

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

Affiliated to Mahatma Gandhi University, Kottayam, Kerala

SYLLABUS FOR UNDERGRADUATE PROGRAMME

BACHELOR OF SCIENCE (HONOURS) AQUACULTURE

SACA – UGP

(WITH EFFECT FROM 2024 ADMISSION)



Syllabus of B.Sc. (Honours) Industrial Fisheries

Proposed by the Board of Studies on 29th February 2024

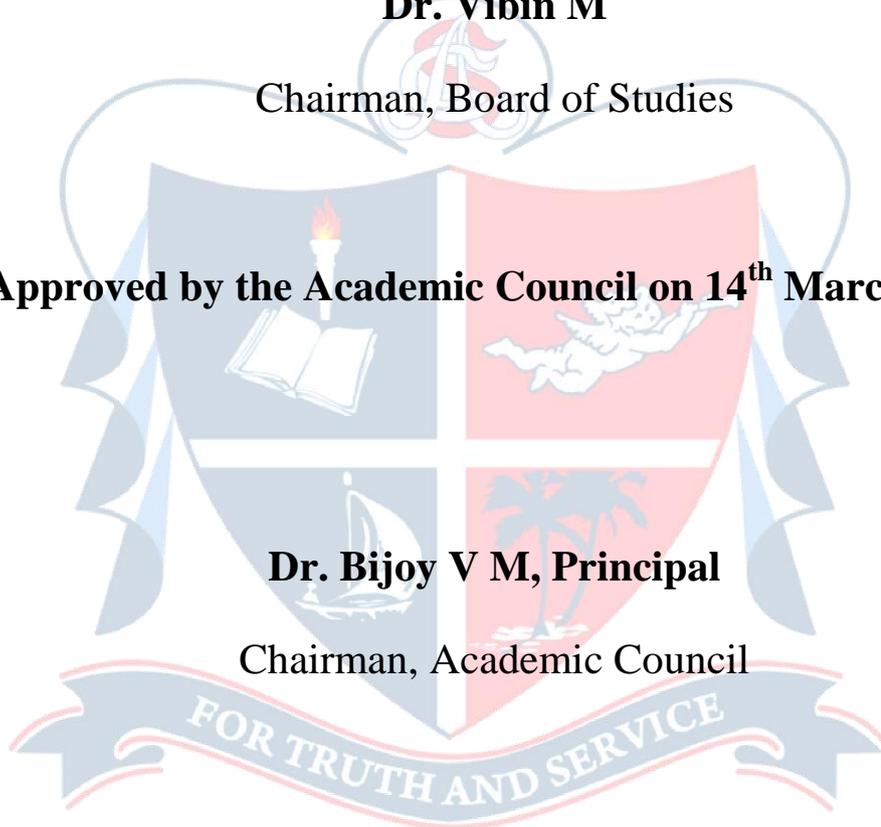
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Chairman, Board of Studies

Approved by the Academic Council on 14th March 2024

Dr. Bijoy V M, Principal

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Adopted by the Governing Council on 27th March 2024

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Board of Studies in Aquaculture

St. Albert's College (Autonomous), Ernakulam

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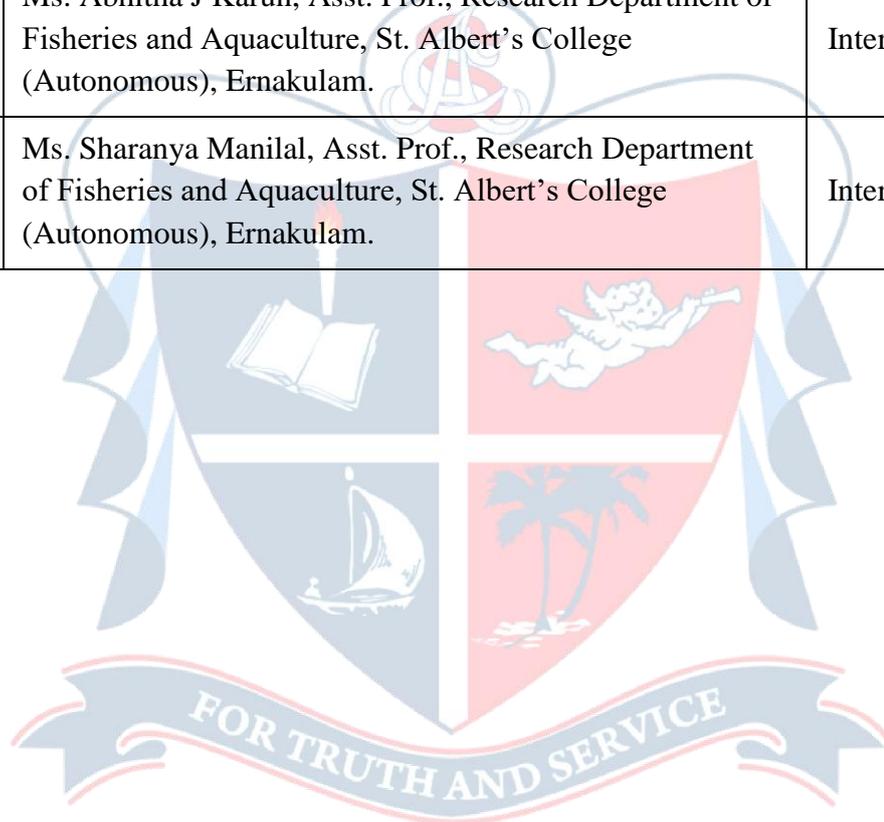


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Preface

Considering the National Educational Policy, the Kerala Higher Education Reforms Commission recommended an overall change in the undergraduate curriculum, by adopting Four Year Undergraduate Program (FYUGP) to elevate Kerala's undergraduate education in competence with well-known Universities and Colleges in India and abroad. The syllabus and curriculum prepared having multiple advantages like flexible Choice Based Credit Semester System (CBCSS), Multidisciplinary Approach, Multiple Entry and Exit options and having three major pathways include (a) 3-year UG Degree (b) 4-year UG Degree (Honours) and (c) 4-year UG Degree (Honours and Research).

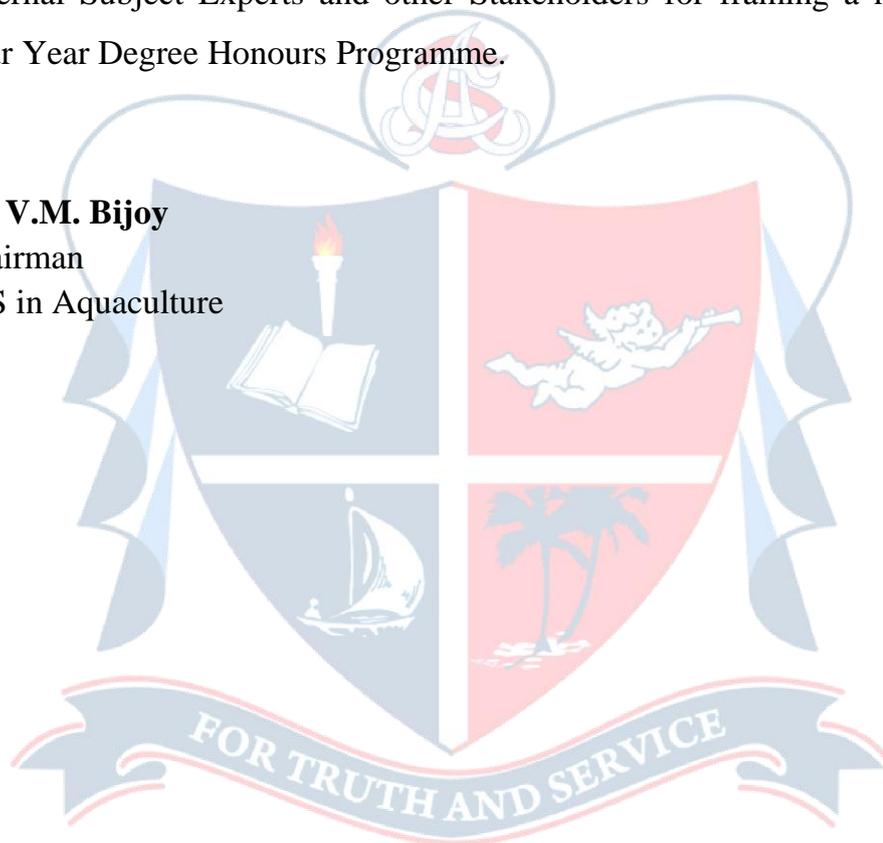
The Board of Studies (BoS) nominated for the preparation of Syllabus and Curriculum in Aquaculture by the Mahatma Gandhi University Kottayam conducted several meetings and have done meticulous efforts and hard work to implement changes in the existing curriculum and education system. After systematic and well-planned efforts of all the members of the committee, the proposed syllabus and curriculum was developed in Aquaculture including Forty Nine courses comprising different categories like Discipline Specific Courses (DSC), Multidisciplinary Courses (MDC), Value Added Courses (VAC) and Skill Enhancement Courses (SEC) in order to cater the needs of the student community for global competitiveness and employability.

Aquaculture in India is a significant economic activity and a flourishing sector with varied resources and potentials. Through 'Blue Revolution' and its subsequent strategies, India's Aquaculture production increased from 0.75 million tonnes during 1950-51 to 17.54 million tonnes during 2022-23 contributes 8% of the global fish production which placed the country to the position of second largest producer of Aquaculture in the world. At present, the Indian fisheries sector contributes in

multiple ways to safe guard country's economy, livelihood security besides providing nutrient rich food to the consumers.

At this juncture, we are adopting the major components of MG University Syllabus and also integrating the Signature Courses prepared by the Board of Studies in Aquaculture, St. Albert's College (Autonomous). We thankfully acknowledge and express deep sense of gratitude to the Board of Studies in Aquaculture, MG University, comprising the Chairperson, Faculty Members of the Expert Committee, External Subject Experts and other Stakeholders for framing a new curriculum of Four Year Degree Honours Programme.

Dr. V.M. Bijoy
Chairman
BoS in Aquaculture



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-point scale.
- xxxii. 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.
- xxxiii. Credit Point (P) of a course is the value obtained by multiplying the grade point (G) by the credit (C) of the course: $P = G \times C$
- xxxiv. 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
- xxxv. Grade Card means the printed record of students' performance, awarded to them.
- xxxvi. 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.
- xv. 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.

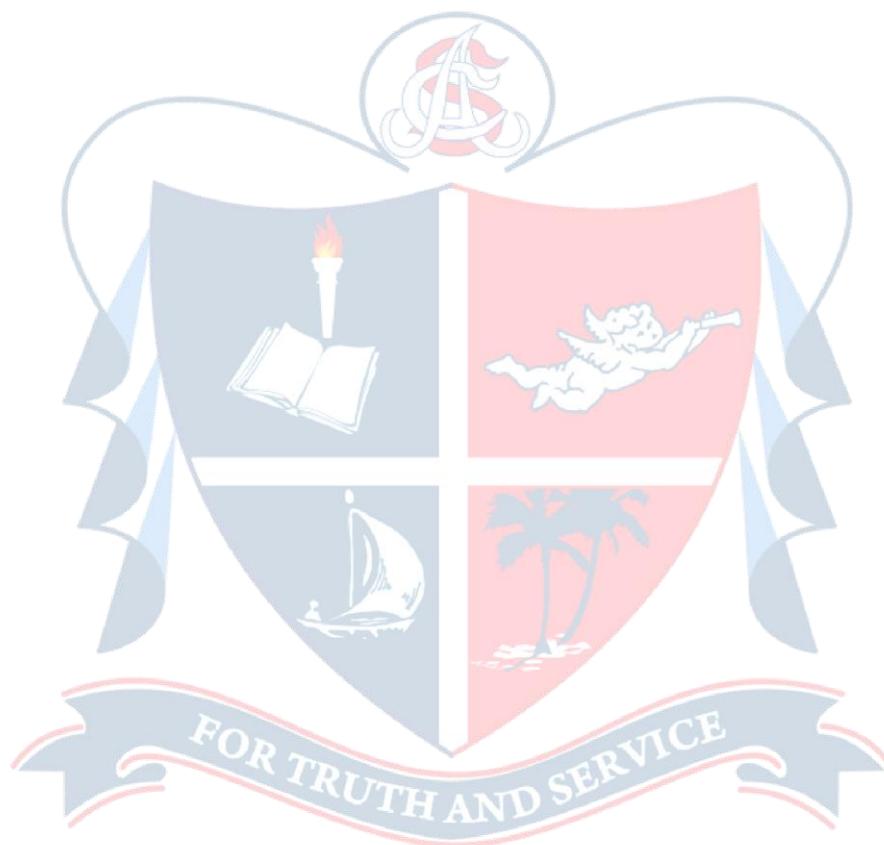
14. Programme Pathways and Curriculum Structure

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	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	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		

Pathway Option 2 – Major with Minor

Course Components	No. of Courses												
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8	Total	
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		

Pathway Option 3 – Double Major

Course Components	No. of Courses											Total	
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	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/Dissemination 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		

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)
- Practical assignment
 - Observation of practical skills
 - Viva voce
 - Quiz
 - Interview
 - Oral presentations
 - Computerized adaptive testing
 - In-class discussions
 - Group tutorial work
 - Reflection writing assignments
 - Home assignments
 - Self and peer Assessments
 - 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 i^{th} semester, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

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

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.

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

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

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

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

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

RTS**Syllabus Index****Name of the Major Subject: Aquaculture****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
24SACAQ U1DA101	Introduction to Aquaculture Systems and Resources	DSC A	4	5	3	-	2	
24SACAQ U1MD101	General Perspectives in Aquaculture	MDC	3	4	2	-	2	-

L — Lecture, T — Tutorial, P — Practical/Practicum , O — Others

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
24SACAQ U2DA101	Ornamental Fish Culture and Breeding	DSC A	4	5	3		2	
24SACAQ U2MD101	Introduction to Aquarium and Ornamental Fishes.	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
24SACAQU 3DA101	Culture of Fish Food Organisms	DSC A	4	4	4	-	-	-
24SACAQU 3DA102	Taxonomy and Morphology of Finfishes.	DSC A	4	5	3	-	2	-
24SACAQU 3DB101	Anatomy and Physiology of Finfishes and Shellfishes.	DSC B	4	5	3	-	2	
24SACAQU 3DE101	Seaweed Culture and Utilisation	DSE*	4	5	3	-	2	-
24SACAQU 3DE102	Aquatic Ecology, Water and Soil Quality Parameters.	DSE*	4	5	3	-	2	-
24SACAQU 3DE103	Reproductive Biology and Endocrinology	DSE*	4	5	3	-	2	
24SACAQU 3MD101	Fishery Byproducts and Value Addition.	MDC	3	3	3	-	0	-
24SACAQU 3VA101	Aquatic Pollution and Management.	VAC	3	3	3	-	0	-

* DSE Select any 1

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
24SACAQU 4DA101	Nutrition and feeding of Fishes	DSC A	4	5	3	-	2	
24SACAQU 4DA102	Taxonomy and Morphology of Shellfishes.	DSC A	4	4	4	-	-	-
24SACAQU 4DB101	Reproductive Physiology, Endocrinology and Induced Breeding Techniques.	DSC C	4	5	3	-	2	

24SACAQU 4DE101	Advanced Aquaculture Production Systems	DSE*	4	5	3	-	2	
24SACAQU 4DE102	Fishing Craft and Gear Technology	DSE*	4	5	3	-	2	
24SACAQU A4DE103	Physiology and Internal organisation of Finfishes and Shellfishes	DSE*	4	5	3	-	2	
24SACAQU 4DE104	Seed Production and Hatchery Management of Shellfishes	DSE*	4	5	3	-	2	
24SACAQU 4SE101	Aquafarm Management	SEC	3	3	3	-	-	
24SACAQU 4VA101	Sustainable Aquaculture Practices	VAC	3	3	3	-	-	

* DSE- Select Any one

INTERNSHIP OF TWO CREDITS

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
24SACAQU 5DA101	Seed Production and Hatchery Management of Finfishes	DSC A	4	5	3	-	2	
24SACAQU 5DA102	Post Harvest Technology and Quality Control	DSC A	4	5	3	-	2	
24SACAQU 5DE101	Inland and Marine Capture Fisheries	DSE*	4	4	4	-	-	
24SACAQU 5DE102	Fish Genetics and Biotechnology	DSE*	4	4	4	-	-	
24SACAQU 5DE103	Value Added Fishery Products and Byproducts	DSE*	4	4	4			
24SACAQU 5DE104	Aquaculture Ecosystem Management and Climate Change	DSE*	4	4	4		-	

24SACAQU 5DE105	Coldwater Aquaculture, Recreational Fisheries and Integrated Multitrophic Aquaculture	DSE*	4	4	4	-	-	
24SACAQU 5DE106	Fish biodiversity conservation and management	DSE	4	4	4			
24SACAQU 5DE107	Coastal Ecosystem Management	DSE	4	4	4			
24SACAQU 5SE101	Aquarium Fabrication and Setting	SEC	3	3	3	-	-	

*DSE- Select Any 3

Semester: 6

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hour s/ week	Hour Distribution /week			
					L	T	P	O
24SACAQU 6DA101	Coastal Aquaculture and Mariculture	DSC A	4	5	3	-	2	
24SACAQU 6DA102	Fish Microbiology and Quality Assurance of Seafood	DSC A	4	5	3	-	2	
24SACAQU 6DE101	Fish Pathology, Immunology and Health Management	DSE* (Bunch 1)	4	5	3	-	2	
24SACAQU 6DE102	Management of Ornamental Fish Culture	DSE* (Bunch 1)	4	5	3		2	
24SACAQU 6DE103	Fisheries Economics and Extension	DSE* (Bunch 2)	4	4	4	-	-	
24SACAQU 6DE104	Fish Biochemistry	DSE* (Bunch 2)	4	4	4		-	
24SACAQU 6SE101	Artificial Fish Feed Preparation	SEC**	3	3	3	-	-	
24SACAQU 6SE102	Preservation Techniques for Aquatic Specimens and Museum Collections	SEC**	3	3	3			

24SACAQU 6SE103	Hatchery Technology of Living Jewels and Aquascaping	SEC	3	4	2		2	
24SACAQU 6VA103	Aquaculture for Sport and Recreational Fishing	VAC	3	4	2		2	
24SACAQU 6VA101	Socioeconomic Upliftment through Fisheries	VAC	3	3	3	-	-	

* DSE Select Any one from Bunch 1

* DSE Select Any one from Bunch 2

** SEC Select any one from SEC

Semester: 7

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
24SACAQ U7CC101	Biophysics, Instrumentation and Microtechniques	DCC	4	5	3	-	2	
24SACAQU 7CC102	Fish Population Dynamics	DCC	4	4	4	-	-	
24SACAQU 7CC103	Aquatic Toxicology	DCC	4	4	4	-	-	
24SACAQU 7CE101	Fisheries Oceanography	DCE	4	4	4	-	-	
24SACAQU 7CE102	Aquaculture Engineering	DCE	4	4	4			
24SACAQU 7CE103	Deep Sea Fisheries, GIS and Remote Sensing	DCE	4	4	4	-	-	

DCC Discipline Specific Capstone Component

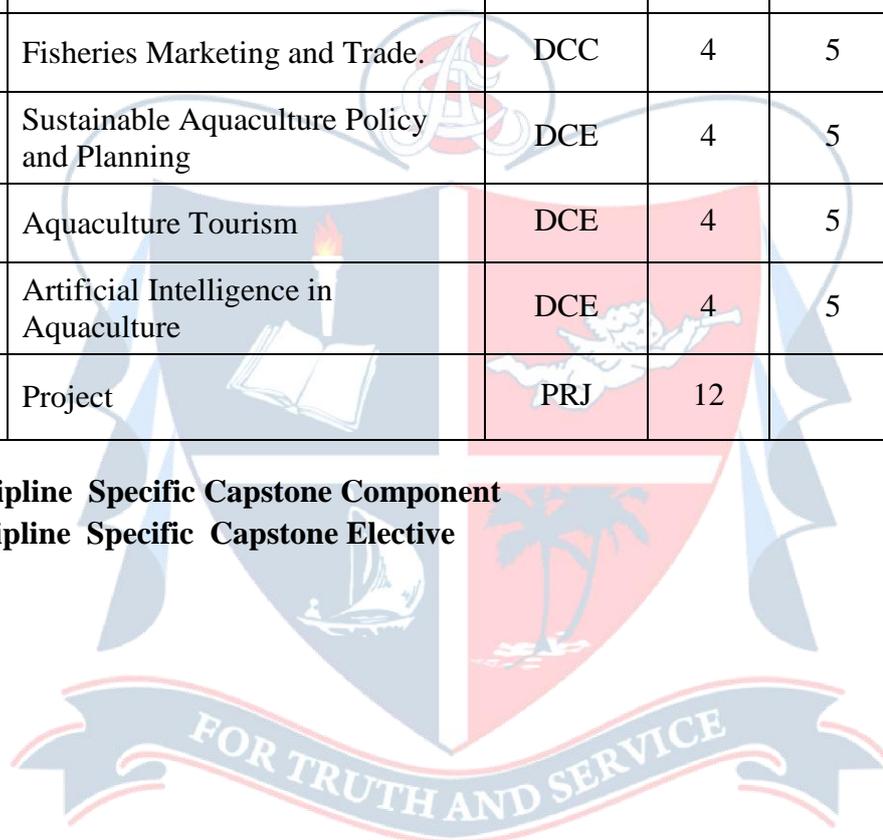
DCE Discipline Specific Capstone Elective

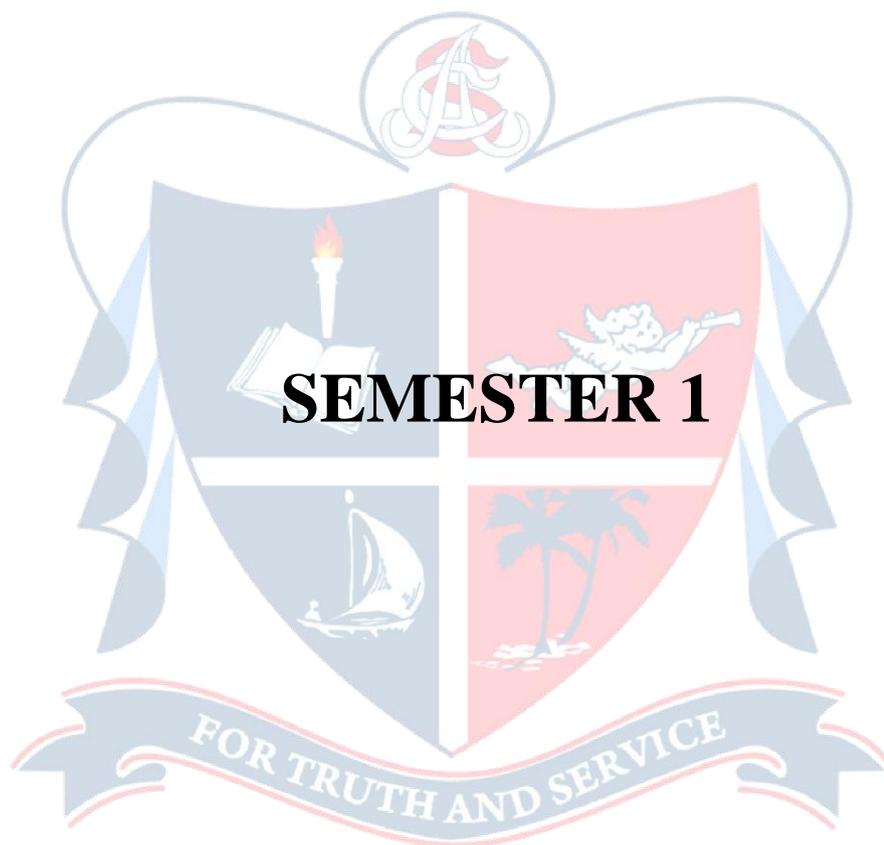
Semester: 8

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
24SACAQU 8CC101	Research Methodology and Biostatistics	DCC	4	5	3	-	2	
24SACAQU 8CC102	Fisheries Marketing and Trade.	DCC	4	5	3	-	2	
24SACAQU 8CE101	Sustainable Aquaculture Policy and Planning	DCE	4	5	3	-	2	
24SACAQU 8CE102	Aquaculture Tourism	DCE	4	5	3		2	
24SACAQU 8CE104	Artificial Intelligence in Aquaculture	DCE	4	5	3	-	2	
24SACAQ U8PR101	Project	PRJ	12		-	-	-	

DCC Discipline Specific Capstone Component

DCE Discipline Specific Capstone Elective





	<h2>Department of Fisheries and Aquaculture</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
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Programme	Aquaculture					
Course Name	Introduction to Aquaculture Systems and Resources					
Type of Course	DSC A					
Course Code	24SACAQU1DA101					
Course Level	100					
Course Summary	Aquaculture is breeding, raising, and harvesting fish, shellfish, and aquatic plants. It is an environmentally responsible source of food and commercial products, helps to create healthier habitats, and is used to rebuild stocks of threatened or endangered species. Through aquaculture, our oceans, seas, and inland freshwaters hold huge potential to provide us with increased amounts of healthy and Nutritious Food.. This is needed to feed an ever-growing human population so aquaculture helps us with our 'food security'. This paper introduces the basics of Aquaculture.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Basic knowledge regarding classification of animal kingdom and Ecology is desirable					

COURSE OUTCOMES (CO)

CO. No.	Expected Course Outcome	Learning Domains *	PO No
1	Differentiate different types of Aquaculture systems	R	4,10
2	Understand Pond Structure and Construction	A	1
3	Analyse different agri and livestock-based system	An	2
4	Outline the economic benefits of integrated farming techniques	A	1
5	Categories different cultivable organisms based on their external characteristics	U	3
6	Evaluates new strategies in aquaculture development	E	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	Introduction to AI in Aquaculture and Fisheries Management			15 Hours
	1.1	Introduction to Aquaculture- Scope and Potential of Aquaculture in Indian scenario and the world	3	1
	1.2	Importance of Aquaculture as compared to Agriculture and Capture Fisheries. Qualities of Candidate species for Aquaculture	3	1
	1.3	Types of Aquaculture - fresh water, brackish water, mariculture and metahaline culture. Classification based on structure -Pond culture, raceway culture, Tank culture, floating cages, Pen culture, Rack, raft culture, long line culture , On Bottom Culture. Classification based on type- Monoculture, Monosex culture , Polyculture	5	1
	1.4	Extensive, semi -intensive and Intensive methods of Aquaculture.	2	1
	1.5	Static and Open systems of Aquaculture, based on water exchange	2	1
2	Pond Culture and Integrated Farming			15 Hours
	2.1	Type of fish ponds, Structure, Design and Construction of Fish Ponds. Water Controlling structures in Fish Ponds – Sluice gates	3	2
	2.2	Water and Soil Quality parameters in Pond Fish Culture. Pre-stocking and Post Stocking Management of Ponds	3	2
	2.3	Integrated Farming- Introduction, Scope and Salient Features Sewage Fed Fish Culture	3	3
	2.4	Agri based Farming- Paddy-cum-fish culture, Banana- cum- fish culture. Mulberry cum fish culture	3	3

	2.5	Livestock based Farming- Pig-cum-fish culture, Poultry-cum-fish culture, Cattle-cum-fish culture, Duck-cum-fish culture. Economics of Integrated Farming	3	3
	Cultivable Aquaculture resources and Recent Trends in Aquaculture Practices			
	15 Hours			
3	3.1	Cultivable fin fishes- carps-indigenous and exotic species- Air breathing fishes, Cold water fishes, Sport fishes, Tilapia, Etroplus- Morphological features and Classification	3	4
	3.2	Cultivable Shellfishes – Morphological features and classification. Crustaceans- Fresh water prawn, Shrimps, Crab Molluscs- Mussels, Pearl oyster, Edible oyster, clams	3	4
	3.3	Cultivable Echinoderms - Sea urchin, Sea cucumber Cultivable Sea weeds	3	4
	3.4	Recent Trends in Aquaculture Practices: Recirculating Aquaculture systems Biofloc technology	3	5
	3.5	IMTA(Integrated multitrophic Aquaculture Aquaponics/Hydroponic	3	5
		PRACTICALS		
	30 Hours			
4	4.1	Identification of Cultivable Finfishes	5	4
	4.2	Identification of Cultivable Crustaceans	5	4
	4.3	Identification of cultivable bivalves Identification of Sea urchins, Sea Cucumbers and Sea Weeds.	5	4
	4.4	Identification of different culture systems	5	1
	4.5	Setting up of an Aquaponics system or recirculating water system.	5	5
5	Teacher Specific content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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SUGGESTED READINGS

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	General Perspectives in Aquaculture					
Type of Course	MDC					
Course Code	24SACAQU1MD101					
Course Level	100					
Course Summary	Aquaculture, the cultivation of aquatic organisms, has emerged as a vital component of global food production and economic development. This course provides a comprehensive prelude to introduction to aquaculture, branches of aquaculture, aquaculture environment, and scope of aquaculture. Designed for individuals with diverse backgrounds, this course offers a solid foundation for understanding the multifaceted world of aquaculture.					
Semester	I	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2		1		60
Pre-requisites, if any	Students should possess knowledge regarding general characters of animal kingdom.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identifies different types and systems of aquaculture.	U	1,2
2	Analyze the different parameter which determines the quality of water essential for good aquatic life.	A	1,2
3	Comprehend marketing strategies in aquaculture	An	1,2
4	Investigate the role of various water pollutants	C	1,2
5	Manifest skill in checking the water quality of nearby water bodies	E	1,2
6	Develop fundamental skills in fabricating and setting up of an aquarium	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	Introduction To Aquaculture, Culture Systems, Aquaculture and the Environment 15 Hours			
1	1.1	Definition of aquaculture, brief history and development of aquaculture. Advantages of Aquaculture over Capture Fishery and Agriculture	1	1
	1.2	Candidate Species in Aquaculture- Requirements of Candidate Species Candidate Species of Fishes, Crustaceans, Bivalves, Abalones, Seaweeds.	3	1
	1.3	Types of aquaculture – fresh water aquaculture , brackish water aquaculture, mariculture and metahaline aquaculture , Areas available for Aquaculture	2	1
	1.4	Scope of aquaculture, Aquacultural education, research on aquaculture and hazards for aquaculture	2	1
	1.5	Extensive culture , intensive culture, semi – intensive culture, Monoculture , polyculture, mono sex culture ,Cage culture , pen culture, Raceway culture, Raft culture , Longline culture, Rack Culture.	2	2
	1.6	Water quality parameters – Physical – temperature, turbidity, conductivity, hardness. Chemical – Salinity, P ^H , Dissolved oxygen, BOD, COD, ORP, TDS. Ammonia, Nitrite , Phosphate Activity – checking the water quality of nearby water bodies	3	3
	1.7	Water quality management , waste management , habitat conservation and restoration Water pollution and its effects on aquatic life	2	3
2	Ornamental Fishes, Aquarium Setting, Aquaculture Economics, marketing and Aquapreneurship 15 Hours			
2	2.1	Common aquarium fishes – Gold fish , tiger barb , Sword tail, platy , guppy , fighter	4	4
	2.2	Requirements for an aquarium , aquarium fabrication and setting, Aquarium plants, Aquarium Accessories , Ornamental	4	4

		fish trading Activity – Construct an aquarium using glass or Visit a nearby aquarium and prepare a report.		
	2.3	Introduction to aquaculture economics. definition and scope of aquaculture economics	3	5
	2.4	Cost and earnings of aquaculture, aquapreneurship – definition and areas	2	5
	2.5	Introduction to aquaculture marketing. Marketing principles in aquaculture .Marketing strategies in aquaculture	2	5
		PRACTICAL	30 Hours	
3	1	Estimation of p ^H water samples	4	4
	2	Estimation of turbidity of water samples	4	4
	3	Estimation of hardness of water samples	4	4
	4	Estimation of salinity, alkalinity	4	4
	5	Estimation of Nitrite, Phosphate, Ammonia	4	4
	6	Estimation of dissolved oxygen and BOD of water samples	4	4
	7	Estimation of CO ₂	2	2
	8	Aquarium making , Aquarium Accessories	4	4

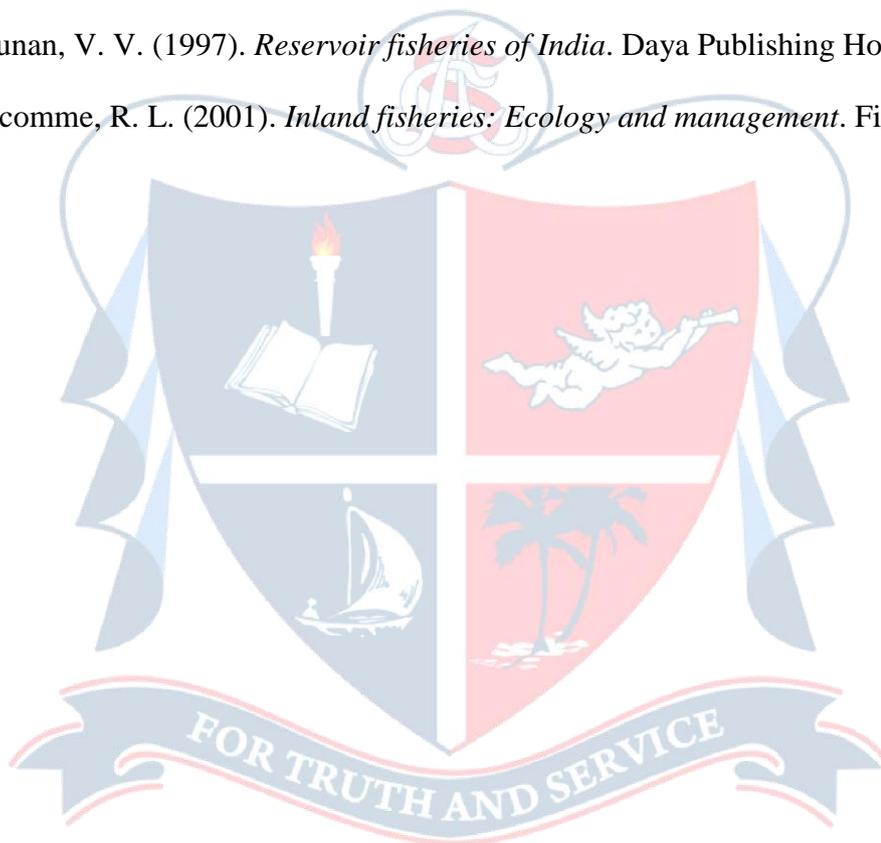
Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory – 15 Marks Practical – 15 Mark
	B. Semester End examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (5 out of 9) 5 X 3 = 15 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total= 35 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

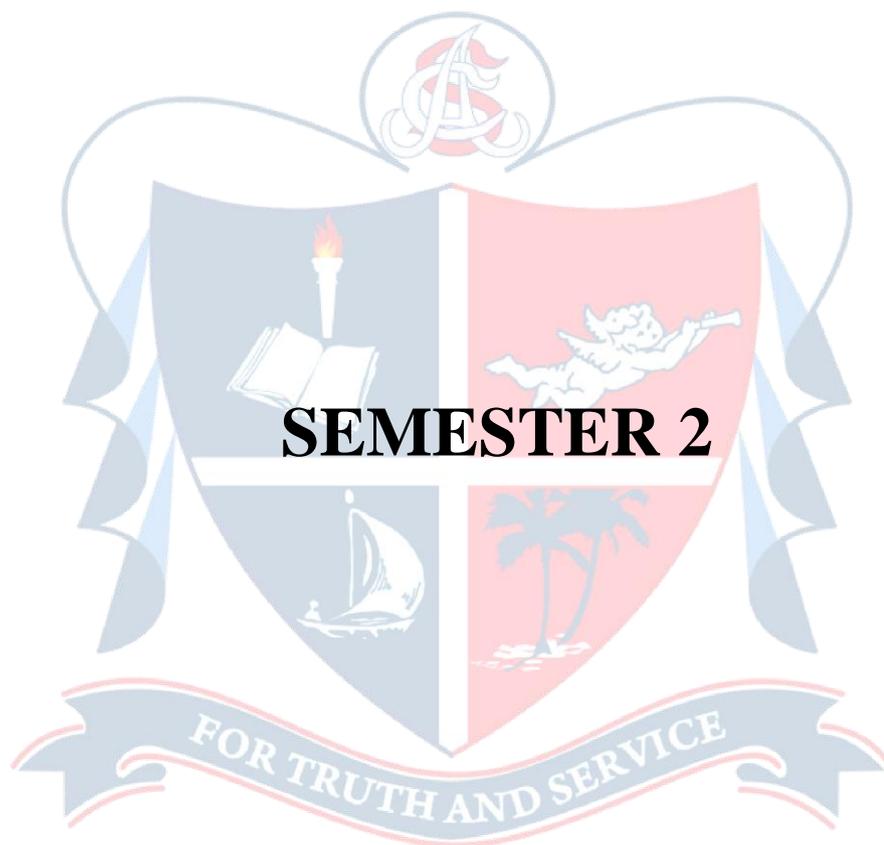
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	<h2>Department of Fisheries and Aquaculture</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
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Programme	Aquaculture					
Course Name	Ornamental Fish Culture and Breeding					
Type of Course	DSC A					
Course Code	24SACAQU2DA101					
Course Level	100					
Course Summary	India has the potential to earn about \$5 billion as foreign exchange by the way of exports of ornamental fishes. India's domestic trade in this area is growing at the rate of 20% annually and demand at the domestic market is higher than the supply. This is identified as a potential area for development. This paper provides an overview of the ornamental fish resources and setting and maintenance of aquarium. The commerce and trade of ornamental fishes is also dealt with in this course.					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3		1		75
	Basic information regarding Taxonomy of the animal kingdom is desirable.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Students should be able to construct and maintain Home Aquarium	A	4,10
2	Ability to manage home as well as commercial aquarium	A	1
3	Prepare formulated supplementary feed for fish with locally available feed ingredients	A	2
4	Develop skill in breeding different aquariums fishes	An	3
5	Construct aquarium and take this as a self-employment opportunity	A	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	Introduction to Aquarium and Ornamental Fishes		15 Hours	
	1.1	Definition, History, Scope and importance,	2	1,2
	1.2	Diversification in ornamental fish keeping-Aquarium keeping-as a hobby, Breeding, rearing and trading of ornamental fishes	4	1
	1.3	Aquarium, Design , Aquarium accessories-, Aerators, Aquarium heaters, Thermometer, Air pump, Nets, Lighting etc Filtration of Aquarium water; Types of Filters-Mechanical, Biological and Chemical Filtration.	5	1
	1.4	Aquarium plants- classification , propagation methods	4	1
2	Common ornamental fishes and Aquarium Management		15 Hours	
	2.1	Indigenous freshwater fishes, Exotic Ornamental Fishes, Marine Ornamental Fishes, Aquarium shrimps and other Aquatic ornamental animals.	3	2
	2.2	Water quality management- source, types, water quality parameters	3	2
	2.3	Setting up and maintenance of freshwater and Marine Aquariums, Aquascaping	3	2
	2.4	Feed for ornamental fishes- live and formulated feed	3	2
	2.5	Common diseases of aquarium fishes and their control measures	3	2
3	Commercial Production of Ornamental fishes and Ornamental Fish Trade		15 hours	
	3.1	Introduction, brood-stock management, feeding	3	4
	3.2	Breeding of Livebearers (Guppy), Egg layers (Goldfish) and Nest Builders (Pearl Gourami) Larval care and Feeding.	3	4
	3.3	Ornamental Fish Trade- Introduction, Procedures for Export of Ornamental Fishes, Packing.	3	4
	3.4	Funding agencies and schemes for ornamental fish culture marketing and trade	3	5

	3.5	Economics of ornamental fish culture	3	5
4	PRACTICALS		30 Hours	
	4.1	Construction, Setting up and Maintenance of a Freshwater Aquarium	10	1
	4.2	Study of Aquarium Accessories	4	1
	4.3	Study and Setting up of Aquarium Filters	4	2
	4.4	Identification of common Indigenous and Exotic Ornamental Fishes	4	2
	4.5	Preparation of Aquarium Feed	4	2
	4.6	Hatching of Artemia cysts	4	3
5	Teacher Specific Content			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Mark
	B. Semester End examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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1. Adey, W. H., & Loveland, K. (1998). *Dynamic aquaria: Building living ecosystems*. Academic Press.
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- Jayashree, K. V., Tharadevi, C. S., & Arumugam, N. (2015). *Home aquarium and ornamental fish culture*. Saras Publication.



Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Introduction to Aquarium and Ornamental Fishes					
Type of Course	MDC					
Course Code	24SACAQU2MD101					
Course Level	100					
Course Summary	This course provides an overview of the aquarium hobby, focusing on the principles of setting up and maintaining aquariums, selecting and caring for ornamental fishes, and promoting responsible aquarium keeping. This course, gives emphasis on development of entrepreneurial potential and skills amongst the students.					
Semester	2	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2		1		60
Pre-requisites, if any	Students should possess knowledge regarding general characters of animal kingdom.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate the design and construction of home and public aquaria	U	PO 1
2	Understand the setting and maintaining of aquariums in addition to water quality management.	U	PO 2
3	Understand the handling and transport of aquarium fishes for trade and research purposes.	U	PO 1
4	Develop technical know-how for ornamental fish nutrition and disease management.	AP	PO 1
5	Illustrate the importance of ornamental fish culturing in relation with entrepreneurship development	U	PO 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	Introduction to Aquarium Hobby		10 Hrs	
	1.1	History of Aquariums Overview of the aquarium hobby Benefits of an Aquarium The potential scope of aquarium fish industry as a Cottage Industry Importance of responsible aquarium keeping	3	1
	1.2	Types of Aquariums and their significance Aquarium Accessories Filtration systems	3	1
	1.3	Design and construction of public , fresh water and marine aquaria Design and construction of Oceanarium Activity – Construction of an aquarium	4	1
2	Aquarium management. Nutrition and Diseases of Aquarium Fishes, Diversity of Freshwater and Marine Ornamental Fishes		20 Hrs	
	2.1	Setting up of fresh water and Marine Aquaria Aquarium maintenance and water quality, Quarantine Measures. Control of snails and algal growth	3	2
	2.2	Types of Fish Feeds- Live, Natural and Artificial Feeds Common Diseases of Aquarium Fishes- Symptoms, Prophylaxis and Treatment	3	4
	2.3	Common Species of indigenous and exotic , Live bearing and Egg Laying Freshwater Ornamental Fishes, their taxonomy and biology. Breeding of Goldfish(Egg layer), Guppy (Live bearer) and <i>Betta</i> (Nest builder)	3	5
	2.4	Diversity of Freshwater aquarium plants and their classification	3	5
	2.5	Marine ornamental fishes – varieties and their habitat, Major Marine Ornamental Fish Resources of India, collection methods of Marine Ornamental Fishes.	3	5
	2.6	Packing and Transportation of Ornamental Fishes and use of Anaesthetics in Ornamental Fish Transportation	3	5
	2.7	Other ornamental organisms – anemones, shrimps, lobsters, star fishes	2	5

	PRACTICALS		30 Hrs	
	3	3.1	Fabrication of all-glass aquarium demonstration	6
	3.2	Setting-up and maintenance of aquarium	6	2
	3.3	Introduction to Aquarium accessories and equipments.	6	2
	3.4	Identification of common Marine, Live bearing and Egg Laying ornamental fishes.	6	2
	3.5	Conditioning and packing of ornamental fishes	6	3
4	Teacher Specific Content			

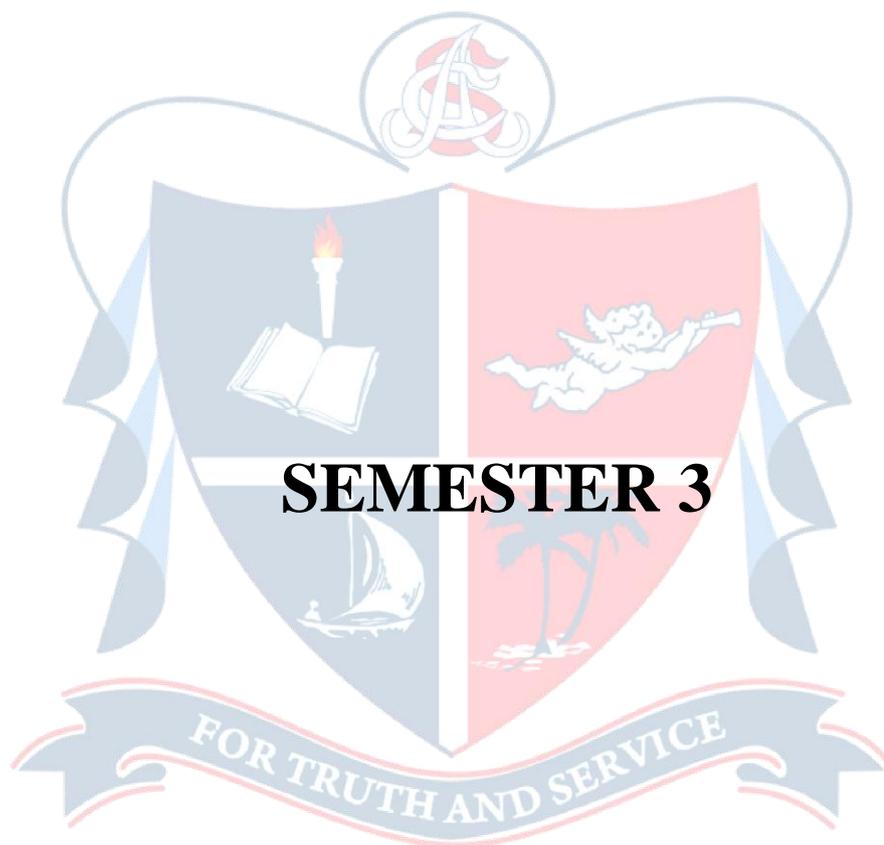
Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	<p>Mode of Assessment</p> <p>A- Continuous Comprehensive Assessment (CCA)</p> <p>Theory – 15 Marks</p> <p>Practical – 15 Marks</p>
	<p>B. Semester End Examination</p> <p>Theory</p> <p>Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks</p> <p>Short Answer Questions (5 out of 9) 5 X 3 = 15 Marks</p> <p>Essay (1 out of 3) 1 X 10 = 10 Marks</p> <p>Total= 35 Marks</p> <p>Practicals</p> <p>Lab Report = 5 Marks</p> <p>Identification of Spotters = 15 Marks</p> <p>Principle and Procedure = 12 Marks</p> <p>Viva = 3 Marks</p> <p>Total = 35 Marks</p>

References

1. Adey, W. H., & Loveland, K. (1998). *Dynamic aquaria: Building living ecosystems*. Academic Press.
2. Boruchowitz, D. E. (n.d.). *The simple guide to freshwater aquariums*.
3. Dawes, J. (1995). *Live bearing fishes: A guide to their aquarium care, biology, and classification*. Cassell Pvt.
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6. Hargreaves, V. (2007). *Complete book of the freshwater aquarium: A comprehensive reference guide to more than 600 freshwater fish and plants, plus how to set up and maintain an aquarium*. Thunder Bay Press.
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13. Wittenrich, M. L. (2007). *The complete illustrated breeder's guide to marine aquarium fishes*. Microcosm/TFH.

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- Haridas, H., et al. (2019). *Training manual on freshwater ornamental fish breeding and aquascaping techniques*. ICAR-Central Inland Agricultural Research Institute.
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Culture of fish food organisms					
Type of Course	DSC A					
Course Code	24SACAQU3DA101					
Course Level	200					
Course Summary	This course equips graduate students with comprehensive knowledge and practical skills necessary for the sustainable production and effective utilization of live feeds in aquaculture. Students will gain insights into the biological, nutritional, and environmental aspects of live feed culture, preparing them to address the challenges and contribute to the advancement of aquaculture practices.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should possess knowledge regarding various animal groups having potential to be utilized as feed for fishes.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate comprehensive knowledge of the principles and practices associated with the production and utilization of diverse live feeds in fish culture systems.	A, S	1,2
2	Evaluate the nutritional composition and biological requirements of phytoplankton and zooplankton to optimize their cultivation techniques for sustainable fish nutrition.	E	1,2
3	Critically assess and compare alternative live feed sources, exploring their nutritional value, cultivation methods and practical applications in varied fish culture systems.	A, E	1,2

4	Develops methodologies and operational techniques involved in the mass culture of Artemia, considering its significance as a crucial live feed in aquaculture	A, S	1,2
5	Formulates strategies for the effective incorporation of periphyton in fish culture systems, considering its ecological role, cultivation methodologies, and its potential as a supplementary or primary feed source	C, A	1,2
6	Prepares enriched live feeds with essential nutrients, including proteins, lipids (such as omega-3 fatty acids), carbohydrates, vitamins, and minerals, to improve the nutritional quality of these live feeds	A, 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	Live feeds		15 Hours	
	1.1	Different live feeds and their nutritional value. Manipulation of pond for natural feed production.	4	1
	1.2	Candidate species of phytoplankton and zooplankton for fish and shell fish culture - diatoms, micro algae, nano plankton, artemia, copepods, cladocera and rotifers. Activity 1. Identification of fish food organisms, phytoplankton and zooplankton	6	1
	1.3	Enrichment of live feed with essential nutrients, including fatty acids, vitamins, minerals and probiotics	5	1
2.	Culture of Phytoplankton		15 Hours	
2	2.1	Methods of collection, maintenance of pure culture of phytoplankton. Activity 1. Collection of phytoplankton from local sources 2. Enumeration of Phytoplankton using Haemocytometer	4	2

	2.2	Different media used for culture. Batch culture and continuous culture and their application in hatcheries. Activity Preparation of culture media	4	2
	2.3	Mass culture of important microalgae- <i>Chaetoceros</i> , <i>Tetraselmis</i> , <i>Skeletonema</i> , <i>Spirulina</i> and <i>Chlorella</i> , <i>Isochrysis</i> Activity 1. Isolation of Microalgae (Serial Dilution/Streak Plating, Micropipetting) 2. Mass Culture of Microalgae	7	2
Culture of Zooplankton and Artemia Culture			15 Hours	
3	3.1	Methods of collection, maintenance and rearing of rotifers, cladocerans, copepods, and insect larvae. Activity Collection of zooplankton from local sources	3	2
	3.2	Mass culture of zooplankton. Harvest, storage and feeding.- Rotifers, Cladocerans, Artemia, Copepods	5	2
	3.3	Different strains of Artemia. Artemia culture. Cyst production.	4	4
	3.4	Enrichment of Artemia cyst and larvae. Decapsulation of Artemia cysts. Hatching, storage and feeding. Activity 1. Hatching of Artemia cysts and determination of Hatching rate 2. Decapsulation of Artemia cysts	3	4
Alternative live Feeds and Periphyton culture			15 Hours	
4	4.1	Culture methods of Infusoria, Chironomids, white worms, earthworms, mosquito larvae, BSF larvae, tubifex worms.	8	5
	4.2	Nutritional qualities of alternative live feeds.	2	5
	4.3	Importance of periphyton in aquaculture. Species composition and nutritional quality.	3	5

	4.4	Methods for the development and maintenance of periphyton	2	5
5	Teacher Specific content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

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1. Anderson, K., et al. (2020). Evaluation of protein sources in aquafeed formulations. *Aquaculture Nutrition*, 2020(12), 225-240.
2. Banerjee, S., & Keshavanath, P. (2017). *Aquaculture and fish nutrition*. BS Publications.
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Taxonomy and Morphology of Finfishes					
Type of Course	DSC A					
Course Code	24SACAQU3DA102					
Course Level	200					
Course Summary	This course provides a comprehensive study of the morphology and taxonomy of finfish, emphasizing the structural diversity, classification, and identification of fish species. Students will gain theoretical knowledge and practical skills in fish morphology and taxonomy through lectures, laboratory work, and field experiences					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3		1		75
	Students from diverse backgrounds, including biology, environmental science, chemistry, geology, or related disciplines, may find this course relevant to their academic interests and career goals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the finfish diversity and its significance	U	1
2	Comprehend the sample collection methods, preservation and identification of fish	An, A	1,2
3	Develop skill in using dichotomous keys for the accurate identification of the fish.	C,S	1,2
4	Manifest skill in differentiating morphological features of fish specimens belonging to different families	E	1,4,5
5	Investigate molecular method for fish identification	E,S	3
6	Evaluate the importance of blending classical and molecular taxonomy	E,C	1,3

***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)**

Modue	Units	Course description	Hrs	CO No.
Taxonomy and External morphology of finfish			15 Hours	
1	1.1	Overview of finfish diversity, Importance of finfish in fisheries and ecosystems, Historical developments in fish taxonomy	3	1
	1.2	Collection, preservation, labelling and curation methods	4	2,6
	1.3	Morphological, morphometric and Meristic characters of fish	4	2,6
	Systematic position of fishes in Phylum Chordata upto orders; Use of dichotomous keys and taxonomic literature (any family –Eg: <i>Elopidae</i> , <i>Megalopidae</i>) and (any genus – Eg: <i>Mystus</i>)			
Classification & General morphology of fin fishes			21 Hours	
2	2.1	Classification of Super class Agnatha with examples (include systematic position and general/specific characters)	3	4,6
	2.2	Classification of Super class Gnathostomata-Grade Pisces with examples(include systematic position and general/specific characters)	3	4,6
	2.3	Classification of Class Chondrichthyes (Subclass Elasmobranchii and Holocephali) with examples (include systematic position and general/specific characters)	4	4,6
	2.4	Classification of Class Osteichthyes (Subclass Dipnoi, Crossopterygii and Actinopterygii) with examples (include systematic position and general/specific characters)	4	4,6
	2.5	Classification of Actinopterygii (Infraclass Chondrostei, Holostei and Teleostei) with examples (include systematic position and general/specific characters)	3	4,6
	2.6	General characters of Orders/Families of freshwater cultivable species (<i>Anguillidae</i> , <i>Cyprinidae</i> , <i>Siluriformes</i> , <i>Anabantidae</i> , <i>Channidae</i> , <i>Salmonida</i> , <i>Cichlidae</i>) and marine capture fisheries (<i>Clupidae</i> , <i>Scombridae</i> , <i>Carangidae</i> , <i>Leiognathidae</i> , <i>Sciaenidae</i> , <i>Trichiuridae</i> , <i>Nemipteridae</i> , <i>Serranidae</i> , <i>Harpodontidae</i> , <i>Aridae</i>).	4	4,6

Molecular techniques in fish taxonomy			9 Hours	
3	3.1	DNA Barcoding techniques of fish –Procedure, DNA isolation, DNA sequencing, DNA quantification methods, Electrophoresis	4	5,6
	3.2	Karyotyping	3	5,6
	3.3	Metabarcoding	2	5,6
PRACTICAL			30 Hrs	
4	4.1	Study of Morphology	6	2
	4.2	Dichotomous Key Identification of selected fish species	6	3
	4.3	Identification of fishes up to species level	6	2,3
	4.4	Identification of scale types and fins (Cycloid, Ctenoid, Placoid)	6	1,2
	4.5	Identification of larvae of cultivable fishes (Catla, Rohu, Mrigal)	6	4
5. Teacher specific Content				

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

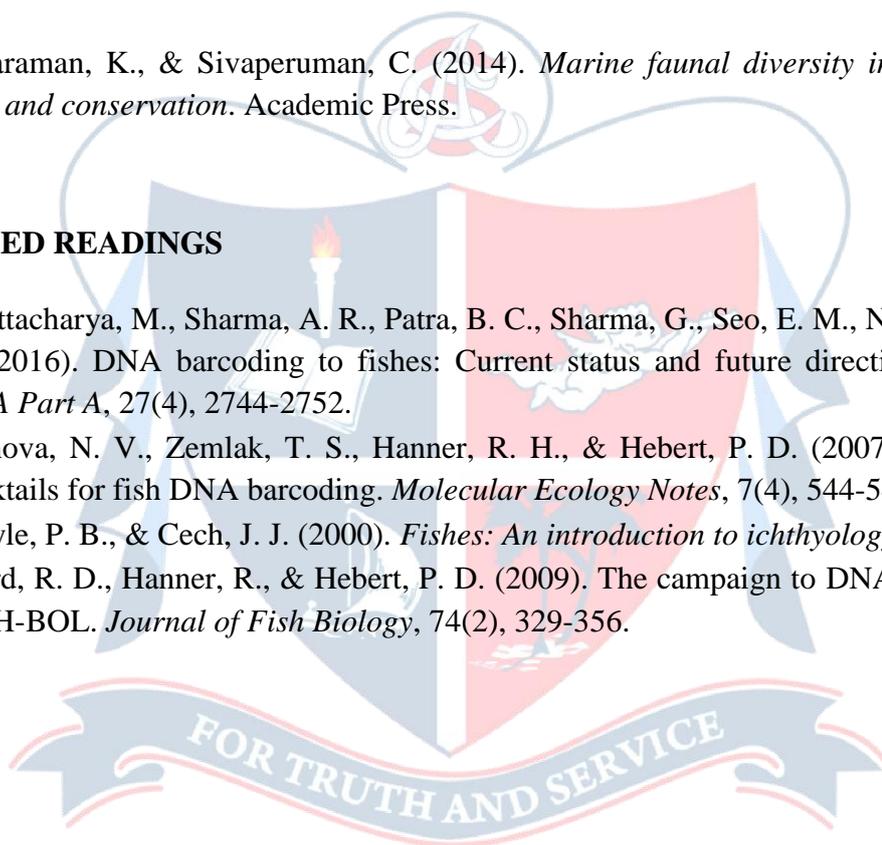
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Anatomy and Physiology of Finfishes and Shell fishes					
Type of Course	DSC B					
Course Code	To be prepared by the College					
Course Level	200					
Course Summary	This course deals with the knowledge on how well an aquatic organism gets adapted in the aquatic ecosystem maintaining good health. Structure and functioning of different body systems such as digestive system, circulatory system, respiratory system, reproductive system and excretory system of finfishes and shell fishes are detailed. The food and feeding habits of fin fishes and shellfishes are incorporated. The study of age and growth in fish is a prerequisite to generate the information on recruitment, longevity, mortality and fluctuations in fishery caused by various year classes, all of which can contribute towards planning for a rational exploitation of the fish stocks. The topics included in this paper also support management of successful aquaculture practices.					
Semester	3	Credits		4	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical		Others
		3		1		75
Pre-requisites, if any	Students should possess basic knowledge on various organs and organ systems of an organism					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the digestive system and process of digestion in fin fishes and shell fishes.	U	

2	Summarize the circulatory and respiratory systems of fin fishes and shell fishes	U	
3	Utilize the knowledge on excretory, reproductive and nervous system of finfishes and shellfishes	A	
4	Compare the food and feeding habits of fin fishes and shell fishes	U	
5	Estimate the age and growth of fishes by various methods	C	
6	Examine and Analyze various organs and organ systems of finfishes and shellfishes	An	
*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	Digestive system of fin fishes and shell fishes		15 Hrs.			
	Circulatory and respiratory system of finfishes and shellfishes					
	1.1	Structure of digestive system of finfish Associated digestive gland and their functions Digestive system of Shrimp and Bivalve			5	1
	1.2	Structure of heart, blood vascular system of finfishes and Bivalves			4	1
	1.3	Gills and process of respiration in finfishes Accessory respiratory organs of finfishes.			3	1
	1.4	Swim bladder Swimming activity, Social behavior and migration in fishes	3	1		
2	Excretory, reproductive and nervous system		15 Hrs.			
	Food and feeding habits of finfishes and shell fishes					
	2.1	Excretory organs in finfish, their physiological functions and mechanism of excretion. Osmoregulation in finfishes. Endocrine control of osmoregulation. Excretory organs and physiology of excretion in shell fishes –shrimps, bivalves	5	3		

	2.2	Structure and physiology of reproductive system of finfishes. Structure and physiology of reproductive system of shrimp and crab	3	3
	2.3	Nervous and lateral line system, sense organs (eye, ear, olfactory organs) of finfishes.	4	3
	2.4	Natural food of fishes. Feeding habits and types of feeding in fishes- Carnivorous, Herbivorous and Omnivorous, Predators, Grazers, Suckers, Strainers and parasites. Feeding habits and method of feeding in shell fishes (Shrimp, bivalve, cephalopod).	3	4
	Age and growth studies of fish			15 Hours
3	3.1	Growth of finfishes- Absolute and relative growth, isometric growth and allometric growth. The cube law.	3	5
	3.2	Methods for determination of growth checks. Length frequency analysis. Analysis of growth using hard parts like scales, otoliths and vertebrae.	3	5
	3.3	Estimation of growth by direct methods. Marking and tagging of fish for growth studies.	3	5
	3.4	Methods of studying reproduction Maturity Stages, Gonadosomatic Index, Ova Diameter Frequency studies.	3	5
	3.5	Determination of size at first maturity and spawning season, Fecundity and its determination.	3	5
	PRACTICAL			30 Hours
4	1	Dissect and study the digestive system of fin fishes		
	2	Structure of gills of finfishes (Herbivore, omnivore, carnivore)	4	6
	3	Gut content analysis of finfishes	4	6
	4	Nervous system of prawn	4	6
	5	Study of gill structure of crustacean	2	6
	6	Study of gill structure of bivalve	2	6
	7	Dissect and understand the reproductive organs of finfishes	4	6

	9	Familiarize various types of tags used in age and growth studies	2	6
	10	Analysis of length frequency data	4	6
5	Teacher specific content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (5 out of 9) 5 X 3 = 15 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total= 35 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total = 35 Marks

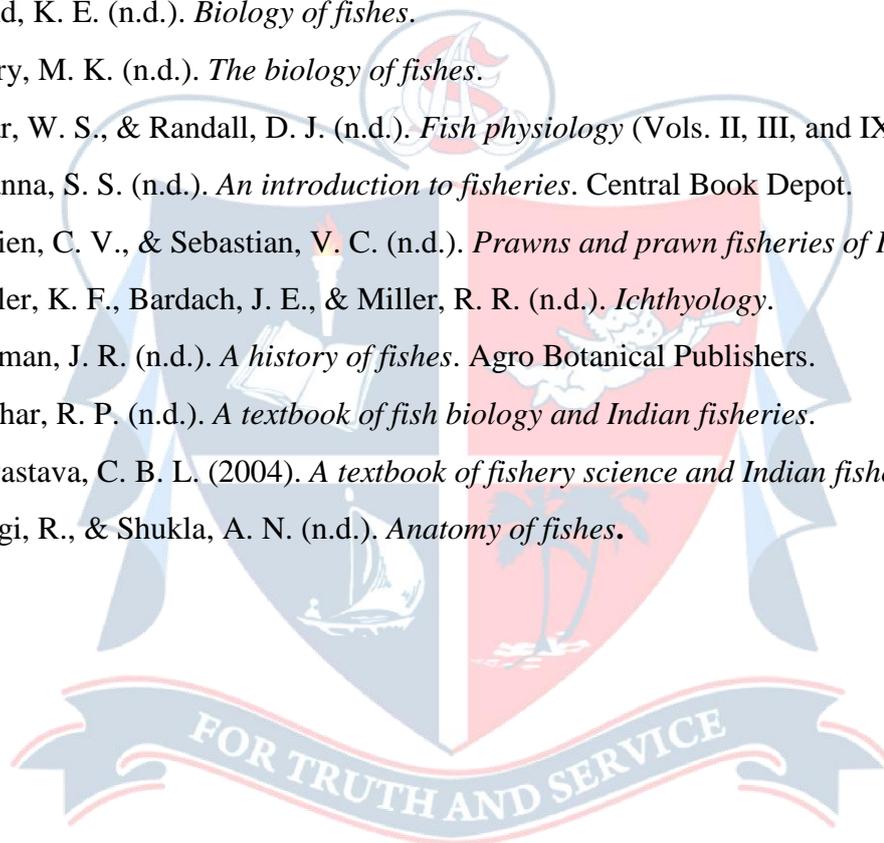
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Seaweed Culture and Utilisation					
Type of Course	DSE					
Course Code	To be prepared by the College					
Course Level	200					
Course Summary	Seaweeds are macroscopic algae that grow in marine, shallow coastal waters and on rocky shores and have emerged as a topic of interest in aquaculture owing to their wide application potentials. They are a new renewable source of food, energy, chemicals, and medicines with manifold nutritional, industrial, biomedical, agriculture, and personal care applications. Though the industrial application of seaweed is on the rise there is a short supply of raw materials to meet the demands. In this scenario seaweed culture and its supply to the industry is of a high demand. The course covers topics such as seaweed identification, introductory seaweed culture techniques, propagative methods and its product utilization possibilities.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3		1		75
Pre-requisites, if any	Knowledge about general resources from the oceans and seas is desirable					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Classify the economically important sea weeds.	U	2,10
2	Prepare the students for the culture of the economically important seaweeds.	C	1,2, 3,6,10
3	Utilize the seaweeds for the extraction of different products.	U, A	1,2, 10

4	Understand the reproduction and lifecycle of the seaweeds.	U	1,2,3,6, 10
5	Develop skill to scientifically identify seaweeds.	U, S	1,2, 4, 10
6	Identify the reproductive bodies of seaweed.	S, I, U	1, 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	Taxonomy, Morphology and Reproduction of economically important seaweeds.		17 Hours	
	1.1	Green Algae (Chlorophyceae): <i>Enteromorpha compressa, Monostroma</i> Brown Algae (Phaeophyceae): <i>Undariapinnatifida, Laminaria</i> spp. Red Algae (Rhodophyceae): <i>Porphyra</i> spp	9	1, 5
	1.2	Reproduction and life cycle Sexual and asexual reproduction methods. Different propagation methods of seaweeds.	8	4, 6
2	Seaweed culture in India		14 Hours	
	2.1	Distribution of seaweeds in Indian coast.	2	2, 3
	2.2	Criteria for selecting a good site in open waters and in seawater ponds for seaweed culture.	2	2, 3
	2.3	Growth of seaweeds and factors affecting growth pattern, environmental monitoring, causes of mortality.	4	2, 3
	2.4	Small scale, commercial scale and recent developments in culture operations. Types of seaweed culture -Fixed off bottom culture: Floating raft/cage culture: Bottom culture: Greenhouse culture: Spray culture: Raceway culture; IMTA-Integrated multi trophic aquaculture	6	2, 3
3	Utilization of seaweeds		14 hours	
	3.1	Post – harvest technology of cleaning, washing and storage.	2	3

	3.2	Chemical composition of seaweed.	4	3
	3.3	Processing and extraction of algin, alginic acid and alginates, processing and extraction of agar, mannitol and carrageen.	6	3
	3.4	Application of seaweeds as Pharmaceuticals.	2	3
4	Practicals		30 Hours	
	4.1	Identification of economically important seaweeds and their reproductive bodies.	4	1,6
	4.2	Identification/preparation of culture models.	4	1,2
	4.3	Field study of distribution and zonation of sea weeds, collection of sea weed material.	8	1,2,5,6
	4.4	Visit to a Research Institution undertaken seaweed culture	6	1,2,5,6
	4.5	Visit to a Seaweed processing industry	8	1,2,5,6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Programme	Aquaculture					
Course Name	Aquatic Ecology, Water and Soil Quality Parameters					
Type of Course	DSE					
Course Code	To be prepared by the College					
Course Level	200					
Course Summary	This course explores the fundamental principles of aquatic ecology, soil science, and the assessment of water quality parameters. Emphasis is placed on understanding the interrelationships between aquatic ecosystems, soil composition, and various water quality parameters, with a focus on monitoring and managing environmental health. Practical exercises, field trips, and hands-on projects can further enhance the learning experience for students in this course.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students from diverse backgrounds, including biology, environmental science, chemistry, geology, or related disciplines, may find this course relevant to their academic interests and career goals. Even if they don't match the requirements, students who are really interested in the subject could still be eligible to enrol.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental principles of aquatic ecology, soil science and explain the interconnections between them. Apply the ecological concepts to analyse and interpret the dynamics of various aquatic ecosystems.	U, An	1,5,6
2	Apply standard methods and instrumentation for the measurement and analysis of physicochemical parameters in water samples.	A	1,3,

3	Analyse the relationships between biological parameters and environmental factors and to evaluate the role of bio-indicators in detecting the health of aquatic ecosystems.	An	1,6
4	Proficiency in using variety of equipment and instruments for field sampling	C,S	1,2
5	Evaluate the emerging issues of water quality and ecosystem health	E, An	1,6
6	Develop fundamental skills in doing the water and soil quality parameters	A, S	1,9
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
	Introduction to Aquatic Ecology and principles of soil science		15 Hours	
1	1.1	Definition and scope of aquatic ecology. Key aquatic ecosystems (lakes, oceans, rivers, wetlands).	2	1
	1.2	Pond Ecology – Physico chemical characteristics of pond, zonation/stratification, Abiotic and biotic components, food chain in pond ecosystem.	2	1
	1.3	Riverine Ecology - Physico chemical characteristics of river, zonation/stratification, Abiotic and biotic components, food chain in riverine ecosystem, Adaptations of lotic animals.	3	1
	1.4	Marine, Estuarine and Brackish water Ecology - Physico chemical characteristics, Zonation, zonation / stratification, Abiotic and biotic components, food chain in marine, estuarine and brackish water ecosystem. Characteristics of Coral reef community. Classification of estuaries	3	1
	1.5	Lacustrine and Reservoir Ecology - Classification of lakes, Zonation / Stratification in lakes, Abiotic	3	1

		and biotic components, Biological communities of lakes. Major lakes and reservoirs in Kerala and India, Effects of dams.		
	1.6	Soil formation, composition and physico-chemical properties.	2	1
	Water Quality Parameters (Physico-chemical & Biological)		15Hours	
2		Introduction to water quality assessment		
	2.1	Activity – checking the water quality of nearby water bodies.	3	2,6
	2.2	Physical parameters (temperature, salinity, turbidity)	3	2,6
	2.3	Chemical parameters (pH, dissolved oxygen, ammonia-nitrogen, nitrite-nitrogen, nitrate-nitrogen)	3	2,6
	2.4	Aquatic micro/macro invertebrates as bio indicators (phytoplankton, zooplankton, benthos, HAB (Harmful Algal Bloom).	3	3
	2.5	Role of phytoplankton and zooplankton abundance in water quality assessment; Fish and their role in ecosystem health.	3	3
3	Methods of monitoring water / soil Quality & emerging issues in aquatic ecology		15hours	
	3.1	Sampling techniques for water and soil Soil –Random sampling, Grid sampling, Zone sampling Water - Random sampling, Systematic sampling, Haphazard sampling, Stratified random sampling, Judgemental(sampling)	3	4
	3.2	Laboratory analysis of water quality parameters Physical parameters (temperature, salinity, turbidity) – Standard methods Chemical parameters (pH, dissolved oxygen, ammonia-nitrogen, nitrite-nitrogen, nitrate-nitrogen) - Standard methods.	4	4

	3.3	Field measurements and instrumentation –Water sampler, grab plankton net, pH meter, refractometer, thermometer, secchi disc).	4	4,6
	3.4	Micro plastic pollution, Pharmaceutical Contaminant; Emerging pathogens and Harmful Algal Blooms HABs	4	5
PRACTICAL			30 Hours	
4	4.1	Estimation of P ^H water samples	6	
	4.2	Estimation of turbidity of water samples , Estimation of salinity, Alkalinity	6	
	4.3	Estimation of dissolved oxygen , CO ₂ and BOD	4	
	4.4	Aquatic macro and micro invertebrates and algae.	6	
	4.5	Familiarisation with water and soil sampling Equipments and Methods. Random, Grid and Zone sampling of soil and water.	8	
5	Teacher Specific Content			

Content for Classroom transaction (Units)

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Programme	Aquaculture					
Course Name	Reproductive Biology and Endocrinology					
Type of Course	DSE					
Course Code	24SACAQU3DE103					
Course Level	200					
Course Summary	<p>Reproductive physiology of finfishes as well as shellfishes is a vast scientific field, which directly concerns a set of physiological processes essential for reproduction, beginning with egg fertilization and ending with sexual behaviour and spawning. As endocrine system regulates gonadal development, growth, and reproduction, fish endocrinology has been the focus of various studies for basic understanding of these physiological events and for advances in aquaculture. Fish seed collections from the natural site of spawning possess problems of being mixed with spawns of predaceous fishes. Even though much care is taken in identifying the fish seed by adopting various methods, their separation sometime becomes difficult. To overcome these difficulties, induced breeding has been developed. This technique assures a timely available supply of seed spawn for fish culture.</p>					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess a basic knowledge of reproductive organs and endocrine glands					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the various reproductive techniques in finfishes and shellfishes and the factors controlling reproduction.	U	2,9
2	Introduce the endocrine and neurosecretory system of finfishes and shellfishes.	U	1,10
3	Develop skill on the techniques of induced breeding of fin fishes and shellfishes Activity : Visit to any private or government fin fish hatchery and learn induced breeding technique of fin fishes/ shrimp	S	2
4	Choose different anesthetics used in fish reproduction	R	2,10
5	Outline the basics of embryology of fishes	U	1,3,9
6	Develop fundamental skills in reproductive biology and induced breeding techniques	A,S	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.
	Reproductive system and modes of reproduction			15 Hrs
1	1.1	Reproductive systems and Sexual dimorphism in fish, crab and prawn	3	1
	1.2	Types of reproduction: Viviparity, ovoviviparity, oviparity in Teleosts and Elasmobranchs.	3	1
	1.3	Classification of maturity stages of ovary and testes in fishes and prawns.	1	1
	1.4	Oogenesis and spermatogenesis in fishes.	5	1
	1.5	Hermaphroditism- different types. Sex reversal and sex determination in fishes.	5	1
2	Neurosecretory and endocrine systems of finfishes			15 Hours

	2.1	Organisation, structure and Functions of Neurosecretory and endocrine systems in fin fishes. Pituitary, Thyroid, Chromaffin tissue, Interrenal tissue, Pancreatic islets, Corpuscles of Stannius, Ultimobranchial Glands, Gonads, Gastro-intestinal Hormones, Pineal organ, Caudal neurosecretory system or Urophysis.	5	2
	2.2	Neuroendocrine control of reproduction. Role of Hypothalamus - Pituitary – Gonadal axis in control of maturation in fishes	2	2
	2.3	Gonadotropin releasing hormones, gonadotropins and sex steroids.	3	2
	2.4	Neuroendocrine systems in crustaceans and control of reproduction. Sinus gland complex and X- organs. Pericardial and Post-commisural organs. True Endocrine organs-Y- organs, androgenic gland and Mandibular organs	3	3
	2.5	Hormones produced by the neuroendocrine and true endocrine glands and their role in the control of reproduction and moulting in Crustaceans. Parasitic castration	2	3
	Induced breeding techniques ,Cryopreservation and Embryonic Development of Fishes Eyestalk Ablation			15Hours
3	3.1	Principles of induced maturation and spawning in fishes and crustaceans. Levels of control in induced breeding and maturation in fishes. Environmental control of reproduction in fishes and prawns.	3	4
	3.2	Use of hormones and hormone analogues in fishes- Gonadotropin releasing hormones, Gonadotropins and Sex steroids. Methods of hormonal administration. Hypophysation, Linpe Method, Ovaprim. Eyestalk ablation- Its principle and application in crustacean hatcheries.	3	4
	3.3	Anaesthetics, Pharmaceutical and Non – Pharmaceutical Methods of Anaesthesia and their use in Fish Breeding and Handling Use of hormones for producing monosex population and sex reversal in fishes.	3	4
	3.4	Principles and methods of cryopreservation of gametes	3	5

	3.5	Types of eggs in fishes – Pelagic, Demersal and according to yolk content. Embryonic development- Cleavage, fate map of Blastula, gastrulation- Invagination, Involution, Delamination, Convergence, Epiboly. Hatching Post Embryonic development and Larval development.	3	5
4	PRACTICALS		30 Hrs	
	4.1	Dissection of Reproductive organs of Teleost Fish	6	6
	4.2	Identification of Maturity Stages in Teleost Fish	6	6
	4.3	Sexual Dimorphism in Teleost Fishes , Prawns and Crabs	4	6
	4.4	Estimation of Fecundity and Gonadosomatic Index	6	6
	4.5	Identification of embryonic and larval Stages of Fishes	4	6
	4.6	Larval stages of Prawns , Crabs and Lobsters	2	6
	4.7	Identification of Equipments in electrocauterisation and Cryopreservation	2	6
5	Teacher Specific Content			

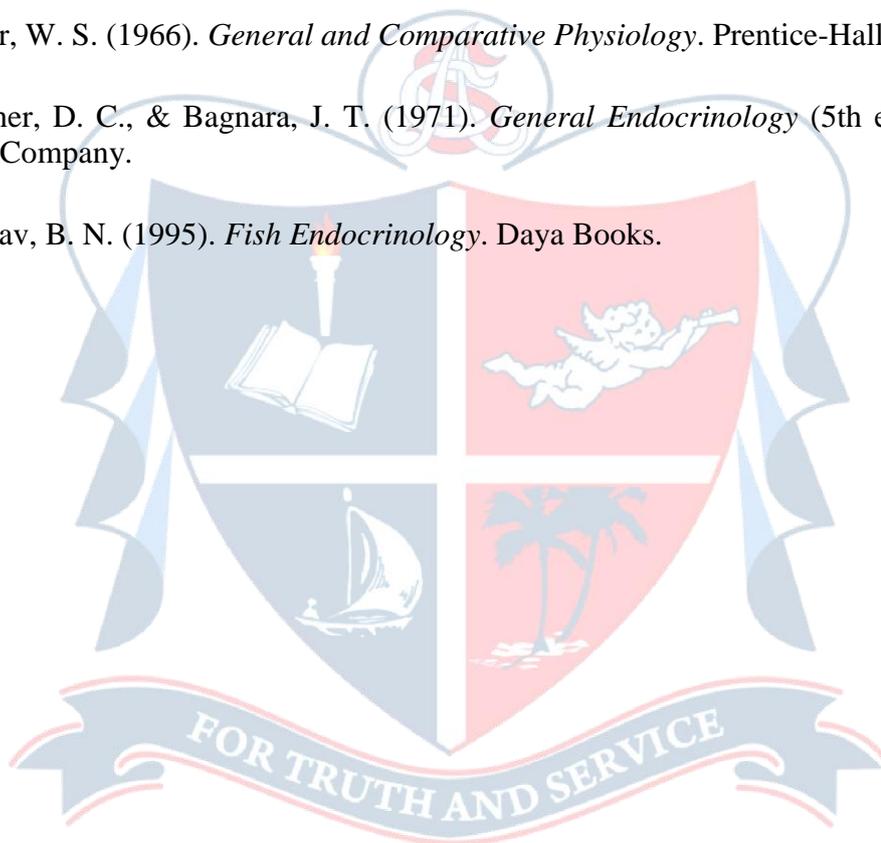
Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Programme	Aquaculture					
Course Name	Fishery Byproducts and Value Addition					
Type of Course	MDC					
Course Code	24SACAQU3MD101					
Course Level	200					
Course Summary	This course explores the various byproducts generated in the fishing industry and focuses on value addition through processing techniques, creating sustainable practices and developing innovative products from fishery byproducts.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Students should attain knowledge regarding value added product development in seafood sector				
		3				45

