine pollution; sewage pollution and organic enrichment, land reclamation on estuarine ecology.	2	2, 3
3	**Life in estuaries** (10 hrs)			
	3.1	Distribution of estuarine organisms; Primary producers (Phytoplankton; microalgae; mangroves etc);	2	1, 3
	3.2	Primary consumers (microzooplankton; mesozooplankton and meiofauna)	2	3
	3.3	Secondary consumers (Fishes; birds and invertebrates)	3	1, 3
	3.4	Role of primary producers; primary and secondary consumers in estuarine ecosystem.	3	1, 3
4	**Phytoplankton and Zooplankton (20 hrs)**			
	4.1	Quantitative and qualitative studies of phytoplankton and zooplankton (micro & mesozooplankton); Methods used for the collection. Different types of plankton nets (phyto and zooplankton); Classification of plankton (based on size)	6	3, 4
	4.2	Fixation and preservation of plankton samples. Sorting and counting procedure (phyto and zooplankton)	6	3, 5
	4.3	Community structure; phytoplankton and zooplankton as indicator organisms.	4	3, 4, 5

	4.4	Interrelationship between phytoplankton and zooplankton. Harmful Algal Blooms and its impacts.	4	3, 4, 5
5		**Teacher specific (Practical/field visit)**		
	1	Field visit (any two freshwater and estuarine ecosystem), Marine/Brackish water research institute visit		
	2	Plankton sample collection (phyto and zooplankton), their basic taxonomic identification using standard keys		
	3	Zooplankton slide preparation; primary productivity studies		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Videos, Institutional visits.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**LIVESTOCK AND POULTRY MANAGEMENT**					
Type of Course	**DCE**					
Course Code	**24SACZOO7DE404**					
Course Level	**400**					
Course Summary	Livestock & Poultry Management focus on the basic techniques for rearing Cattle, Goat, Pig and Rabbit and poultry. Its emphasis on the shelter breeding, feeding and management of livestock and poultry.					
Semester	**VII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practicum	Others	
		4	---	--	---	60
Prerequisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify common breeds and diseases of rabbits, pigs, Indian goat poultry, quail, and ducks.	U	1,2
2	Differentiate the housing and nutritional requirements of rabbits, pigs, Indian goats, poultry, quail, and ducks.	A	1, 2,3
3	Select breeding stock for livestock, poultry, quail, and duck.	A	1, 2
4	Demonstrate skills in cuniculture, poultry, quail, duck, piggery, and dairy farming.	C	1, 2, 3, 6
5	Create health care plans for rabbits, pigs, poultry, quail, Indian goats, and ducks in order to prevent diseases.	C	1, 2,3

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

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Poultry Husbandry**	**15**	
	1.1	Introduction, Morphology of chick. Poultry breeds in India, 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, 2, 3,4, 5
	1.2	Quail farming (Coturnix coturnix) Introduction, care of quail chicks, care of adult quails, care of breeding quails, ration for quail, care of hatching eggs. Health care, use of quail egg and meat. Sources of quality chicks.	5	1, 2, 3,4, 5
	1.3	Duck farming Husbandry of ducks – Breeds in India, Advantages of duck rearing. Housing, feeding and management of ducks.	3	1, 2, 3,4, 5
2		**Dairy farming**	**19**	
	2.1	Definition and importance of cattle farming, Breeds of cattle.	3	1,3
	2.2	Housing for dairy cattle, Management of cross breed cows, Health management, Milk production	8	2,3,4, 5
	2.3	Introduction and Breeds of Indian Goat. Medicinal importance of goat milk. Avoidance of goatery odour in milk.	2	1,4
	2.4	Breeding Management Fitness of purchase for first breeding – methods of detection of heat – Natural Service and artificial insemination – Care of the pregnant Animals – Breeding	3	3,4

		stock –Use of teaser – Culling.		
	2.5	Feeding Management Feeding habits of Goats, Nutritional requirement of goat, Housing, care of kids.	1	2
	2.6	Health Management Management in the prevention and control of diseases, Deworming, Dipping, and spraying.	2	5
3		**Piggery (Pig Farming)**	**11**	
	3.1	**Piggery** : Piggery development in India, Breeds of Pigs, Advantages and disadvantages of swine keeping. Selection of quality adults, mechanism of reproduction, and management.	5	1,3
	3.2	Housing and Feeding Sanitation and hygiene of Pigs, Nutrition and Digestion in pigs.	4	2
	3.3	Diseases and prevention	2	5
4		**Cuniculture**	**15**	
	4.1	**Cuniculture** : 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	1
	4.2	**Rabbit production - Housing and Breeding** :	5	2,3,4,
	4.3	Health care and Management of young rabbits, managing broiler rabbits, managing wool rabbits, Feeding of rabbits.		5
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning approach	**Classroom Procedure (Mode of transaction)** Lecture, Videos, Farm visits..
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory** **Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**SOLID WASTE MANAGEMENT**					
Type of Course	DCE					
Course Code	**24SACZOO7DE405**					
Course Level	400					
Course Summary	Principles, practices, and challenges associated with the management of solid waste, generation, collection, transportation, treatment, disposal, recycling and the environmental and public health implications of improper waste management, and the regulatory frameworks governing waste disposal. Students explore the importance of adopting sustainable waste management practices to minimize environmental pollution, conserve natural resources, and promote public health. They also examine the social, economic, and cultural factors influencing waste generation and management decisions.					
Semester	VII	Credits			4	Total
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Hours
		4	--	--	--	60
Pre requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the types, sources, composition, and characteristics of solid waste, including hazardous and non-hazardous materials.	U	2,3
2	Describe waste management techniques, including waste reduction, recycling, composting, and landfill management, and the benefits and limitations of each approach.	U	2,3
3	Demonstrate skills in composting and thermal conversion methods.	A,S	2
4	Acquire skills in developing comprehensive and sustainable waste management plans tailored to specific contexts, considering factors such as waste generation rates, local regulations, community needs, and	A,S	2,8

	available resources.		
5	Analyse landfill design, construction, operation, and closure procedures to determine their environmental impacts and propose mitigation measures for environmental sustainability.	An	1,8
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

Course Contents

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction**	**15**	
	1.1	Definition, overview of solid waste management, types of solid wastes, sources of solid wastes, properties of solid wastes, Factors affecting the type and quality of waste, causes of solid waste generation, associated risks of solid wastes, Physical and chemical composition of municipal solid waste, hierarchy of waste management options.		1,4
2		**Solid waste management**	15	
	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. Methods of handling and processing of solid wastes: separation, screening, size reduction, densification, baling, cubing, compaction, and pelleting.		2
3		**Landfilling**	**15**	
	3.1	Site selection criteria, landfill layout, landfill sections, 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.		5
4		**Composting and thermal conversion methods**	**15**	
	3.1	Composting: definition, types, process description, design and operational consideration of aerobic composting; process description, design and operational consideration of anaerobic composting.		3