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify fishery byproducts and understand market trends, present status and distribution of value-added seafood products and consumer preferences	U, An	1, 4
2	Explain the technical preparation of fish mince-based products with special emphasis on surimi production.	E, An	1, 2, 6
3	Explain the preparation, packaging and storage as well as quality evaluation of coated fishery products.	E, U	1,2, 5

4	Summarize the preparation of a number of other value added products such as pickles, wafers, chutney powders, steaks, cutlets etc, from fish or shrimp.	U,I	1,6
5	Apply principles of sensory evaluation to assess product quality and study the characteristics of fish, its nutritional quality and relation to spoilage	A, S	1,8,9
6	Develop to prepare by-products like chitin, chitosan, fish silage, fish meal, fish oil etc. for commercial gain	C,A	4,5,10
*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.
	Value Addition in Seafoods		6hrs	
1	1.1	Overview of Value added products; Present market trends and consumer preferences, Scope of value addition.	3	1
	1.2	Status of value addition in Indian seafood sector, Types of value added products. Significance and advantages of value addition in the seafood industry.	3	1
Fish Mince based Products, Coated fishery products and other Value Added Products			22 Hrs	
2	2.1	Definition of Fish mince and Surimi. Raw materials used for surimi. Production of fish mince and Surimi including Flow chart	4	2
	2.2	Fibreized and other products from Fish Mince	4	2
	2.3	Equipments used for surimi preparation. Different methods in assessing quality of surimi. Define cryoprotectants. Role of different cryoprotectants in surimi production.	5	2
	2.4	Definition of coated fishery products and its preparation. Battered and breaded fishery products and its applications.	4	2

	2.5	Preparation of products viz. fish / prawn pickle, fish wafers, prawn chutney powder, fish soup powder, fish protein hydrolysate, fish stacks, fillets, marinated products.	5	3
	Fishery By-products, Quality Control and Safety in Value Added Products		17 hrs	
3	3.1	Production of chitin, chitosan and glucosamine hydrochloride from shrimp shell waste. Definition of fish silage, Types of fish silages and their preparation. Uses of silage.	5	5,6
	3.2	Isinglass, shark fin rays, gelatin from fish waste. Ambergris, beche-de-mer, squalene, fish meal and oil.	4	5,6
	3.3	Seaweed products - agar, alginic acid and carrageenan. Extraction of collagen from fish processing wastes, properties and application.	4	6
	3.4	Spoilage in thermal processed products – Quality evaluation of thermal processed products Curing and drying of fish – Spoilage in dry fish products	4	5
4	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks

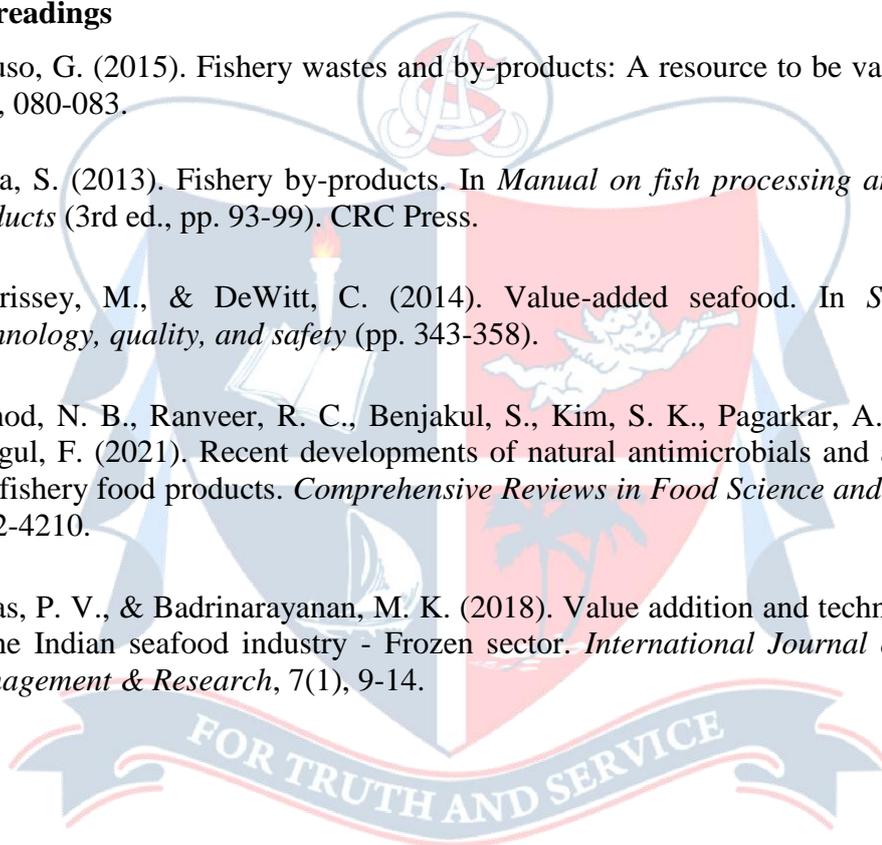
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Aquatic Pollution and Its Management					
Type of Course	VAC					
Course Code	24SACAQU3VA101					
Course Level	200					
Course Summary	The course is designed to expose undergraduate students to various dimensions of aquatic pollution, resulting environmental and public health hazards, and various tools available for monitoring and reduction of pollution. It covers the classification of aquatic pollution, sources of pollution, and types of pollution, the methods for evaluation and management of water quality of aquatic bodies and its physical, chemical, and biological pollutions.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3				45
Pre-requisites, if any	Students should possess knowledge regarding water bodies.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the sources of aquatic pollutants.	U	1,2, 9, 10
2	Outline the different types of contaminants.	U	1, 2, 10
3	Explain the microbial impacts on environment.	U	1, 2, 10
4	Categorize the pollutants and it remedial measures	An	1, 2, 3, 6
5	Utilise the principles of bioremediation for management of aquatic pollution.	A	1, 2, 6, 10
6	Develop interest in the public on the management of aquatic pollution.	I,A, S	1, 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)**

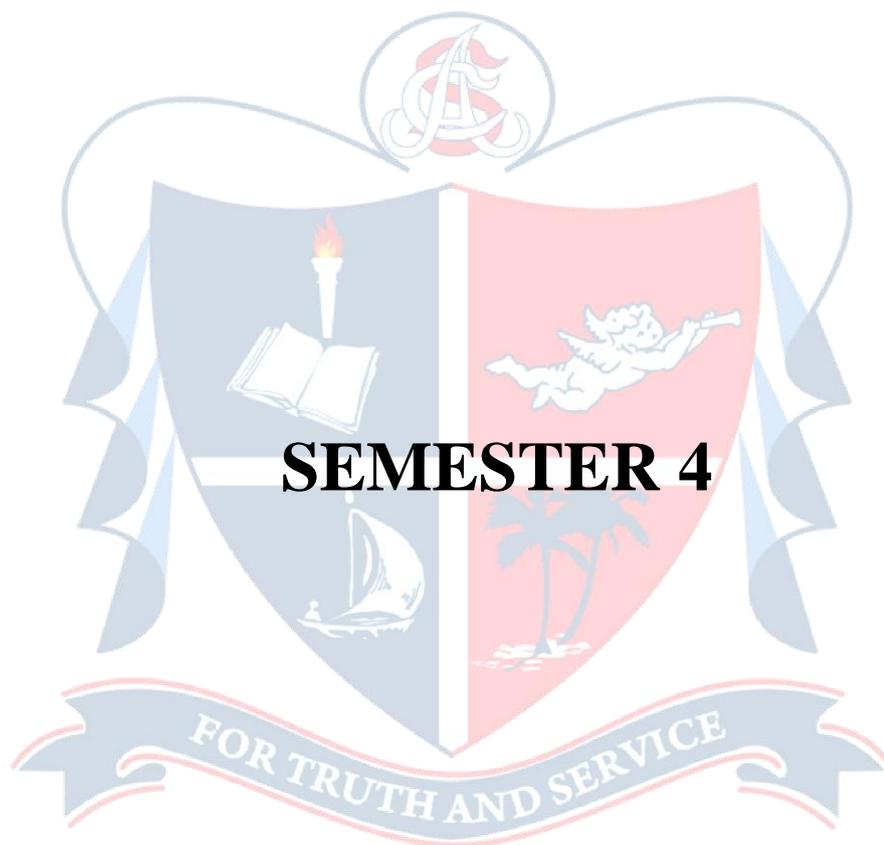
Module	Units	Course description	Hrs	CO No.
1	Introduction to aquatic pollution		8 Hours	
	1.1	Introduction & Definition	2	1
	1.2	Sources of pollutants	2	1
	1.3	Toxic organic compounds and their impacts in the aquatic organisms	2	1
	1.4	Physical, chemical and biological classification of water pollution.	2	1
2	Types of pollution & its effects on aquatic environment , Eutrophication		13 Hours	
	2.1	Sewage and domestic wastes, Agricultural Waste, Pesticides, Heavy Metal Pollution	2	2
	2.2	Oil, Thermal, Radioactive and Microbial Pollution	3	2
	2.3	Major and minor nutrients and their concentration in eutrophicated water – Categories - Eutrophic & Oligotrophic; -Anthropogenic & Natural	2	2,3
	2.4	Organic detritus & nutrients, BOD, COD.	2	2,3
	2.5	Red Tides and its causes, Algal Blooms in Indian waters	4	2,3
3	Monitoring and control of pollution, Bioremediation and Phytoremediation		24 Hours	
	3.1	Laws related to water pollution in India , Water Quality Index	2	4
	3.2	Biological indicators of pollution	2	4
	3.3	Solid waste management	2	4
	3.4	Principles and factors of Bioremediation and Phytoremediation	2	5
	3.5	Bioremediation and phytoremediation strategies. Advantages and disadvantages of bioremediation and phytoremediation	4	5
	3.6	Activity – any 2 1. Physical characteristics of polluted waters. Prepare a report. OR Visit to a sewage treatment plant/ waste dumping site. Prepare a report	12 Hrs	

		2. Beach cleaning - Solid waste removal from beaches. Prepare a report. OR Solid waste removal from any aquatic ecosystem. Prepare a report.		
Module 4	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (5 out of 9) 5 X 5 = 25 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Report Submission – 5 Marks Total – 50 Marks

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Nutrition and Feeding of Fishes					
Type of Course	DSC A					
Course Code	24SACAQU4DA101					
Course Level	400					
Course Summary	Proper feed management is central to sustainable fish farming and also maintaining environment. Since many types of nutritional and non-nutritional components can be integrated in modern fish feeds, feed becomes critical not only to the species cultured, but also to environment, since feed wastes can significantly degrade the environment. This course provides an insight into the underlying principles of fish nutrition, bioenergetics, feed ingredients, feed formulation, quality control and feed management system to equip the student for initiating sustainable aquaculture practices.					
Semester	4	Credits		4	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical		Others
		3		1		75
Pre-requisites, if any	Students should possess basic knowledge regarding fishes and nutrients in various food groups.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Comprehends the application of nutrition principles in aquaculture practices, focusing on enhancing growth, reproduction, and overall health of farmed fish through optimized feeding regimes., understand the structure of alimentary canal and its role in digestion of food.	U	1,2
2	Estimates the energy budgets in fish by exploring the bioenergetics of fish nutrition, including the processes of energy acquisition, utilization, and allocation within fish metabolism.	An	1,2

3	Identify the feed ingredients and formulate an ideal fish feed considering protein, lipid, and carbohydrate sources, to optimize feed conversion ratios.	A	1,2,3
4	Develops skill in feed manufacture and ensure its quality by practices that minimize feed wastage, contamination, and degradation during storage and distribution.	S	1,2,6
5	Acquires understanding of the feed management systems in aquaculture	U	1,2
6	Identify nutritional deficiencies and disorders in fish, and learn approaches for preventing and managing these conditions through proper dietary adjustments and supplementation.	An	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.
		Nutritional requirements and energetics of cultivable fishes.	15 Hours	
1	1.1	Major nutrients: Carbohydrate, protein, lipid, vitamin, mineral and micronutrients	4	1
	1.2	Nutritional requirements of various stages of fish- larvae, juveniles and adults.	2	1
	1.3	Bioenergetics, gross energy, Intake energy, Faecal energy, Urinary energy, digestible energy, metabolizable energy, Total heat production, net energy, specific dynamic action (SDA), retained energy Factors affecting digestibility, factors affecting energy requirement of fish, nitrogen balance index.	5	2
	1.4	Gross conversion efficiency, Feed conversion ratio, SGR, feed conversion efficiency, protein efficiency ratio Measurement of calorific value- Component Analysis, Wet oxidation, Bomb Calorimetry	4	2
2. Feed formulation			15 Hours	

	2.1	General principles of feed formulation, different methods of feed formulation – Pearson's square method, Linear programming.	5	4
	2.2	Types of feeds – wet, moist dry (pellet-steam compressed, extruded and crumbles, flakes, powdered, microencapsulated, microcoated diet)	3	4
	2.3	Farm feed, Starter, grower, finisher and broodstock feed.	2	4
	2.4	Feed manufacture- Grinding, Mixing, Pelleting, Equipments used in feed manufacture and processing; weighing scales, Grinder/pulverizer, Mixer, Pelletizer/extruder, Crumbler, sifter, Drier, Vacuum coater/ fat sprayer ,bag seamer.	3	4
	2.5	Economics of feed preparation	2	4
	Feed Ingredients and feed management		15 Hours	
3	3.1	Ingredient classification: Conventional and unconventional feed ingredients(Plant and animal sources)Quality evaluation of feed ingredients. Physical, Chemical and Biological, non-nutrient components of the diet	4	3
	3.2	Feed additives and supplements and their functions(Binders, antioxidants, chemo attractants, feeding stimulants, pigments, antimicrobial agents ,anabolic agents and growth promoters)	3	3
	3.3	Feed storage- Microbial damage, insect, rodent damage, chemical changes during storage. Fungus and associated toxins	2	3
	3.4	Ration size/feeding rate and feeding frequency, Record keeping, Nutritional deficiency disorders, symptoms and diseases in fishes-Fish scurvy, Lipidosis, Avitaminosis, Thiamine deficiencies.	3	5,6
	3.5	Feeding methods and devices: Broadcasting, Bag feeding, Tray feeding, Raft feeding, demand feeder, Mechanical automatic feeder, Blower feeder. Check tray feed monitoring.	3	5
	4. Practical 30 Hours			
4	1	Gut content analysis to study natural food in fish	3	6
	2	Qualitative analysis of carbohydrate, lipid and protein.	3	6
	3	Pearson's square to formulate a feed of desired nutritional quality	3	6

	4	Study of identification feed ingredients of plant origin (oil cakes and meals eg: Groundnut oil cake, coconut oil cake, Mustard oil cake)	3	6
	5	Study of identification feed ingredients of animal origin (Fish meal, Crustacean meals, Molluscan meals, Blood meal etc)	3	6
	6	Identification of non-conventional feedseg. Spirulina etc. and Feed Additives (Binders, Antibiotics etc).	3	6
	7	Study of feeding methods/devices	3	6
	8	Study of equipment used in manufacture of fish feeds ((Oven, Pelletiser, Feed Press and Die Plate, Extruders etc.)	3	6
	9	Formulation of artificial feed for aquarium fishes and prawns with locally available ingredients	3	6
	10	Visit to an aquaculture farm to study feeding practices	3	6
5	Teacher specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

References

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture				
Course Name	Taxonomy and Morphology of shell fishes				
Type of Course	DSC A				
Course Code	24SACAQU4DA102				
Course Level	200				
Course Summary	This course focuses on the systematic study of shellfish, emphasizing their taxonomy, classification, and morphological characteristics. Students will gain a thorough understanding of the diversity within the shellfish group and develop skills in identifying and classifying different species based on morphological features.				
Semester	4		4		Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	
		4		30	60
Pre-requisites, if any	Students from diverse backgrounds, including biology, environmental science, chemistry, geology, or related disciplines, may find this course relevant to their academic interests and career goals.				

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the fundamental principles of taxonomy.	U	1
2	Analyse the role of morphological characteristics in classical taxonomy and its integration with modern molecular approaches.	An, A	1,3
3	Understand and develop fundamental skills in identification of bivalve molluscs	U,S	1,5
4	Understand and Develop fundamental skills in identification of gastropod molluscs.	U, S	1,5
5	Understand and Develop fundamental skills in identification of economically important crustaceans.	U, S, An	1,5
6	Evaluate the importance of blending classical and molecular taxonomy.	E,C	5,6

***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.
		Principles of taxonomy	10 Hours	
1	1.1	Basic principles of biological classification	2	1
	1.2	Kinds of classification- Phenetic, natural, cladistics, evolutionary and omnispective classification.	2	1
	1.3	Concept of species; Kinds of species-allopatric, sympatric, insular, panmictic and apomictic, and polytypic species	3	1
	1.4	International Code of Zoological Nomenclature; kinds of names- tautonyms, synonymy, homonymy. Typification, type and its kinds - primary types eg: holotype, lectotype and paratype, syntype, neotype	3	1
		Introduction to shellfish & Bivalve Morphology and Taxonomy	20 Hours	
2	2.1	Classification of phylum Mollusca up to class'	3	2
	2.2	Traditional taxonomy methods of bivalve, cephalopods and crustaceans.	3	2,6
	2.3	Molecular techniques in shellfish classification- DNA barcoding technique- procedure- region amplified-primer used (any mollusc)	4	2,6
	2.4	Systematic position of bivalve molluscs	3	3,6
	2.5	Morphological characteristics of bivalves Activity: 1. Identify bivalves from your neighborhood aquatic systems 2. Dichotomous Key Identification of commercially important bivalves	4	3,6
	2.6	Ecological roles (Bio fouling and Shellfish poisoning) and economic importance of commercially important bivalves (<i>Pecten</i> , <i>Crassostrea madrasensis</i> , <i>Perna viridis</i> , <i>Pinctada fucata</i> , Scallops)	3	2,6
		Gastropod and cephalopod taxonomy and morphology	15Hours	
3	3.1	Classification of gastropod and cephalopod mollusks and characters Activity:	5	4,6

		1. Cephalopod Morphology: (Examination of preserved cephalopod specimens. Identification of key features such as tentacle arrangement, eye structure, and mantle characteristics).		
	3.2	Morphological characteristics of gastropods and cephalopod Activity: 1. Identify a gastropods and cephalopods from your neighbourhood aquatic system 2. Dichotomous Key Identification of commercially important gastropods	5	4,6
	3.3	Torsion in gastropods, economic importance of commercially important gastropods and cephalopods (<i>Unio, Pila globosa, Teredo, Sepia, Loligo, Octopus, Nautilus</i>)	5	4,6
4	Crustacean Taxonomy and Morphology		15 Hrs	
	4.1	Morphological characteristics of major crustacean groups- <i>P. indicus, Scylla serrata</i> and <i>Panulirus homarus</i> Activity: 1. Identify crustaceans from your neighborhood aquatic system 2. Dichotomous Key Identification of commercially important crustaceans 3. Mount the appendages of prawn	10	5,6
	4.2	Ecological diversity and economic significance of Crustacea Activity: 1. Identification of larval stages of Crustaceans and Molluscs.	5	5.6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

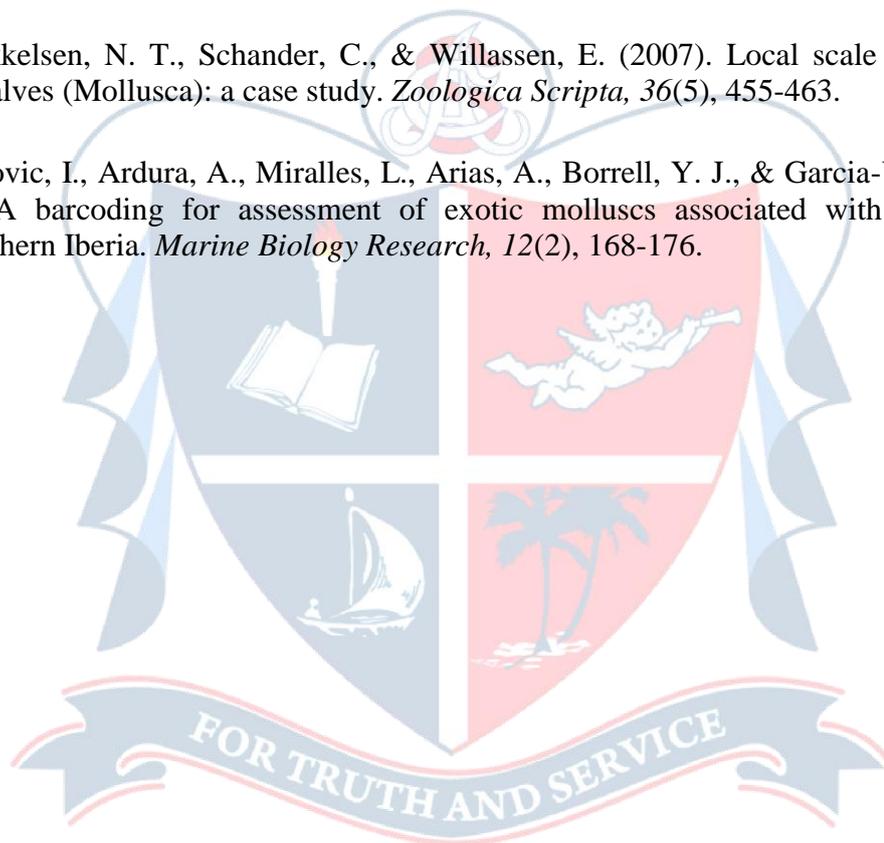
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Reproductive Physiology, Endocrinology and induced breeding techniques					
Type of Course	DSC C					
Course Code	24SACAQU4DB101					
Course Level	200					
Course Summary	<p>Reproductive physiology of finfishes as well as shellfishes is a vast scientific field, which directly concerns a set of physiological processes essential for reproduction, beginning with egg fertilization and ending with sexual behaviour and spawning. As endocrine system regulates gonadal development, growth, and reproduction, fish endocrinology has been the focus of various studies for basic understanding of these physiological events and for advances in aquaculture. Fish seed collections from the natural site of spawning possess problems of being mixed with spawns of predaceous fishes. Even though much care is taken in identifying the fish seed by adopting various methods, their separation sometime becomes difficult. To overcome these difficulties, induced breeding has been developed. This technique assures a timely available supply of seed spawn for fish culture.</p>					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		Students should possess a basic understanding on feeding habits and feeds of fishes.				
		3		1		75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the various reproductive techniques in finfishes and shellfishes and the factors controlling reproduction.	U	2,9
2	Introduce the endocrine and neurosecretory system of finfishes and shellfishes.	U	1,10
3	Develop skill on the techniques of induced breeding of fin fishes and shellfishes Activity : Visit to any private or government fin fish hatchery and learn induced breeding technique of fin fishes/ shrimp	S	2
4	Choose different anesthetics used in fish reproduction	R	2,10
5	Outline the basics of embryology of fishes	U	1,3,9
6	Develop fundamental skills in reproductive biology and induced breeding techniques	A,S	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.
		Reproductive system and modes of reproduction	15 Hrs	
1	1.1	Reproductive systems and Sexual dimorphism in fish, crab and prawn	3	1
	1.2	Types of reproduction: Viviparity, ovoviviparity, oviparity in Teleosts and Elasmobranchs.	3	1
	1.3	Classification of maturity stages of ovary and testes in fishes and prawns.	1	1
	1.4	Oogenesis and spermatogenesis in fishes.	5	1
	1.5	Hermaphroditism- different types. Sex reversal and sex determination in fishes.	5	1
2	Neurosecretory and endocrine systems of finfishes		15 Hours	

	2.1	Organisation, structure and Functions of Neurosecretory and endocrine systems in fin fishes. Pituitary, Thyroid, Chromaffin tissue, Interrenal tissue, Pancreatic islets, Corpuscles of Stannius, Ultimobranchial Glands, Gonads, Gastro-intestinal Hormones, Pineal organ, Caudal neurosecretory system or Urophysis.	5	2
	2.2	Neuroendocrine control of reproduction. Role of Hypothalamus - Pituitary – Gonadal axis in control of maturation in fishes	2	2
	2.3	Gonadotropin releasing hormones, gonadotropins and sex steroids.	3	2
	2.4	Neuroendocrine systems in crustaceans and control of reproduction. Sinus gland complex and X- organs. Pericardial and Post-commisural organs. True Endocrine organs-Y- organs, androgenic gland and Mandibular organs	3	3
	2.5	Hormones produced by the neuroendocrine and true endocrine glands and their role in the control of reproduction and moulting in Crustaceans. Parasitic castration	2	3
	Induced breeding techniques ,Cryopreservation and Embryonic Development of Fishes Eyestalk Ablation			15Hours
3	3.1	Principles of induced maturation and spawning in fishes and crustaceans. Levels of control in induced breeding and maturation in fishes. Environmental control of reproduction in fishes and prawns.	3	4
	3.2	Use of hormones and hormone analogues in fishes- Gonadotropin releasing hormones, Gonadotropins and Sex steroids. 3 Methods of hormonal administration. Hypophysation, Linpe Method, Ovaprim. Eyestalk ablation- Its principle and application in crustacean hatcheries.	3	4
	3.3	Anaesthetics, Pharmaceutical and Non – Pharmaceutical Methods of Anaesthesia and their use in Fish Breeding and Handling Use of hormones for producing monosex population and sex reversal in fishes.	3	4
	3.4	Principles and methods of cryopreservation of gametes	3	5
	3.5	Types of eggs in fishes – Pelagic, Demersal and according to yolk content. Embryonic development- Cleavage, fate map of Blastula, gastrulation- Invagination, Involution, Delamination, Convergence, Epiboly. Hatching Post Embryonic development and Larval development.	3	5

4	PRACTICALS		30 Hrs	
	4.1	Dissection of Reproductive organs of Teleost Fish	6	6
	4.2	Identification of Maturity Stages in Teleost Fish	6	6
	4.3	Sexual Dimorphism in Teleost Fishes , Prawns and Crabs	4	6
	4.4	Estimation of Fecundity and Gonadosomatic Index	6	6
	4.5	Identification of embryonic and larval Stages of Fishes	4	6
	4.6	Larval stages of Prawns , Crabs and Lobsters	2	6
	4.7	Identification of Equipments in electrocauterisation and Cryopreservation	2	6
5	Teacher Specific Content			

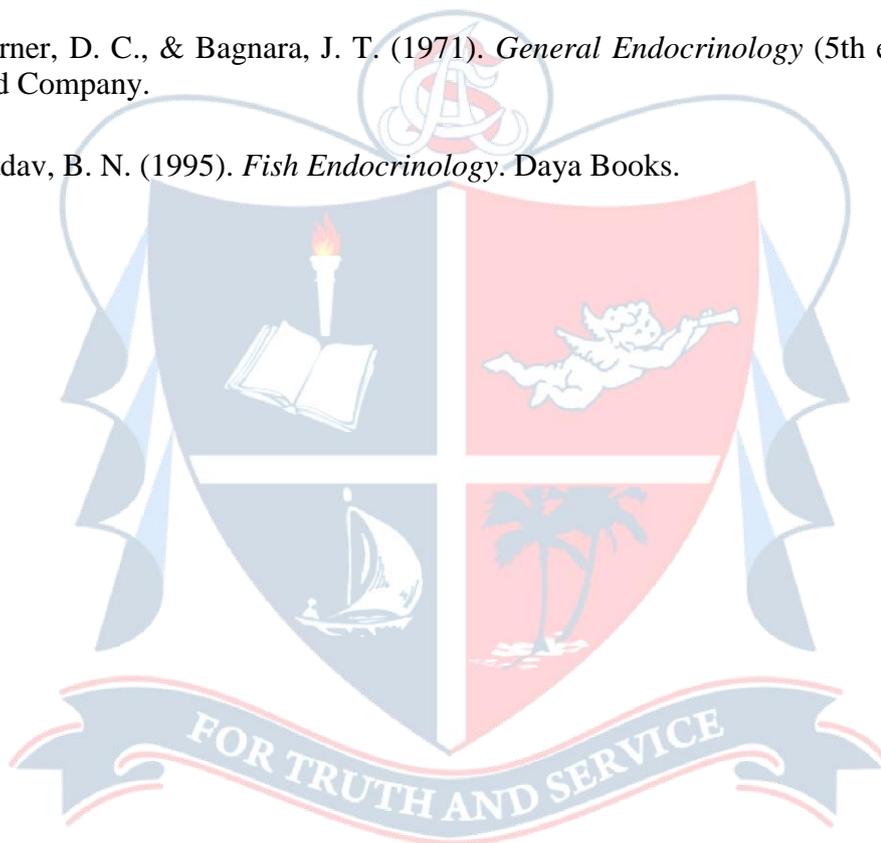
Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Programme	Aquaculture				
Course Name	Advanced Aquaculture Production Systems				
Type of Course	DSE				
Course Code	24SACAQU4DE101				
Course Level	200				
Course Summary	The ultimate aim of any food production system is to increase the production levels in minimum space and time. This can be achieved either by genetically improving the ability to convert food to flesh of culture species or by using high efficiency feed or by improvement in the culture system, enabling stocking in high densities. This course aims to familiarize the student with the nuances of hi-tech aquaculture production systems including Biofloc technology, Recirculating Aquaculture systems, Aquaponics, as well as running water systems. This course also introduces the student to different types and methods of farming.				
Semester	4			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	
		3		1	75
Pre-requisites, if any	Students need to have an idea of the existing aquaculture practices and traditional systems of aquaculture.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Evaluate the importance and role global aquaculture and understand the constraints and future prospects in Aquaculture	E,U	1
2	Understand the principles and systems of Biofloc	U	2
3	Evaluate and understand Recirculating Aquaculture Systems	E,U	2

4	Create an Aquaponics system; Understand water quality maintenance and Nutrient Recycling in Aquaponics systems	C, U, E	1,2,9
5	Understand significance of running water systems and raceways	U	1,10
6	Understand the concept of working of IMTA and PAS	U	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	Units	Course description	Hrs	CO No.
1	Introduction and overview of Aquaculture production		5 Hrs	
	1.1	Overview of Global Aquaculture production	1	1
	1.2	Constraints and future prospects in Aquaculture production in India and around the world	2	1
	1.3	Types of farming systems – Cluster Farming, Organic Farming, Satellite Farming, Cooperative Farming	1	1
	1.4	Enhancing the carrying capacity of culture systems	1	1
2	Climate Change impact		20 Hrs	
	2.1	Principles of Biofloc; Factors influencing biofloc formation, Microbial communities in bioflocs;	4	2
	2.2	Carbon sources, C:N Ratio; Biofloc quantity and Quality; Biofloc as a feed ingredient; Nutrient recycling in a biofloc system.	4	2
	2.3	Stocking of finfish and shellfish in Biofloc medium, Bioremediation in wastewater Aquaculture	3	2
	2.4	Recirculating Aquaculture System- Design and Components, Design of mechanical and biological filters for water reuse systems	5	3
	2.5	Disposal of wastes and control of pollution to environment; biofiltration and Nitrifiers; suitable culture species for indoor culture systems, polyhouses	4	3
3	Strategies for sustainable aquaculture and guiding principles for sustainable aquaculture		20 Hrs	
	3.1	Aquaponics Systems- Principle, Components and Design	4	4
	3.2	Water Quality and System Maintenance; Ratio of Fish and Plants, Resource Utilization	4	4
	3.3	Nutrient recycling in Aquaponics systems and zero discharge of nutrients	4	4
	3.4	Running water systems; Flow through systems,	4	5

		Raceways (IPR)		
	3.5	Integrated multitrophic Aquaculture Systems; Partitioned Aquaculture Systems (PAS)	4	5
4	Practicals		30 Hrs	
	4.1	Study of the components of Biofloc, RAS and Aquaponics Systems	10	2,3
	4.2	Preparation and Maintenance of Aquaponics and Recirculating Aquaculture Systems	10	4,5
	4.3	Estimation of Ammonia, Nitrite, Nitrate , pH, Dissolved Oxygen and Carbon dioxide in different Aquaculture Systems	10	6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

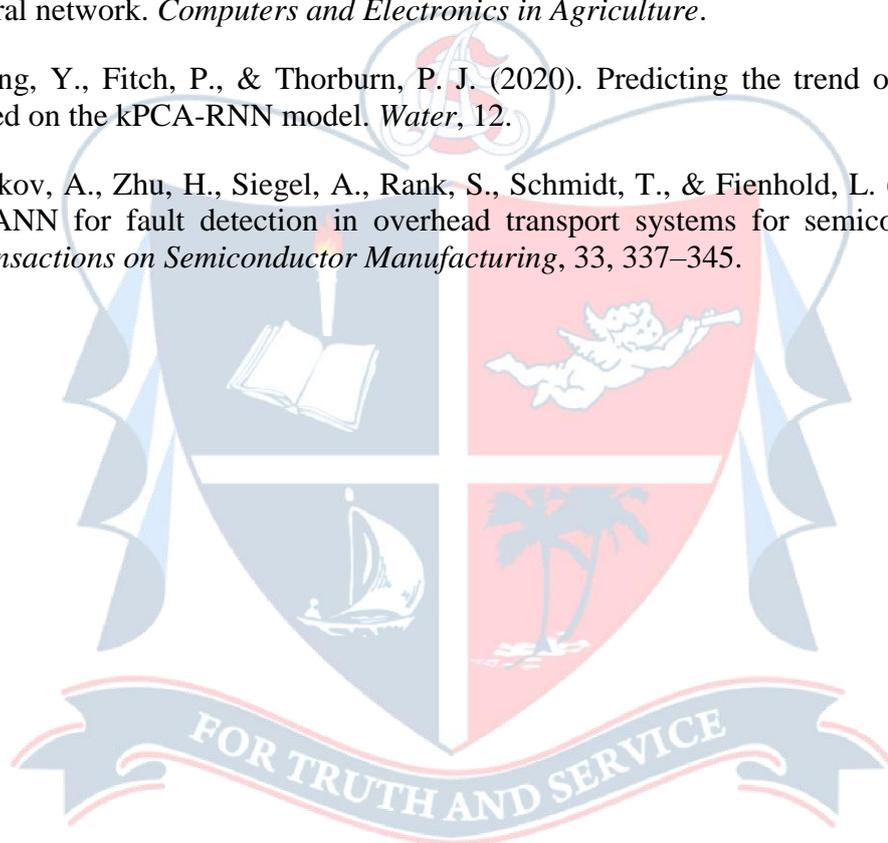
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Programme	Aquaculture					
Course Name	Fishing Craft and Gear Technology					
Type of Course	DSE					
Course Code	24SACAQU4DE102					
Course Level	200					
Course Summary	<p>Craft and gear technology is a term used in the context of fishing. Crafts or Boats provides a platform for fishing operations, carrying the crew and fishing gears. Nets or gear are the instruments used for catching fish. Various types of gears and crafts used in different parts depending upon the nature of water bodies and targeted species. The use of crafts and gears in fishing plays a very important role in enhancing the production. The syllabus covers topics such as traditional and modern fishing crafts of India, mechanization of fishing crafts, boat building materials, their maintenance, equipment, rules and regulations of fishing operation, and safety, different types of gears, their design, principle of operation, fish finding devices, Code of conduct of responsible fishing.</p>					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess interest in fishery technology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the basic principles fishing craft and gear operations.	U	1,2
2	Skills to identify different craft, boat building materials, gears, gear accessories, fishing gear materials	S	1,2,3
3	Develop interest in ecosystem conservation	I	6,7,8
4	Recall the maintenance procedures of craft and gear	R	3,6,10,9
5	Recognize the importance of fisheries legislation and responsible fishing	U	6,7,8,10
6	Understand the role of fish finding devices in fishing.	U	1,4,5,6

**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	Fishing crafts		12 Hours	
	1.1	Classification and description of different type of fishing crafts in India (inland and marine) traditional, motorized and mechanized. Terminologies of craft. Activity: Field visit to Harbour	4	1,2
	1.2	Fishing craft technology- Fishing craft materials- wood, steel, aluminum, Ferro-cement, FRP (GRP)-advantages and disadvantages. Craft care and maintenance - Marine corrosion, Fouling.	4	1,4
	1.3	General arrangements of different type of fishing boats - Trawlers, gill netters, purse seiners, long liners, trollers, deep sea vessels.	4	1,2
2	Fishing gear		13 Hours	

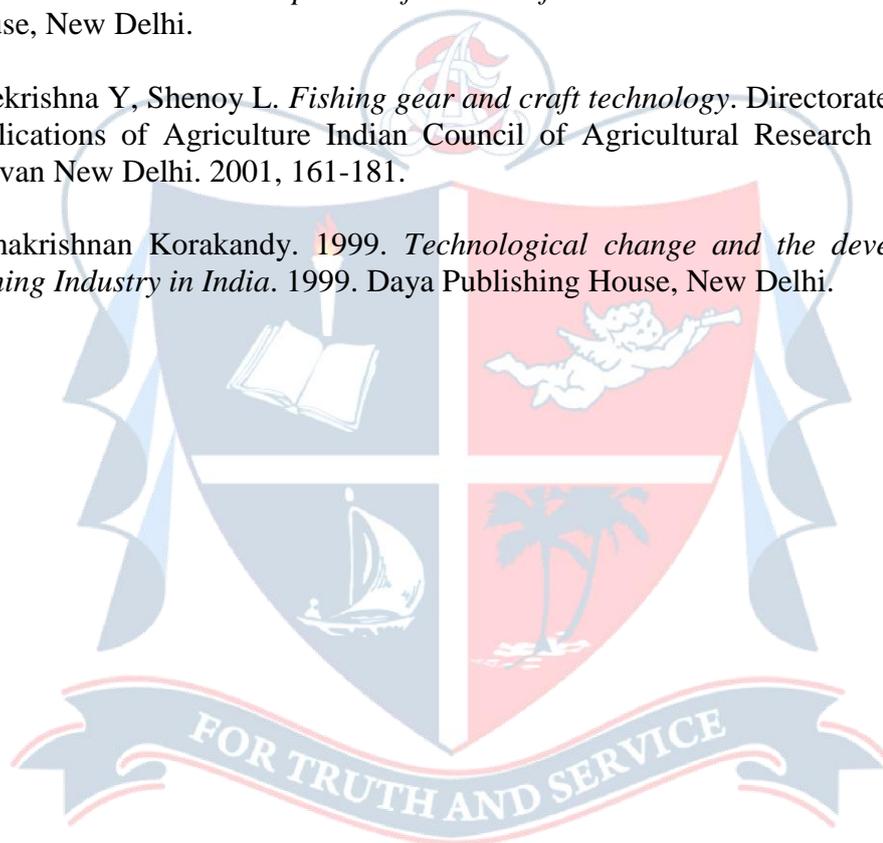
	2.1	Classification of fishing gear (FAO and A. Von Brandt). Care and maintenance.	2	1, 2
	2.2	Operation and design - trawl, purse seine, gill net, line fishing and squid jigging.	5	1, 2
	2.3	Important fishing gear accessories- floats, sinkers, otter board, hook, swivel, shackle, ropes.	2	2, 4
	2.4	Fishing gear materials- natural, synthetic materials, properties and preservation, yarn numbering systems, direction of netting, type of knots, meshes, fly meshing. Mounting and webbing different methods, hanging co-efficient. Activity: Visit to Matsysfed net making factory.	4	2, 4
3	FAD's, Fish finding devices and conservation, Responsible Fisheries and Fisheries Legislation		20 hours	
	3.1	Fish aggregating devices and artificial reefs; Impact of artificial reefs on fish stock improvement;	4	6,3
	3.2	Turtle Exclusion Devices (TED) - By-catch Reduction Devices (BRD).	3	6,3,2
	3.3	Fish finder, GPS navigator, sonar, net sonde, gear monitoring equipment, remote sensing. Activity: Visit to CIFT/CIFNET	3	6,2
	3.4	Concept of Responsible Fisheries; Monsoon trawl ban, closed season, mesh size regulations, juvenile fishing	3	3,5
	3.5	Exclusive Economic Zone (EEZ), Coastal Regulation Zone (CRZ), Integrated Coastal Zone Management (ICZM). MSY, MEY, Over fishing, Recruitment over fishing, Aqua-ranching.	3	3,5
	3.6	Indian fisheries Act.1976. Coast Guard Act.1978, Maritime zones of India Act.1981.	4	3,5
4	Practical		30 Hours	
	4.1	Identification of fishing crafts	4	2
	4.2	Identification of fishing gears, fishing accessories, (floats/sinkers/hook)	10	2
	4.3	Types of knots	4	2,1
	4.4	Identification of material used for gears -synthetic and natural fibers, twines, ropes, iron wares	4	2,1
	4.5	Study of Different Types of FAD's	4	2,1
	4.6	Study of Fish Finding devices (GPS navigator, Sonar, Net Sonde, Gear Monitoring Equipment and Remote Sensing)	4	1,2
5	Teacher specific content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Programme	Aquaculture					
Course Name	Physiology and Internal Organisation of Finfishes and Shellfishes					
Type of Course	DSE					
Course Code	24SACAQUA4DE103					
Course Level	200					
Course Summary	<p>This course deals with the knowledge on how well an aquatic organism gets adapted in the aquatic ecosystem maintaining good health. Structure and functioning of different body systems such as digestive system, circulatory system, respiratory system, reproductive system and excretory system of finfishes and shell fishes are detailed. The food and feeding habits of fin fishes and shellfishes are incorporated.</p> <p>The study of age and growth in fish is a prerequisite to generate the information on recruitment, longevity, mortality and fluctuations in fishery caused by various year classes, all of which can contribute towards planning for a rational exploitation of the fish stocks. The topics included in this paper also support management of successful aquaculture practices.</p>					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess basic knowledge on tissues, various organs and organ systems of animals					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Explain the digestive system and process of digestion in fin fishes and shell fishes.	U	1,2,10

2	Summarize the circulatory and respiratory systems of fin fishes and shell fishes	U	1,3
3	Utilize the knowledge on excretory, reproductive and nervous system of finfishes and shellfishes	A	10
4	Compare the food and feeding habits of fin fishes and shell fishes	U	1,2
5	Estimate the age and growth of fishes by various methods	C	3
6	Examine and Analyze various organs and organ systems of finfishes and shellfishes	An	1,2,10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	Digestive system of fin fishes and shell fishes Circulatory and respiratory system of finfishes and shellfishes		15 Hrs.	
	1.1	Structure of digestive system of finfish Physiology of digestion Associated digestive gland and their functions Absorption and assimilation of nutrients Hormones in the regulation of digestion Factors affecting the process of digestion Digestive system and Physiology of digestion in shell fishes (shrimp, bivalve and cephalopod)	5	1
	1.2	Structure of heart, blood vascular system Cardiovascular physiology of finfishes. Cardiovascular physiology of shell fishes.	4	1
	1.3	Gills and process of respiration in finfishes Accessory respiratory organs of finfishes.	3	1
	1.4	Swim bladder Swimming activity, social behaviour and migration in fishes	3	1
2	Excretory, reproductive and nervous system Food and feeding habits of finfishes and shell fishes		15 Hrs.	
	2.1	Excretory organs in finfish, their physiological functions and mechanism of excretion. Osmoregulation in finfishes. Endocrine control of osmoregulation. Excretory organs and physiology of excretion in shell fishes (shrimp, bivalve and cephalopod).	5	3

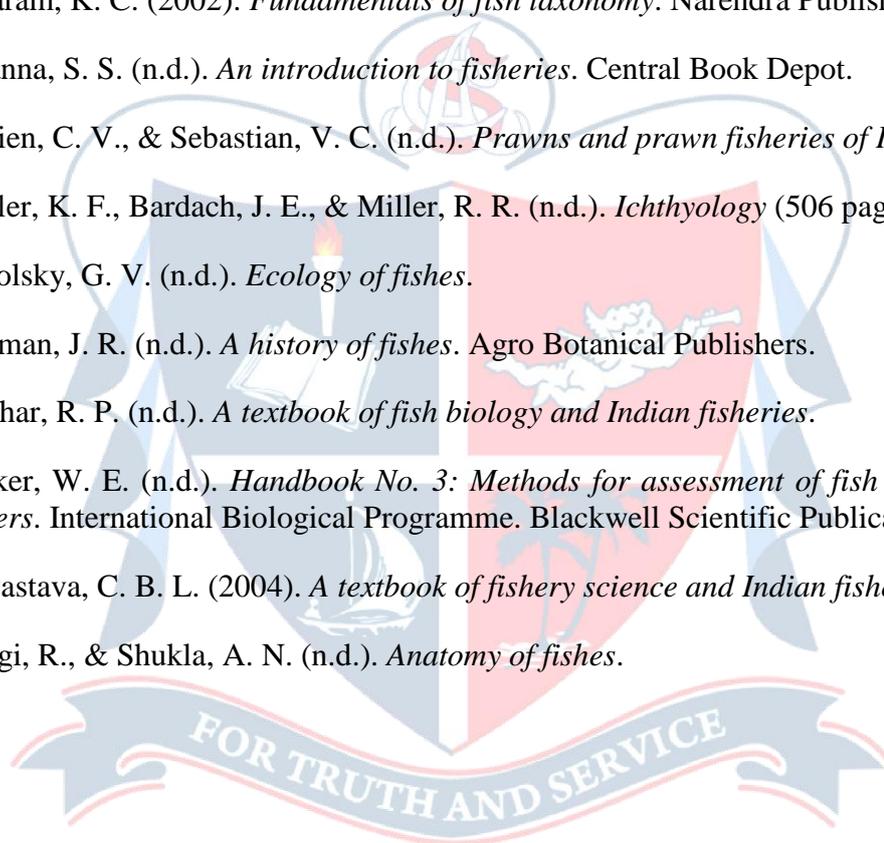
	2.2	Structure and physiology of reproductive system of finfishes. Structure and physiology of reproductive system of shrimp and crab	3	3
	2.3	Nervous and lateral line system, sense organs (eye, ear, olfactory organs) of finfishes. Nervous system and sense organs of shell fishes (shrimp and bivalve).	4	3
	2.4	Natural food of fishes. Feeding habits and types of feeding in fishes- Carnivorous, Herbivorous and Omnivorous, Predators, Grazers, Suckers, Strainers and parasites. Feeding habits and method of feeding in shell fishes (Shrimp, bivalve, cephalopod).	3	4
3	Age and growth studies of fish 15 Hours			
	3.1	Growth of finfishes- Absolute and relative growth, isometric growth and allometric growth. The cube law.	3	5
	3.2	Methods for determination of growth checks. Length frequency analysis. Analysis of growth using hard parts like scales, otoliths and vertebrae.	3	5
	3.3	Estimation of growth by direct methods. Marking and tagging of fish for growth studies.	3	5
	3.4	Methods of studying reproduction Maturity Stages, Gonadosomatic Index, Ova Diameter Frequency studies.	3	5
	3.5	Determination of size at first maturity and spawning season, Fecundity and its determination.	3	5
4	PRACTICAL 30 Hours			
	1	Dissect and study the digestive system of fin fishes	4	6
	2	Structure of gills of finfishes (Herbivore, omnivore, carnivore)	4	6
	3	Gut content analysis of finfishes	4	6
	4	Nervous system of prawn	4	6
	5	Study of gill structure of crustacean	2	6
	6	Study of gill structure of bivalve	2	6
	7	Dissect and understand the reproductive organs of finfishes	4	6
	9	Familiarize various types of tags used in age and growth studies	2	6
	10	Analysis of length frequency data	4	6
5	Teacher specific content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Seed Production and Hatchery Management of Shellfishes					
Type of Course	DSE					
Course Code	24SACAQU4DE104					
Course Level	300					
Course Summary	The course provides an in- depth knowledge on the seed production and hatchery management of various shellfish species through theoretical and practical components. The course is designed to cover topics such as brood stock selection, conditioning, seed production, larval rearing, and hatchery management.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess knowledge on the general biology of aquatic organisms.					

COURSE OUTCOMES (CO)

CO No	Expected Course Outcome	Learning Domains*	PO No
1	Summarize the current status of seed production techniques of shellfish species	U	1,2
2	Plan the broodstock selection and conditioning of shellfish for optimal seed production.	A	1,2
3	Develop skills in induced maturation, seed production and larval rearing.	A	1,2,10
4	Construct and develop techniques for live feed culture unit	C, A	3,9,10
5	Examine the water quality aspects of hatchery.	An	1,2
6	Develop fundamental skills in site selection and design of hatcheries.	A, C, S	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	Introduction to seed collection and reproductive biology of shellfish 15 Hours			
	1.1	Current status of seed production of shellfish.	1	1
	1.2	Seed resources of various shellfishes. Site selection of seed resources, Collection methods and identification of different shellfish seed.	3	1
	1.3	Constraints and prospects in collection of seed.	1	1
	1.4	Reproductive biology of crustaceans (prawns, shrimps, crabs, lobsters) and molluscs (mussels, oysters, scallops, clams and cockles).	2	2
	1.5	Reproductive hormones in crustaceans and molluscs.	1	2
	1.6	Mechanism of reproduction in prawns, shrimps, crabs, lobsters, mussels, oysters, scallops, clams and cockles.	3	2
	1.7	Sexual maturity, breeding seasons of commercially important shellfish species.	1	2
	1.8	Factors affecting maturation and spawning.	1	2
	1.9	Life cycle of important shellfish (<i>Penaeus monodon</i> , <i>Macrobrachium rosenbergii</i> , <i>Scylla serrata</i> , lobster, edible oyster, pearl oyster, fresh water mussel).	2	2
2	Broodstock Management and seed production 10 Hours			
	2.1	Availability of broodstock. Selection criteria for broodstock (prawns, shrimps, crabs, lobsters, mussels, oysters, scallops, clams and cockles).	2	3
	2.2	Nutritional requirements of broodstock.	2	3
	2.3	Transport, captive rearing and maturation of broodstock.	2	3
	2.4	Induced maturation and seed production of commercially important crustaceans (prawns, shrimps, crabs, lobsters, mussels, edible oysters, pearl oysters, scallops, clams and cockles).	4	3

3	Hatchery Technology and Management		20 Hours	
	3.1	Site selection and facilities required for a shellfish hatchery (prawn, shrimp, oyster and mussels)	3	4,5,6
	3.2	Culture and use of different live feeds in shellfish hatcheries.	3	4,5,6
	3.3.	Larval diseases and their management.	2	4,5,6
	3.4.	Water quality (salinity, pH, dissolved oxygen, ammonia, nitrite, and nitrate) and feed management.	2	4,5,6
	3.5.	Different chemicals and drugs used for water quality and health management in hatcheries.	2	4,5,6
	3.6.	Hatchery standards and biosecurity; sanitary and phyto sanitary (SPS) measures; better management practices (BMPs).	3	4,5,6
	3.7.	Quality assessment of seeds. Packaging and transport of seed.	3	4,5,6
	3.8.	Economics of seed production.	2	4,5,6
4	Practical		30 Hours	
	4.1	Identification of brood stock of important crustaceans (prawns, shrimps) and molluscs (mussels).	5	2
	4.2	Observations on gonadal maturation of <i>Penaeus monodon</i> and <i>Macrobrachium rosenbergii</i> .	4	2
	4.3	Identification of larval stages of crustaceans (prawns, shrimps) and molluscs (mussels).	3	3
	4.4	Demonstration of eyestalk ablation in <i>Penaeus monodon</i> .	4	3
	4.5	Familiarization of collection and packing techniques of shrimp/prawn seeds.	5	6
	4.6	Water quality analysis (salinity, pH, dissolved oxygen, ammonia, nitrite, nitrate) in hatcheries	4	5
	4.7	Demonstration of setting up of a live feed unit	5	4
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

References

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Programme	Aquaculture					
Course Name	Aqua farm Management					
Type of Course	SEC					
Course Code	24SACAQU4SE101					
Course Level	200					
Course Summary	Provides a comprehensive understanding of the principles and practices involved in the management of aqua farms, such as site selection, facility design, water quality management, stocking, and sustainable practices.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3				45
Pre-requisites, if any	Basic knowledge regarding fishes and fish rearing is desirable.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain s*	PO No
1	Summarize the different systems of aquaculture including recent techniques in aquaculture systems.	U	1
2	Understand the importance of aquaculture and criteria for the site selection of an aqua farm and selection species. Design and planning an aqua farm or hatchery	U, A, S	1, 2

3	Demonstrate the pre-stocking pond preparation steps such as drying, ploughing, liming, and manuring and fertilization and proper procedures for grow out	A, S	1, 2
4	Develop sufficient professional knowledge in fish farm to start own enterprise, outline the major diseases associated with farming practices and develop knowledge on disease management tools	A, S	5, 6, 10
5	Illustrate feed formulation techniques for the manufacture of nutritionally balanced feed	A, C, S	1, 2
6	Mastery on hatchery operation and harvesting methods, familiarity with equipment operation	A, S	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.
	Introduction to Aquafarm Management & Site Selection		5 Hours	
1	1.1	Overview of aquaculture and its importance. Historical perspective and global trends. Sustainable aquaculture practices.	2	1
	1.2	Criteria for site selection Types of aquaculture facilities (ponds, raceways, tanks) Facility design considerations and planning.	3	2
2	Pre-stocking Management and Aquatic Species Selection		13 Hours	
	2.1	Preparation of pond Dike construction Eradication of undesirable aquatic weeds ,Eradication of weed fishes, Liming of pond, Basal manuring and fertilization Eradication of aquatic insects Bio fencing Activity: Attend training in fish farm	10	3, 4

	2.2	Selection of fish and shellfish species Criteria for the selection of species	3	2
	Stocking, Post Stocking Management, Harvesting and Post-Harvest Handling		27 Hours	
3	3.1	Handling and transportation of aquatic species Stocking densities and ratios	2	
	3.2	Water Quality Management Importance of water quality in aquaculture Monitoring and controlling water parameters Aeration and circulation systems Activity: Field trips to aquafarms	8	4
	3.3	Types of aquafeeds Feed formulation and nutritional requirements Feeding strategies and schedules Activity: Visit/training in fish feed mills	5	5
	3.4	Common diseases in aquaculture Prevention and treatment of diseases Quarantine practices	3	4
	3.5	Harvesting techniques Processing and storage of aquaculture products Value addition and marketing Activity: Visit farm at the time of harvesting	9	6
4	Teacher specific content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks

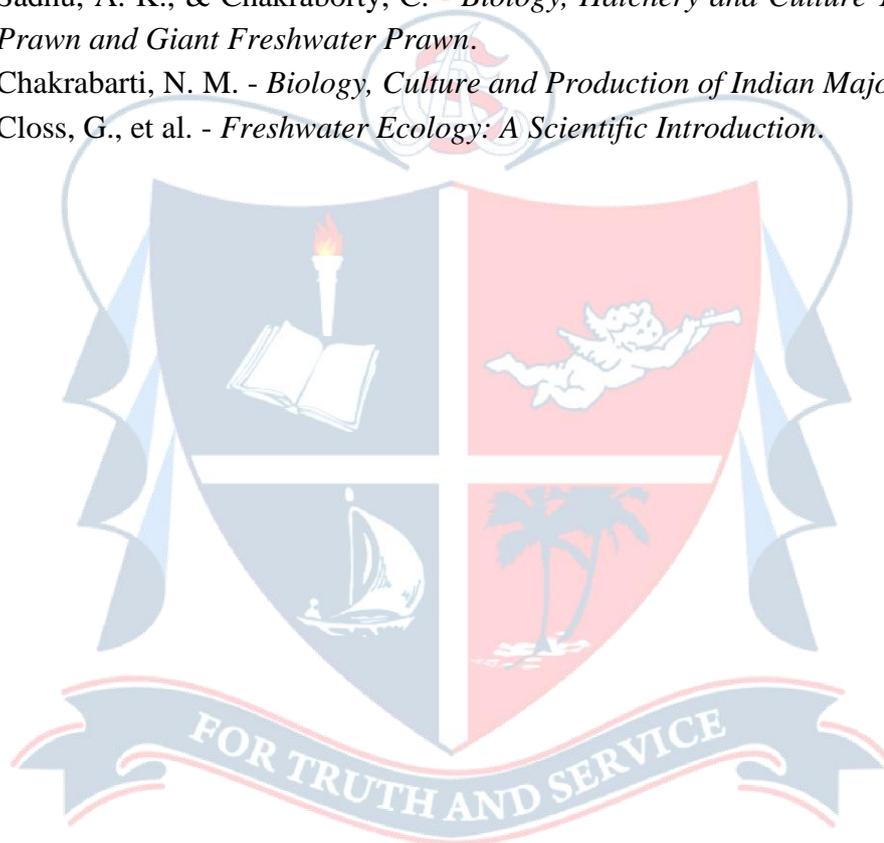
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- Rath, R. K. - *Freshwater Aquaculture*.
- Sadhu, A. K., & Chakraborty, C. - *Biology, Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*.
- Chakrabarti, N. M. - *Biology, Culture and Production of Indian Major Carps: A Review*.
- Closs, G., et al. - *Freshwater Ecology: A Scientific Introduction*.





Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Sustainable Aquaculture Practices					
Type of Course	VAC					
Course Code	24SACAQU4VA101					
Course Level	300					
Course Summary	<p>The course emphasizes the need and methods for sustainable aquaculture. Sustainable aquaculture is the aquaculture practice which focuses on environmental, economic, and social sustainability to improve capacity building and utilize land effectively for the aquaculture sector. Aquaculture encompasses a wide range of different aquatic farming practices with regard to species (including seaweeds, molluscs, crustaceans, fish and other aquatic species groups), environments and systems utilized, with very distinct resource use patterns involved, offering a wide range of options for diversification of avenues for enhanced food production and income generation in many rural and peri-urban areas. The student gains ideas on the 4 Pathways for sustainable aquaculture- Responsible production; Improving livelihoods; Healthy Consumption and an enabling environment.</p>					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3				45
Pre-requisites, if any	A preliminary and basic idea on natural resources and sustainable practices for utilizing natural resources is desirable.					

COURSE OUTCOMES (CO)

CO. No.	Expected Course Outcome	Learning Domains*	PO No
1	Creating knowledge on reducing health issues through sustainable methods.	U	1,2
2	Developing skill to assess issues and thereby maintain sustainability of ecosystems through responsible production.	S	1,2
3	Utilize aquaculture practices which focus on environmental, economic and social sustainability to improve capacity building and utilize land effectively for the aquaculture sector.	An	1,2
4	Formulate methods for enhancing the economic viability of aquaculture practices.	C	1,2
5	Evaluate the basic concepts about planning and aquaculture development.	E	1,2
6	Acquire in-depth knowledge and field exposure on sustainable aquaculture practices.	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)**

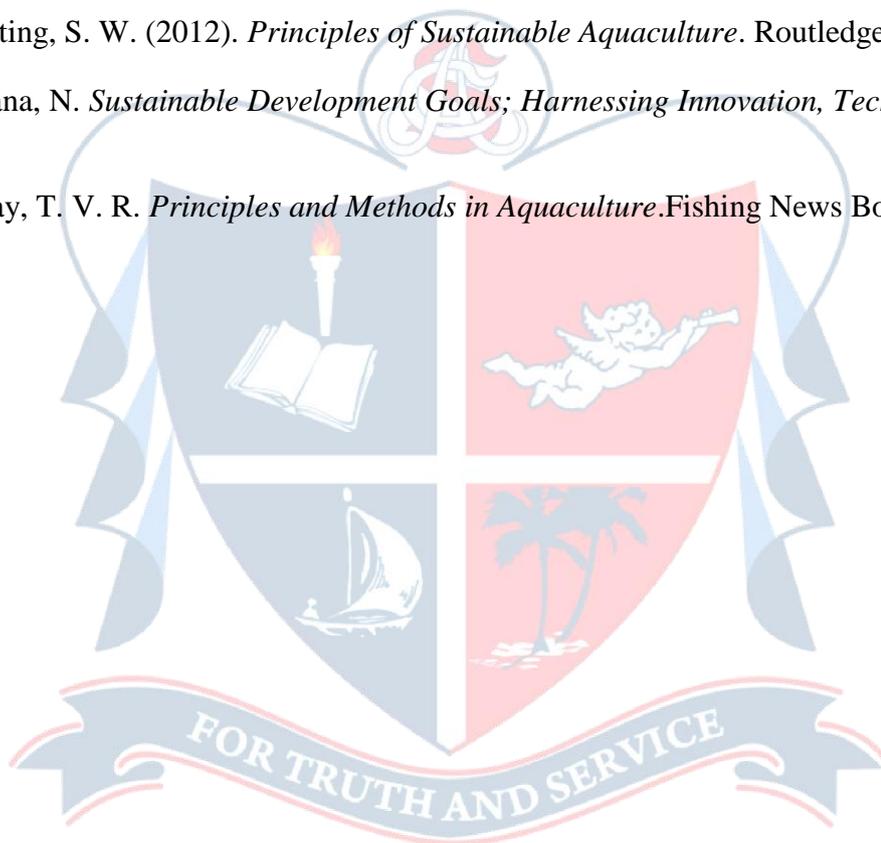
Module	Units	Course description	Hrs	CO No.
1	Sustainability Aquaculture : Present Scenario and Problems		10 Hours	
	1.1	Role of aquatic resources in food and nutrition; Aquatic resource and livelihood systems.	3	1
	1.2	Different culture systems-Extensive culture , intensive culture, semi – intensive culture; RAS & Integrated Multi Trophic Aquaculture systems, Biofloc fish farming	5	1
	1.3	Trends in global and Indian aquaculture and its constraints	2	1
2	Environmental and Socioeconomic Issues, Strategies for sustainability		20 Hours	
	2.1	Impacts of climate change; global warming Environmental degradation and disease outbreaks; Micro plastics in aquaculture; pollution; Eutrophication.	5	2,3
	2.2	Socioeconomic issues: Conflicts over water and land use; conflicts of interest between aqua farmers and fishermen; resistance from local public; anti-dumping duties; waste water management in aquaculture.	4	2,3
	2.3	Sustainability concept; food security; biosecurity; organic	4	2,3

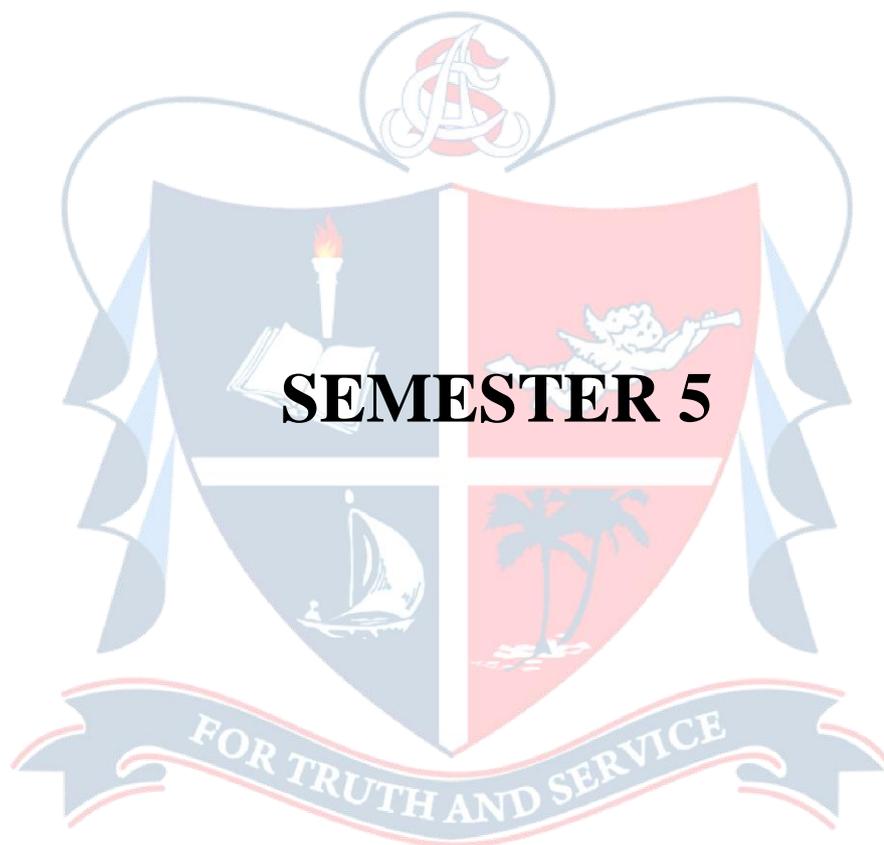
		farming; integrated farming; responsible aquaculture; rotational aquaculture; bioremediation; role of biotechnology, traceability; Seed certification, Sustainable use of antibiotics.		
	2.4	Coastal Aquaculture Guidelines Source Book, FAO Code of Conduct for Responsible Fisheries.	4	2,3
	2.5	Aquaculture Stewardship Council, Ecolabelling, Marine Stewardship council	3	2,3
3	Economic viability, Field Visit and Activity		15 Hours	
	3.1	Export vs. Domestic marketing, value addition.	3	4,5
	3.2	Application of renewable energy in aquaculture - solar energy, wind, and tidal energy.	2	4,5
	3.3	Field visit to organic aquaculture farms OR Survey on good aquaculture practices among aqua farmers	5	6
	3.4	Create awareness on sustainable aquaculture practices among the aquafarmers through seminars/talks OR Attend Seminar on Sustainable practices.	5	6
4	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	<p>Mode of Assessment</p> <p>A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks</p> <p>B. Semester End Examination</p> <p>Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks</p>

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Seed Production and Hatchery Management of Finfishes					
Type of Course	DSC A					
Course Code	24SACAQU5DA101					
Course Level	300					
Course Summary	This course offers an insight into seed production and hatchery technology of major finfishes. Seed production is the production of fish seeds in controlled condition in a hatchery. It involves broodstock rearing, artificial breeding methods, larval rearing and live feed culture. The aim of seed production is to produce fish seeds with desirable characters such as fast growth, disease resistance and so on by artificial propagation methods. To develop a successful seed production, infrastructure facilities, equipment, and trained personnel are mandatory.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess knowledge regarding the basic biology of fishes.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain different types of seed production and breeding methods.	U	1
2	Formulate different criteria for designing a hatchery and the selection of equipment.	C	1,2
3	Analyze different steps and procedures involved in the preparation and management of nursery and rearing systems of fish breeding.	An	1

4	Prepare the criteria for the selection of broodstock and broodstock management	U	1
5	Develop an Insight of natural breeding of finfishes and sexual maturity of different types of food fishes.	A, S	1
6	Develop fundamental skills in setting up of a fish hatchery	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	Hrs	CO No.
		Hatchery management and seed production	15 Hours	
1	1.1	Criteria for the selection and construction of a hatchery. General design of hatcheries. Larval rearing unit, live feed culture unit. Water quality monitoring and management. Hatchery protocols, Economics of seed production	5	2,6
	1.2	Equipments and infrastructure facilities - Mechanical and biological filters, Incubators, Structure of hatching hapa. Breeding in hatching hapa. Auxiliary facilities in a hatchery- pumping unit, Electrical generator room, laboratory.	3	2
	1.3	Current trends in seed production, Selection criteria for broodstock and brood stock management, sex determination, Quarantine and disease management in hatcheries.	3	4
	1.4	Fish seeds- Types of seeds, embryonic development, Seed collection methods, Transportation of fish seed. Quality assessment of seeds. Larval rearing stages. Methods of breeding- Induced breeding- Hypophysation, stripping, Injection with LHRH-a, Bundh breeding techniques.	4	1
		Seed production and hatchery management of freshwater fishes and air breathing fishes	15 Hours	
2	2.1	Seed production and larval rearing of Indian major carps and exotic carps. Production of common carp seeds by different methods- Dubisch method, Sundanese, Tjimindi, methods followed in China and India.	4	3,5
	2.2	Induced breeding methods of carps, types of carp hatcheries- glass jar hatchery, Chinese circular hatchery.	3	1, 2
	2.3	Types of air breathing fishes. Respiratory adaptations of air breathing fishes. Seed production and nursery rearing of air breathing fishes- <i>Anabas testudineus</i> , Murrels - snake head.	4	3,5

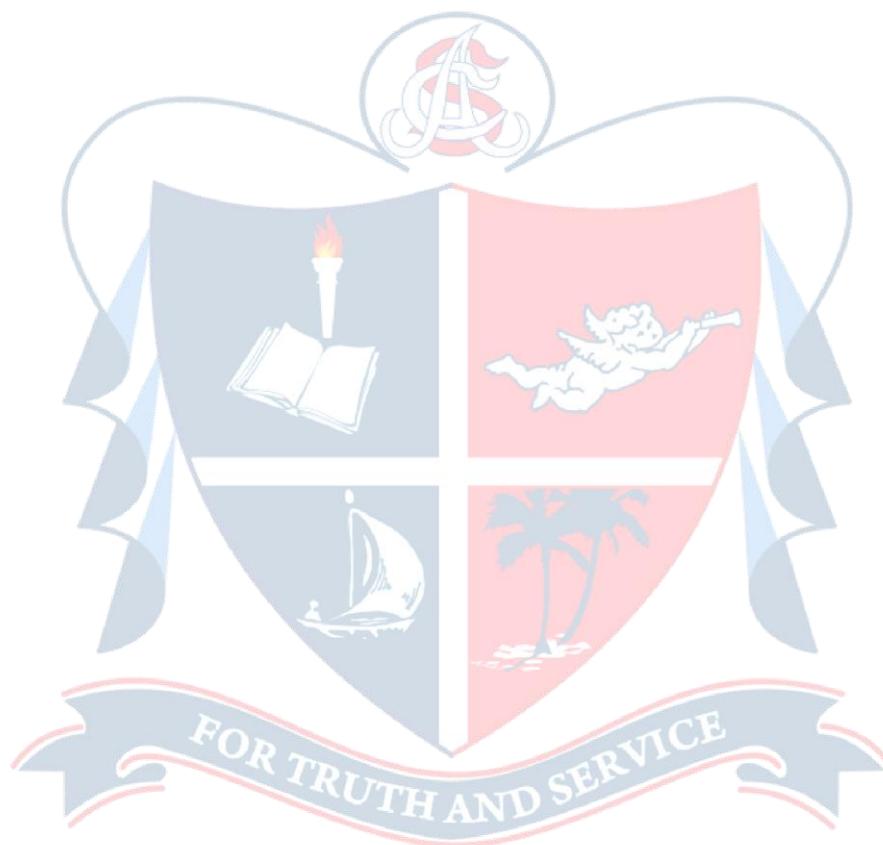
	2.4	Seed production and hatchery management of airbreathing catfishes- <i>Clarias</i> spp, <i>Heteropneustes</i> sp, <i>Pangasius pangasius</i> sp	4	3,5
		Seed production and hatchery management of brackish water and marine fishes	15 Hours	
3	3.1	Seed production and hatchery technology of brackish water fishes –Tilapia, <i>Mugil cephalus</i> , <i>Chanos chanos</i> , <i>Etroplus suratensis</i> , <i>Lates calcarifer</i> .	8	3,5
	3.2	Seed production and hatchery technology of marine fishes - Cobia, Grouper, silver pompano.	7	3,5
4	PRACTICAL		30 Hours	
	1	Demonstrate induced breeding by hypophysation or stripping	6	1
	2	Culture of live feed for hatchery	6	3,5
	3	Estimation of water quality in a hatching unit	6	6
	4	Identification of fish larval stages	6	1,3,5
	5	Demonstrate packaging of fish seed and brood fishes for transportation	6	2,6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

References

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2. FAO. (2007). *Manual for Operating a Small-Scale Recirculation Freshwater Prawn Hatchery*.

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Programme	Aquaculture					
Course Name	Post Harvest Technology and Quality control					
Type of Course	DSC A					
Course Code	24SACAQU5DA102					
Course Level	300					
Course Summary	Post-Harvest Technology and Quality Control is a specialized course that delves into the processes and techniques involved in handling, processing, and ensuring the quality of fish products after harvest. Overall, the course aims to equip students with the knowledge and skills needed to effectively manage. The post-harvest phase of fish production, ensuring quality, safety, and sustainability in the fisheries industry. Practical applications, hands-on experiences, and exposure to industry practices may also be integral parts of the course.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess knowledge regarding general characters of fish					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Gain knowledge of the various post- harvest processes, including harvesting methods, handling, storage, transportation and packaging.	U	1,2
2	Familiarize with different preservation techniques of aquatic products	S, A	1

3	Familiarize with different freezing technology and techniques used in seafood industry	U, K	1
4	Identify the importance of packaging in food processing industry	U	1,2
5	Understanding National and International quality standards	S, A	2
6	Comprehend the principles of quality control and assurance in the context of fishery products, emphasizing factors that affect product quality	A, U	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	Handling and pre-treatment		10 hours	
	1.1	Fresh and spoiled fish & shellfish- characteristics of fresh fish, post mortem changes after death of fish. Onboard handling of seafood.	3	1
	1.2	Pre-treatment of fish-washing, Grading/ count, gutting, filleting, beheading, peeling, deveining etc. Depuration in shell fishes	3	1
	1.3	Quality of water and ice in fish handling and processing. Different types of ice used in the seafood industry. Chlorination of water. Refrigeration cycle- principle & working.	4	1
2	Preservation Techniques		19hours	
	2.1	Principles of smoking, drying and salting of fish, Traditional drying / curing methods. Spoilage of dried products Different types of Smoking: Cold, hot smoking, electrostatic smoking. Spoilage of smoked products.	4	2
	2.2	Thermal processing (Cooking, Sous-vide, Canning). Canning- Outline of canning operations, Selection & preparation fish, blanching, clinching, exhausting, can seaming & washing, proceeding/ sterilization. Spoilage of canned products	4	2

	2.3	Freezing- slow & quick freezing, factors affecting freezing, freezing curve of fish, Types of freezers, IQF, Freeze drying and its significance. AFD and its merits	4	3
	2.4	Thawing. Conductive thawing methods (in air, water, vaccum) & non conductive methods of thawing (electrical resistance, dielectric, microwave, hybrid).	3	3
	2.5	Irradiation of food products	1	4
	2.6	Types of freezers used in seafood industry. Chilled and frozen storage of fish and fishery products.	3	4
3	Packaging and Quality Assurance		16Hours	
	3.1	Packaging- functions, requirements for fishery products, Different types of packing materials. Modified atmosphere packaging, controlled packaging and aseptic packaging. Flexible packing, retort pouch processing of fish and fishery products. Significance of Retortable pouch processing	4	4
	3.2	Changes associated with freezing - Super cooling, crystallization, thaw drip, gaping of fillets, thaw rigor, recrystallization & desiccation, discolouration, toughness.	3	3
	3.3	Quality control – basic concepts& problems, quality assurance. Sanitary and hygiene requirements. Sanitation procedures in seafood processing plants. Waste management in fish processing industries. Risk factors in seafood biotoxins, seafood pathogens, endogenous parasites.	4	5, 6
	3.4	Physical, chemical & biological hazards in seafood. Quality control programmes - pre-shipment inspection,HACCP – concept, process and CCPs	3	5, 6
	3.5	Export of fishery products from India – major countries, important products, export documents and procedures. Traceability. Quality certifications- IPQC, MIPQC, BRCCGS and ISO Series in seafood industry. Eco labelling.	2	5, 6

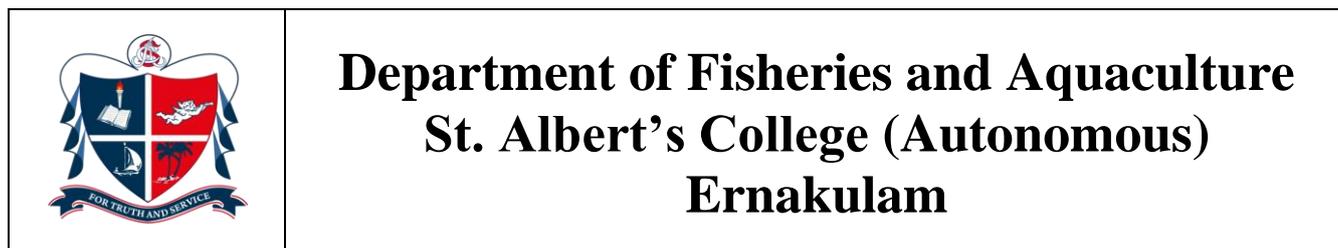
4	PRACTICAL			30 Hours
1	Evaluation of fish / fishery products for organoleptic, chemical and microbial quality.	3	1	
2	Sanitary standards in fish processing units.	3	5, 6	
3	Filleting of fish, treatments, glazing, packaging, freezing.	3	1	
4	Process flow of Prawns, Lobster, Squid, Cuttle Fish, Crab etc. in different styles	3	1	
5	Freezing: Studies on physical, chemical and sensory changes during freezing. Production of frozen fishery products- dressed fish, fillets, minced fish, surimi, Production of prawn products- whole prawns, HL, PUD, PD, Butterfly prawns.	3	3	
6	Chill storage studies: Chemical, physical and sensory analysis, determination of shelf life. Handling of fish, bivalves, prawns, molluscs, Depuration, treatment with chemicals, evaluation of freshness of fish.	3	3	
7	Canning: Canning process of table fishes, Bivalves, Crustaceans in different containers, Canned culinary preparations, Examination of canned fishery products. Defects in canned fishery products.	3	2	
8	Preparation of dried, cured and fermented fish products, examination of salt, protein, moisture in dried / cured products, examination of spoilage of dried / cured fish products, marinades, pickles, sauce..	3	2	
9	Field visit in a reputed seafood processing plant	6	6	
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks

	<p>Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks</p> <p>Essay (1 out of 3) 1 X 10 = 10 Marks</p> <p>Total – 50 Marks</p> <p>Practicals</p> <p>Lab Report = 5 Marks</p> <p>Identification of Spotters = 15 Marks</p> <p>Principle and Procedure = 12 Marks</p> <p>Viva = 3 Marks</p> <p>Total – 35 Marks</p>
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Programme	Aquaculture					
Course Name	Inland and Marine Capture Fisheries					
Type of Course	DSE					
Course Code	24SACAQU5DE101					
Course Level	300					
Course Summary	The course introduced to study the basics of marine and inland waters of the world and India, their fish fauna; global fish production trends; major fish producing countries and ecosystems; detailed account on pelagic, demersal, deep sea, riverine, lacustrine, reservoir, wetlands and estuarine fisheries, including crafts and gears; The students will get practical training on collection and identification of marine and inland fishery resources, demonstration of craft and gears and biometric studies through the visits to fish landing centres.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should possess knowledge regarding marine and inland aquatic resources.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Students able to understand the different types of inland fisheries resources of the world and India	U	1,2
2	Acquire knowledge regarding the present status of marine fisheries	A	1,2

3	Categorize and estimate the species wise landing pattern of pelagic fishery resources of India	An, C	1,2
4	Categorize and estimate the species wise landing pattern of demersal fishery resources of India	An, C	1,2
5	Formulate deep sea fishing policy of India	C, S	1,2,6
6	Evaluate the present status of crustacean and molluscan fishery resources of India	E	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	Inland fishery resources	21 Hours		
1	1.1	Major inland waters of the world and India, their fish fauna; global inland fish production trends; major inland fish producing countries and ecosystems.	3	1
	1.2	Major river systems of India and Kerala and their fisheries. Current status, trend, and fishing methods of riverine fisheries	2	1
	1.3	Classification of reservoirs, present productivity levels and fishery potentials. Problems and prospects of reservoir fisheries in India. Measures to increase their production and economic management of reservoirs	3	1
	1.4	Estuarine fisheries resources of India, Fisheries of major estuarine systems in India and Kerala. Fishing methods, recent statistics of catches, problems encountered in fisheries development of major estuaries Activity: Collection and identification of fishes from rivers, reservoirs, lakes, estuaries and wetlands	6	1