		Vermicomposting: species of earthworms used. Black soldier flies for waste decomposition, Thermal conversion methods: incineration/combustion, pyrolysis and gasification, energy recovery system. **ACTIVITY**: Prepare a vermicomposting unit and submit report along with geo-tagged photos		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Videos
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 30marks** Quiz, Test Papers, Seminar, Activity Report (on behavioral study)
	B. End Semester Examination **Theory Total = 70 marks, Duration 2 hrs** Multiple Choice Questions 1 x 20 = 20 Marks Short Essays 6 out of 8, 5 x 6 = 30 Marks; Essays – 2 out of 4, 10 x 2 = 20 Marks

REFERENCES

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Semester-VIII

Department of Zoology
St. Albert's College (Autonomous)
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**ADVANCED IMMUNOLOGY**					
Type of Course	**DCC**					
Course Code	**24SACZOO8CC401**					
Course Level	**400**					
Course Summary	Covers concepts in immunogenetics, immunotherapy and the molecular basis of immune-related diseases. Students gain a deep understanding of cutting-edge research, including the role of immunology in cancer, autoimmunity, and infectious diseases. Practical applications in advanced areas such as vaccine development and emerging immunotherapies are also discussed. Overall, this course equips students with a comprehensive knowledge of advanced immunological principles and their relevance in modern biomedical research					
Semester	**VIII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Describe fundamental understanding of Antigens and Antibodies¸ Antigen- Antibody reactions and their clinical applications¸ structure of Immunoglobulins¸ Hypersensitivity reactions	U	1
2	Assess the role of MHC and Complement system in immunological mechanisms	E	2
3	Differentiate autoimmune diseases and immunodeficiency disorders	An	3
4	Appraise the recent trends in vaccine production immunotherapy and transplantation immunology	E	3

5	Develop skills in performing immunological tests	S & I	4
Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1		**Antigen, Antibody & Antigen-Antibody Interaction**	**17**	
	1.1	Antigens: Types - Haptens, Adjuvants, Epitopes (T cell and B cell Epitopes).	2	1
	1.2	Immunoglobulins: fine structure, classes and functions. Antigenic determinants of immunoglobulin – Isotype, Allotype and Idiotype. Mechanisms of antibody diversity (V(D)J recombination).	3	1
	1.3	Hybridoma technology. Monoclonal antibodies and clinical uses. Novel antibody engineering techniques	2	1
	1.4	Strength of antigen-antibody interaction- antibody affinity and avidity.	2	1
	1.5	Types of antigen-antibody reactions - Cross-reaction, Precipitation, Agglutination and Flocculation	2	1
	1.6	Immunological Techniques - ELISA, RIA, Immunoprecipitation, Widal, Coombs, VDRL and Radio-allergosorbent Test (RAST). Flow cytometry and fluorescence. Immunoelectron microscopy and Immunofluorescence.	6	1
2		**Complement system and MHC**	**8**	
	2.1	The Complement system and its activation pathways Classical, Alternate and Lectin Pathways. Terminal sequence of complement activation (MAC).	2	2
	2.2	Regulation of complement activity and complement deficiencies.	3	2

	2.3	General organization and inheritance of MHC. MHC genes - HLA Complex in humans. MHC-peptide interaction. Expression of MHC molecules on different cell types. Biological significance of MHC.	3	2
3		**A. Immunodeficiency diseases, Autoimmunity and Hypersensitivity**. & **B. Vaccines and Transplantation Immunology**	**20**	
	3.1	**A. Immunodeficiency diseases, Autoimmunity and Hypersensitivity** Congenital immunodeficiency diseases. A brief account on SCID, Wescott-Aldrich Syndrome (WAS), Ataxia, Chronic Granulomatous Disease (CGD), Leukocyte Adhesion Deficiency (LAD). Acquired Immunodeficiency Disease (AIDS).	3	3
	3.2	Autoimmunity. Organ- specific autoimmune diseases (Hashimoto's thyroiditis) and Systemic auto-immune diseases (Pernicious Anemia).	2	3
	3.3	Acute and Chronic Inflammation. A brief account on Role of Chemokines and cytokines in immune system. Hypersensitivity. A brief account on different types with example. IgE- mediated (type- I) hypersensitivity (Anaphylaxis). Antibody- mediated cytotoxic (type- II) hypersensitivity (Transfusion reaction). Immune complex-mediated (type- III) hypersensitivity (Arthus reaction). Delayed type (type- IV) hypersensitivity (Mantaux test). Stimulatory (type V) hypersensitivity (Grave's diseases)	4	1
	3.4	B. **Vaccines and Transplantation Immunology** Types of Vaccines - Whole organism vaccines, Purified macromolecules as Vaccines, Recombinant vector vaccines, DNA, and mRNA vaccines. Synthetic peptide vaccines, Multivalent subunit vaccines. Therapeutic cancer vaccines.	3	4
	3.5	Vaccine Development Process - Preclinical research and animal testing, Clinical trial phases (I, II, III), Regulatory approval and post-marketing surveillance. Ethical aspects of vaccine research and distribution: Public perception and vaccine hesitancy, Balancing individual rights and public health	5	4
	3.6	Transplantation Immunology: Different types of Transplantations. Immunologic basis of graft rejection. Clinical manifestation of graft rejection. General and specific immunosuppressive therapy for transplant recipients.	3	4
4		**Practicals**	**30**	5

	1	Differential leucocyte and total leucocyte count		
	2	Histological study of Bone marrow, Thymus, Spleen and lymph nodes through slides/ Photographs		
	3	Principle and procedure of separation of lymphocytes from whole blood, showing videos of the experiment		
	4	Principle and procedure of separation of T and B lymphocytes, showing videos of the experiment		
	5	Virtual lab/Demonstration/Lab visit/ Short video of WIDAL Test, Western Blotting, ELISA, VDRL Test		
	6	Single diffusion in one dimension (Oudin test)		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, videos, Interactive discussions and case studies
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**ANIMAL SYSTEMATICS**					
Type of Course	**DCC**					
Course Code	**24SACZOO8CC402**					
Course Level	**400**					
Course Summary	Covers principles of classification, evolutionary relationships, and the development of taxonomic systems. Students learn to identify and classify organisms based on morphological, molecular, and ecological characteristics. Emphasis is placed on understanding phylogenetic relationships &the hierarchical structure of taxonomy, from species to higher taxonomic levels.Students explore the history of taxonomy, current methods, and the impact of technology on modern systematics. Practical aspects include fieldwork and specimen collection for species identification.					
Semester	**VIII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	1	----	75
Pre requisites if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1.	Understand the principles of taxonomy, Principles and application of Zoological nomenclature	U	1,10
2.	Appreciate the role of taxonomy in biodiversity conservation and its significance in understanding and preserving natural ecosystems.	Ap	6
3.	Identify and classify organisms using taxonomic keys, molecular techniques and morphological characteristics.	E	2
4.	Understand the principles of phylogeny, recent trends and its applications	U	1,2