	1.5	Lacustrine fisheries: Fish fauna of natural lakes. Management and conservation of fisheries of lakes	2	1
	1.6	Flood-plain capture fishery- present status of their exploitation and future prospects. Bheel fisheries resources of India: Open and closed bheels Activity: Classify the different types of crafts and gear used in inland fishing	5	1
2	Marine fishery resources		22 Hours	
	2.1	Introduction to marine fisheries of the world; Major fishing zones of world and India. Global marine fish production trends. FAO status	3	2
	2.2	Introduction to marine fisheries of India. Pelagic, demersal and deep-sea fishery resources	2	2
2	2.3	Pelagic fisheries of India: sardines, mackerels, anchovies, white baits, tuna, seer fish, carangids, ribbonfish, shads and other clupeids, barracudas, Bombay duck, pomfrets, mullets Activity- Visit- Marine fish landing Centre, Collection and identification of <i>commercially important marine fin fishes</i> .	6	3
	2.4	Features and trends in the production of pelagic fisheries. Conservation of pelagic fish stock	2	3
	2.5	Demersal fisheries of India: Elasmobranchs (sharks, rays and skates), perches, threadfin breams, groupers, snappers, Bull's eye, flat fishes, sciaenids, eels.	5	4
	2.6	Features and trends in production of demersal fisheries. Conservation of demersal fish stock Activity: Classify the different types of crafts and gear used in marine fishing	4	4
	Deep sea fishery resources		4 Hours	

3	3.1	History of deep-sea fishing. Oceanic and deep-sea fisheries of India. Potential resources.	2	5
	3.2	Deep sea fishing policy of India	2	6
		Crustacean and molluscan fishery resources	13 Hours	
4	4.1	Crustacean fishery of India: Penaeid and non-Penaeid shrimp fisheries.	3	6
	4.2	Lobster fishery, Crab fishery	2	6
	4.3	Molluscan fishery of India: Mussel fishery, Oyster fishery, Clam fishery. Cephalopod fishery, Gastropod fishery <i>Activity:</i> Collection and identification of commercially important shellfishes	8	6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Fish Genetics and Biotechnology					
Course Name	Aquaculture					
Type of Course	DSE					
Course Code	24SACAQU5DE102					
Course Level	300					
Course Summary	The course imparts knowledge on the principles and techniques employed in the field of fish genetics and biotechnology. The course is designed to cover aspects on selective breeding, hybridization, sex manipulation, chromosome manipulation and different molecular biological techniques used in aquaculture. Genetic modification and biotechnology embrace tremendous potential to improve the health of fish population.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should possess knowledge regarding general introductory biology.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the fundamental tools in genetics and biotechnology	U	1, 2
2	Categorize the different hybridization methods and the methods of sex determination in fish	An	1, 2
3	Explain the various sex manipulation techniques to suit the needs of aquaculture	U	1, 2
4	Summarize the various chromosome manipulation techniques adopted in aquaculture	U	1, 2
5	Develop fundamental skills to demonstrate PCR amplification and recombinant DNA technology in fisheries and aquaculture.	A, S	1, 2, 10

6	Examine the applicability of molecular biology in marine biology and aquaculture	An	1, 2, 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to fish genetics and biotechnology		15 Hours	
1	1.1	Introduction to genetics. Gene, chromosome as basis of inheritance. Phenotype and genotype. Test cross and back cross. Modalism. Activity: Problems on Mendelian inheritance	6	1
	1.2	Population genetics - Hardy-Weinberg law and its significance. Factors affecting Hardy-Weinberg's law. Activity: Problems on Hardy-Weinberg law	5	1
	1.3	Practical applications of genetics in aquaculture. Scope and the present status of marine biotechnology.	2	1
	1.4	Activity: Preparation of models of DNA and Chromosomes	2	1
2	Selection, hybridization and domestication		8 Hours	
2	2.1	Principles of breeding- methods and selection. Genetic selection, mass selection, genotypic selection, family and sib selection, progeny testing and combined selection.	4	2
	2.2	Hybridisation -selective hybridisation, intra-specific and inter-specific hybridisation, heterosis. Inbreeding and its consequences.	3	2
	2.3	Domestication and strain evaluation.	1	2
	Genetics of fish sex determination and chromosome manipulation		10 Hours	

3	3.1	Genetics of sex determination in fish. Gonochorism, Hermaphroditism, Protandry, Protogyni, Sexual dimorphism, Environmental influence of sex Determination.	4	2
	3.2	Androgenesis, Gynogenesis, Polyploidy	3	4
	3.3	Monosex production, super male fish production techniques, sex reversal–mechanisms and applications.	3	3
Biotechnological applications in Aquaculture and marine sciences 27 Hrs				
4	4.1	Introduction to molecular biological techniques applicable in aquaculture and marine sciences.	1	6
	4.2	Recombinant DNA technology - cloning, vectors, transformation. Use of PCR for aquatic health management. GMOs (Transgenics) in aquaculture; genes of interest- Anti- Freeze Protein, disease resistance genes, growth hormone gene, gene transfer mechanisms in production of transgenic fish. Activity: Demonstration of PCR amplification	10	5
	4.3	Synthetic hormones for induced breeding	2	6
	4.4	Cryopreservation of fish gametes. Probiotics, prebiotics, bioremediations, immunostimulants, immunomodulators. Vaccines–bio film vaccines, DNA vaccines, recombinant vaccine. Activity: Familiarisation of Equipments used in cryopreservation	8	5
	4.5	Marine bio resources–bioactive compounds from the sea, marine natural products and metabolites from different marine organisms. Marine toxins.	6	6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

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Programme	Aquaculture					
Course Name	Value Added Fishery Products and Byproducts					
Type of Course	DSE					
Course Code	24SACAQU5DE103					
Course Level	300					
Course Summary	This course explore the various byproducts generated in the fishing industry and focuses on value addition through processing techniques, creating sustainable practices and developing innovative products from fishery byproducts.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should have an overview of the different commercially available fishes used in Fish processing Industry.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify fishery byproducts and understand market trends, present status and distribution of value-added seafood products and consumer preferences.	U, An	1, 4
2	Explain the technical preparation of fish mince-based products with special emphasis on surumi production.	E, An	1,2,6
3	Explain the preparation, packaging and storage as well as quality evaluation of coated fishery products.	E, U	1,2,5
4	Summarize the preparation of a number of other value added products such as pickles, wafers, chutney powders, steaks, cutlets etc., from fish or shrimp.	U, I	1,6
5	Apply principles of sensory evaluation to assess product quality	A, S	1, 8, 9

	and study the characteristics of fish, its nutritional quality and relation to spoilage.		
6	Develop to prepare by-products like chitin, chitosan, fish silage, fish meal, fish oil etc. for commercial gain	C, A	4, 5, 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 Value Addition in Seafoods, Fish Mince Based Products		20 Hrs.	
	1.1	Definition of Value Addition Overview of Value added products; Present market trends and consumer preferences, Scope of value addition. Activity: Sensory Evaluation of Fish	4	1
	1.2	Status of value addition in Indian seafood sector, Types of value added products. Significance and advantages of value addition in the seafood industry.	4	1
	1.3	Fish Mince Based Products Definition of Fish mince and Surumi. Raw materials used for surumi. Production of fish mince and Surimi including Flow chart	4	2
	1.4	Fibreized and other products from Fish Mince.	2	2
	1.5	Equipments used for surimi preparation. Different methods in assessing quality of surimi. Define cryoprotectants. Role of different cryoprotectants in surimi production.		
2	Coated fishery products and other Value Added Products		15hrs	
	2.1	Definition of coated fishery products and its preparation. Battered and breaded fishery products and its applications.	5	3
	2.2	Packaging and storage of coated products.	5	

		Quality evaluation		3
	2.3	Preparation of Value Added Products viz. fish / prawn pickle, fish wafers, prawn chutney powder, fish soup powder, fish protein hydrolysate, fish stacks, fillets, marinated products. Activity: 1. Fish filleting and preparation of fish steak. 2. Fish/Prawn pickling 3. Preparation of fish wafers, fish cutlet and fish fingers.	5	4
3	Fishery By-products		17 hrs	
	3.1	Production of chitin, chitosan and glucosamine hydrochloride from shrimp shell waste. Extraction of collagen from fish processing wastes, properties and application. Definition of fish silage, Types of fish silages and their preparation. Uses of silage. Activity: 1. Preparation of silages from low cost Fishes and Fishery wastes 2. Study and preparation of flowcharts for the production of Chitin and Chitosan from fishery waste	6	6
	3.2	Isinglass, shark fin rays, gelatin from fish waste. Ambergris, beche-de-mer, squalene, fish meal and oil- Extraction and Preparation in brief Activity: Identification and Study of preparation of Fishery byproducts like Isinglass, shark fin rays, gelatin from fish waste. Ambergris, beche-de-mer, squalene, fish meal and oil. Or Industrial visit to units manufacturing Fishery byproducts/Value added products	6	6
	3.3	Seaweed products - agar, alginic acid and carrageenan. Activity: Study of production of seaweed products- agar, alginic acid and carrageenan.	5	6
4	Quality Control and Safety in Value Added Products		8 Hrs	
	4.1	Fish as raw material for processing Factors affecting quality of fresh fish: intrinsic and extrinsic factors.	4	5

	4.2	Spoilage in thermal processed products – Quality evaluation of thermal processed products Curing and drying of fish – Spoilage in dry fish products	4	5
5	Teacher Specific Content			

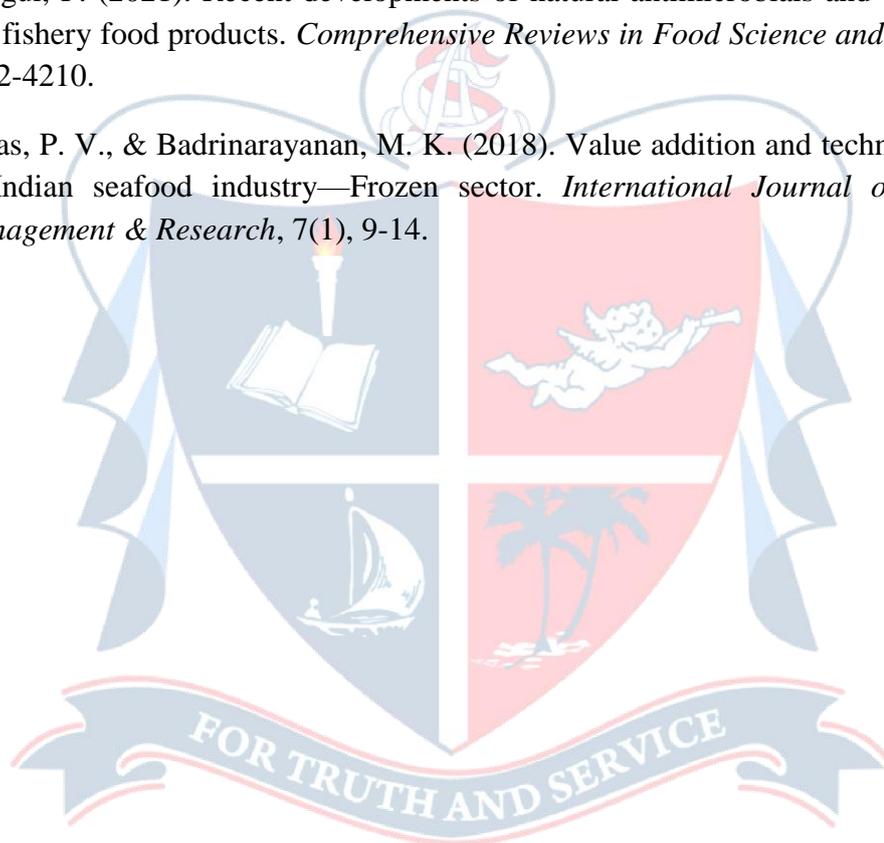
Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

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Suggested Readings

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2. Datta, S. (2013). Fishery by-products. In *Manual on fish processing and value added fish products* (3rd ed., pp. 93-99). CRC Press.
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Aquaculture Ecosystem Management and Climate Change					
Type of Course	DSE					
Course Code	24SACAQU5DE104					
Course Level	300					
Course Summary	The course provides an in-depth exploration of the impacts of climate change on marine and freshwater ecosystems, emphasizing the challenges and opportunities it presents for sustainable aquaculture practices. Through a blend of theoretical knowledge and practical application, students will learn to assess vulnerabilities, devise adaptation strategies, and contribute to the resilience of aquatic resources in the face of global climate change.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		4				60
Pre-requisites, if any	Students should possess a preliminary knowledge on climate change issues and common Aquaculture Practices.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the basic science of climate change, its global effects, and the importance of communication and public awareness.	U	1,2
2	Analyze the impact of climate change on marine and freshwater ecosystems, including ocean acidification and deoxygenation.	An	1,9
3	Evaluate the vulnerability of aquaculture to climate change and identify sustainable adaptation and mitigation practices.	E	1,2,10

4	Apply traditional knowledge and technological innovations to enhance climate resilience in aquaculture practices.	Ap	1,9
5	Evaluate policies and governance frameworks to enhance climate resilience in aquaculture at both international and national levels	E	2,3
6	Apply field-based learning to observe and assess the application of climate-smart aquaculture practices in real-world settings	Ap	1,3
*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)

Modul	Units	Course description	Hrs	CO No.
1	Fundamentals of climate change and Effects on Aquatic Ecosystems		12 Hrs	
	1.1	Introduction to Climate Change: Overview, causes, and global effects.	3	1
	1.2	Climate Change Science: Understanding greenhouse gases	2	1
	1.3	Impact of Climate Change on Global Weather Patterns: Changes in temperature, precipitation, and extreme weather events.	4	1
	1.4	Climate Change Communication and Public Awareness	3	1
2	Climate Change and Aquatic Ecosystems		16 Hrs	
	2.1	Effects on Marine Ecosystems: Ocean acidification, sea temperature rise, and impacts on coral reefs.	4	22
	2.2	Effects on Freshwater Ecosystems: Changes in river flows, lake temperatures, and ice cover	4	2
	2.3	Biodiversity Loss and Species Migration: Consequences for aquatic food webs and species distribution	4	2
	2.4	Ocean Deoxygenation and Its Effects	4	2
3	Climate Change Impacts on Aquaculture and Mitigation practices		20 Hrs	
	3.1	Vulnerability of Aquaculture to Climate Change: Risk assessment and management. Adaptation Strategies for Aquaculture: Breeding, feed management, and disease control	4	3
	3.2	Climate-Induced Changes in Aquatic Pathogens and Disease Dynamics Reducing carbon footprint in aquaculture operations.	4	3

	3.3	Integrated Multi-Trophic Aquaculture (IMTA), recirculating aquaculture systems (RAS). Ecosystem-based Aquaculture Management: Conservation and restoration of aquatic habitats	4	3
	3.4	Carbon Sequestration in Aquatic Environments: Blue carbon ecosystems Water Use Efficiency and Management: Techniques for reducing water footprint.	4	3,4
	3.5	Policy and Governance for Climate-Resilient Aquaculture: International agreements and national strategies	4	5
4	Climate Resilience in Indian Aquaculture		12 Hrs	
	4.1	Impact of Monsoon Variability on Aquaculture:	2	6
	4.2	Mangrove Ecosystems as Natural Defenders	2	4
	4.3	Traditional Knowledge and Adaptation Strategies	2	4
	4.4	Technological Innovations for Climate-Smart Aquaculture	2	6
	4.5	Policy Framework for Climate-Adaptive Aquaculture in India Activities: Visit or make models of IMTA and RAS Field Trips	4	5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

References

1. Barange, M., Field, J. G., Harris, R. P., Hofmann, E. E., Perry, R. I., & Werner, F. (Eds.). (2010). *Marine ecosystems and global change*. Oxford University Press.

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Programme	Aquaculture					
Course Name	Cold water Aquaculture, Recreational Fisheries and Integrated Multitrophic Aquaculture					
Type of Course	DSE					
Course Code	21SACAQU5DE105					
Course Level	300					
Course Summary	Coldwater Fish Culture explores all husbandry activities associated with cold water fish culture. The curriculum follows the entire life cycle of a fish lot in a hatchery setting. Participants will explore the various techniques and calculations most often used in the aquaculture industry, including egg enumeration and handling, egg incubation, hatching methods, methods in brood stock management, and fish stocking. Students able to understand different sport fishes and importance as sport fisheries. Students gain knowledge on advanced integration practices along with aquaculture for enhancing aquaculture production.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should possess knowledge regarding aquaculture and integration in aquaculture					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the global status of cold-water fisheries, with an emphasis on India, assessing challenges and opportunities.	U	1,2
2	Identify and differentiate major cold-water fish species in India, highlighting their ecological and economic significance.	U, An	1,2
3	Demonstrate an in-depth understanding of the biology, breeding, and culture of trouts and Mahseer, including their environmental requirements	C, U	1,2

4	Design and evaluate the construction and management of cold-water fish farms, considering species-specific needs and environmental impacts.	C, E	1,2
5	Evaluate sports fishes' life history, selecting appropriate equipment, and methods for sports fishing while considering conservation practices.	E	1,2
6	Design and construct a model integrated fish farm, aquaponics and IMTA considering environmental effects and conducting an economic analysis of different integrated culture systems.	C	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.
		Introduction	14 Hours	
1	1.1	Introduction: Status of cold-water fisheries in world with special reference to India. Major cold water fish species in India <i>Activity: Identification of cold water fish species; Primary and secondary sexual characters in cold-water fishes</i>	4	1,2
	1.2	Threats to cold water fish diversity in India; habitat destruction, overexploitation, exotic fish introduction, and climate change	3	1,2
	1.3	Biology, and captive breeding of snow trout, exotic trout's, mahseer and common carps	4	1,2,3
	1.4	Specific environmental parameters pertaining to cold water fish culture and metabolic interaction, Feeds suitable for cold water aquaculture.	3	1
		Culture of Coldwater fishes	18 Hours	
2	2.1	Culture of major trout species (<i>Oncorhynchus mykiss</i> , <i>Salmo trutta fario</i> , <i>Schizothoracichthys esocinus</i> , <i>S. longipinnis</i> , <i>S. niger</i> , <i>Schizothorax richadsonii</i>) from India	4	3
	2.2	Culture of Mahseer (<i>Tor putitora</i> , <i>Tor tor</i> , <i>Tor khudree</i> , <i>Neolissochilus hexagonolepis</i>) and Common carp (<i>Cyprinus carpio cummuinis</i> , <i>Cyprinus carpio specularis</i> , <i>Carrasius carrasius</i>) species from India. <i>Activity: Identification of larval stages of trout and mahseer; Preparation of hatchery layout for cold-water fishes</i>	6	3

	2.3	Construction and management of cold-water fish farms, Polyculture of exotic carp in mid-hill region based on three Chinese carps, post-harvest and harvest issues in trout with regards to cold water species <i>Activity- Visit to cold water fish hatchery</i>	5	3,4
	2.4	Special factors for consideration in cold water fish seed production and nursery rearing. Issues and Desired Interventions: Potential and Innovative Strategies for the Development of Coldwater Aquaculture in India- problems encountered in fisheries development of rivers supporting cold water fisheries	3	4
		Recreational Fisheries	10 Hours	
3	3.1	Introduction, Development of Recreational Fisheries in India. Major sport fishes	2	5
	3.2	Equipment's for sports fishing, fishing methods, area suitable for sports fishing, etc <i>Activity: Studies on different types of sports fishing equipment</i>	4	5
	3.3	Management and conservation of sports fisheries through aquaculture	2	5
	3.4	Sport fisheries and tourism, recreational aquaculture	2	5
		Multilevel Integrated Aquaculture Systems and Integrated Multitrophic Aquaculture System (IMTA)	18 hour	
4	4.1	Integrated fish farming: Global status, integration with agricultural (paddy), horticultural crops (vegetable and fruits) and livestock (cattle, poultry, ducks, pigs and other terrestrial animals) <i>Activity- Construct a model integrated fish farm</i>	4	6
	4.2	Effective recycling of wastes, nutrient budgeting indifferent integrated farming systems. Production levels and economics	2	6
	4.3	Bioprocessed manures in integration: Vermicompost, farmyard manure compost, biogas slurry, etc. Advantages of biomanures, Control of microbial interactions, Fermentation of manures <i>Activity: Preparation of Vermicompost; Analysis of nutrient value of different manures</i>	4	6
	4.4	IMTA Concepts: Integrated multitrophic aquaculture systems and design of an IMTA unit, Aqua tourism. <i>Activity: Visit an IMTA unit</i>	3	6
	4.5	Aquaponics: concept, Principles, types and operation <i>Activity: Different models of aquaponics; Nutrient analysis and management in aquaponics</i>	2	6

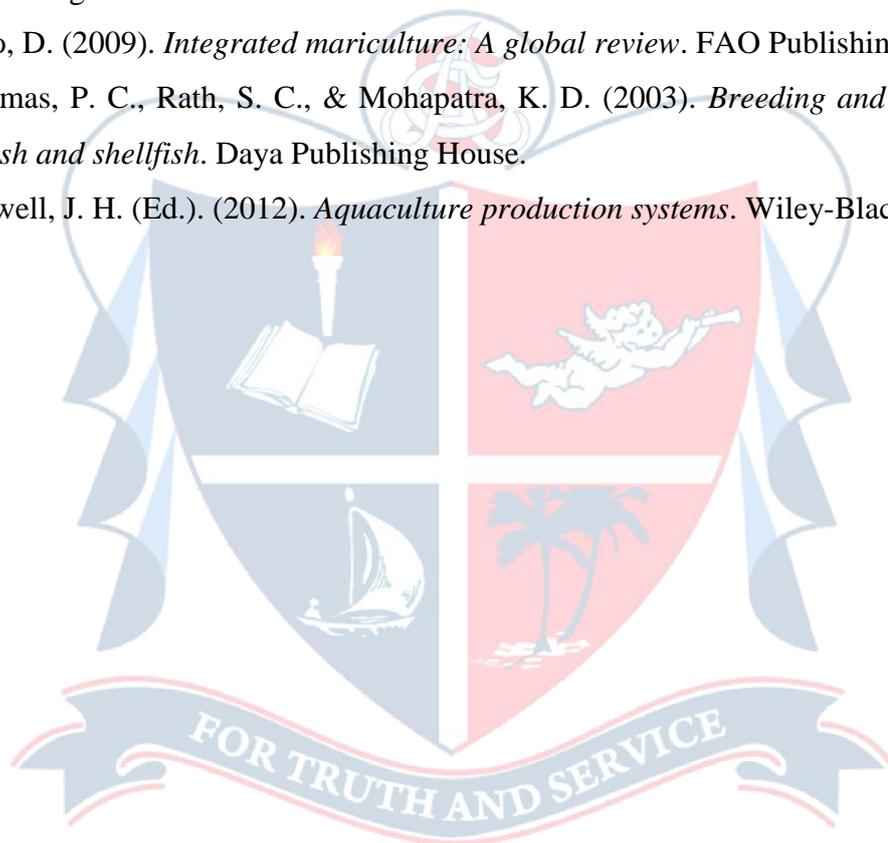
	4.6	Bio-resource flow in integrated aquaculture system: Discharge of nutrient wastes from integrated aquafarms	1	6
	4.7	Environmental effects, and potential for integrated multi-trophic aquaculture, An economic analysis of different integrated culture systems	2	6
5		Teachers Specific Content		

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	<p>Mode of Assessment</p> <p>A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks</p> <hr/> <p>B. Semester End Examination</p> <p>Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks</p>

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	<h2>Department of Fisheries and Aquaculture</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
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Programme	Aquaculture					
Course Name	Fish biodiversity conservation and management					
Type of Course	DSE					
Course Code	24SACAQU5DE106					
Course Level	300					
Course Summary	The aim of the course is that the students understand fish biodiversity in the context of ecosystem dynamics, ecosystem functioning and provision of ecosystem services. Students will know how to assess biodiversity with different methodologies and they will be able to conduct a critical analysis of measures to manage biodiversity.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		60		0	Activities (1.2, 1.4, 3.2)	60
Pre- requisites, if any	Students should possess knowledge regarding biodiversity					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Get a deep knowledge on biodiversity richness in global scale and biogeography of India.	U	1
2	Assess the value of biodiversity wealth of our Nation	A	1
3	Analyze various threats to our biodiversity and able to suggest measures for conservation Strategies	An, C	1,2
4	Trained effectively and scientifically to convey the message of sustainable use of resources and conservation of biodiversity to the public and young generation	An,C	1,2

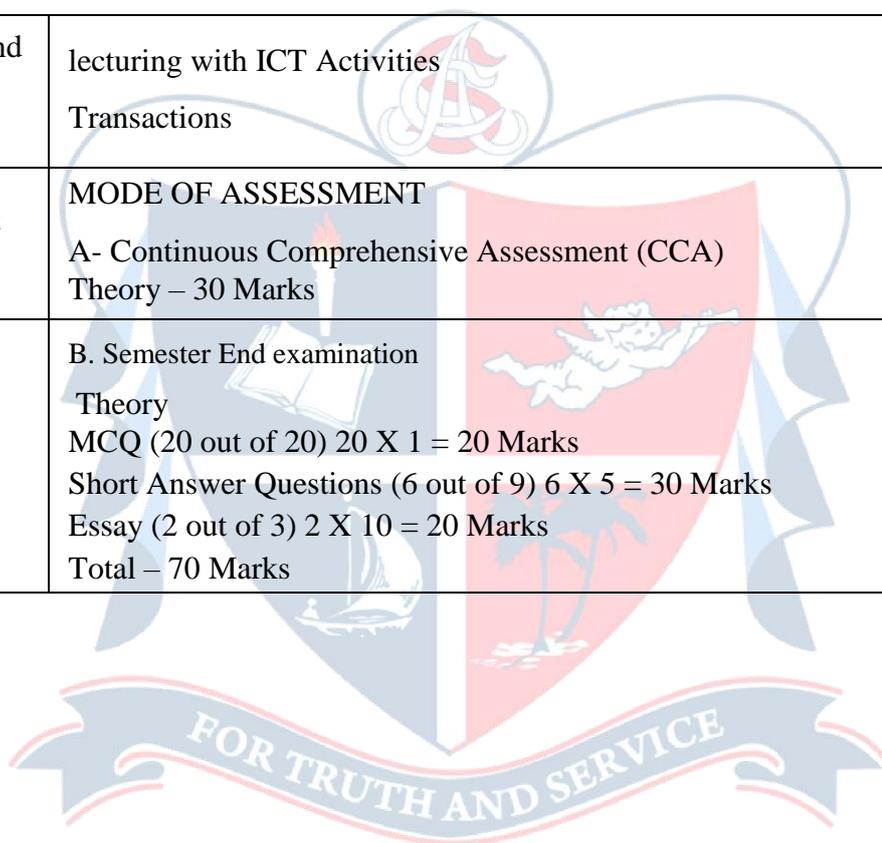
***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
	Fish diversity		13 Hours	
1	1.1	Diversity; Introduction- Definition, Categories of biodiversity - Species diversity, Genetic Diversity; and Habitat Diversity.	5	1
	1.2	Biodiversity indices and their significance; Concepts of Index of Biotic Integrity (IBI).	3	1
	1.3	Hotspots of Biodiversity: Criteria for determining hot spots. Indo-Burma (Eastern Himalaya), Western Ghats and Sundaland region <i>Activity-Visit Western Ghats biodiversity hotspot and collect fish samples</i>	5	1,2
	Species concept for conservation related decisions		10 Hours	
2	2.1	Unique species- umbrella species-flagship species, Keystone species, state fish concept	5	1,2
	2.2	Endangered species extinction- recovery-CITES- NBA- WWF, Migratory stock- Essential Habitat-EBSA.	5	1, 2
	Biodiversity conservation methods		15 Hours	
3	3.1	IUCN criteria - Red List, Marine Protected Areas, Sanctuaries and Biosphere reserves, Establishment of National marine parks, in situ and ex situ conservation, Participatory approach- <i>Activity- Visit to any sanctuary/ protected area in Kerala</i>	5	3,3
	3.2	Conservation value index – criteria – Medicinal and biological, IBI –stock resilience-recovery. Wildlife protection act, Biodiversity Act,	5	3
		International treaties and conventions (CITES, CMS, RAMSAR Convention), - Convention on Biological Diversity.	5	3
	Aquatic biodiversity		12Hours	
4	4.1	Aquatic Biodiversity: Ichthyobiodiversity of India, status, major diversity, species etc	3	3
	4.2	Threats-Over exploitation, habitat reclamation, pollution, habitation. Impacts of anthropogenic intervention on aquatic biodiversity: Damming of rivers, Linking of rivers, Construction of sea walls, Micro hydel power stations, oil rigs,	6	3

	4.3	Impact of climate change on the ecosystem biodiversity, health and productivity	3	3
5	Conservation biology of biodiversity			10 Hours
	5.1	Concept of hotspots- Ecological integrity: Minimum population sizes, Inbreeding depression, Genetic tolerance of extreme conditions	5	3,4
	5.2	Restoration of populations at risk of extinction, Conservation – management of invasive species- Economic valuation of biodiversity and ecosystems	5	4

Teaching and Learning Approach	lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End examination Theory MCQ (20 out of 20) 20 X 1 = 20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 3) 2 X 10 = 20 Marks Total – 70 Marks





Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	B.Sc. AQUACULTURE					
Course Name	Coastal Ecosystem Management					
Type of Course	DSE					
Course Code	24SACAQU5DE107					
Course Level	300					
Course Summary	Coastal Zone Management and Sustainable Development are closely interconnected concepts that aim to balance the economic, social, and environmental aspects of coastal areas to ensure long-term well-being. Coastal zones are dynamic and complex ecosystems that provide numerous ecological, economic, and social benefits. However, they are also vulnerable to various threats, including climate change, pollution, overexploitation of resources, and population pressure.					
Semester	5	Credits		4	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical		Others
		60				60
Pre-requisites, if any	Students from various branches of sciences					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understanding of coastal ecosystems, including their ecological, geological, and hydrodynamic features	U	1
2	Familiar with the principles and concepts of Coastal Zone Management, including the regulatory frameworks, tools, and techniques used in the planning and management of coastal areas	U,A	1, 2, 6, 8
3	Principles and goals of sustainable development, emphasizing the importance of balancing environmental, economic, and social considerations.	U,A	1, 6, 7,8

4	Develop skills in integrated planning and management of coastal areas, considering the various factors influencing these regions.	An,S	3,6,8,9,10
5	Understanding the risks associated with natural hazards in coastal areas and developing skills in assessing and mitigating these risks, including strategies for dealing with climate change impacts	A,S	6, 7, 8
6	Engage with local communities, stakeholders, and decision-makers in the planning and implementation of CZM initiatives, emphasizing the importance of participatory approaches.	U, A	4,5,7,9
7	Skills in environmental monitoring and assessment, including the use of technology and data collection methods to track changes in coastal ecosystems	S	6,8,10
8	Skills in developing and implementing projects related to CZM and sustainable development, including budgeting, monitoring, and evaluation	Ap	1,9,10
*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	Units	Course description	Hrs	CO No.
1		Introduction to Coastal Zones and Sustainable Development	15	
	1.1	Historical perspective and evolution of CZM	3	1, 2
	1.2	Overview of coastal ecosystems and their significance	6	1
	1.3	Principles of sustainable development, Interactions between human activities and coastal environments	6	1,2,6
		Coastal Ecosystems, Biodiversity and Climate change	15	
2	2.1	Coastal habitats: beaches, wetlands, mangroves, and coral reefs Activity: Field visit	3	1,2
	2.2	Biodiversity conservation in coastal zones, Threats to coastal biodiversity	6	2,5
	2.3	Impacts of climate change on coastal areas, Sea-level rise, storms, and extreme weather events, Adaptation and resilience strategies	6	3,5,6
3		Sustainable Resource and Shoreline Management, Coastal Pollution	15	

	3.1	Fisheries management in coastal areas, Aquaculture and mariculture practices, Tourism and recreation: balancing economic benefits with environmental impact	4	4, 5, 7
	3.2	Causes and consequences of coastal erosion, Shoreline protection strategies, Integrated coastal zone planning	5	5,8
	3.3	Sources and types of coastal pollution, Monitoring and assessment of water quality, Pollution control and remediation measures Activity: water sample collection and analysis	6	5,6,7
4	Integrated Coastal Zone Management Plans, Future Challenges and Opportunities		15	
	4.1	Developing ICZM plans: principles and steps	3	4,7,8
	4.2	Emerging issues in coastal zone management, Future trends in sustainable development	3	5,8
	4.3	Practical exercises and group projects, Research and innovation in coastal sciences Activity: Field visit, survey	9	8

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End examination, Written Exam Theory MCQ (20 out of 20) 20 X 1 = 20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 3) 2 X 10 = 20 Marks A. Total – 70 Marks

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(Repeat for 5 Modules each of Minimum 15 hrs and Maximum 20hrs Duration)

SUGGESTED READINGS

- Karim, M. S., & Hoque, R. (2009). Integrated coastal zone management and sustainable development of coastal area: A short overview of international legal framework. *Integrated coastal zone management*, 170-177.
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Aquarium Fabrication and Setting					
Type of Course	SEC					
Course Code	24SACAQU5SE101					
Course Level	300					
Course Summary	Aquarium Keeping and Aquarium Fish Breeding is one of the most popular and enticing hobbies in the world today. It is in fact a multibillion dollar industry and needs trained expertise. India, with its rich resources of endemic and unique specimens is slated to become a major player in the field. The country needs trained personnel and expertise in order to utilize its rich potential of resources. The course is aimed at imparting skill in the preparation of varieties of aquaria using the latest materials and techniques available.					
Semester	5	Credits		3	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical		Others
		3				45
Pre-requisites, if any	Students should possess knowledge regarding general characters of fishes					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate the design and construction of home and public aquaria	U	1
2	Illustrate the setting and maintenance of aquariums in addition to water quality management.	U	1
3	Management of home as well as commercial aquariums.	AP	2
4	Develops skills to handle different aquarium equipment	AP	1

5	Manage and Maintain Aquascaping and Decorations in an aquarium	AP	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	Introduction to Aquaria		10 Hrs	
	1.1	Definition of aquarium, scope and history	2	1
	1.2	Fabrication of home aquarium Activity: Construction of a Freshwater Aquarium	3	1
	1.3	Design and construction of public fresh water and marine aquaria.	3	1
	1.4	Types of materials used in aquarium fabrication- Suitability, Advantages and Disadvantages	2	1
	Aquarium Accessories		10 Hrs	
	2.1	Aeration of water and Types of Aerators	2	2
	2.2	Different kinds of Filters and Lighting	2	2
	2.3	Thermostat for aquaria	2	2
	2.4	Hand nets and other equipments	2	2
	2.5	Aquarium gravels, pebbles, hood and aquarium plants	2	2
3	Aquarium Setting, Maintenance and Aquarium Trade		25 Hrs	
	3.1	Site selection for Aquaria	2	2
	3.2	Setting up of fresh water aquarium Activity: Set up a Freshwater Home Aquarium	3	2,5
	3.3	Setting up of marine aquarium	3	2
	3.4	Aquascaping- Different styles and Types	2	2
	3.5	Water quality parameters, Cleaning of aquarium, Filtration of Aquarium water – different types of Filters and Filtration. Activity 1. Measurement of water Quality parameters 2. Setting up of a Biofilter and Recirculating System.	5	2

	3.6	Nutritional requirements of aquarium fishes, Artificial and Live Feeds for Aquarium Fishes, Activity: Hatching of Artemia cysts	5	3
	3.7	Present Status of aquarium trade in India and the World.	5	4
4	Teacher Specific Content			

Teaching and Learning Approach	lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory- 25 Marks
	B. Semester End Evaluation (ESE) Theory Very Short Answer Questions (10 out of 12):10X 1=10 Short Answer Questions (6 out of 9): 6x5=30 Essay (1 out of 3):1 X 10= 10 Marks Total – 50 Marks

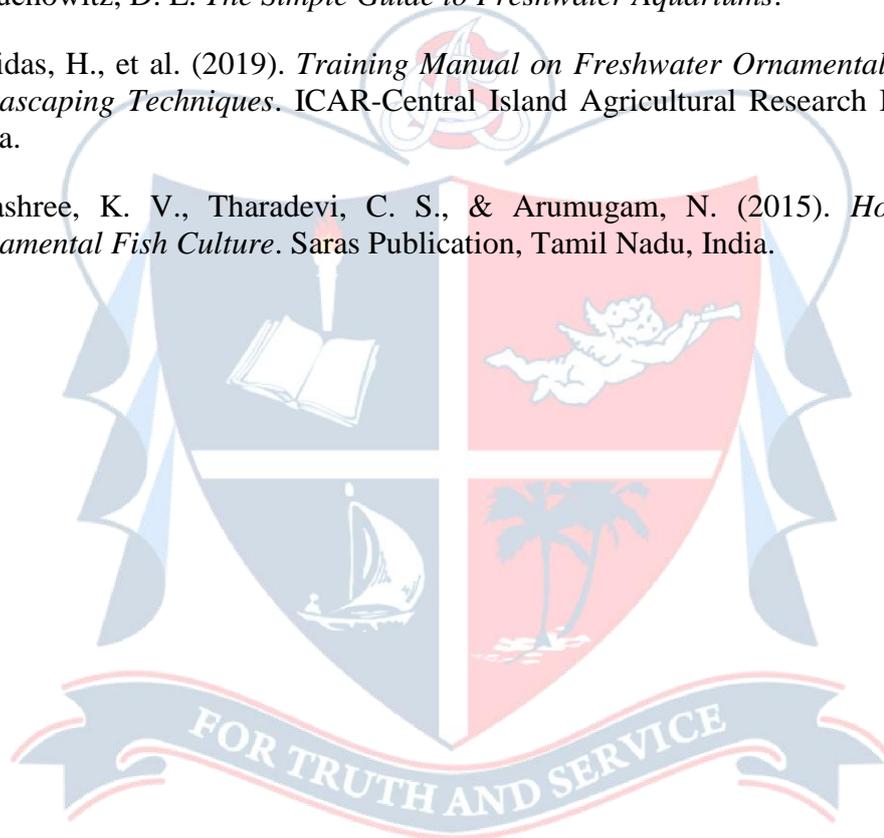
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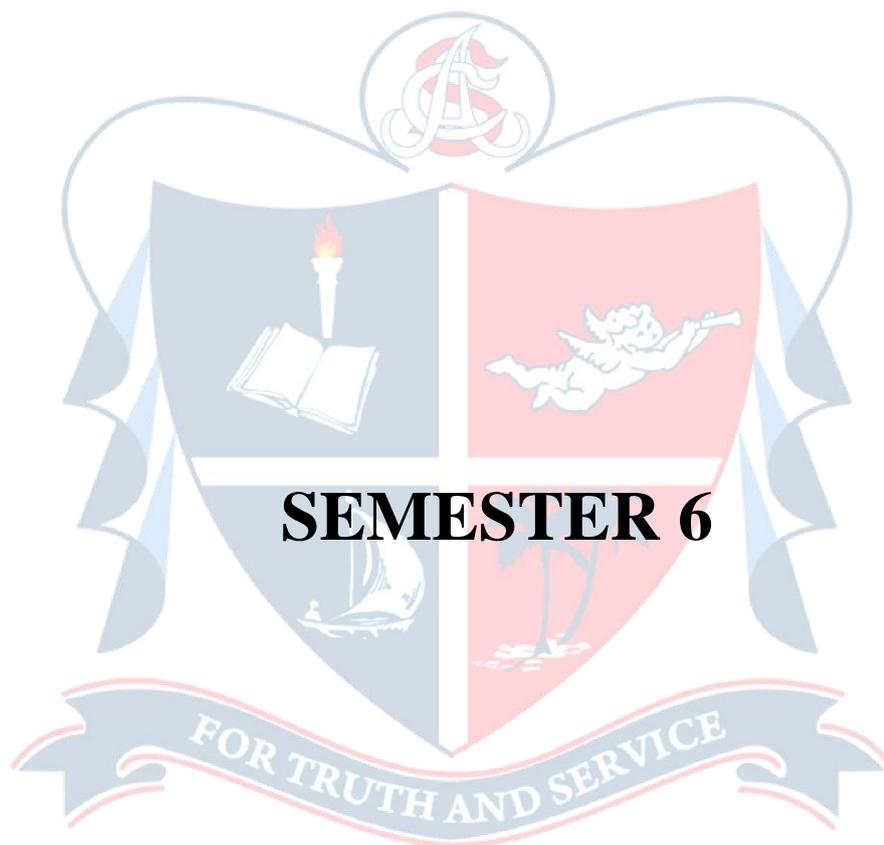
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3. Jayashree, K. V., Tharadevi, C. S., & Arumugam, N. (2015). *Home Aquarium and Ornamental Fish Culture*. Saras Publication, Tamil Nadu, India.







Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Coastal Aquaculture and Mariculture					
Type of Course	DSC A					
Course Code	24SACAQU6DA101					
Course Level	300					
Course Summary	<p>The importance of coastal aquaculture in the context of augmenting fish production, improving rural economy and productive utilization of water resources is well-established. Mariculture is and will increasingly become an important producer of aquatic food in coastal areas, as well as a source of employment and income for many coastal communities. Well-planned and -managed mariculture can also contribute positively to coastal environmental integrity. Considering the fact that mariculture's future development will occur, in many areas, with increasing pressure on coastal resources caused by rising populations, and increasing competition for resources, this course aims to pay considerable attention to improve the sustainable aquaculture production through environmentally sound technology and better management</p>					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture 3	Tutorial	Practical 1	Others	
Pre-requisites, if any	Students should possess basic knowledge in aquaculture					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Design coastal aquaculture systems (tanks, ponds, pens, cages, etc.)	C	1,2

2	Understand the commercially important cultivable brackish water and marine organisms and learn to apply the knowledge acquired in field	U, A	1,2
3	Design grow-out culture units of fin fishes (tanks, ponds, pens, cages, etc.) / provide consultancy services to the farmers	C	3,5,6
4	Design grow-out culture units of shell fishes / provide consultancy services to the farmers	C	4,5,6,9
5	Develop skill to manage aqua farm in effective and sustainable manner	A,S	4,5,8,9
6	Develop interest in entrepreneurship and skill to utilize various aquaculture practices	I,S	7,10
*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.
		Site selection, Design and Construction of coastal aquaculture farms and Selection of Candidate species	15 Hours	
1	1.1	An overview of sea farming and shore-based aquaculture - global and Indian perspective; scope, potential and emerging trends	2	1
	1.2	Principles of coastal aquaculture and mariculture. Sea Ranching	2	1
	1.3	Farming systems: Cage, Pen, Traditional- Pokkali, Basabadha; extensive, modified extensive, semi intensive and intensivesystems	2	1
	1.4	Site selection for marine and brackish water farms. Farm construction, Water treatment	3	1
	1.5	Selection of candidate species for coastal aquaculture and its biology and early development (sea bass, mullet, milkfish, grouper, cobia, snappers, pearlspot, tiger shrimp, white shrimp, mud crab, lobster, mussel, clam, oysters (edible and pearl oyster), lobster, seaweeds, abalones, scallops, sea urchin and sea cucumbers).	3	2

	1.6	Economic and market values of important coastal aquaculture species (seabass, mullet, milkfish, grouper, cobia, snappers, pearlspot, tiger shrimp, white shrimp, mud crab, lobster, mussel, clam, oysters (edible and pearl oyster), lobster, seaweeds, abalones, scallops, sea urchin and sea cucumbers)	3	1,2,5
2	Culture of fin fishes and Shell fishes		15 Hours	
	2.1	<i>Chanos chanos</i> , <i>Mugil cephalus</i> , <i>Etroplus suratensis</i> , <i>Trachinotus blochii</i> , <i>Lates calcarifer</i> , <i>Rachycentron canadum</i> , groupers.	4	3,5
	2.2	Different mariculture techniques and technological advancements	4	3
	2.3	Culture of Shrimp, Mud crab, lobsters, clams, mussels, oysters (pearl and edible), Pearl implantation.	4	4
	2.4	Culture of sea cucumbers, Seaweed, abalones, sea urchin, scallops.	3	4
3	Farm Management		15 Hours	
	3.1	Farm Management and monitoring of brackish water and marine fin fishes (<i>Chanoschanos</i> , <i>Mugil cephalus</i> , <i>Etroplussuratensis</i> , <i>Trachinotusblochii</i> , <i>Lates calcarifer</i> , <i>Rachycentron canadum</i> , groupers). Farm Management and monitoring of brackish water and marine shell fishes Shrimp, Mud crab, lobsters, clams, mussels, oysters (pearl and edible), sea cucumbers, Seaweed, abalones, sea urchin, scallops	5	5
	3.2	Sampling, Feeding and Feed Management of <i>Chanos chanos</i> , <i>Mugil cephalus</i> , <i>Etroplus suratensis</i> , <i>Trachinotus blochii</i> , <i>Lates calcarifer</i> , <i>Rachycentron canadum</i> , groupers, Shrimp, Mud crab, lobsters, clams, mussels, oysters (pearl and edible), sea cucumbers, Seaweed, abalones, sea urchin, scallops.	5	5
	3.3	Harvesting methods <i>Chanoschanos</i> , <i>Mugil cephalus</i> , <i>Etroplus suratensis</i> , <i>Trachinotu sblochii</i> , <i>Lates calcarifer</i> , <i>Rachycentron canadum</i> , groupers, Shrimp, Mud crab, lobsters, clams, mussels, oysters (pearl and edible), sea cucumbers, Seaweed, abalones, sea urchin, scallops	5	5
4	PRACTICAL		30 Hours	
	1	Collection and identification of seeds of commercially important fin fishes and shellfishes.	6	
	2	Estimation of seed survival, Biomass estimation.	4	

	3	Estimation of Water quality parameters of farm (pH, salinity, dissolved oxygen, ammonia, nitrite, nitrate, phosphate, primary productivity, alkalinity, hardness).	10	
	4	Familiarize material, apparatus and machinery for shore-based aquaculture and sea farming	4	
	5	Estimation of feed intake. Growth and health monitoring	4	
	6	Fouling organisms in cages and pens, rafts and rack.	2	
5	Teacher specific content			

Teaching and Learning Approach	Lecturing with ICT activities
Assessment Types	Transactions Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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	<h2>Department of Fisheries and Aquaculture</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
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Programme	Aquaculture					
Course Name	Fish Microbiology and quality assurance of seafood					
Type of Course	DSC A					
Course Code	24SACAQU6DA102					
Course Level	300					
Course Summary	<p>The desirable nutritional qualities make fish and fishery products as an ideal source of animal protein requirements of fish-eating population. Several microorganisms responsible for spoilage and also human pathogens associated with foods affect the safety and quality of food meant for human consumption. At the same time the highly perishable nature of fresh fish calls for application of preservation techniques to maintain its keeping quality. This course deals with the microorganisms associated with fish and fishery products in their natural environment and as contaminants during capture, handling, processing and preservation, role of microorganisms in spoilage, microorganisms of human health significance, and the intrinsic and extrinsic parameters that regulate the activity of food associated microorganisms.</p>					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3		1		75
	Students should possess basic knowledge on microorganisms and seafood industry.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the history and importance of microorganisms in fish foods.	U	1,2
2	Utilise the knowledge of the microorganisms in fresh and processed fish foods, the factors affecting the microbial growth and their role in food spoilage.	A	1,2
3	Examine the microbes involved in food borne infections and intoxications.	An	1,2
4	Infer the various ways of fish spoilage and its control.	An	1,2
5	Evaluate the sanitary and quality standards in fish processing industries.	E	1,2,6,9
6	Develop fundamental skills in microbiology and quality assurance of seafood.	A, S	1,2,5
*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	Significance of microbes in foods and Microorganisms in seafood		17 Hours	
1	1.1	Role and significance of microorganisms in foods.	3	1
	1.2	Basic microbial principles of fish preservation and processing- application of low temperature, high temperature, drying, irradiation and chemicals.	3	1
	1.3	Microorganisms in fresh and processed fish – raw fish, chilled fish, frozen fish, cured fish, canned fish, fermented, irradiated, value added and other miscellaneous fish products.	4	1
	1.4	Factors (intrinsic and extrinsic) affecting the growth and survival of microorganisms in fish.	4	2
	1.5	Psychrophiles, halophiles and the mesophiles, their role in spoilage and food poisoning.	3	2

2	Microbes of public health concern and fish spoilage		20 Hours	
2	2.1	Bacteria involved in foodborne infections and intoxications– <i>Vibrio parahaemolyticus</i> , <i>V. cholerae</i> , <i>Listeria monocytogenes</i> , <i>Clostridium</i> , <i>Salmonella</i> , <i>Shigella</i> , <i>Staphylococcus</i> , <i>E. coli</i> .	4	3
	2.2	Biological hazards associated with fish and fishery products: Marine toxins; mycotoxins, parasites and viruses.	3	3
	2.3	Occurrence, growth, survival, pathogenicity, prevention and risk assessment of common bacteria present in fish.	4	3
	2.4	Types of spoilage of fish and fish products. Indicators/Indices of fish spoilage.	3	4
	2.5	Microbial spoilage of fish/shell fish and its prevention/control	3	4
	2.6	Assessment of quality of fish and fishery products.	3	4
3	Sanitary and Quality management		8 Hrs	
3	3.1	Bacteria of sanitary significance.	1	5
	3.2	Quality Indicators of fish products. Disinfectants, detergents and cleaning schedule. Process water quality in fish processing industries.	2	5
	3.3	Concepts of Quality Management; TQM, SSOP, GHP, GMP.	2	5
	3.4	Quality standards for fish and fishery products – BIS, FSSAI, Codex Alimentarius, ISO 9000 series and HACCP. Microbiological standards and criteria.	3	5
4	PRACTICALS		30 Hrs	
4	4.1	Activity: Training in a fish processing plant or in a laboratory of government or private sector research organization to study the isolation, culture and enumeration of microbes in water, ice, fish and fish products, detecting microbes by biochemical tests and molecular methods, assessment of freshness and quality of fresh and processed fish/ shellfish. Submission of a hand written report of the activity.	10	6
	4.2	Assessment of freshness of fish and shrimp by using organoleptic characters.	4	6
	4.3	Familiarization of common possible bacteria in seafood.	4	6
	4.4	Gram staining of bacteria.	4	6
	4.5	Determination of available chlorine.	4	6
	4.6	Sterilization techniques, Media preparation, Isolation and maintenance of bacteria	4	6
5	Teacher specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

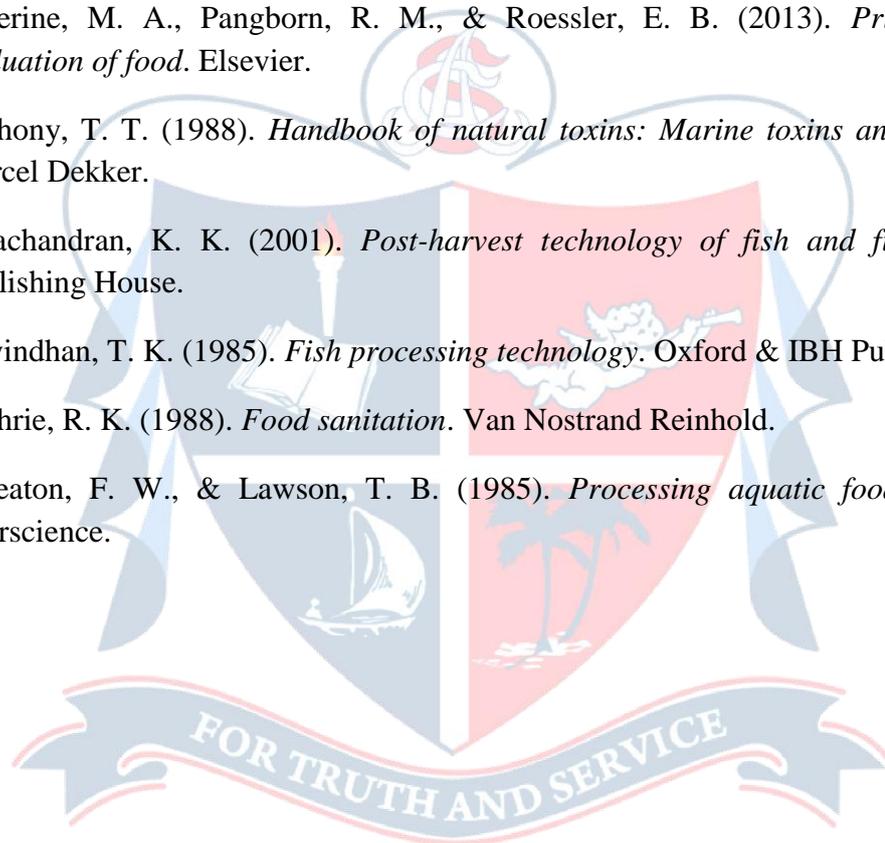
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Fish Pathology, Immunology and Health Management					
Type of Course	DSE					
Course Code	24SACAQU6DE101					
Course Level	300					
Course Summary	Fish Pathology, Immunology and Health Management, provides a comprehensive exploration of finfish and shellfish pathology, various diseases, their causative agents and diagnostic techniques. The course fosters a holistic understanding of aquatic animal health, equipping graduates with the knowledge and skills necessary for effective disease management and prevention in the field of aquaculture.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		60
Pre-requisites, if any	Basic knowledge on Microbiology and cell organization of Microorganisms					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify various diseases in fish and shell fishes and understand the acquired and innate immune system of finfishes and crustaceans	U	1,2,9
2	Implement best management practices and biosecurity principles to maintain aquatic animal health and prevent disease outbreaks in aquaculture	A	1,2
3	Apply the principles of disease diagnosis to identify and characterize various diseases.	An	1,2

4	Critically evaluate the efficacy of various therapeutics and disease prevention and management strategies applied at farm level	E	1,2,5,10
5	Perform conventional diagnostic methods including gross examination, histopathology and microbiology to diagnose finfish and Shellfish diseases	S	1,2
6	Design protocol/risk assessment plan to identify and mitigate potential disease threats to an aquaculture facility	C	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	Introduction to Finfish and Shellfish Pathology and Immunology and Aquatic Animal Health Management		15 Hrs	1
1	1.1	Significance of fish diseases in relation to aquaculture. Definition of health and disease. Host, pathogen and environment interaction.	1	1
	1.2	Pathophysiology- Stress and General Adaptation Syndrome; the cellular stress response; Inflammatory Response-Acute and chronic.	3	1
	1.3	Immunology of Finfishes- Nonspecific Defense Mechanism (Surface Barriers, Nonspecific humoral factors and Non-Specific Cellular factors) and Specific Defense Mechanism (Lymphocytes, Lymphoid organ, Immunoglobulins, cell Mediated Immunity). Immune system of shrimps. Factors affecting immune response.	4	1
	1.4	Introduction to aquatic animal health management	1	1
	1.5	Disease monitoring, surveillance, quarantine certification (SPF, SPR, SPT) and risk analysis.	2	1
	1.6	Fish Vaccine and adjuvants, Vaccine types and Production and Delivery Mechanisms	1	1
	1.7	Immunostimulants and nutraceuticals in Fish health	1	1
	1.8	Therapeutics and sanitizers used in aquaculture	1	1

	1.9	Best Management Practices and biosecurity principles in Aquaculture	1	4, 6
2	Infectious Diseases, Non-infectious Diseases and Disorders and Parasitic Diseases of Fin and Shell Fishes		15 Hrs	
	2.1	OIE listed and notifiable diseases- Epizootic haemopoietic necrosis, viral hemorrhagic septicemia, Spring viraemia of carp, Epizootic Ulcerative syndrome, Gyrodactylosis, White spot disease, Baculoviral midgut gland necrosis (list out only the disease-causing agent and target tissue)	1	1
	2.2	Bacterial diseases of finfishes (Etiology, pathogenesis, epidemiology, prophylaxis, treatment and control measures of Aeromonas and Columnaris; Mention the causative agents, treatments and Control for Furunculosis, Bacterial gill disease, Vibriosis, Mycobacteriosis, Enteric Red Mouth, Edwardsiellosis, Pasteurellosis, Streptococcosis) and shellfishes (Mention the causative agent, treatment and control for Vibriosis, Acute Hepatopancreatic Necrosis Disease, Necrotizing, Hepatopancreatitis, Rickettsial diseases, Mycobacteriosis)	3	3,4
2	2.3	Viral Diseases of finfishes (Etiology, pathogenesis, epidemiology and control of Tilapia Lake Virus-TiLV; Mention other viral diseases - Spring Viraemia of Carp-SVC, Viral Haemorrhagic Septicaemia-VHS, Lymphocystis, Koi herpes Virus-KHV, Infectious Salmon Anaemia -ISA, Infectious Haematopoietic Necrosis (IHN), Red Seabream Iridoviral disease) and Crustaceans (Etiology, pathogenesis, epidemiology and control WSSV; mention other viral diseases-Yellow Head Virus, Infectious Hypodermal and Haematopoietic Necrosis Virus, Monodon Baculovirus, Baculovirus penaei, Baculovirus Midgut-gland Necrosis, Macrobrachium rosenbergii nodavirus).	3	3,4
	2.4	Fungal diseases of finfishes (Aphanomyiasis, Cotton wool disease, Branchiomycosis and Aspergillosis, EUS) and Shellfishes -Lagenidium, Sirolpidium, Fusarium.	2	3,4

	2.5	Fish Parasites: Life cycle of <i>Ichthyophthirius</i> ; Pathology, treatment and control of disease caused by protozoan parasite (<i>Costia</i> , <i>Ichthyophthirius</i> , <i>Myxozoans</i>), Metazoan parasites (Trematodes- <i>Dactylogyrus</i> , <i>Gyrodactylus</i> , cestodes: <i>Diphyllbothrium</i> ; Nematodes: <i>Camallanus</i>), Crustacean parasites (<i>Lernea</i> , <i>Argulus</i> , <i>Ergasilus</i>). Shellfish Parasites: Microsporidian, Haplosporidian, ciliates.	3	3,4
	2.6	Nutritional- Amino Acids, Fatty acids, Vitamins and Minerals and Environmental Diseases- water quality related, irritants.	2	1
	2.7	Aflatoxins, Ichthyotoxins, Algal blooms and Aquatic pollution	1	1
3	Disease Diagnostic Techniques		15 Hrs	
	3.1	Principal of disease diagnosis – Level I (Farm Level/ Farmers level-behavioral changes, Sample collection of gills and mucus) Level-2 (histopathology, bacteriology, virology, water analysis), Level -III- Fast and confirmatory diagnosis of infections	1	3
	3.2	Conventional diagnostic methods- Microscopical, microbiological, histopathological, hematological and biochemical methods	4	1
3	3.3	Molecular techniques in disease diagnosis- Single PCR, Real-Time PCR, Quantitative PCR, Reverse Transcription PCR	3	1
	3.4	Serological techniques in disease diagnosis-ELISA, Western blotting, Immunodiffusion, Immunoelectrophoresis, Agglutination test, Fluorescent Antibody Techniques, Rapid Immunochromatographic Tests, Hemagglutination and Inhibition tests, Multiplex Immunoassays.	7	1
4	PRACTICAL		30 Hrs	
	4.1	On-farm practical sampling sessions and case studies	5	5
	4.2	Dose determination and application of therapeutants	2	5
	4.3	Preparation of medicated feeds	2	5,6
4	4.4	Wet mount preparation	2	5
	4.5	Identification of diseases and causative agents involved - Bacterial, fungal and parasites	10	3

	4.6	Blood collection and haematological techniques	2	5
	4.7	PCR, Gel Diffusion, Histopathology, Antibiotic sensitivity test (Demonstration or Visit to Nearby Institutes).	7	1
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Management of Ornamental Fish Culture					
Type of Course	DSE					
Course Code	24SACAQU6DE102					
Course Level	300					
Course Summary	This course delves into the ornamental fish industry, emphasizing the biology, breeding, culture, and management of ornamental fish. It addresses system design, water quality, nutrition, health, breeding methods, and marketing. The aim is to provide students with the skills and knowledge needed for successful ornamental fish management, focusing on sustainability and conservation.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		60
Pre-requisites, if any	Students should be familiar with common ornamental fishes and aquaria.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identify major ornamental fish species and their ecological requirements, and understand the significance of biodiversity."	K,U	1,2
2	Explain the setup and management of aquarium systems, emphasizing the selection of equipment and species compatibility.	U	1,2
3	Apply techniques for maintaining water quality and health management practices in ornamental fish culture	Ap	1,9
4	Analyze breeding strategies and genetic selection principles to enhance ornamental fish production.	An	1,10

5	Evaluate market trends, regulatory impacts, and sustainability practices within the ornamental fish industry.	E	1,2,9,
*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 Ornamental Fish Culture and Aquarium Management		15 Hrs	
	1.1	Overview of Ornamental Fish Industry Importance of Ornamental Fish in Aquaculture	3	1
	1.2	Major Marine and Freshwater Ornamental Fish and their ecological needs	3	2
	1.3	Introduction to Aquarium and Aquarium Accessories- Aquarium Heater, Thermometer, Air Pump, Air Stone, Heating and Lighting	3	3
	1.4	Setting up of aquarium – under gravel filter, pebbles, plants, drift wood, ornamental objects and selection of fishes Types of Filtration of water Recirculating Systems	3	2
	1.5	Cleaning the aquarium; maintenance of water quality. Control of snail and algal growth Handling, care and transportation of fish. Temperature acclimation, oxygen packing.	3	2
2	Strategies for the Commercial Production of Ornamental Fishes		20 Hrs	
	2.1	Species of ornamental fishes; their taxonomy and biology- Live bearers, Gold fish and koi, Gourami, Barbs, Angel fish, cichlids	3	1
	2.2	Commercial production of goldfish, live bearers, gouramies, barbs, angel fish Maturation, secondary sexual characters, breeding habits, spawning, parental care. Larval rearing	3	4
	2.3	Biology, Hatchery and Seed Production of Marine Ornamental Fishes – Clown Fishes	3	4
	2.4	Indigenous Ornamental Fishes of Kerala, Seed production of Miss Kerala.	3	1

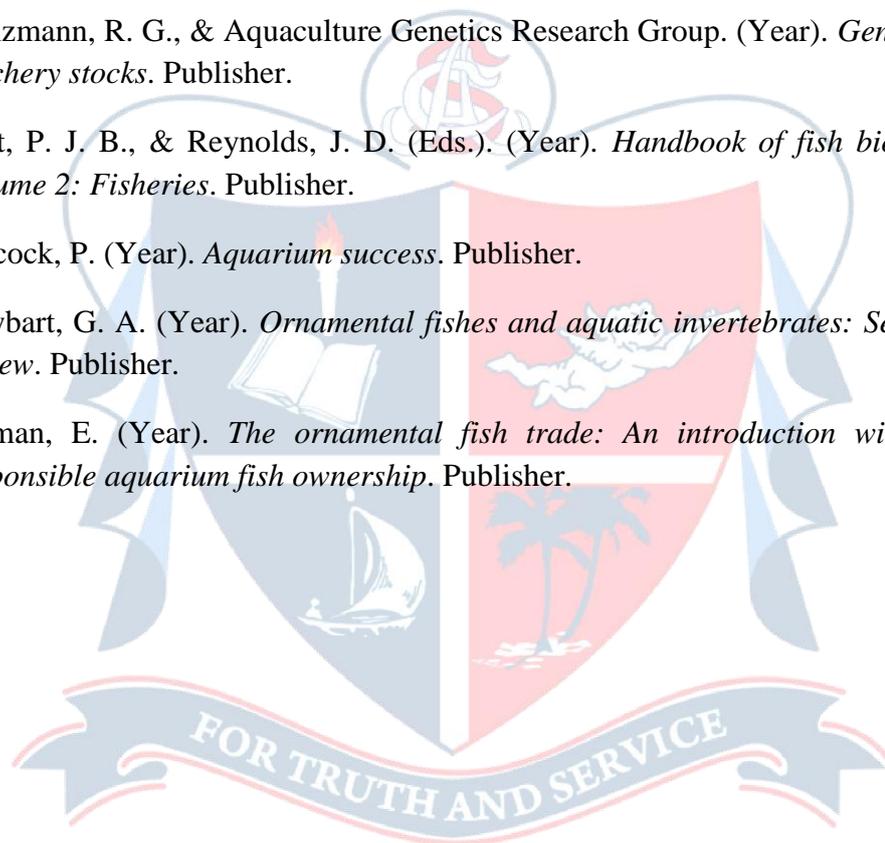
	2.5	Freshwater aquarium Plant and their propagation	3	2
	2.6	Nutritional Requirements, Feeds and Feeding Strategies of Ornamental Fishes.	5	3
3	Marketing, Conservation and Sustainable Practices		10 Hrs	
	3.1	Market trends and consumer preferences	2	5
	3.2	Export and import regulations	2	5
	3.3	Environmental impacts of ornamental fish culture	2	5
	3.4	Conservation breeding programs	2	5
	3.5	Regulatory frameworks and certifications	2	5
4	PRACTICALS		30 Hrs	
	4.1	Identification of commercially important Ornamental Fishes	3	1
	4.2	Design and construction of Beginner's Aquarium	3	1
	4.3	Testing of pH, ammonia, Nitrite and Nitrate	3	3
	4.4	Artemia Hatching, Estimation of Hatching rate at different salinities	3	3
	4.5	Preparation and Administration of live and pelleted feeds.	3	3
	4.6	Packaging Techniques for Ornamental Fishes	3	5
	4.7	Identification of Aquarium Plants	2	2
	4.8	Visit to Ornamental Fish Farm or Trade Centre	10	5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks

	Identification of Spotters = 15 Marks Principle and Procedure = 12 Marks Viva = 3 Marks Total – 35 Marks
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Fisheries Economics and Extension					
Type of Course	DSE					
Course Code	24SACAQU6DE103					
Course Level	300					
Course Summary	The course in Fisheries Economics and Extension provides a comprehensive exploration of the economic principles and extension strategies applied in the context of fisheries management and development. Designed to equip students with a deep understanding of the economic aspects of fisheries, as well as effective extension techniques.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		60
Pre-requisites, if any	Students should possess basic understanding of social sciences and critical thinking skills					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understanding of economic principles relevant to fisheries.	U	1,2
2	Understand the functions of fishermen cooperatives, village societies, producing and marketing apex societies and address financing and special problems with remedial measures.	U	6,7

3	Design and implement effective fisheries extension programs, utilizing communication and behaviour change theories to engage with communities and stakeholders. Design informative and engaging extension materials, including bulletins, leaflets and booklets.	C,S	3,6,7,9
4	Analyze and present case studies on social, gender issues and conflicts within the fisheries contexts	An	1,2
5	Foster community engagement by integrating participatory approaches and addressing social and cultural factors in fisheries management.	C,S,E	4,5,6
6	Evaluate the economic viability of a aquaculture unit- (Planning and Budgeting)	E	7,9
<i>Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	CO No.
	Introduction to Economics and Fisheries Co-operatives		15 Hrs
1	1.1	Economics-definition, scope and role. Basic concept of economics -goods, services, wants, utility. Demand and Supply, Individual demand, Market demand, Value based Pricing and Cost Based pricing.	5 1
	1.2	Elasticity of demand, Law of diminishing marginal utility.	2 1
	1.3	Co-operation- basic principles, co-operative legislation and its administrative structure.	2 1,2
	1.4	Fishermen co-operatives, its functions, village societies, producing and marketing apex societies. Financing and special problems of fishermen cooperatives and remedial measures. Activity: Case study on social/gender issues and social conflicts in fisheries.	3 1,2
	1.5	Role of National Co-operative Development Corporation, KVK, ADAK, NIFAAM, Matsyafed, FISHCOPFED, NFDB, MPEDA, and NABARD in uplifting the socio- economic conditions of fishermen.	3 1,2

		Feasibility Studies	15 Hours	
2	2.1	Feasibility Analysis in fisheries Project- Introduction to Feasibility Analysis (Definition and importance). Identify the components of feasibility studies (Technical, Economical and Financial aspects). Undiscounted measures of Project Worth (Ranking by inspection, Payback Period). Time Value of Money. Discounted Measures of Project Worth (Discounted payback period, Net present worth-NPW, Benefit-cost ratio- BC Ratio). Internal Rate of Return- Understanding IRR, Decision criteria based on IRR.	9	2
	2.2	Risk and uncertainty. Sensitivity Analysis- Partial sensitivity analysis, Best Worst Scenario Analysis, Monte Carlo Analysis. <i>Activity:</i> Economic valuation studies to estimate the economic value of fisheries, resources, including the value of fish stock for commercial and recreational purposes- Collect fish landing/culture data and analyze its impact on Indian economy	6	
		Cost and Returns in Fisheries	15 Hrs	
3	3.1	Break Even Analysis in fisheries Cost Concepts- Variable Cost, Fixed Cost, Total Cost, Junk Cost, Average Cost, Marginal Cost, Opportunity cost	8	1,2
	3.2	Farm planning, budgeting- Complete and Partial budgeting. <i>Activity:</i> Evaluate the economic viability of an Aquaculture unit-(Planning and Budgeting).	7	1,2
		Fisheries Extension and Teaching Methods	15 Hrs	
4	4.1	Introduction to Fisheries education and fisheries management- Meaning objectives, principles, importance and scope in fisheries <i>Activity:</i> Communication Skills- Public speaking	3	1,2
	4.2	Fisheries Extension Methods- Individual, group and mass contact methods, their effectiveness, factors influencing their selection and use <i>Activity:</i> Make a radio talk on any fish farming technique or any fishery related event- Mass Communication technique	4	1,2

		Make a video reel on any farming technique/ value addition in fish or activity of a fishing village- Mass communication technique		
	4.3	Extension Program Planning and Evaluation- Steps and importance, participatory planning process Study of social issues/ problems through participatory and rapid rural appraisal techniques Prepare Questionnaire, Collection of socio-economic data from fishing villages	4	1,2
	4.4	Extension Teaching methods- Selection, Planning, use, demonstration, exhibition, farmer fairs, field days, tours Activity: Design Posters or Flip Charts Design extension materials: bulletins, leaflets, booklets	4	1,2
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	<p>Mode of Assessment</p> <p>A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks</p> <p>B. Semester End Examination</p> <p>Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks</p>

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	<h2>Department of Fisheries and Aquaculture</h2> <h3>St. Albert's College (Autonomous)</h3> <h3>Ernakulam</h3>
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Programme	Aquaculture					
Course Name	Fish Biochemistry					
Type of Course	DSE					
Course Code	21SACAQU6DE104					
Course Level	300					
Course Summary	This course delves into the biochemical constituents of aquatic life, covering the intricate biochemistry of proteins, lipids, and enzymes found in fish, crustaceans, and molluscs. It explores their structural, functional, and post-mortem changes, alongside the preparation and properties of marine polysaccharides, emphasizing the practical applications and impacts of these biochemical processes on seafood quality and nutrition.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Activities	
		4				60
Pre- requisites, if any	Students should have a preliminary knowledge of organic chemistry and Biochemistry					

COURSE OUTCOMES(CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the biochemical constituents of fish, crustaceans, and mollusks, including their proteins and lipids.	U	1,2,3
2	Analyze the structural and functional properties of seafood proteins and lipids, Nucleic Acids and Vitamins, understanding their importance in nutrition and food processing.	An	1.,9,10
3	Evaluate the impact of post-mortem biochemical changes and processing methods on the quality of seafood.	E	1,2

4	Apply knowledge of enzymatic reactions, including kinetics and mechanisms, to assess seafood quality and shelf-life.	A	1,3
5	Investigate the roles of polysaccharides in seafood, focusing on the preparation and applications of chitin, chitosan, and glucosamine.	An	2
6	Synthesize knowledge of antioxidants, oxidation indices, and enzyme classifications to develop strategies for preserving seafood quality.	C	1,9,10
*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)

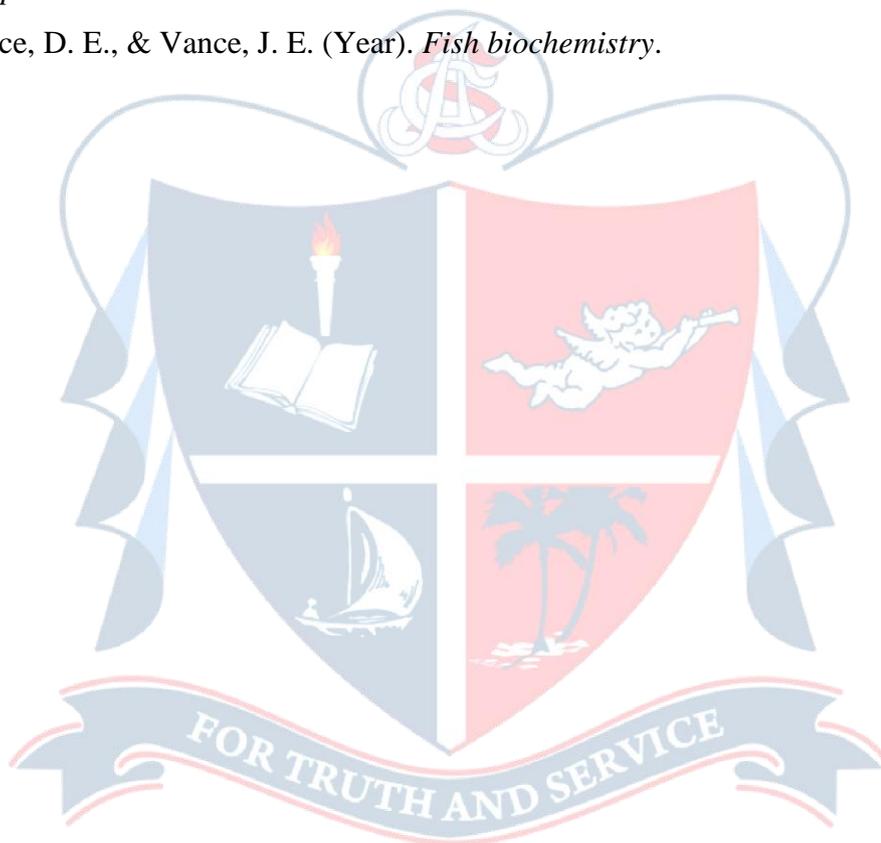
Module	Units	Course description	Hrs	CO No.
1	Biochemical Composition of Fish		12 Hrs	
	1.1	Biochemical constituents of fish, crustaceans and mollusks.	3	1
	1.2	Biochemistry of fish proteins, Classification. Sarcoplasmic proteins, Myofibrillar proteins and Stroma proteins	3	1
	1.3	Structure of fish muscles and Post mortem biochemical changes, rigor mortis	3	1
	1.4	Non-protein nitrogenous compounds, K value	3	1
2	Proteins and Nucleic Acids		12 Hrs	
	2.1	Functional properties of seafood proteins: Solubility, emulsification, viscosity, water holding, stability, gelation,	3	2
	2.2	Precipitation of proteins, Salting in and Salting out Denaturation and coagulation of proteins Changes in proteins during processing	3	2
	2.3	Nucleic Acid Chemistry: Classification; Types of DNA and RNA, Metabolic functions of nucleotides,	3	2
	2.4	Sense and antisense RNA, RNA interference; Cistron, Operon and transposon; RNA splicing, miRNA and lncRNA.	3	2
3	Seafood Lipids and Vitamins		21 Hrs	
	3.1	Seafood lipids: Composition and nutritive value Triglycerides, phospholipids, Non-saponifiables including sterols and vitamins.	5	2

	3.2	Classification and naming of fatty acids, MUFA, PUFA, HUFA , Omega 3 Fatty acids Lipases and Phospholipases	4	2
	3.3	Auto-oxidation of fatty acids, rancidity Pro- and anti-oxidants, Oxidation indices, Peroxide value , TBA Value, FFA value	4	6
	3.4	Vitamins:Classification, Active forms of vitamins, Types of vitamins and essential minerals	4	2
	3.5	Deficiency syndromes of vitamins and minerals; Clinical significance of vitamins and essential minerals.	4	2
4	Enzymes and Polysaccharides		15 Hrs	
	4.1	Structure and function of enzymes	3	4
	4.2	Kinetics of enzyme activity, KM value, Turnover number,	3	4
	4.3	Mechanism of Enzyme activity	3	4
	4.4	Classification of enzymes Ribozymes, Abzymes, Synthetic enzymes, Co – enzymes, Cofactors and Prosthetic groups	3	4
	4.5	Polysaccharides: Naming and classification Preparation of Chitin, Chitosan and Glucosamine	3	5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	<p>Mode of Assessment</p> <p>A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks</p> <p>B. Semester End Examination</p> <p>Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks</p>

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture				
Course Name	Artificial Fish Feed Preparation				
Type of Course	SEC				
Course Code	24SACAQU6SE102				
Course Level	300				
Course Summary	The course mainly focus on, Introduction to feed requirements of Fish, Raw materials for artificial fish feed, Feed Formulation Techniques, Types of feeds and measurement of calorific value, Feed Manufacturing equipment, additives and supplements.				
Semester	6	Credits		3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	
		3			45
Pre-requisites, if any	Students should possess knowledge regarding general characters fishes , digestive system of fishes, feeding behavior of fishes				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understanding aquaculture and its significance. Develop skills for preparing Pearson's square	U,C	1,2
2	Identifying nutritional needs of various fish species	A	1,2
3	Exploring primary ingredients for fish feed	An	1,2
4	Understanding essential nutrients for fish growth and health. Manifest skills of various manufacturing process like extrusion, grinding pelleting etc, Evaluating the nutritional balance of the various artificial feeds.	U,E	1,2

5	Understanding the role of pro biotics and pre biotics in fish nutrition. Understanding the purpose and types of additives.	U,E	1,2
6	Develop fundamental skills in the preparation of artificial feeds	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	Introduction to Feed Requirements of Fish		12 Hrs	
	1.1	Nutritional needs of various fish species , Basics of fish feed composition	3	1
	1.2	Economic significance feed usage in Aquaculture, environmental considerations regarding fish feed in aquaculture.	3	1
	1.3	Feed Conversion Ratio(FCR), Food Efficiency Ratio(FER)	3	1
	1.4	Factors affecting digestibility, immunostimulants, growth promoters, preservatives.	3	1
2	Raw Materials for Artificial Fish Feed Preparation and Feed Formulation Techniques		15 Hrs	
	2.1	Raw materials of plant origin , raw materials of animal origin , non conventional materials Activity: Identification of Feed Ingredients of Plant and Animal Origin	3	2
	2.2	Protein and amino acid requirement, carbohydrate and lipid requirement, Essential fatty acids, Non protein nitrogen Sources.Vitamin and mineral requirements, vitamin C for fish and shell fishes.	3	2
	2.3	Principles of feed formulation – Pearson's square method, Linear programming, Proximate analysis	3	3

		Activity – prepare different feed formulation with two ingredients using pearson's square .		
	2.4	Types of feeds- Wet feeds, dry feeds , moist feeds Larval feeds – Minced diets, microparticulate diets, spray dried diets, microbound diets, micro coated diets and microencapsulated diets	3	3
	2.5	Measurement of calorific value – Component analysis, Wet oxidation , Bomb Calorimetry.	3	3
	Types of Feeds, Feed Manufacturing Equipments		18 Hrs	
3	3.1	Different forms of feed-fodders, mash, pellets, floating and sinking feeds. Feedformulation - methods, square method. Dry Feed manufacturing processes, Extrusion, Palletization , Different size and grades of fish / shrimp feeds - starter, grower and finisher feeds.	4	4,5
	3.2	Micro-bound feed, micro encapsulated feed. Storage and transportation of feeds. Quality problems- toxins, pests, rancidity	4	4,5
	3.3	Equipments used in feed preparation – Oven/dryers , pelletizer, feed press , die plate , extruder, grinders, mixers, coolers, elevators , crumbler , feed mills Activity – visit a feed manufacturing unit and submit a brief report	4	4
	3.4	Additives – definitions , types – binders , anti oxidants, pigments, anabolic agents , antimicrobials and health supplements Role of additives in immune health and stress reduction.	3	4
	3.5	Enzymes, probiotics, pre biotics. Importance of emulsifiers and stabilizers.	3	5
4	Teacher Specific Content			

Teaching and Learning Approach	lecturing with ICT Activities Transactions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory- 25 Marks
	B. Semester End Evaluation (ESE) Theory Very Short Answer Questions (10 out of 12):10X 1=10 Short Answer Questions (6 out of 9): 6x5=30 Essay (1 out of 3):1 X 10= 10 Marks Total – 50 Marks

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Preservation Techniques for Aquatic Specimens and Museum Collections					
Type of Course	SEC					
Course Code	24SACAQU6SE102					
Course Level	300					
Course Summary	The course provides in-depth training in preserving aquatic specimens, combining traditional and advanced techniques with a focus on ethical practices and conservation. It prepares students for roles in museum curation and aquatic research.					
Semester	6	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3				45
Pre-requisites, if any	Students should possess knowledge about basic preservatives and Preservation Techniques for organisms.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the fundamentals and importance of aquatic specimen preservation.	U	1,2
2	Apply basic principles of taxonomy and classification in the context of specimen preservation.	Ap	1,2,9
3	Design educational and engaging museum displays incorporating modern technology.	C	1,2
4	Master various chemical and physical preservation techniques for aquatic specimens.	Ap	1,2
5	Utilize advanced preservation techniques, including non-invasive imaging and digital preservation.	An	1,2,3

6	Develop skills in specimen preparation, cataloging, and exhibition, adhering to ethical considerations.	C	1,3
*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	Introduction to Aquatic Specimen Preservation and Museum Display Techniques		12 Hrs	
	1.1	Overview of Aquatic Specimen Preservation, History and Importance of Specimen Preservation in Museum	3	1
	1.2	Basic principles of Taxonomy and Classification, Ethical Considerations in Specimen Collection and Preservation	3	2
	1.3	Museum Display Techniques: Designing Educational and Engaging Displays, Lighting and Climate Control for Aquatic Displays	3	3
	1.4	Interactive Displays: Incorporating Technology in Exhibits, Maintenance of Live Aquatic Exhibits	3	3
2	Techniques in Aquatic Specimen Preservation		18 Hrs	
	2.1	Preservation Techniques: Chemical- Formalin , Alcohol Freeze Drying and Cryopreservation Techniques Embedding Techniques , Plastics and Resins	4	5
	2.2	Skeleton preparation: Cleaning and Assembly	3	5
	2.3	Tissue Sampling and DNA preparation	3	5
	2.4	Photographic Documentation of Aquatic Specimens Creating Replicas: Molds and Casts	4	6
	2.5	Labeling and Cataloguing Specimens Storage and Long-term Care of Preserved Specimens Activity: Museum Visit	4	6
3	Advanced Preservation Techniques for Aquatic Specimens		15 Hrs	
	3.1	Microscopic Techniques for Aquatic Organisms	3	5
	3.2	Anoxic Preservation Techniques	3	5
	3.3	3D Scanning and Digital Preservation	3	6

	3.4	Non-invasive Imaging Techniques	3	5
	3.5	Preservation of Large Aquatic Animals	3	4
4	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks

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Programme	BSc. Aquaculture					
Course Name	Hatchery Technology of Living Jewels and Aquascaping					
Type of Course	SEC					
Course Code	24SACAQU6SE103					
Course Level	300					
Course Summary	Participants will gain insights into candidate species in the Indian aquarium trade both marine and freshwater, including other aquarium organisms and plants with an emphasis on export potential and propagation methods. The course covers broodstock development, seed production and larval rearing of indigenous and exotic fishes, including marine species. Engineering aspects and construction are addressed, encompassing the fabrication and maintenance of freshwater and reef aquariums, small-scale ornamental fish farm design and backyard fish hatchery creation. Management aspects include best practices, green certification, biosecure production disease control, nutrition, water quality management and the entire process from harvesting to quarantine. The course also explore Aquascaping principles, styles and elements are introduced.					
Semester	6	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		30		30	Activity: 2.3 and 3.3	45
Pre-requisites, if any	NA					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate a thorough understanding of various candidate species in the Indian aquarium trade.	U	1
2	Develop practical skills in breeding freshwater and marine ornamental fishes.	A, S	1, 2, 10

3	Develop expertise in execution of various Aquascaping styles.	A	1, 2, 10
4	Understanding of sustainable practices in ornamental fish farming and green certifications	U	1,2, 10
5	Design small-scale ornamental fish farms, construction and maintenance of aquarium. Develop skills in managing facilities such as backyard fish hatcheries, incorporating accessories and equipment	A, S	1,2
6	Demonstrate knowledge of the nutritional requirements of ornamental fishes and in water quality management practices. Apply the knowledge in preparation of different feed types.	U, A,	1, 2, 10
7	Apply theoretical knowledge through hands on practical sessions	A, S	2
8	Develop skills in hatchery management and other essential aspects of the ornamental fisheries industry.	A, S	1, 2, 10
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

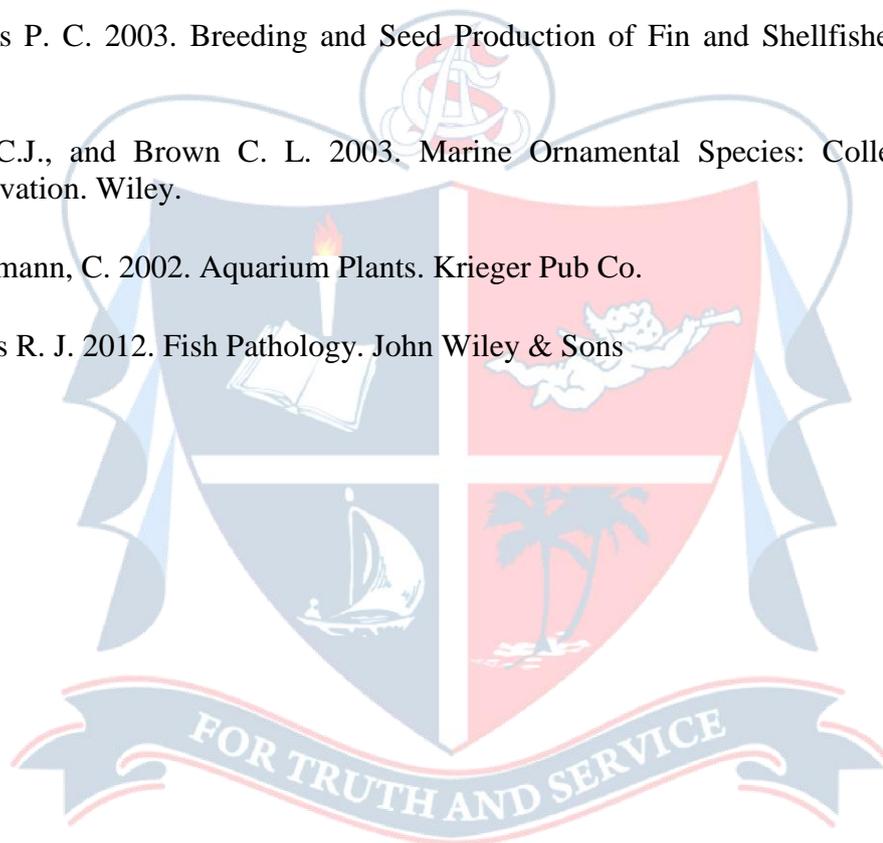
Module	Units	Course description	Hrs	CO No.
1	Broodstock Development, Seed Production and Larval Rearing of Ornamental fishes		20	
	1.1	Indigenous fishes – Miss Kerala, Melon barb, Rosy barb, Rasbora, Dwarf Gourami, Giant danio	5	2,4
	1.2	Exotic Fishes- Gold fish, Koi carp, Angelfishes, Guppy, Molly, Betta, Tetras, Gourami, Oscar	5	2,4
	1.3	Marine Fishes- Clown fishes, Damsel fishes, Anthias, Designer clowns <i>Activity:</i> Breeding of any two freshwater / marine ornamental fishes.	4	2,4
	1.4	Best Management Practices for Ornamental Fish Hatchery	2	6
	1.5	Biosecurity in Ornamental Fish Production	1	
	1.6	Water quality management, Harvesting, sorting, Conditioning, Packing, Transport and Quarantine Procedure	3	6
2	Aquascaping		10	
	2.1	Introduction to Aquascaping. Principles of Aquascaping	1	3,8

	2.2	Styles of Aquascaping- The Dutch Aquascaping; Jungle Aquascaping; Japanese/Zen style; Wabi-Kusa Style; Iwagumi Aquascaping; Nature/ Amano Aquascaping- Concave shape, Convex shape, Triangle shape; Paludarium/German style; Taiwanese Aquascaping; Walstad / El natural style Aquascaping.	5	3,8
	2.3	Elements of Aquascaping- Aquatic plants- Carpeting, small, medium, tall, large and floating; Imagination; Background; Substrate; Layout; Accessories; Focal points; Foreground, Midground, Background; Planting; Fishes.	2	3,8
	2.4	Maintenance of Aquascape- Aquarium lighting; Carbon dioxide; Fertilizers; trimming	2	3,8
		Practical 30 Hours	Hrs	CO
	1	Live feed production-For larval rearing and Brood stocks	5	2
	2	Conditioning and Packing of Ornamental fishes	4	8
	3	Demonstration-Preparation of artificial feed for ornamental fishes	4	6
	5	Problems: Calculation on dosage of therapeutants	3	8
	6	Aquascaping	4	3
	7	Hatchery Training- Minimum 3 days to 5 days in any Government Institutes or Private firms	10	8

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Power point Presentation, Text book and Research Article; Field Visit
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) Theory – 15 Marks Practical – 10 Marks
	B. Semester End examination Theory MCQ (15 out of 15) 15 X 1=15 Marks Short Answer Questions (4 out of 6) 4 X 5 = 20 Marks Total - 35 Marks Practicals Lab Exam (Identification of Spotters/ Principle and Procedure) = 10 Marks Record = 3 Marks Viva = 2 Marks Total – 15 Marks

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Programme	Aquaculture					
Course Name	Socioeconomic upliftment through fisheries					
Type of Course	VAC					
Course Code	24SACAQU6VA101					
Course Level	200					
Course Summary	Socioeconomic upliftment through fisheries is an inevitable part of nation building as the fisheries sector makes a valuable contribution to economic and social development of rural areas. The course content aims to make the students understand about the socioeconomic and socio-demographic profiles of fishermen community and its impact on the productivity of fisheries and their livelihood. Economic valuation provides a means for measuring and comparing the various benefits of fisheries resources and their ecosystems, and can be a powerful tool to aid and improve their wise use and management.					
Semester	6	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3				45
Pre-requisites, if any	It is desirable for the students to have a social awareness of the different communities of people living around them and a basic knowledge of Fisheries and its contribution towards the economy					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Introduce socio-economic perspectives of fisheries sector.	U	1,2
2	Analyze the condition of a fishing village.	An	1,2, 4
3	Understand the role of aquaculture in rural development.	U	1
4	Awareness about the role of fishery cooperatives in developing nations.	Ap	1,2
5	Decipher the role of different agencies in entrepreneurship development.	U, E	1,2
6	Awareness about social responsibility and develop fundamental skills in writing a report.	E, C, S	4,6, 10

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

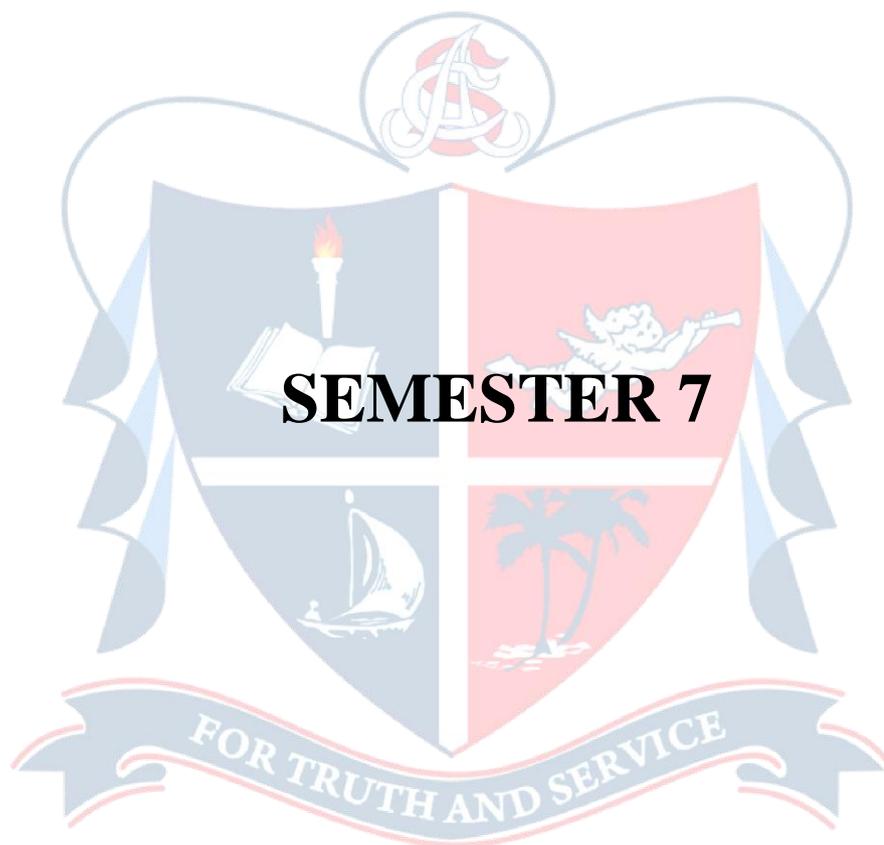
COURSE CONTENT**Content for Classroom transaction (Units)**

Module	Units	Course description	Hrs	CO No.
1	Introduction to the socioeconomic condition of fishermen community		17 Hours	
	1.1	Introduction to the socioeconomic condition of fishermen community.	3	1
	1.2	Activity: • Preparation of questionnaires for socioeconomic survey. • Conduct of socioeconomic survey of nearby fishermen community	6	6
	1.3	Economy of fishermen: Fishermen populations, Fishing villages	4	1
	1.4	GDP from fisheries sector, foreign exchange earnings and employment potential of fishing industry& fishing villages.	4	1
2	Prospective of Aquaculture in Socio-Economic impact & Rural Development, Marketing of Fish and Fishery Products		18 Hours	
	2.1	Resource use and development, Socio-economic analysis	3	2
	2.2	Socio-demographic profile, work contribution, household expenditure, income contribution, decision making, female headed household, impact of different age groups.	4	2
	2.3	Markets and their kinds. Price determination, problems of fish marketing in India.	3	3,4
	2.4	Exports of fish and fishery products, recent trends.	3	3,4
	2.5	Role of MPEDA in exports of fish and fishery products.	2	3,4
	2.6	Role of other Govt. institutions - NFDB, NABARD, State Fisheries Department	3	3,4
3	Fishery co-operatives and Entrepreneurship Development		10 Hours	
	3.1	Functions, financial assistance, input supplies, marketing of fish.	1	4
	3.2	Role of fisheries corporations and Missionary Organizations in fisheries development.	1	4
	3.3	Agencies and schemes providing assistance to self-help groups involved in fisheries sector.	1	5
	3.4	Success stories of aquaculture practice/ processing units/feed preparation units managed by self-help groups.	2	5
	3.5	Activity: Visit to any unit pertaining to fisheries sector managed by self-help groups and write a report.	5	6
4	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks

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Programme	Aquaculture					
Course Name	Biophysics, Instrumentation and Microtechniques					
Type of Course	DCC					
Course Code	24SACAQU7CC101					
Course Level	400					
Course Summary	<p>Biophysics, instrumentation, and micro technique are three important topics in life science that are interrelated and have significant applications in the field of aquaculture and fisheries. Biophysics is the study of biological systems using the principles of physics. It helps us to understand the physical properties of biological systems and how they function. Instrumentation refers to the development and application of various tools and techniques used to study and measure biological systems. They help in in collecting data, making observations, and conducting experiments in research. Micro technique is a set of methods used to prepare micro-objects for studying. It is currently being employed in many fields in life science. The combination of these three topics is essential in the study of biological systems at the molecular and cellular level. They help us understand the physical and chemical properties of biological systems and how they interact with each other.</p>					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess knowledge regarding basic principles and laws of Physics and familiarity with common instruments used in laboratories.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Utilize the basic principle related to osmosis and diffusion for the better management of aquaculture systems	A	1, 2
2	Create awareness about the principle and working of instruments required in the field of aquaculture and fisheries research.	C	2, 10
3	Examine the anatomic studies with the help of micro techniques	An	2, 9
4	Develops skill to prepare specimens and operate microscopes	A	9,10
5	Understand the principle and working of microscopes.	U	3, 9, 10
6	Evaluate the various separation techniques used for the separation of biological molecules.	E	1,2,3,9,10

***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	Units	Course description	Hrs	CO No.
1	Diffusion and Osmosis		12 Hrs	
1	1.1	Diffusion, concentration gradient and Fick's Law, diffusion coefficient, stocks-Einstein equation, pressure gradient and Graham's Law, Gibbs-Donnan equilibrium.	5	1
	1.2	Osmosis, Vant Hoff's Law, Osmotic concentration and osmotic pressure, biological significance of osmosis in fishes.	3	1
	1.3	Biophysics of cell membrane, Different models, their structure, Physics-chemical properties of cell membrane, factors affecting the passage of materials across cell membranes.	4	1
2	Instrumentation and Microtechniques		23 Hrs	
	2.1	Colorimetry, spectrophotometry- U.V. visible, IR double beam, atomic absorption, Mass spectroscopy, Raman spectroscopy FT-IR and LC-MS, Atomic Absorption spectroscopy	4	2
	2.2	pH meter: Standardization of pH meter, Preparation of Buffers; conductivity meter, salinometer and refractometer.	4	2
	2.3	Principles of microscopy; Different types of microscopes and their principles (bright field, dark field and phase contrast, confocal, fluorescence) microphotography. Electron microscope principle, types, ultrastructure studies using electron microscopy.	7	2,4,5

	2.4	Preparation of tissue for light microscopy-Fixation, Dehydration methods, embedding, clearing, sectioning and Staining.Preparation of whole mounts, smear and squash.Fixation and processing of tissues for electron microscopy studies.	7	3,4
	2.5	Micrometry – Occular, Stage, Caliberation and measurement	1	3
3	Separation techniques		10 Hrs	
3	3.1	General principle of Chromatography, Different types (absorption, partition, ion exchange, affinity, high performance/pressure liquid chromatography,gas and gel filtration).	4	2,6
	3.2	Electrophoresis: General principles, Methodology & Applications of Electrophoresistechniques, paper, agarose gel, polyacrylamide gel (native and SDS) electrophoresis & isoelectric focusing.	4	2,6
	3.3	Centrifugation: basic principle and different types. Centrifugation techniques-Differential centrifugation, principle, design, types andapplications of different Centrifuges.	2	2,6
4	Practicals		30 Hrs	
	4.1	Measure the diameter of fish egg by micrometry	2	3
	4.2	Preparation of whole mounts, smear and squash	3	3
	4.3	Preparation of tissue sections for light microscopy-Fixation, Dehydration methods, embedding, clearing, sectioning and Staining.	15	3
	4.4	Measure the water pH by pH meter Measurement of Salinity by Salinometer and Titration Measure the concentration of colored solution by colorimetry.	8	2
	4.5	Preparation of materials for Column Chromatography and Thin Layer Chromatography	2	5
5	Teacher specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions Field Visits Practicals
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory

	Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Lab Report = 5 Marks Identification of Spotters = 10 Marks Principle and Procedure = 17 Marks Viva = 3 Marks Total – 35 Marks
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Programme	Aquaculture					
Course Name	Fish Population Dynamics					
Type of Course	DCC					
Course Code	24SACAQU7CC102					
Course Level	400					
Course Summary	A course on fish stock assessment typically covers various methodologies, tools, and techniques used to evaluate and manage fish populations in aquatic ecosystems.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should possess knowledge regarding the basic science and mathematics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Mastery in understanding population dynamics and different types of fish stocks	U	1,2
2	Competency in applying sampling methodologies for fishery data collection and abundance estimation.	A	1,2
3	Comprehensive understanding of growth dynamics in fish populations and proficiency in assessing and estimating mortality rates	U, A, C	1,2
4	Mastery in using various prediction models to forecast fish population trends and competency in employing trophic and ecosystem-based models to study complex interactions within marine ecosystems.	An, C	1,2
5	Develops skill for using software like FiSAT and R programming for fish stock assessment	A, S	1,2

6	Understanding the various types and impacts of overfishing and analyzing the role of regulatory measures in sustainable fisheries management	U, C	2,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Introduction to fish population dynamics			14 Hours	
1	1.1	Introduction: population, dynamics, population dynamics, stock assessment	2	1
	1.2	Distribution and types of stock - unit stock-mixed stock-straddling stock	2	1
	1.3	Characterization of stock (life history traits, truss network, environmental signals, otolith shape; genetic analyses, applied marks); Principle and general procedure of fish stock assessment	2	1
	1.4	Principles of stock assessment: Aims, fish abundance, surplus production, production functions	2	1
	1.5	Sampling techniques: Collection of fishery data, Field procedure, Abundance estimation, Transect Study, Sampling-survey, Fish landing centre, Exploratory survey, Fishery independent survey, non-extractive abundance sampling, Catch effort assessment <i>Activity- A field trip to nearby fish landing centre. Collection of fishery data at landing centres from different gears separately. Collection of length frequency data for various groups of finfish and shellfish.</i>	6	2
Growth models			19 Hours	
2	2.1	Growth parameters: Length of infinity, Growth coefficient, VBGF equation	3	3
	2.2	Principles of growth; Growth parameter estimation Gulland and Holt Plot, Ford – Walford plot & Chapman's method, Chapman's method,	4	3
	2.3	Mortality parameters; Types of mortality; Estimation of total, natural and fishing mortality rates, Exploitation	8	3

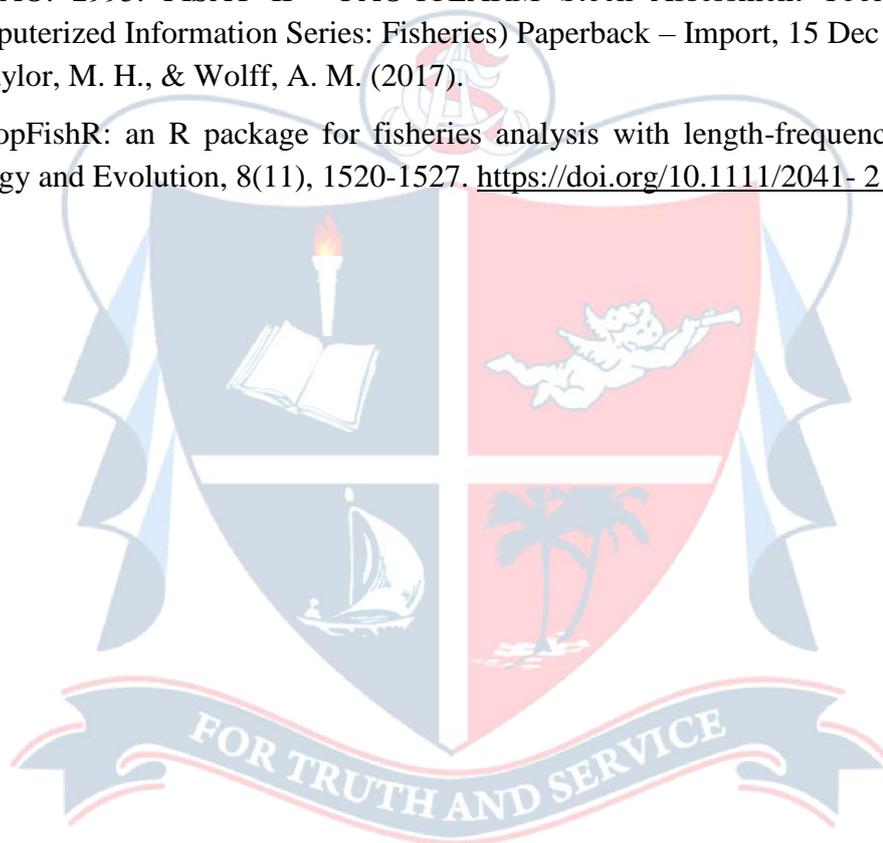
		ratio, Exploitation rate <i>Activity: Estimation of age and growth based on length frequency data. Growth, mortality, population and stock parameters employing computer based software (FiSAT)</i>		
	2.4	Recruitment and gear selectivity: Timing and size of recruitment	2	3
	2.5	Factors influencing recruitment; Principle and estimation of gear selectivity – trawl net and gill net selectivity	2	3
		Fishstock assessment models	21 Hours	
3	3.1	Analytical models: Cohort dynamics and life history; Virtual population analysis;	2	4
	3.2	Prediction models (Thompson and Bell model; Yield per recruit model and Relative Yield per Recruit model)	3	4
	3.3	Surplus production models / Holistic models: Schaefer's model, Fox model, Swept area method,	3	4
	3.4	Trophic models: Ecosystem based models – Principles, Applications, Ecopath with Ecosim	3	4
	3.5	Software's: Software for fish stock assessment, Computer based software's, FiSAT, Monte Carlo simulations <i>Activity- Estimate growth, mortality and exploitation pattern of a species using FiSAT software</i>	6	5
	3.6	R program: basics- Application of R program in fisheries. Troph Fish R Software.	4	5
		Fisheries Management	6 hours	
4	4.1	Overfishing- Growth overfishing, Recruitment overfishing, Ecosystem over fishing, regulatory measures	2	6
	4.2	CPUE- fishing effort, catchability coefficient	2	6
	4.3	Open access fishery, fisheries regulations, current regulatory objectives	2	6
5	Teachers Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

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Programme	Aquaculture					
Course Name	Aquatic Toxicology					
Type of Course	DCC					
Course Code	24SACAQU7CC103					
Course Level	400					
Course Summary	Toxicants are harmful substances introduced into the environment from various sources like agricultural, Industrial and Domestic wastes. Aquatic organisms can accumulate these toxins in their tissues, causing deleterious effects on their consumers. Knowledge on the introduction of toxicants into the environment, their integration into ecological cycles and the harmful effects produced by them is essential in taking up mitigating and remedial measures. This course provides an insight into aquatic toxicants, factors influencing their toxicity, methods of detection and amelioration and the safety measures needed to be taken. As such, the course is imperative for a student of Aquaculture and Fisheries Science.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				75
Pre-requisites, if any	Students from diverse backgrounds, including biology, environmental science, chemistry, geology, or related disciplines, may find this course relevant to their academic interests and career goals. Even if they don't match the requirements, students who are really interested in the subject could still be eligible to enroll.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	On completion of this course the student should be able to: Know main classes of toxic agents in water bodies toxicological processes in water bodies	U, An	1,5,6

2	Analyse main effects of toxic agents	An	2, 6, 8
3	Develop skills for the assessment of water pollution	An, S	1, 6, 8
4	Analyse and evaluate fish stress	An, E	2, 8
5	Evaluate the dynamics of radiotoxicity and develop skills in the usage of instruments related to radiotoxicity measurements	E,S	1, 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.
	Toxicity	15 Hours		
1	1.1	Toxicology: Definitions, Branches of Toxicology, Historical developments, Major Types of aquatic toxicants and its deleterious effects.	2	1
	1.2	Factors influencing toxicity- environmental, genetic and nutritional	2	1
	1.3	Measurement and evaluation of the ecological effects of toxicants; Genotoxicity; neurotoxicity	4	1
	1.4	Toxicology of emerging contaminants, PBDE (PolyBrominated Diphenyl Ether), New generation pesticides and antibiotics.	4	1
	1.5	Antibiotic resistance- Antibiotics – use and misuse including the development of antibiotic-resistant bacteria; AMR, WHONET and ATLAS; Regulatory bodies: safety regulations at national and international levels	3	1
	Metabolism and Xenobiotics	15Hours		
2	2.1	Metabolism: Metabolism of toxic substances by aquatic microbes and other organisms - consequences, synergistic and antagonistic effects; Acute poisons and accumulative poisons.	3	2,6
	2.2	Bioaccumulation, bioconcentration and biomagnification; Systemic effects of toxic metals; pesticides and herbicides	2	2,6
	2.3	Effect of selected toxicants on aquatic life and detoxification mechanisms	2	2,6
	2.4	Interaction of pollutants with abiotic factors (e.g., temperature, pH, dissolved oxygen). Synergistic and	3	3

		antagonistic effects of multiple pollutants. Implications for assessing and managing environmental toxicity. Role of biofilter organisms in water quality maintenance		
	2.5	Chemotherapeutic agents: antiprotozoal agents, ectoparasiticide, antihelmenthic, anaesthetics.	3	3
	2.6	Antimicrobial drugs: antibacterial, antifungal, antiviral drugs and their delivery system.	2	3
	Toxicity evaluation		15 Hours	
3	3.1	Toxicity Testing - Microcosm and Mesocosm Tests; Response Relationships; Toxicity Bioassay. Toxicity testing - Chronicity factor, Untoward effects, Common causes, Diagnosis of poisoning, Factors modifying toxicity, Toxicokinetics, Toxicodynamics Activity: 1. Toxicity Testing with Aquatic Organisms -Select a standard test organism and expose them to different concentrations of a toxicant. Monitor and record mortality, growth, and behavioral changes over a specified time period. Calculate LC50 (lethal concentration for 50% of the population)	4	4
	3.2	Toxicity evaluation of heavy metals on selected organisms by bioassay techniques; Toxicity assessment of pesticides; PCBs and hydrocarbon on selected organisms; Activity 1. Bioaccumulation Study -Expose a group of organisms (e.g., mussels, fish) to a known concentration of a contaminant over time 2. Study of Geoaccumulation Index 3. Study of Pollution Load Index	4	4
	3.3	Drugs in aquaculture and fish health management: E.O., USEPA, ANZECC, FDA and ISO standards of levels of drugs.	4	4,6
	3.4	Pharmacological studies: kinetics and dynamics, detoxification.	3	4,6
4	Module 4: Radiation Toxicology		15 hours	
	4.1	Radiation ecology: Definition, Natural and anthropogenic radiation; Types of radiation and their sources.	4	5
	4.2	Radionuclide ecology- distribution of radionuclide in different ecosystems. Dynamics of radionuclides in food chain. Identification of radionuclide sensitive organism –external exposure, internal exposure and risk factors.	5	5
	4.3	Environment Impact of radiotoxicity: On phytoplankton, zooplankton, microalgae, benthic microorganism, molluscs,	3	5

		crustaceans and fish. Safety measures for human health.		
	4.4	Measurement of radioactivity: counting systems, radiation spectrometry, and liquid scintillation counter.	3	5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

REFERENCES

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Programme	Aquaculture					
Course Name	Fisheries Oceanography					
Type of Course	DCE					
Course Code	24SACAQU7CE101					
Course Level	400					
Course Summary	Fisheries oceanography is the study of oceanic processes that affect marine ecosystems and the relationship of these ecosystems to the abundance, distribution, and availability of fishery species. Knowledge on fisheries oceanography is needed to improve fisheries resource management.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				75
Pre-requisites, if any	Students should have a basic knowledge about marine life and organisms					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Clear knowledge on different oceanographic processes and marine ecosystem.	U	1
2	In depth knowledge of the community interactions at specific aquatic ecosystems.	U	1
3	Recognize the oceanographic and ecological processes that affect fishery abundance and distribution.	An	1,2
4	Use and apply various sampling devices for marine biological studies.	A	2
5	Application-level knowledge on fisheries oceanography	A	2

6	Collect, analyze, interpret and communicate marine scientific data.	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)

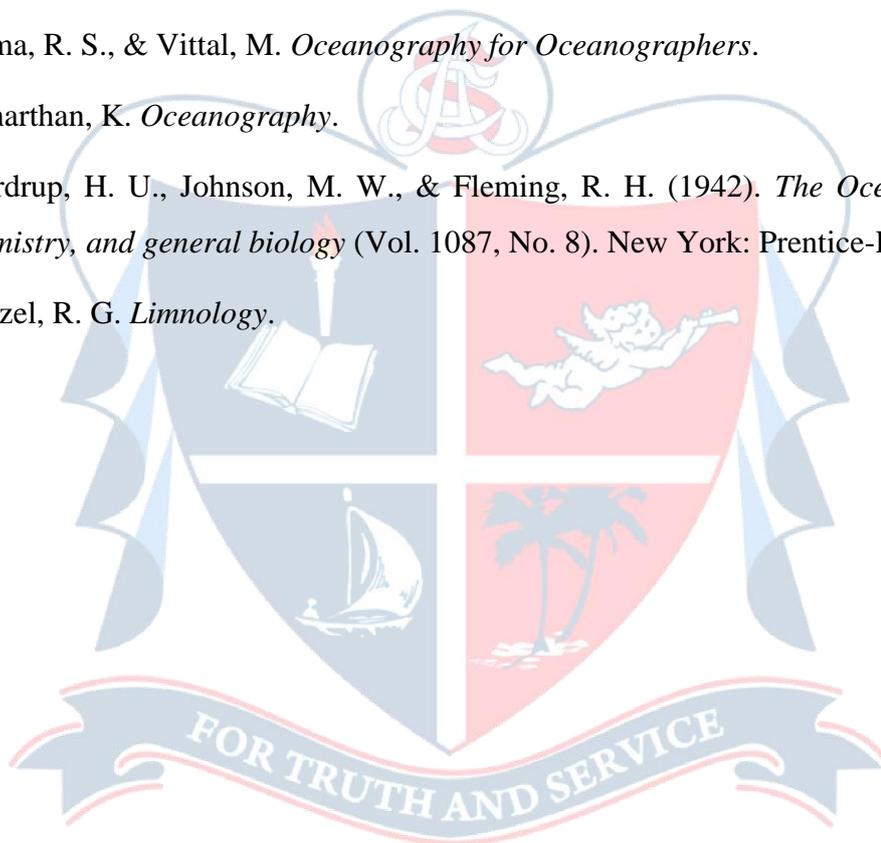
Module	Units	Course description	Hrs	CO No.
Introduction to Marine Environment			10 Hrs	
1	1.1	History of marine biological investigations in India and major expeditions.	3	1
	1.2	Salient features of world oceans. Oceanographic features of Arabian Sea, Bay of Bengal and Andaman Sea.	3	1,2,3
	1.3	Movements of Ocean Water Physico-chemical features of Marine environment- tides, currents, waves, upwelling and monsoon cycles, Mud banks.	4	1,2,3
Composition and Properties of Sea water			13 Hrs	
2	2.1	Elemental composition of water Estimation of Primary Productivity Activity: 1. Analysis of physico-chemical parameters of sea water. 2. Chlorophyll Estimation	5	1
	2.2	Physical parameters of sea- tides, waves, light, colour, temperature, currents, density & pressure. Chemical parameters of sea- salinity, dissolved oxygen, pH and nutrients. Oceanographic Equipments. Activity: Theory and operation of equipments used for sampling water, sediment, plankton and benthos.	8	1,4,5
Marine Ecosystem			19 Hours	
3	3.1	General characteristics of the marine environment. Zonation of sea. Deep Ocean Topographic features – Continental shelf, continental slope, continental rise, oceanic ridges, trenches, sea mounts, guyots, plateaus, submarine canyons.	6	1,2
	3.2	Biological divisions of the sea. Zonation and adaptations – intertidal, rocky, sandy and	8	1,2

		muddy shore- associated fauna and their adaptations. Deep sea adaptations. Pelagic and Benthic adaptations of the ocean community.		
	3.3	Population of the oceans - phytoplankton, zooplankton, benthos and nekton. Marine food chains and food webs. Activity: 1. Methods of collection, analysis and preservation of phytoplankton, zooplankton and Benthos. 2. Identification of major zooplanktons, phytoplankton and benthic organisms. 3. Chlorophyll Estimation	5	1,2,6
4	Fisheries Hydrography , Fish Finding Devices and Fisheries Forecasts 18 Hours			
	4.1	Fishery hydrography - Influence of fishery independent factors - El Nino Southern Oscillation (ENSO).	4	3
	4.2	Upwelling and fisheries - climate change and fisheries. Oceanography in relation to fisheries.	4	5,6
	4.3	Introductory information on echo sounder, Sonar, Netsonde, Global positioning Systems, Remote Sensing, Potential Fishing Zones. Application of Geographic Information System (GIS) in fisheries.	7	5
	4.4	Code of conduct of responsible fishing-Turtle Exclusion Devices (TED)-By-catch Reduction Devices (BRD).	3	5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Aquaculture Engineering					
Type of Course	DCE					
Course Code	24SACAQU7CE102					
Course Level	400					
Course Summary	Aquaculture Engineering focuses on the design, construction and management of system for cultivating aquatic organisms. This interdisciplinary field combines elements of civil, mechanical and environmental engineering to address the unique challenges of fish and shellfish farming. Topics covered include water quality management, system design, aquaponics, and sustainable practices to optimize production while minimizing environmental impact. Students learn to apply engineering principles to create efficient and environmentally sound aquaculture systems fostering the responsible growth of the aquaculture industry.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				75
Pre-requisites, if any	Strong foundation in basic sciences, provide the fundamental knowledge necessary for understanding the biological and physical aspects of aquaculture systems.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand technical components of farm designing, different components of aquafarms – peripheral dikes, secondary dikes, feeder canals, sluice gate and monks. Recent trends in aquaculture engineering	U, An	1, 2
2	Apply the planning process, site selection and evaluation, design, components and construction of		

	freshwater and brackish water farms (tanks, ponds, cages and hatcheries) and project formulation and layout.	A	1,2
3	Analyze pipeline, water flow and head loss, pumps-different types; understand and develop equipment used for water treatment, filters, ultraviolet light, ozone, heating and cooling and other processes of disinfection.	U, An	1, 2, 4
4	Develop skills in design and fabrication of aerators, compressors, blowers, paddle wheel aerators, and oxygen injection systems. Design recirculation and water use systems Definition, components and design.	A, C	1, 2,6,10
5	Construct different types of feeding equipment, feed control systems, dynamic feeding systems, and instruments for measuring water quality.	C	1,6,8
6	Address the environmental impact of aquaculture operations, includes strategies for minimizing negative effects on ecosystems and surrounding environments.	An, E	6, 7, 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.
	Farm Engineering and Aquafarm Facilities		15 Hours	
1	1.1	<p>Criteria for the selection of site for aquaculture - Surveying – chain survey, plane table survey, leveling. Calculation of earthwork for the construction of ponds. Types of soil, soil sampling methods, prevention of erosion.</p> <p>Activity-</p> <ol style="list-style-type: none"> 1.Survey for aquaculture farm construction 2.Categorise soil according to their size 3. Determination of organic carbon in pond soil and Determination of soil pH 4. Grain Size analysis of soil 5. Calculation of lime requirement of soil 6. Contour Mapping, Chain and Compass Survey 	4	1, 2