5.	Analyze and interpret phylogenetic trees to understand the evolutionary relationships among different species and their common ancestors.	An	1
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Fundamentals of taxonomy and systematics**	**12**	
	1.1	Taxonomy and Systematics – Definition¸ Significance. Linnaeus and taxonomy. Hierarchical system of taxonomy-taxon, category, taxonomic rank, stages in taxonomy.	5	1
	1.2	Species concept - types, sub species, deme and other intra specific categories, Polytypic and monotypic species (Brief account).	3	1
	1.3	Principles and applications of Zoological nomenclature: Zoological nomenclature - International Commission for Zoological Nomenclature - features, principles and rules, structure of ICZN code. Zoobank	**3**	1
	1.4	Scientific name - uninomial, binomial and trinomial.	1	1
2		**Taxonomic tools and techniques**	**20**	
	2.1	Taxonomic procedures: collection, preservation, curation and process of identification.	3	2
	2.2	Zoological type: Definition and significance of Holotype, Paratype, Allotype, Neotype, Syntype, Lectotype.	2	3
	2..3	Taxonomic keys: Different types of taxonomic keys - single access keys, synoptic keys, dichotomous, polytomous keys and computer aided keys. Merits and demerits of keys.	4	3
	2.4	Taxonomic publications: Types of taxonomic publications - atlas, catalogue, checklist, field guide, field book, hand book, manual. (Brief account). Encyclopedia of Life (EOL).	3	2
	2.5	**Modern trends in Taxonomy:** Approaches in taxonomy – Morphological, embryological, ecological, behavioural, cytological, biochemical, numerical, molecular approaches in taxonomy. e-taxonomy, Cybertaxonomy, Integrative taxonomy	**5**	4

	2.6	DNA Barcoding: steps involved in barcoding and applications of barcoding. Barcoding of life. International Barcode of Life (iBOL).	3	5
3		**Phylogenetics and Cladistics**	**13**	
	3.1	Phylogenetics: Phylogenetic tree - types (cladogram, phenogram, phylogram, dendrogram, curvogram, eurogram, swoopogram, chronogram), Molecular phylogeny – DNA markers (mitochondrial markers- Cyt b, Cyt C oxidase; nuclear markers – 16S rRNA, ITS, microsatellite repeats) (Brief description only). Molecular clock hypothesis. Phylocode. Tree of life.	8	2
	3.2	Cladistics: Clade (monophyletic, paraphyletic, polyphyletic) Phenotypic trait, ancestral versus derived characters - Plesiomorphy, apomorphy, synapomorphy and autapomorphy.	5	4
4		**Practicals**	30	
	1	Study of museum specimens - 25 invertebrates and 25 vertebrates.		1
	2.	Preparation of dichotomous key of 4 specimens up to family/order (Insects/Spiders/ Fishes/ Snakes - any three taxa).		
	3.	Comparative study across different species to identify similarities and differences (Mosquito, Ant, Butterfly, Moth, Honeybee, Earthworm, Prawn, Spider, Crab – minimum two species each from any five taxa).		
	4	Preparation of Cladogram based on the specimens provided (based on at least five museum specimens).		
	5	Visit to a Zoology Museum.		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning approach	**Classroom Procedure (Mode of transaction)** Lecture, museum visit
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report

	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks)** **Duration- 1 hrs**

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**PANDEMIC SCIENCE**					
Type of Course	**DCE**					
Course Code	**24SACZOO8DE401**					
Course Level	**400**					
Course summary	The course is designed to understand the history and outbreaks of major pandemics of the world, basics of epidemiology, parasitism and explains major diseases with itscausative organism.					
Semester	**VIII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	---	75
Prerequisite, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Describe the Global History of Epidemics & Pandemics Outbreaks, Epidemics and Pandemics in India	**U**	1,3,6
2	Distinguish Epidemics & Pandemics,epidemiology and their outbreak management	U	1,2,3,6, 10
3	Explain Parasitism,pandemics caused by bacteria, virus,fungi,protozoa and multicellular parasites	R, U, An	1,2,3, 10
4	Analyse the diseases by observing the symptoms	An	1,2

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Epidemiology**	**15**	
	1.1	Global History of Epidemics & Pandemics Outbreaks, Epidemics and Pandemics in India	3	1
	1.2	Definition of Epidemiology. Epidemiological methods (Public health surveillance, remote sensing), Measuring infectious disease frequency, Patterns of infectious disease in population, Emerging and re- emerging infectious disease and pathogens.	6	1
	1.3	Control of epidemics - Outbreak management including quarantine, isolation, contact tracing. Vaccines (Whole cell, Acellular, Recombinant vaccines, DNA vaccines and mRNA Vaccines). The Epidemic Diseases Act, 1897, 1977 and amendment in 2020. The Disaster Management Act, 2005 Act No. 53 of 2005	6	2
2		**Bacterial, Viral and fungal diseases**	**17**	
	2.1	Bacterial diseases: Diphtheria, Tuberculosis, Leprosy, Plague, Gastritis, Leptospirosis, Cholera, Botulism STDs Gonorrhea and Syphilis.(causative agent, mode of transmission, prophylaxis)	4	3
	2.2	Viral diseases: Covid 19, Influenza, Chicken Pox, Measles, SARS, Small pox, H1N1 Flu., Bubonic Plague, Poliomyelitis, West Nile fever, Dengue fever, Ebola (Viral Haemorrhagic fever), Nipah Virus, Chikun gunya, Rabies, AIDS, Common Cold, Genital Herpes, Hepatitis B**.** **Prion Disease –CJD** (causative agent, mode of transmission, prophylaxis)	10	3
	2.3	Fungal diseases: Mucormycosis (Black fungus), Cryptococcosis. (causative agent, mode of transmission, prophylaxis)	3	3
3		**Parasitism and Parasitic diseases**	13	

	3.1	Host- parasitic relationship, Ecological importance of parasitism, Pathogenicity, Stages ofdisease progression, Direct & Indirect means of disease transmission.	4	3
	3.2	Establishment of disease- Portal of entry & exit. Invasiveness & Virulence.	4	3
	3.3	Protistan diseases -Malaria, Trypanosomiasis. (causative agent, mode of transmission, prophylaxis)	3	3
	3.4	Multicellular Parasitic diseases- Taeniasis, Filariasis. Schistosomiasis (causative agent, mode of transmission, prophylaxis)	2	3
4		**Practicals**	**30**	
		Marking pandemic outbreaks on world map with year (Bubonic Plague/ Spanish flu/ Kuru /Nipah) and add an account.		3
		Pathogenic Bacterial and Parasite Identification M*ycobacterium tuberculi, Leptospira, Wucheraria bancrofti, Trypanosoma, Schistosoma* (specimen/photographs)		
		Insect Vector Studies- *Xenopsylla cheopis, Aedes aegypti, Anopheles* mosquito, *Culex, Phlebotomus* (specimen/photographs)		
		Principle and procedure for Screening for pulmonary tuberculosis sputum ZN staining- procedure		
		Principle and procedure for Isolation and identification tests of pathogenic bacteria-like *Vibrio cholerae*		
		Principle and procedure of the Test for Virulence factors of bacteria- capsule staining		
		Principle and procedure of Serological tests used to detect viral & bacterial antigens		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning approach	**Classroom Procedure (Mode of transaction)** Tutorial, Videos on Biology, Visit to any relevant research institution.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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St. Albert's College (Autonomous)
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**DEVELOPMENTAL BIOLOGY**					
Type of Course	DCE					
Course Code	**24SACZOO8DE402**					
Course Level	**400**					
Course Summary	Explore the fundamental concepts and mechanisms that regulate animal development from fertilization of the egg to formation of the adult organism. Encompasses the biology of regeneration, metamorphosis and growth and differentiation of stem cells.					
Semester	**VIII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	1	--	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Discuss the genetic, cellular, and tissue control of development	*U*	1,6
2	Explain the sequence of events and the mechanism of fertilisation in invertebrates and vertebrates.	*U, An*	2
3	Compare and contrast early developmental strategies of model organisms.	*An, E*	4
4	Understand integrated processes that transforms an amorphous mass of cells into a complete organ in the developing embryo	*U, An*	6
5	Analyse the different developmental stages of organisms like drosophila chick embryo and frog through the techniques like sectioning staining etc.	*U, An*	8

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**PATTERNS AND PROCESSES OF ANIMAL DEVELOPMENT**	**10**	
	1.1	**Levels of commitment** **Specification**-mechanism of developmental patterning Autonomous, Conditional and Syncytial specification **Determination**-mechanism of cell differentiation Differential gene expression and gene transcription Selective nuclear RNA processing Selective messenger RNA translation Differential protein modification	4	1
	1.2	**Cell-to-cell communication-mechanism of morphogenesis** Induction and competence **Paracrine signaling**: Morphogen gradients, Fibroblast growth factors, RTK pathway and JAK STAT pathway, Hedgehog pathway, Wnt pathway, TGF-β superfamily and Smad pathway **Juxtacrine Signaling** :The Notch pathway: Juxtaposed ligands and receptors for pattern formation Brief account only	4	1
	1.3	**Stem cells:** Embryonic stem cells; adult stem cells; medical applications and ethical issues.	2	1
2		**FERTILIZATION & EARLY DEVELOPMENT**	18	
	2.1	**External Fertilization in Sea Urchins** Biochemical and molecular aspects of fertilization Species-specific sperm-egg recognition. Polyspermy: fast block and slow block	4	2
	2.2	**Internal Fertilization in Mammals** Translocation and capacitation Hyperactivation, thermotaxis, and chemotaxis The acrosome reaction and recognition at the zona pellucida Gamete fusion and the prevention of polyspermy Activation of the mammalian egg	4	2
	2.3	**Early development of Drosophila**	5	3

		Egg, cleavage, mid-blastula transition, gastrulation. Gene action in development of drosophila:- Maternal effect genes, zygotic genes, gap genes, pair rule genes, segment polarity genes; homeotic genes Anterior- posterior patterning in Drosophila; Dorsal Ventral patterning; Left-right patterning. Dorsal protein gradient.		
	2.4	**Early development of Amphibia** Fertilization, Cortical Rotation, and Cleavage The mid-blastula transition: Preparing for gastrulation; Amphibian Gastrulation The dorsal-ventral and anterior-posterior axes formation Primary embryonic induction; Molecular Mechanisms of Amphibian Axis Formation Organizer and its functions; Nieuwkoop centre Molecular basis of mesoderm induction Neural induction and its regional specificity. Left-Right Axis formation	5	3
3		**ORGANOGENESIS & POST EMBRYONIC DEVELOPMENT**	17	
	3.1	**Vulva formation in *Caenorhabditis elegans*** Generation of vulval precursor cell Vulval cell induction and differentiation RTK pathway, Notch-delta and lateral induction Anchor Cell invasion Vulval morphogenesis	4	4
	3.2	**Tetrapod limb development** Limb Anatomy and Limb Bud formation Hox Gene Specification of Limb Outgrowth: Generating the Proximal-Distal Axis of the Limb The apical ectodermal ridge Specifying the Anterior-Posterior Axis Generating the Dorsal-Ventral Axis Cell Death and the Formation of Digits and Joints	4	4
	3.3	**Metamorphosis in Insects** Types, Hormonal control and molecular mechanism of insect metamorphosis	3	5
	3.4	**Amphibian Metamorphosis** Changes associated with amphibian metamorphosis Hormonal control of amphibian metamorphosis Regionally specific	3	5

		developmental programs		
	3.3	**Regeneration** Types and histological processes Polarity and metaplasia in regeneration Lens regeneration in amphibians	3	5
4		**Practicals**	30	
	1	Developmental stages of Drosophila – Culturing method and larval instar identification		5
	2	Developmental stages of frog (egg, blastula, gastrula, neurula, tadpole, with external gill and internal gill) using permanent slides/Diagrams		
	3	Serial sections of embryo (tadpole/chick).		
	4	Vital staining of early gastrula of chick and tracing the development of stained parts - Window method.		
	5	Blastoderm mounting and age determination of chick embryo (18hr/ 24hr/ 33 hr/ 48 hr/ 72 hr) using vital stains.		
	6	Preparation of permanent slides of blastoderm of chick embryo- at least one (18hr, 24hr, 33 hr, 48 hr or 72 hr)		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning approach	**Classroom Procedure (Mode of transaction)** Lecturing, videos, practical
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks

	Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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SUGGESTED READING

https://web.as.uky.edu/Biology/faculty/cooper/Population%20dynamics%20examples%20with%20fruit%20flies/08Drosophila.pdf

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Programme	**B.Sc. Zoology**					
Course Name	**Advanced Toxicology**					
Type of Course	DSC					
Course Code	**24SACZOO8DE403**					
Course Level	**400**					
Course Summary	This course provides a comprehensive understanding of the principles, mechanisms, and applications of toxicology. Student will explore the fundamental concepts of toxicodynamics, toxicokinetics, risk assessment, and environmental toxicology. The course delves into advanced topics such as molecular mechanisms of toxicity, analytical toxicology, and regulatory toxicology.					
Semester	**VIII**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3	**-**	**1**	**-**	**75**

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the key toxicological principles, concepts, and terminology	U	
2	Analyse the mechanisms of toxic action, exposure pathways, and risk assessment methodologies	An	
3	Apply toxicological knowledge to evaluate and interpret data from toxicological studies	Ap	
4	Evaluate the effectiveness of risk management strategies and propose innovative solutions.	E	
5	Create innovative strategies for risk assessment and management of toxic substances in various environmental and occupational settings.	C, S	

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	**Principles of toxicology** **Introduction to Toxicology** Definition, scope, and history of toxicology	2	1,3
	1.2	**Toxicodynamics** Mechanisms of toxic action, including target organ toxicity, enzyme inhibition, receptor interactions, and cellular responses to toxicants.	3	1,3
	1.3	**Toxicokinetics** ADME, LADMET hypothesis. Absorption, distribution, metabolism, and excretion of toxicants. Genotoxicity and carcinogenicity – Mechanisms and Tests. Organ toxicity – Respiratory, dermal, hepato, neuro and nephro. Factors influencing toxicity, Toxic effects- systemic toxic effects and organ specific toxic effects	4	1,3
	1.4	**Dose-Response Relationships** Concepts of dose, response, and toxicity; LD50, ED50, NOEC, LOEC and therapeutic index; dose-response curves and risk assessment.	3	
2	2.1	**Toxicants** **Classification of Toxicants** Classification based on origin- natural toxins and synthetic toxins. Classification based on routes, based on physical form, based on chemical form, based on chemical activity, based on target site, based on their uses, environmental toxic agents.	3	2,3
	2.2	**Pesticides and heavy metals** Pesticides- uses of pesticides, classification of pesticides, pesticide toxicity, measurement of pesticide toxicity. Heavy metals- contamination source, entry routes, toxic effects of heavy metals, mode of action of heavy metals, symptoms of heavy metal toxicity, control of heavy metal toxicity.	3	2,3
	2.3	**Emerging pollutants** Definition and classification of emerging pollutants. Sources and pathways of emerging pollutants- Pharmaceuticals and Personal Care Products (PPCPs), Nanomaterials, Endocrine Disrupting Chemicals (EDCs), Microplastics, Per and Polyfluoroalkyl Substances (PFAS).	4	2,3

3	**3.1**	**Toxicological processes and mode of action of toxicants** **Molecular Mechanisms of Toxicity** Role of oxidative stress, inflammation, apoptosis, and necrosis in toxicity. Mechanisms of genotoxicity, mutagenicity, and carcinogenicity. Application of genomics and proteomics to toxicology.	4	2,4
	3.2	**Animal models** Types, species and strains of animals used in toxicity studies. Dosing profile for animal models. Studies on toxicology, pathology and metabolism in mouse and rat. Laws and Regulations Governing Animal Care and Use in Research.	4	1,2,4
4	**4.1**	**Analytical toxicology** Toxicological Analysis: Principles of sample collection, preparation, and analysis. Analytical Techniques: Chromatography (GC, HPLC, LC-MS), spectroscopy (UV-Vis, IR, NMR), and mass spectrometry.	3	1,2,4
	4.2	**Biomarkers of Exposure** Use of biological markers to assess exposure to toxicants. Quality Assurance and Quality Control: Importance of analytical accuracy and precision in toxicology.	4	1, 2, 4
5	**5.1**	**Regulatory toxicology and risk management** **Toxicology and Regulatory Affairs** Role of toxicology in drug development, food safety, and environmental protection. Risk Assessment and Management: Principles of risk assessment, risk management, and communication.	4	1, 2
	5.2	**Toxicological Testing and Safety Evaluation** In vitro and in vivo toxicity testing methods. Case Studies in Toxicology: Analysis of real-world toxicological issues and controversies	4	1, 2, 5
6		**Practicals**	30	
	1	Laboratory exercises on sample preparation and analysis		
	2	Water and soil quality analysis for selected pollutants using field data – Geo accumulation index (Igeo), pollution load index (PLI), Comprehensive Environmental Pollution Index (CEPI).		
	3	Determine the LC_{50} (Lethal Concentration 50) of a test substance on a specific organism using experimental data.		
	4	Analysis of a product label for compliance with toxicological regulations.		
	5	Field trip to a contaminated site		

		The record must be a compilation of all the 5 above.		
7		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Videos, Farm visits.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

References

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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**AQUATIC BIOLOGY**					
Type of Course	DCE					
Course Code	**24SACZOO8DE405**					
Course Level	400					
	Course Summary Explores the biological principles governing life in freshwater and marine environments. Students delve into the diversity of aquatic organisms, their interactions with each other and their environment, and the ecological processes that shape aquatic ecosystems.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Explain Aquatic Ecosystems, knowledge of the diverse range of aquatic habitats, their interconnectedness, and the processes that sustain life within them.	U	1,3
2	Infer the importance of preserving aquatic biodiversity by monitoring the basic standards of water.	U	1, 2, 3

3	Evaluate the anthropogenic interventions affecting the aquatic ecosystems .	E	2,3
4	Apply ecological principles to conserve aquatic environments, including nutrient cycling, energy flow, and trophic interactions.	A	2,3, 4, 6
5	Understanding of the physical and chemical characteristics of aquatic environments, such as water chemistry, hydrodynamics, and the effects of physical processes on aquatic organisms	A	6, 7, 11

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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Aquatic Biomes**	15	1
	1.1	Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands,streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs		
2		**Freshwater and Marine Biology**	15	
	2.1	**Freshwater Biology** **Lakes**: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico–chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous. **Streams:** Different stages of stream development, Physico-chemical environment, Adaptation of hill stream fishes. **Ponds**	8	1,2
	2.2	**Marine Biology** Major divisions of marine environment; Physical properties of seawater - Thermal properties of seawater1 Chemical properties of seawater : Concept of chlorinity , salinity	7	

		and density of seawater; Primary and Secondary Productivity of the coastal environment; Phytoplankton and Zooplankton - Classification, distribution, their role in coastal ecosystems and adaptations. Primary production and factors affecting primary production. Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.		
3		**Management of Aquatic Resources**	15	
	3.1	Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Water pollution acts of India, Sewage treatment Water quality assessment BOD & COD		1,4
4		**Practicals**	**30**	
	1	Determine the area of a water body using graphimetric method.		5
	2	Identify the important macrophytes, phytoplankton and zooplankton present in a lake ecosystem.		
	3	Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body		
	4	Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.		
	5	Field study: Visit to a Sewage treatment plant/Marine bioreserve/Fisheries Institutes and submission of report		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning approach	**Classroom Procedure (Mode of transaction)** Lecturing, Tutorial, ICT Enabled Learning. Experiential learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report

	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report

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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**FISHING AND FISH PROCESSING TECHNOLOGIES**					
Type of Course	DCE					
Course Code	**24SACZOO8DE406**					
Course Level	400					
Course Summary	Describes traditional and modern fishing techniques, ecological impacts, & sustainable management. Explores fish handling, preservation, & transformation into marketable products, emphasizing quality control, food safety & technological advancements. Through lectures, demonstrations, & field trips, students gain practical insights into industry challenges & opportunities, preparing them for informed decision-making in the seafood sector.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	---	75
Pre requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Describe various fishing methods, including traditional practices and modern technologies and their ecological impact and sustainability in the seafood industry.	U	2,3
2	Explain fish handling, preservation, and processing techniques, such as chilling, freezing, and canning, and the quality control standards and food safety regulations.	U	2,6,7

3	Apply the sustainable management strategies for fisheries, resource conservation, ecosystem health.	A	1,6,7
4	Evaluate the technological advancements of fish processing equipments,packaging materials for improving efficiency, product quality, and market competitiveness.	E	1,2,3
5	Compare different fishing methods, fish processing technologies, fishery by products and sustainability practices in the fisheries sector	A,E	1,6,7
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Fishing Technologies**	**15**	1
	1.1	**Fishing Crafts:** Classification of fishing crafts: Types of fishing crafts: traditional, motorized; different traditional fishing crafts of India. Outline of the method of construction of fishing boats in wood, fibre glass and Ferro cement and steel. Recent advances in fishing craft technology	5	
	1.2	**Fishing Gears:** Basic principles of gear design and capture mechanism. Fishing gear for closed water systems. Classification of gears: **Active** Gears - Design and operation of – trawls, purse seines, ring seines, beach / shore seine, boat seine, pole and line, squid jigs, trolling. **Passive** (low energy fishing) Gears - Design and operation of - gill nets, long lines, hooks, traps, stake net, dol net, Chinese dip nets, cast nets. Destructive fishing methods like electrical fishing, poisoning and use of dynamites. Prohibited fishing practices. Preservation of fishing gears. Fishing gear materials and their properties. Recent advance in fishing gear technology.Estimation of weight of netting.	5	
	1.3	**Advancements in fishing technology and responsible fishing** Fish aggregating devices and artificial reefs. Light fishing and Lantern fishing. Impact of artificial reefs on fish stock.	5	

		Fish Finding Devices: Introductory information on echo-sounder, sonar, netsonde, global position systems, remote sensing, and potential fishing zones. Code of conduct of responsible fishing – Illegal, Unreported and Unregulated (IUU) fishing, Turtle Exclusion Devices (TED), By-catch Reduction Devices (BRD).		
2		**Fish Processing technology**	**20**	
	2.1	Principles of fish preservation. Precautions taken in handling fish in the fishing vessel, landing center and processing plant. Importance of hygiene and	3	
		sanitation in fish handling. Quality of water and ice in fish handling and processing. Common equipment and utensils used in the processing plant. Preparation of ice. Different types of ice used in the seafood industry and their merits. Preservation by refrigerated seawater and chilled sea water		2,4
	2.2	**Freezing** : Refrigeration, refrigeration load, refrigerants, cold storage of fish. Crystallization, freezing curves for purewater and water in fish, physical and chemical changes on freezing, effect of freezing on location and size of ice crystals **Technological aspects of freezing**: Slow freezing and quick freezing, Air blast freezing, tunnel freezing, fluidized bed freezing, spiral freezing, immersion freezing, contact plate freezing, cryogenic freezing and high pressure freezing. **Freezing on board fishing vessels**, IQF freezers, selection of a freezing method, cold store and cold storage, and chemical, physical and sensory changes during freezing and cold storage. Chemical treatment of fish prior to freezing, TTT and PPP factors, packing of frozen products, processing and freezing of frozen sea food products for export from India.	4	2,4
	2.3	Canning :Principles of canning: Heat transfer in canned fish, thermal destruction of bacteria, D and D_0value,F_0 value, Z value, determination of process time, cook value, Aseptic packing, containers for canning, unit operations, equipment used for canning, canning of sardine, tuna, and prawns. Retort pouch packaging. Waste management in canning industry, defects of canned product	5	4
	2.4	**Curing and drying:** Water content and water activity, water activity and microbial spoilage, drying of fish, constant rate and falling rate drying period, salting and salting methods, drying methods for fish, packaging and storage. Quality problems and solutions. Maillard reaction, lipid oxidation, microbial, fungal and insect'sinfestation. Packaging of dried products.	5	

		Smoking: objectives, smoke production, smoke components, quality, safety and nutritive value, processing and equipment, Freeze drying of fish. Accelerated freeze drying. Packaging of freeze dried products. Hurdle technology.		
	2.5	Radiation: Radiation preservation, principles of radiation, ionizing radiations and their sources, units, applications ofradiation, Shelf life extension, radappertization, radurisation, radicidation and radiation doses for irradiation of different fish products. Safety of irradiated fish.	3	
3		**Other methods of processing**	**10**	
	3.1	**By-products**: Mince and surimi – Processing, packaging, freezing and storage. Fish protein concentrate, fish meal and oil, fish liver oil, fish hydrolysate, fish silage, Caviar, gelatin, glue, pearl essence, dehydrated jelly fish, squalene, fish maws and isinglass, Ambergris, Beche de mer. Chitin, chitosan, and glucosamine hydrochloride, Utilization of prawn waste and fish processing waste. Processing and extraction of algin, alginic acid, alginates, agar, manitol, and carragernan. Value added products: Coated fish products, batter, bread crumbs, and general procedure for preparation of battered and breaded products, objectives, packaging and storage, equipment for making coated products, quality ofcoated products. Types of coated products: coated fish fillets, fish fingers, coated shrimp products, moulded products, fishcutlets, fish balls, fish burger (patties).Seafood analogues and imitation products.		5
4		**Practicals**	**30**	
	1	Study of various fishing gears (10)		1,4,5
	2	Visit to net making factory, identify different types of nets and their operating mechanism and report submission. Netting twines, rope, netting, cutting, tailoring, mounting, design of nets.		
	3	Visit to boat building yard/institute – submit report: Boat building materials, back bone assembly, planking, and maintenance of fishing boats, traditionaland modern fishing vessels.		
	4	Conduct a survey on indigenous fishing technologies used in and		

		around and submit an account with geo tagged photos and mode of operation		
	5	Biochemical and microbiological test for assessing the quality of fish. **The record must be a compilation of all the 5 above.**		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Experiential learning.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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Department of Zoology
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Programme	**B.Sc. (Honours) ZOOLOGY**					
Course Name	**APPLIED MICROBIOLOGY**					
Type of Course	**DCC**					
Course Code	**24SACZOO8DE407**					
Course Level	**400**					
Course Summary	This course offers an in-depth exploration of microbiology's role in food processing, environmental management, and clinical diagnostics. Students will gain practical experience through laboratory work, emphasizing the application of microbiological principles in various sectors.					
Semester	**VIII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	--	1	--	75
Pre-requisites, if any	**Microbiology and Basic Immunology (Level 300) courses must be completed.**					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Demonstrate a comprehensive understanding of the microbial spoilage of food, the factors influencing microbial growth, and the implementation of effective food preservation methods.	U	1
2	Apply principles of microbial metabolism and bioreactor technology to optimize the production of industrial products, considering downstream processing challenges	EA	2
3	Evaluate the role of microorganisms in environmental processes, including biogeochemical cycles and bioremediation strategies.	E	3

4	Apply appropriate diagnostic techniques for the identification of pathogens and understand the ethical implications of animal models in human disease research.	A & U	3
5	Develop proficiency in standard microbiological techniques for the isolation, identification, and characterization of microorganisms.	A & S	4
Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1	**Food Microbiology**		**8 hrs**	
	1.1	**Importance of food microbiology:** History, development and scope.	1	1
	1.2	**Microbial spoilage of food:** Characteristics of spoiled food. Chemistry of food spoilage.	1	1
	1.3	**Factors affecting microbial growth:** Extrinsic (e.g., temperature, humidity) and intrinsic (e.g., pH, moisture) factors.	1	1
	1.4	**Major foodborne pathogens:** *Salmonella*, *E. coli*, *Listeria monocytogenes*, and *Staphylococcus aureus*, *Acetobacter*, *Lactobacillus*, *Clostridium*, *Propionibacterium*, and *Proteus* (Provide an outline only).	1	1
	1.5	**Food Preservation Methods:** Physical (e.g., refrigeration, drying) and chemical (e.g., preservatives, acids) methods of food preservation.	1	1
	1.6	**Common microbiological tests for food:** Plate count, microscopic analysis, selective isolation media's, biochemical analysis, PCR assays (details to be covered in practical classes)	1	1, 5
	1.7	**Food safety standards and regulations:** FAO & FSSAI standards.	1	1, 2
	1.8	**Microbial supplements:** Single-cell protein (SCP) and probiotics (general classification and microbial component).	1	1
2	**Industrial Microbiology**		**14 hrs**	
	2.1	**Primary and secondary metabolites:** Characteristics with suitable examples.	1	2
	2.2	**Principles of media formulation and optimization:** Types of	3	2

		growth media, nutritional composition, optimization parameters. A very brief overview on RSM and DOE.		
	2.3	**Fermentation types:** Batch, fed-batch, and continuous type fermenters.	2	2
	2.4	**Bioreactors and their applications:** Basic design, principle, types and major applications.	3	2
	2.5	**Production of Industrial Microbial Products:** Investigation of industrial processes for producing antibiotics, enzymes, vaccines, and biofuels.	3	2
	2.6	**Production and downstream processing of microbial products:** Key steps and challenges associated.	2	2
3	**Environmental Microbiology**		**12 hrs**	
	3.1	**Microbial Role in Carbon Cycle:** Discussion on the significance of microbes in the carbon cycle and their applications in carbon capture and storage (CSS).	2	3
	3.2	**Microbial Processes in Nutrient Cycles:** Analysis of microbial processes involved in nitrogen cycle including their applications in waste management.	2	3
	3.3	**Indicator microbes:** Sulfate-reducing bacteria (SRB), Phosphate solubilizing bacteria (PSB), Iron oxidizing bacteria, Oil degrading bacteria, Faecal indicators, Radiation resistant microbes,	3	3
	3.4	**Biofertilizers:** Exploration of biofertilizers such as *Rhizobium*, *Azospirillum*, *Azotobacter*, and *Azolla*, including techniques for mass production and agricultural applications.	2	3
	3.5	**Environmental Biotechnology:** Understanding the role of environmental biotechnology in sewage and solid waste management.	3	3
4	**Clinical Microbiology**		**11 hrs**	
	4.1	**Clinical Sample Handling:** Collection, transport, and preliminary processing of blood, sputum, stool, urine, cerebrospinal fluid, and genital specimens.	3	4
	4.2	**Traditional methods in clinical diagnosis of pathogens:** Evaluation of diagnostic methods for bacterial, viral, fungal diseases, and parasitology.	3	4
	4.3.	**Modern approaches in clinical diagnosis of pathogens:** Automated techniques, Advanced microscopic techniques, Molecular techniques, Immunodiagnostics, Mass-spectrometry methods, and Artificial Intelligence (A brief overview only)	3	4

	4.4	**Animal models for Human disease:** Types of animal models and ethical considerations in microbiological laboratory testing.	2	4
	Practical's		**30 hrs**	
	1	Food microbe enumeration using pour plate /spread plate techniques		5
	3	Evaluating the microbiological quality of milk.		5
	4	Growth curve studies in bacteria (Virtual lab)		5
	5	Microbial staining techniques - Gram staining, negative staining/ spore staining, LPCB for fungal smear		5
	6	Bacterial motility test using hanging drop/ wet mount methods.		5
	7	Slide culture of Fungus		5
	8	Assessing drinking water quality using the MPN technique.		5
	9	Conducting antibiotic sensitivity tests using the Kirby-Bauer method.		5
	10	Analysing cultural characteristics and biochemical reactions of bacteria, including colony morphology and various biochemical tests (catalase, oxidase, IMVIC, TSI, Urease, Nitrate reduction, OF test		5
	11	Serological diagnosis for conditions such as Rheumatoid Arthritis (RA)/ Anti-Streptolysin O (ASO)/ Widal test (interpretation only)		5
5	**Teacher Specific module**			
	5.1	Completing a two-week internship in microbial quality control labs, pharmaceutical industry/ environmental biotechnology labs, or clinical laboratories to gain hands-on experience.		

EVALUATION & ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Tutorial, Videos, Practical's, Virtual labs, Institutional visit.
MODE OF ASSESSMENT	
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks**

	Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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SUGGESTED READING

1. Virtual notes
   1.1. https://microbenotes.com/
   1.2. https://www.icmrfoodnet.in/static/assets/ResearchPapers/FASSAI_MICROBIOLOGY_MANUAL-1.pdf

2. You Tube Channels
   2.1. https://www.youtube.com/@MedicosisPerfectionalis
   2.2. https://www.youtube.com/@pathCast

3. Virtual labs:
   3.1. https://learn.chm.msu.edu/vibl/index.html
   3.2. https://vlab.amrita.edu/?sub=3&brch=73
   3.3. https://vlab.amrita.edu/index.php?sub=3&brch=76
   3.4. https://www.vlab.co.in/

4. Interactive websites
   4.1. https://www.pearson.com/en-us/higher-education/products-services/mastering/microbiology.html

5. Educational platforms:
   5.1. https://onlinecourses.swayam2.ac.in/cec19_ag03/preview
   5.2. https://onlinecourses.nptel.ac.in/noc21_ce07/

6. Podcasts:
   6.1. https://asm.org/podcasts
   6.2. https://microbiologysociety.org/news-press/podcast-microbe-talk.html
   6.3. https://www.microbe.tv/science-shows-by-scientists/

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Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**BIOLOGICAL SPECIMEN PREPARATION TECHNIQUES**					
Type of Course	DCE					
Course Code	**24SACZOO8DE408**					
Course Level	**400**					
Course Summary	Helps to acquire knowledge on preparation of laboratory specimens for display in Biology museums for study purpose and also as an entrepreneurship. Develops research aptitude by introducing frontier areas of biological science such as historic genetic analysis- a valuable tool for study and application of Conservation Genetics- of endangered species.					
Semester	**VIII**	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	---	1	--	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No
1	Describe different animal collection techniques and their application	**U**	1¸2
2	Explain the methods of skeleton preservation blood and smear preparation	**U**	1¸2
3	Apply the knowledge acquired in preserving the specimens	**An**	9,10
4	Formulate innovative ideas to taxidermize a dead specimen	**C**	1¸10
5	Demonstrate skills in Alizarin preparation.	**S¸C**	1¸2

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

COURSE CONTENT Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**Importance and applications of the specimen preparation techniques**	**10**	
		Introduction: importance and applications of the specimen preparation techniques – laboratory/ study purpose; museum display; entrepreneurial. Probable application in DNA extraction, Conservation Genetics.		1,3,5
2		**Collection and Preservation of animals**	**15**	
		Collection techniques for insects, fishes, and birds. Preservation methods for animals belonging to various taxa		1,2
3		**Preparation of museum specimens, permanent slides and blood smear**	**20**	
	3.1	Preparation of museum specimens, Display methods: - wet & dry.	4	2,4
	3.2	Skeletal techniques: - Articulated skeleton, general methods- Clearing- fleshing, maceration, boiling, degreasing, mounting. Staining techniques (alizarin preparations). Taxidermy	9	
	3.3	Preparation of permanent slides- whole mounts, various tissues, sections, stages of cell divisions	5	
	3.4	Preparation of thick and thin blood smear, & its significance	2	
4		**Practicals**	**30**	
	1	Whole mount preparation of small animals, tissues and sections of animals	10	2
	2	Alizarin preparation of small invertebrates and vertebrate skeletal system	5	
	3	Preparation of articulated skeletons	6	
	4	Demonstration of Taxidermy	9	
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Hands on training, demonstration
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

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2. Christopher J. Raxworthy , Brian Tilston Smith (2021) Mining museums for historical DNA: advances and challenges in museomics, Trends in Ecology and Evolution, Vol.36 (11). Science Direct
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Department of Zoology
St. Albert's College (Autonomous)
Ernakulam

Programme	**BSc (Honours) ZOOLOGY**					
Course Name	**BIOINFORMATICS & COMPUTATIONAL BIOLOGY**					
Type of Course	**DCE**					
Course Code	**24SACZOO8DE409**					
Course Level	**400**					
Course Summary	Applies computational methods to analyze large collections of biological data,to make new predictions or discover new biology. Familiarize with biological databases & construction of phylogenetic trees using appropriate software. Principles of conventional drug designing & computer aided drug designing introduced. Scope of AI in Biology is discussed.					
Semester	VIII	Credits			4	Total Hours
Course Details	Learning approach	Lecture	Tutorial	Practical	Others	
		3	-	1	--	75
Pre requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the basics of biological databases & sequence analysis.	U	1,2
2	Discuss genomics and proteomics System Biology & Computational Biology	U, I	3,10
3	Apply bioinformatics tools to analyze molecular sequences	A, An	1,2,10
4	Understand different approaches in computational biology and the	U	2,3

	basic principles of computer aided drug design		
5	Appreciate the role of Artificial Intelligence in Biology	Ap	3,6

*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.
1		**Biological Databases & Sequence Analysis**	20	
	1.1	Scope of Bioinformatics. Bioinformatics Resources - NCBI, EBI, ExPASy, RCSB, DDBJ.	2	1
	1.2	**Biological Databases** Classification of biological databases: Primary databases: Nucleotide sequence databases - GenBank, EMBL, DDBJ; Protein sequence databases – PDB, SWISS-PROT, TrEMBL, PIR; Secondary Databases: Pfam, PROSITE, UniProt K, CATH; Composite Databases – NDB, OWL. Sequence file format: FASTA, GenBank format.	5	1
	1.3	Genome Databases : Viral genome database - ICTV ; Bacterial Genome database - GOLD; Organism specific database - OMIM/OMIA, FlyBase; Sequence submission tool – BankIt, sequin.	3	1
	1.4	**Sequence Analysis** Basic concepts of sequence alignment; Pairwise sequence alignment: BLAST, types of BLAST - blastn, blastp, blastx, tblastn, tblastx; Global and local alignment. Multiple sequence alignment: CLUSTAL W and CLUSTAL Omega. Significance of sequence alignment.	4	1
	1.5	Phylogenetics: Distance based methods - UPGMA, NJ and Minimum Evolution methods, Character based methods - Maximum Parsimony (MP), Maximum Likelihood. Construction of phylogenetic tree – PHYLIP, MEGA. Bootstrapping.	6	1
2		Genomics and Proteomics	7	
	2.1	**Genomics**- Introduction, Structural, functional and comparative genomics. **Proteomics** – Introduction.	3	2
	2.2	**Protein modelling:** - Homology modelling; Threading, *ab initio* prediction, structure evaluation.	4	2

3		**Systems Biology & Computational Biology**	18	
	3.1	Fundamentals of Systems Biology, Definition and principles, Historical perspectives.	2	2
	3.2	Metabolomics, Metabolic pathway database - KEGG, Gene network, Synthetic Biology.	4	2
	3.3	Computational Biology - Introduction, Scope and Application.	2	2
	3.4	Artificial Intelligence**:** Applications and challenges of AI in Biology. Role of AI in Bioinformatics. Algorithms for Bioinformatics prediction: HMM (Hidden Markov Models) and Neural Network.	4	5
	3.5	Drug designing: Principles of Pharmacokinetics and Pharmacodynamics - ADME.	3	4
	3.6	High-throughput screening (HTS), Computer aided drug design (CADD). Molecular docking - Autodock.	3	4
4		**Practicals**	30	
	1	Data base search and data retrieval-using NCBI, PDB and Expasy		1,2, 4
	2	Pairwise sequence alignment –BLAST		
	3	Multiple sequence alignment - Clustal W		
	4	Construction of phylogenetic tree using MEGA		
	5	Protein structure visualization using RASMOL		
	6	Secondary structure prediction of protein - Chou Fasman method		
		Protein motif & domain analysis: eMOTIF& Pfam		
		Homology modeling - SWISS-MODE		
5		**Teacher Specific Module**		

EVALUATION AND ASSESSMENT

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, virtual classes, You -tube videos
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) Theory Total = 25 marks** Quiz, Test Papers, seminar **Practical Total = 5 marks** Lab performance / Record / Field Report / Entrepreneur Interaction Report
	B. End Semester Examination **Theory Total = 50 marks, Duration 1.5 hrs** Multiple Choice Questions -1 x 20 = 20 marks Short Essays - 4 out of 6, 4 x 5 =20 marks Essays - 1 out of 2, 1 x 10 =10 marks **Practicals Total = 20 marks – (Record 3 marks, Viva 2 marks, Skill 15 marks) Duration- 1 hrs**

REFERENCES

1. Ann Gibbons, (1998) Comparative Genomics, Science. Analysis of Genes and Proteins, Wiley India Pvt Ltd. Education.Laboratory Press, New York.

2. Baxevanis, A.D. and Francis Ouellellette, B.F.,(2009) Bioinformatics - A Practical Guide to the analysis of genes.

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SCHEME OF EVALUATION FOR INTERNSHIP

A. INTERNAL EVALUATION - 15 MARKS

Sl.No	Head	Marks
1	Content & relevance of Dissertation as evidenced from work diary	8
2	Presentation	4
3	Viva	3

B. END SEMESTER EXAMINATION - 35 MARKS

Sl No	Head	Marks
1	Content & relevance of Dissertation as evidenced from work diary	20
2	Presentation	10
3	Viva	5

EVALUATION OF PROJECT IN THE EIGHTH SEMESTER OF FOUR YEAR UNDER-GRADUATEPROGRAM

Evaluation of Project

The project should contain:

1. Title page/Front page (Certified by the HOD)
2. Declaration by the candidate
3. Certificate attested by the Supervising teacher
4. Acknowledgement, if any
5. Table of contents
6. Abbreviation, if any
7. Abstract
8. Introduction & Review of Literature
9. Methodology
10. Results and Discussion
11. Summary and Conclusion
12. References

The project report submitted must be duly attested by the Supervising Teacher and certified by the Head of the Department. There shall be a pre submission presentation and evaluation of the project in

the middle of the eighth semester. **Mark for internal evaluation is 60**.

Scheme for internal evaluation

Sl No	Component	Marks
1	Topic/Area selected (relevance)	5
2	Experimentation/Data collection	15
3	Punctuality	5
4	Compilation	10
5	Content	10
6	Presentation	15
	TOTAL	60

The end semester evaluation of the Project shall be according to the Scheme given below.

Sl No	Component	Marks
1	Originality of approach, Introduction & aim of the project/objectives, Organization and Precision of Printed work	10
2	Relevance of the Topic	10
3	Review of Literature	10
4	Methodology	20
5	Involvement	10
6	Result and discussion: tabulation of data, presentation of figure/graphs, clarity of explanations etc.	20
7	Bibliography in correct format	10
8	Conclusions/ Applications to the society	10
9	Presentation of Report and Viva voce	30
10	Exceptional quality of the project	10
	TOTAL	**140**