	1.2	Recent trends in aquaculture engineering	1	1
	1.3	Design of freshwater and brackish water farms. Different components of aquafarms – peripheral dikes, secondary dikes, feeder canals, sluice gate and monks.	4	1,2
	1.4	Various farm equipment. Pumps in aquaculture, different type of pumps.	3	3
	1.5	Pipe line, water flow and head loss, pumps-different types Activity – identify different types of pumps used in Aquaculture.	3	3
	Hatchery facilities, Aeration and Oxygenation		15 Hours	
2	2.1	Components and design of shrimp hatcheries – various components and infrastructure facilities required	3	1, 2
	2.2	Equipment used for water treatment, filters, ultraviolet light, ozone, heating and cooling and other processes of disinfection Aeration of pond water and different types of Aerators	3	3
	2.3	Recirculation and water use systems, definition, components and design.	4	1, 2, 4
	2.4	Various hatchery equipment including aeration devices and pumps, design and fabrication of aerators, compressors, blowers, paddle wheel aerators, oxygen injection system Activity 1. Construct and design Recirculatory system 2. Determination of pump efficiency	5	3, 4,
3	Feeding System and Instrumentation		15 Hours	
	3.1	Different types of feeding equipment	5	5
	3.2	Feed control systems, dynamic feeding systems	5	5
	3.3	Instruments for measuring water quality Activity-Water quality analysis; Construct feeding equipment	5	5
4	Environmental Monitoring and Impact Assessment		15 Hours	
	4.1	Introduction- Definition, history, aim, principles, concept, and scope.	2	6
	4.2	Baseline data collection, methods and steps.	3	6
	4.3	Impact assessment and impact evaluation -EIA processes,	5	6

		stages, EIA statement environment management plan. National Policy on EIA and regulatory framework Activity- Impact Assessment Study on near canals or estuaries		
	4.4	Effluent monitoring, Sewage disposal and treatment,	5	3, 6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

REFERENCES:

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2. Stickney, R. R. (1994). *Principles of aquaculture*. John Wiley and Sons, Inc..
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Deep Sea Fishery, GIS and Remote Sensing					
Type of Course	DCE					
Course Code	24SACAQU7CE103					
Course Level	400					
Course Summary	A Hitherto underexploited realm of the Marine Environment, the deep sea offers a cornucopia of fascinating animals and which if properly exploited has scope towards contributing to food security. GIS and Remote Sensing offers cutting edge technology to gain understanding of the Aquatic resources without actual physical contact. They provide an important tool for planning marine resources exploitation strategies.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		60				60
Pre-requisites, if any	Students should possess knowledge regarding of marine environment and resources.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Remember marine realms	R	4,10
2	Analyze different techniques for gaining remote information on marine exploited resources.	A	1
3	Comprehend the need for remotely locating resources, for their judicious exploitation	An	2
4	Compare different methods of remote sensing	A	1
5	Analyse the role of GIS and Remote sensing in marine fisheries and Aquaculture	An	3
6	Apply the knowledge relating to GIS and Remote Sensing through mobile applications and softwares	A	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	Deep Sea Fishery, Deep Sea Fishing Gear and Accessories		15 Hrs	
1	1.1	Zonation of sea – a brief description Important groups and families of deep sea fishes of Indian EEZ – Oceanic Tunas, Tuna like fishes and Oceanic Squids, Deep sea Shrimps etc. Adaptations of Deep Sea Fishes	3	1
	1.2	UNCLOS – Law of the sea , Baseline Territorial waters, Contiguous Zones, EEZ and high seas National Deep Sea Fishing Policy	2	1
	1.3	Tuna Long Lining, Gill Netting, Squid Jigging and other Deep sea Fishing Methods.	3	2
	1.4	Deck Equipments in Deep Sea Fishing Vessels. Activity: Visit to deep sea fishing vessels to study the layout, manpower, facilities for deep-sea navigation and fishing, instruments and fleet management. Study on deck equipments in deep sea fishing vessels. Mother Boat Concept and Factory Vessels in Deep Sea Fishing.	4	2
	1.5	Weather and warning: Wind, Wave, Current, Cyclones, Squally weathers, Doldrums, Weather forecasting and weather prediction at sea – Weather equipment and storm signals.	3	2
2	Acoustic and Electronic Equipments		15 Hrs	
	2.1	Basics of Sound in water, Ultrasonic sound and its characters Automatic Identification System (AIS)	3	3
	2.2	Acoustic Equipments used in Fishing, Major Components and Types of Echo Sounder and SONAR	3	3
	2.3	Instruments used for evaluation of underwater Gear Performance- Acoustic Trawl Monitoring System	3	3
	2.4	Electronic Equipments in Fishing Vessels- GPS, Vessel Monitoring System (VMS),	3	3
	2.5	Navigational Equipments- RADAR, Autopilot and Chart Plotter Activity: Familiarisation with Acoustic Equipments	3	3
3	Remote Sensing		15 Hrs	

3	3.1	Electromagnetic Spectrum, Radiation Laws, Spectral Reflectance of Earth Materials and Vegetation.	3	4
	3.2	Classification of Remote Sensing based on source, Active and Passive Remote Sensing	2	4
	3.3	Satellite Remote Sensing- Platforms and Sensors, Satellite Systems, Indian Remote Sensing Programme. Activity: Study of satellite information, interpretation of satellite pictures for resource management, case studies on remote sensing and GIS applications.	5	4
	3.4	Application of Remote Sensing in Fisheries and Aquaculture- Application in Fisheries Management, Habitat Mapping, Water Quality Monitoring, Fisheries Compliance and Enforcement.	5	4
4	Geographic Information System (GIS)		15 Hrs	
4	4.1	Introduction to GIS. Differences between GIS and conventional cartography.	3	5
	4.2	Maps, Map Projections, Types of Map Projections and Map Analysis.	4	5
	4.3	Standard GIS software, Data Types- Spatial and Non Spatial Data, Measurement Scales	3	5
	4.4	SST, Ocean Colour Monitoring, PFZ- Basics and Application ,INCOIS- Data dissemination Activity: Study of Ocean colour Maps	3	5
	4.5	Application of GIS in Fisheries and Aquaculture.	2	5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 30 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 2=20 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (2 out of 4) 2 X 10 = 20 Marks Total – 70 Marks

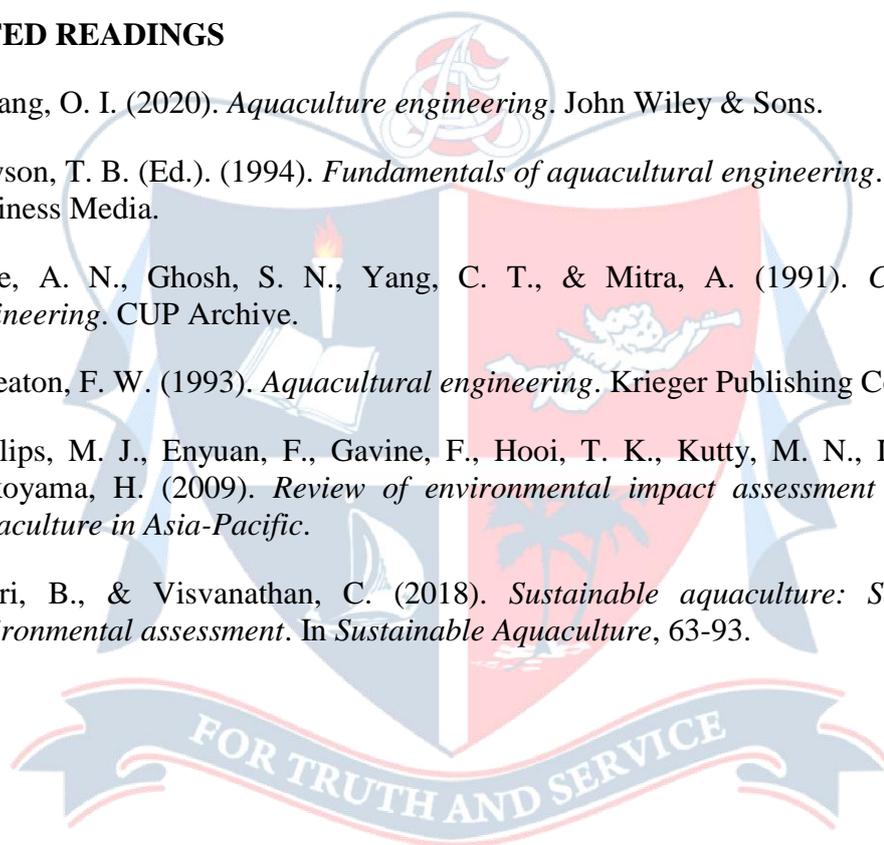
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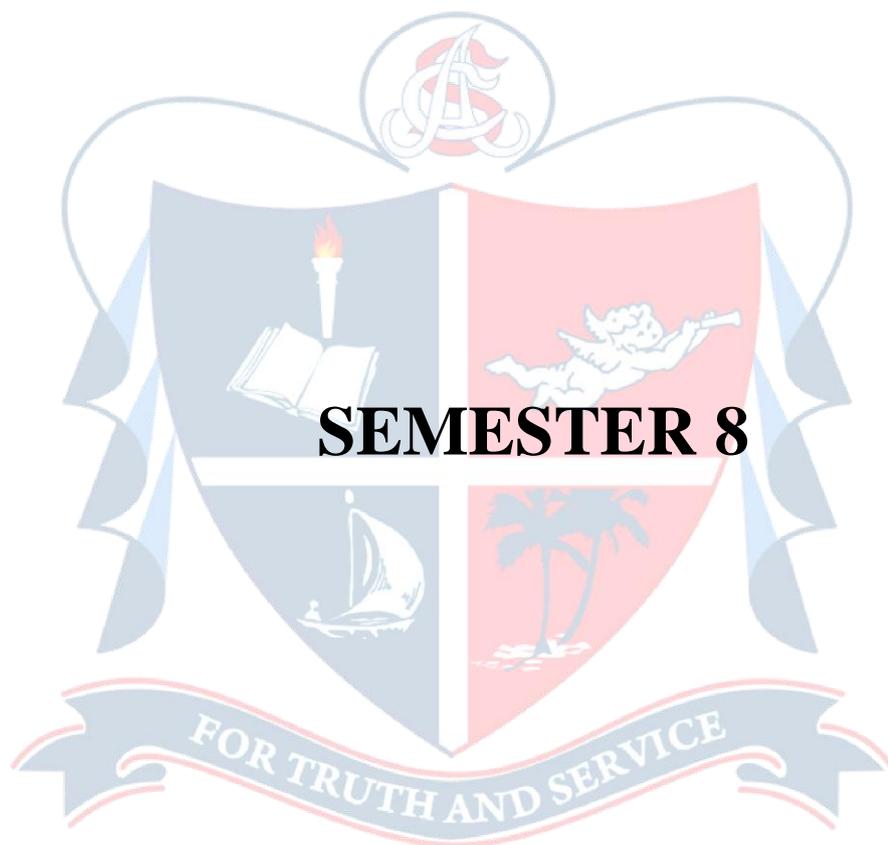
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Programme	Aquaculture					
Course Name	Research Methodology and Biostatistics					
Type of Course	DCC					
Course Code	24SACAQU8CC101					
Course Level	400					
Course Summary	Research is a scientific and systematic search for pertinent information. It is a way of systematically solving a research problem. Students will get familiarized with important steps needed for undertaking a research study. It will give an idea about research process starting from identifying a problem to writing a research report and publication. One can enhance and broaden their knowledge in data management, bio statistical analysis, computer applications, and result representations.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should have a basic knowledge in research and computer application.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Explore the significance and function of research and outline the essential steps required for the execution of a research study.	U	1
2	Gain understanding in research design and the methodologies involved in sample collection, data gathering and report writing.	U	1
3	Design and implement research project.	A,C	1,2

4	Importance of measures that can be used to summarize the data sets.	U	2
5	Understanding, learning, analyzing of descriptive and inferential statistics.	U,A,An	2
6	Awareness and improved comprehension on computer based data presentation and its application.	E,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.
	Research Methodology and Research Design		15 hours	
1	1.1	The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, application of Research, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature.	3	1
	1.2	Different types of research - descriptive, analytical, applied, fundamental, quantitative, qualitative, empirical and conceptual.	2	1
	1.3	Research process, Different steps in Research process- Flow Chart Research Design : Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design. Interpretation – Meaning , Techniques of Interpretation	5	2,3
	1.4	Research Report : Types of reports; (technical and popular), Mechanics in report writing, Layout of report Research report and its structure, journal articles – Components of journal article. Explanation of various components. Structure of an abstract and keywords.	5	1,2,3
	Introduction To Biostatistics		15 hours	

2	2.1	Origin, definition, applications of biostatistics, Criteria of selecting sampling procedure, sampling methods- sampling frame, sample, characteristics of good sample, simple random sampling, Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. purposive sampling, convenience sampling,	3	4,5
	2.2	Data Collection and Analysis- Classification and Tabulation. Diagrammatic representation of Data - graphs and charts – Histograms, Pie Charts, frequency polygon and frequency curves, Frequency distribution Types of data- Primary data & secondary data.	3	4,5
	2.3	Central Measures of tendency- Mean, Median Mode (Merits and Demerits) Measures of dispersion- Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits).	3	4,5
	2.4	Regression, correlation, Skewness & kurtosis, Testing of hypothesis-Parametric & non-parametric test (Theory in brief) Chi Square Test.	3	4,5
	2.5	Probability distributions – Normal, Binomial and Poisson Distribution.	3	4
Application of AI, Research Ethics, Software Tools for Research 15 hours				
3	3.1	Definition and application of AI in aquaculture, operating systems, AI software and its characteristics; Advantages of AI. Computer based software SPSS, FISAT. R program: basics- Application of R program in fisheries.	5	6
	3.2	Ethics in Research - Plagiarism - Definition, different forms, consequences, unintentional plagiarism, copyright infringement, collaborative work.	5	1,2
	3.3	ICT Tools for Research- Role of computers in research, methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	5	6
4	Practicals		30 hours	
	4.1	Preparation of tables and graphs from the given data	5	2

	4.2	Calculation of Measures of Central Tendency, Measures of Dispersion, Correlation and Regression.	5	2
	4.3	Testing of Hypothesis, Chi Square, Probability distributions	5	2
	4.4	Introduction to SPSS and R program in fisheries.	5	6
	4.5	Introduction to Reference Management Softwares and Research Softwares	5	6
	4.6	Preparation of a Research Paper	5	6
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Practical Record = 10 Marks Preparation of Graphs in MS-Excel from the given Data- 5 Marks Calculation of Mean/Media/Mode/Any other Measures of Central Tendency from the data - 5 Marks Calculation of Measures of Dispersion from the data - 5 Marks Problems relating to Testing of Hypothesis/Chi Square/ Probability distribution- 5 Marks Use of Reference Management/Research Softwares – 5 Marks Total – 35 Marks

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	Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam
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Programme	Aquaculture					
Course Name	Fisheries Marketing and Trade					
Type of Course	DCC					
Course Code	24SACAQU8CC102					
Course Level	400					
Course Summary	<p>With the expansion in aquaculture and seafood industry, marketing become an inevitable area of study. This course in marketing and trade covers a range of topics related to understanding consumer behavior, creating effective marketing strategies, and navigating the complexities of international trade. This course equips the students with the knowledge and skills needed to navigate the dynamic and interconnected world of business, whether in the context of local marketing efforts or global trade initiatives.</p>					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		2		75
Pre-requisites, if any	Students should possess basic knowledge on trade, export & import					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Identifies the basic characteristics of market and marketing.	U, I	1
2	Analyze the different parameters for developing and introducing a new product into a market.	An	1,2

3	Explain how the product is priced and distributed	An, A	2
4	Interpret the behavior consumer	S,U, An	1, 8
5	Explain the different agencies and certification related to export & import of fishes	K	1,2
6	Creating knowledge on the current market status of fisheries	A, 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	Introduction to Marketing		15 Hrs	
1	1.1	Marketing- meaning and definition. Objectives of marketing. Functions of marketing. Difference between Marketing and selling. Importance of marketing.	4	1
	1.2	Marketing mix- product, price, promotion, and place. Factors effecting marketing mix.	3	1
	1.3	Market segmentation. Methods of market segmentation (Geographic, Demographic, Psychographic, Behavioral). Targeting- Steps -Targeting strategies (Undifferentiated, Differentiated, Concentrated, Micromarketing). Market positioning concepts and strategy.	4	1
	1.4	Consumer buying behavior and factors influencing it. Demand and Market forecasting. Marketing Research. Uses of marketing research and Information system	4	1
2	Product Planning and Development		16 Hrs	

	2.1	Definition of products, goods and services. Classification of products- (a brief of Consumer and Business products).	2	2
	2.2	New product development- Importance strategy, stages in development process.	3	2
	2.3	Trademark, Brand- branding meaning and role, Brand equity	2	2
	2.4	Pricing strategies- cost based pricing, demand-based pricing, competition-based pricing. Price elasticities. Price determination of fish and fishery products.	3	3
	2.5	Logistics and supply chain. Retailing, Wholesaling, Physical distribution, and Personal Selling.	3	3
	2.6	Channels of distribution, Classification of channels. Factors governing the choice of channels of distribution.	3	3
3	Seafood Trade		14 Hrs	
3	3.1	A brief on international trade- history of GATT & WTO. Different forms of international trade (Export/import, Subsidiaries, Joint ventures, Franchises). Factors influencing international consumer behaviour.	3	4
	3.2	Planning and preparations for export/ import operations. Selection of products and markets for export and Import. Registration process- A general registration process for importing and exporting products	3	4,5
	3.3	Role of agencies in marketing and trade of fish & fishery products- MPEDA, EIC, DGFT-Directorate General of Foreign Trade, Catch certification, Farm traceability, Green certification etc Free trade agreements and HS code (Harmonized System) for fish products.	6	5,6
	3.4	Different marketing practices in fisheries E marketing- scope, concerns and importance Future aspects for diversification of aquatic organisms in export market	2	6
4	Practical		30 Hrs	

	1	Select an organization related to fisheries, observe the operation, and interview an administrator and some customers to identify what is being exchanged and whether the unit is product – sales or market oriented	5	1
	2	Report on export marketing activities in a seafood processing plant in you locality. Consider such topics as the following: What products are exported? How many jobs are created by export marketing? What is the dollar value of exports? How does the exporting business impact the society?	5	2
	3	Interview a marketing manager and prepare a report on consumer decision making and buying behaviour of customers.	5	3
	4	Prepare a report after analyzing any one of the below topics after conducting a survey. <ul style="list-style-type: none"> - If a new product idea is attractive to potential customers - If the intended message in an advertisement is being communicated effectively - Gauge the effect of price change would have on demand of a brand in fisheries How customers feel about an organization and its products	10	2
	5	Visit a seafood processing plant and prepare the below reports. -Export/ Import of Seafood and other aquatic products. -Import procedures for live shrimp/ fish broodstock and larvae.	5	3
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination

	<p>Theory</p> <p>Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks</p> <p>Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks</p> <p>Essay (1 out of 3) 1 X 10 = 10 Marks</p> <p>Total – 50 Marks</p> <p>Practicals</p> <p>Practical Report = 5 Marks</p> <p>Evaluation of Report on export marketing activities in a seafood processing plant - 10 Marks</p> <p>Evaluation of Report on Procedures involved in Export/Import of seafood/other aquatic products/ live shrimp/ fish broodstock and larva – 10 Marks</p> <p>Evaluation/Viva on a Report on Interviewing a Marketing Manager on consumer decision making and buying behavior of customers- 10</p> <p>Total – 35 Marks</p>
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Department of Fisheries and Aquaculture St. Albert's College (Autonomous) Ernakulam

Programme	Aquaculture					
Course Name	Sustainable Aquaculture Policy and Planning					
Type of Course	DCE					
Course Code	24SACAQU8CE101					
Course Level	400					
Course Summary	Any human activity interfering with the natural ecosystems like agriculture or aquaculture need to be sustainable in the long run. Unchecked aquaculture activities tend to degrade the environment, if not properly monitored. This course introduces the student to sustainability issues and influences of climate change on aquaculture practices. It also discusses various strategies to be adopted for attaining sustainability and also familiarizes the student to the guiding principles of sustainable aquaculture.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess a basic knowledge about the different aquaculture practices and their impact on the surroundings and environment.					

COURSE OUTCOMES (CO)

CO No	Expected Course Outcome	Learning Domains*	PO No
1	Analyse the environmental impact of Aquaculture and understand the conflict between Aquaculture and other farming systems	An	1,2
2	Understand the climate change impact brought about by Aquaculture activities	U	1,2
3	Apply measures to reduce energy use and emission of greenhouse gases	A	1,9

4	Understand the concept of sustainability in aquaculture	U	1,10
5	Understand the role and importance of certifying bodies in Aquaculture	U	1,2,9,
*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	Sustainability issues in Aquaculture		15 Hrs	
	1.1	Environmental and Socioeconomic issues in Aquaculture	3	1
	1.2	Introduction and escapement of exotic species, contamination of indigenous gene pool, overexploitation of wild stocks.	3	1
	1.3	Salinisation of soil and water ; Environmental impact of Mangrove deforestation	3	1
	1.4	Environmental impact assessment, Ecosystem approach to Aquaculture	3	1
	1.5	Conflict over water and land use, Conflict of interest between aquafarming and fishermen, aquaculture and other enterprises, social issues, antidumping duties.	3	1
2	Climate Change impact		15 Hrs	
	2.1	Weather elements of concern in aquaculture	3	2
	2.2	Green house gases, Global warming and their impact	3	2
	2.3	Carbon Sequestration in Aquaculture	3	2
	2.4	Microplastics in Aquaculture	3	2
	2.5	Measures and tools to reduce energy use and greenhouse gas emissions in Aquaculture.	3	3
3	Strategies for sustainable aquaculture and guiding principles		15 Hrs	
	3.1	Concept of sustainability, Food security, Biosecurity, Organic farming, responsible aquaculture, Rotational aquaculture, Bioremediation, Role of biotechnology, Traceability.	2	4

	3.2	Energy conservation- Application of renewable energy in Aquaculture; solar energy, wind and tidal energy.	3	4
	3.3	Seed certification, Sustainable use of antibiotics, minimal water exchange system.	3	5
	3.4	Coastal aquaculture Guidelines source book, FAO Code of conduct for responsible Fisheries Holmenskollen Guidelines for sustainable Aquaculture	3	5
	3.5	Best Management practices in aquaculture Coastal regulation zone implication CAA and its role	2	5
	3.6	Ecolabelling , organic certification Pollution Control Board and State Water Bodies protection guidelines.	2	5
4	Practicals		30 Hrs	
	4.1	Visit to aquafarms to collect data on management of used water	3	1
	4.2	Economic evaluation of aquaculture practices	3	1
	4.3	Case studies on environmental issues of different types of farms	3	1
	4.4	Survey on environmental impact of aquaculture farms	3	1
	4.5	Application of GIS and remote sensing on detecting pollution.	3	2
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	<p>Mode of Assessment</p> <p>A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks</p> <p>B. Semester End Examination</p> <p>Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks</p> <p>Practicals 1. Presentation of Report/viva on management of used water in aquaculture farms- 7.5 Marks 2.Economic Evaluation of any type of Aquaculture Practices- 7.5 Marks 3.Presentation of Report/ Viva on case studies of environmental issues of different</p>

	types of farms- 7.5 Marks 4. Presentation of Report on Survey on environmental impact of aquaculture farms – 7.5 Marks 5. Principle and Procedure of Application of GIS and remote sensing on detecting pollution – 5 Marks Total – 35 Marks
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Programme	Aquaculture					
Course Name	Aquaculture Tourism					
Type of Course	DCE					
Course Code	24SACAQU8CE102					
Course Level	400					
Course Summary	<p>The Tourism industry, in addition to providing employment, is also considered as a foreign exchange earner. Aquaculture Tourism is the convergence of the science of Aquaculture and the Tourism Industry. This burgeoning niche within the tourism industry involves offering unique insights into the intricate process of seafood production, while fostering environmental stewardship and cultural exchange. Through an interdisciplinary lens, drawing from diverse fields such as tourism studies, environmental science, economics and sociology, this paper sheds light on the interplay between aquaculture and tourism. This paper critically evaluates the challenges and opportunities associated with the growth of aquaculture tourism, addressing issues such as carrying capacity, resource management, community engagement, and market demand. By identifying best practices and innovative approaches, we hope to provide insights that can inform policymakers, industry stakeholders, and tourism practitioners seeking to harness the potential of aquaculture tourism for sustainable development.</p>					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should possess a basic knowledge about the different aquaculture practices and their impact on the surroundings and Environment.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Understand the concepts and principles of Aquaculture Tourism	U	1,2
2	Analyse Aquatourism product development and its challenges.	An	1,2
3	Evaluate Operational safety and Health issues in Aquatourism	E	1,9
4	Analyse the Economic and Sociocultural impacts of Aquatourism	An	1,10
5	Apply knowledge of policy and regulations to Aquatourism	A	1,2,9
*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	Aquaculture Tourism – Introduction and Concepts		15 Hrs	
	Aquatourism Product Development; Operational and Safety Infrastructure			
	1.1	Aquaculture Tourism- Introduction, Concepts and Principles Emerging Trends in Aquatourism and its potential	2	1
	1.2	Components of Aquatourism Industry; offshore and Inland, surface water and underwater, motorized and non motorized, shoreline recreation, Sport Fishing- Marine and Inland	2	1
	1.3	Nautical Tourism, Maritime Tourism , Cruise Tourism and its potential in India	2	1
	1.4	Beach based leisure pastimes and its spread; Factors influencing the sector's growth and its expansion	2	1
	1.5	Aquatourism Product Development and its challenges; Entrepreneurial characteristics, oppurtunities and challenges in the sector	3	2
	1.6	Setting up and operation of Aqua-tourism business,	4	2

		Career opportunities; participant's behavior and bearing of it on major impacts and its types (case studies of one surface-water, under-water and beach-based each).		
2	Operational, Safety and Health issues in Aquatourism 15 Hrs			
	2.1	Operational and safety Infrastructure: jetties, marinas and its economics, impacts of Marinas	3	3
	2.2	Risk assessment, Strategies and mitigation; Major safety equipment and gears; Clothing; First aid & CPR.	3	3
	2.3	Operation and management of boat-clubs; navigational aids- GPS and its usage, map reading;	3	3
	2.4	Legal and regulatory framework for the business; CZMA and its bearing on off-shore business.	3	3
	2.5	Major destinations for aquatourism in India; case Studies on houseboats of Kerala, water-theme parks and Scuba dive centres.	3	3
3	Aquaspa, Coastal Tourism , Policy and Regulations 15 Hrs			
	3.1	Aquaspa or Fish pedicures- Origin, Cultural roots and Evolution over time Species of Fishes used- their behavior and natural habitat Benefits- Skin exfoliation, Relaxation and potential therapeutic effects on skin conditions Risks and concerns- Spread of infectious diseases	3	4
	3.2	Coastal tourism: Beach resorts, restaurants and parks within the coastal zone as per existing rules and regulations. Impact of pollution on coastal resources.	3	4
	3.3	Economic Impact: Contribution of aquaculture tourism to local economies.	3	4
	3.4	Socio-cultural Implications: Cultural heritage, community involvement, and social aspects of aquaculture tourism.	3	4
	3.5	Policy and Regulation: Government policies, regulations, and management practices related to aquaculture tourism. Activity 1. Site Visits: Field trips to aquaculture facilities and tourism destinations. 2. Case Studies: Analyzing successful aquaculture tourism initiatives and learning from challenges faced.	3	5

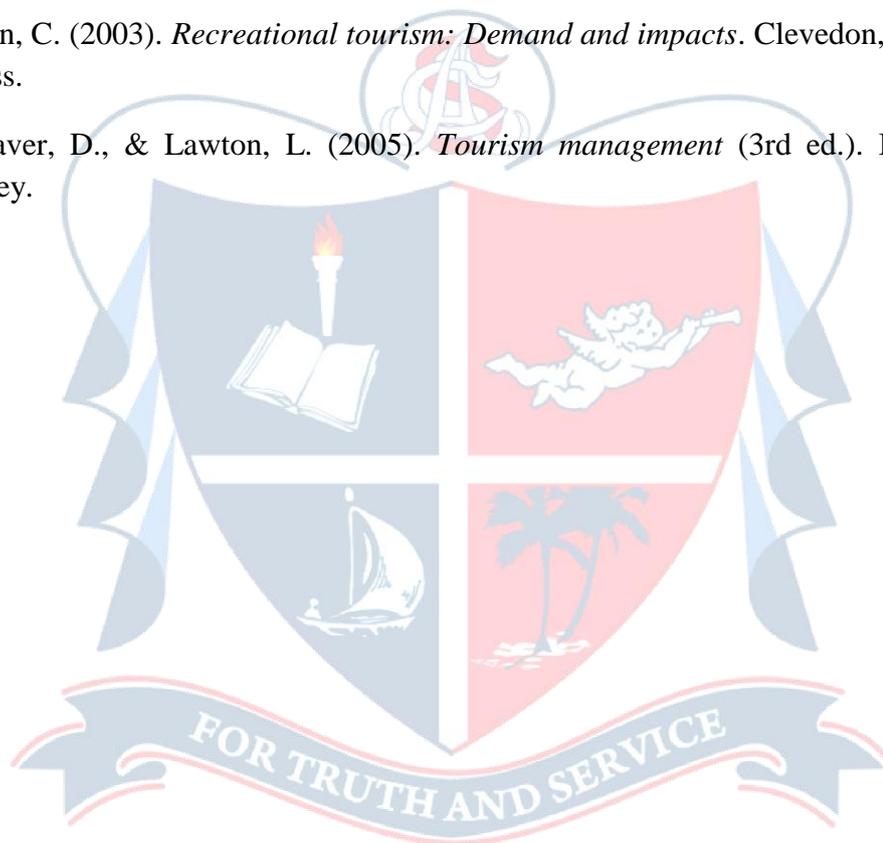
4	Practicals	30 Hrs	
4.1	Visit an Aquatourism Centre and prepare a detailed report on their activities	5	1,2
4.2	Design an itinerary for a visit to an Aquatourism Centre; prepare a cost and budget package for the same	5	2
4.3	Study of Equipments used in Aquaculture (Nets, Feeding tools and Water Testing Kits) Study of Safety Equipments and first aid kits	5	2
4.4	Study of Materials for Marketing and Educational activities (Brochures, Displays, Social Media Tools)	5	4
4.5	Training on using a customer feedback form to improve service quality	5	4
4.6	Prepare a sustainability action plan for a tourism project	5	5
5	Teacher Specific Module		

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Tour Report to an Aquatourism Centre – 10 Marks Preparation of Tourism Brochure/ Customer Feedback form = 5 Marks Identification and Comments on Safety Equipments and fist aid kits – 10 Marks Presentation of a sustainability action plan for a Tourism Project – 5 Marks Viva = 5 Marks Total – 35 Marks

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Programme	Aquaculture					
Course Name	Artificial Intelligence in Aquaculture					
Type of Course	DCE					
Course Code	24SACAQU8CE104					
Course Level	400					
Course Summary	<p>The course "Application of AI Tools in Aquaculture and Fisheries Management" provides an in-depth exploration of how artificial intelligence (AI) technologies are revolutionizing the practices of aquaculture and fisheries management. The course begins with an introduction to AI and its significance in enhancing efficiency, sustainability, and productivity in aquaculture and fisheries management. Students delve into traditional methods and the limitations they pose, paving the way for understanding how AI tools offer innovative solutions. Through modules focused on AI applications in aquaculture, students learn about the implementation of AI-driven sensors, data analytics, and machine learning algorithms for monitoring and optimizing aquaculture environments, automating feeding systems, and detecting diseases early. Challenges and opportunities associated with implementing AI in aquaculture and fisheries management are thoroughly examined, including technical, socio-economic, and ethical considerations. Through case studies, students analyze real-world applications of AI in these industries, understanding both the successes and limitations of AI adoption.</p>					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any		3		1		75
	Students should possess knowledge regarding basics of Artificial Intelligence and Automation.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Creating knowledge on the use of AI tools in aquaculture and fisheries	U	1,2
2	Developing skill to use various AI tools in aquaculture and fisheries	S	1,2
3	Utilize AI tools for the betterment of aquaculture and fisheries sector	An	1,2
4	Formulate methods for the better use of AI tools in aquaculture and fisheries	C	1,2
5	Evaluate the basic concepts of AI tools for the development of aquaculture and fisheries	E	1,2
6	Acquire in depth knowledge and field exposure on the use of AI tools for the development of aquaculture and fisheries	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	Introduction to AI in Aquaculture and Fisheries Management		10 Hours	
	1.1	Definition of AI and its significance in aquaculture and fisheries management	3	1
	1.2	Overview of traditional methods used in aquaculture and fisheries management	5	1
	1.3	AI software and its characteristics; AI in aquaculture, advantages of AI	2	1
2	AI Applications in Aquaculture		9 Hours	
	2.1	Monitoring and optimization of aquaculture environments using AI-driven sensors and data analytics	5	2,3
	2.2	Application of machine learning algorithms for predictive modeling of water quality parameters Use of AI for automated feeding systems and precision aquaculture AI-powered disease detection and early warning systems	4	2,3

		in aquaculture facilities		
3	AI Applications in Fisheries Management and Challenges, Oppurtunities and Future Directions in implementing AI in Aquaculture and Fisheries management		26 Hrs	
	3.1	Utilization of AI for fish stock assessment and population dynamics modeling	3	2,3
	3.2	AI-driven satellite imagery and remote sensing for monitoring fishing activities and detecting illegal fishing	3	2,3
	3.3	Implementation of AI algorithms for optimizing fishing fleet management and route planning AI-based decision support systems for sustainable fisheries management and policy development	5	2,3
	3.4	Scope for Robotics in aquaculture, ROV, AUV, Drones, ASV. Automation for water quality management and health management in aquaculture,	6	3,4
	3.5	Technical challenges such as data integration, model interpretability, and scalability Socio-economic implications of AI adoption in aquaculture and fisheries management. Ethical considerations related to the use of AI in resource management and conservation	5	4,5
	3.6	Opportunities for collaboration between academia, industry, and government agencies to address challenges and promote responsible AI adoption Exploration of emerging trends and future directions in AI research and development for aquaculture and fisheries management	4	6
4	PRACTICALS		30 Hours	
	4.1	Demonstration AI-driven automated feeding system for fish farms. Demonstration Of working of AI powered fish feeding devices	5	4,5
	4.2	Compare the effectiveness of AI-driven monitoring with traditional manual monitoring methods.	5	4,5
	4.3	Demonstration of AI models to identify common fish diseases based on symptoms and visual cues	10	4,5
	4.4	Drones – Types – working (Demo only) Demonstration the applications of drones in aquaculture – Feeding Prepare a model of a drone	10	4,5
5	Teacher Specific Content			

Teaching and Learning Approach	Lecturing with ICT activities Transactions
Assessment Types	Mode of Assessment A- Continuous Comprehensive Assessment (CCA) Theory – 25 Marks Practical – 15 Marks
	B. Semester End Examination Theory Very short answer questions /MCQ (10 out of 12) 10 X 1=10 Marks Short Answer Questions (6 out of 9) 6 X 5 = 30 Marks Essay (1 out of 3) 1 X 10 = 10 Marks Total – 50 Marks Practicals Practical /Industrial visits Record/Lab report= 10 Marks Presentation of Report and viva on any automated or AI driven system in Aquaculture = 10 Marks Identification of drones/ASV/AUV with principle = 10 Marks Viva = 5Marks Total – 35 Marks

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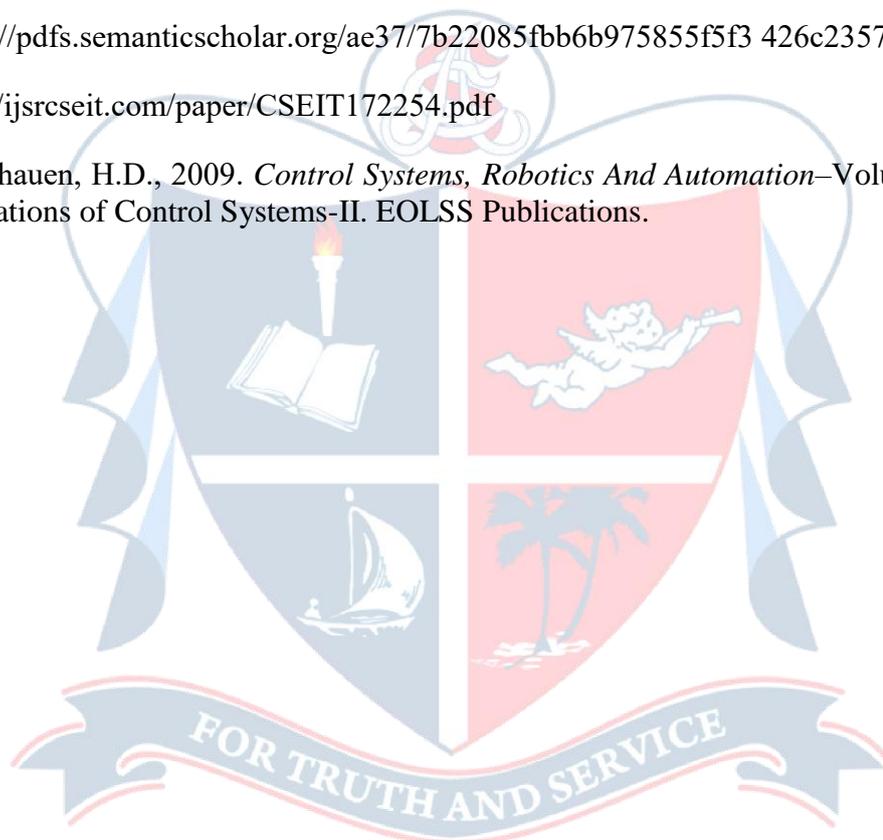
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Suggested Reading

- Balchen, J.G. (Ed), 1986. *Automation and Data Processing in Aquaculture: Proceedings of the IFAC Symposium*, Trondheim, Norway, 18-21 August 1986 (Ifac Symposia Series) 1stEdition
- <https://www.eolss.net/Sample-Chapters/C18/E6-43-35-05.pdf>
- <https://www.sciencedirect.com/science/article/pii/S0144860994000021>
- <https://pdfs.semanticscholar.org/ae37/7b22085fbb6b975855f5f3426c2357294be9.pdf>
- <http://ijsrseit.com/paper/CSEIT172254.pdf>
- Unbehauen, H.D., 2009. *Control Systems, Robotics And Automation–Volume XIX: Industrial Applications of Control Systems-II*. EOLSS Publications.



PROJECT EVALUATION GUIDELINES

1. All students shall prepare and submit project report as part of the programme. The project has to be undertaken on an individual basis.
2. The general guidelines of the Regulations shall apply for both Internal and External Evaluations of Project Report.
3. The Project shall be done under the supervision and guidance of faculty of the Department.
4. Students shall submit the report in the prescribed format before the commencement of the end semester examination of the eighth semester. Internal assessment shall be based on completion of the project, following the norms prescribed in general guidelines.
5. The area of project shall be related to Aquaculture/Fish and Fishery Biology/ related fields/socially relevant topics related to Aquaculture/Fisheries etc. Topics may also be selected with the help of linkages with industry or policy making bodies.
6. The student shall submit copies of the project report, either printed or typed.. The report may be hard bound or soft bound or spirally bound and the printing can be either double sided or single sided. A softcopy of the report shall also be submitted to the department.
7. The report shall contain the following:
 - Title page with topic, details of the student with register number, supervisor details and month and year of submission.
 - Certificate from Supervising teacher and counter signed by the Head of the Department with department seal.
 - Declaration by the student which shall include plagiarism details also. The relevant guidelines issued by the UGC and the University shall be strictly adhered to.
 - Acknowledgement
 - Contents
 - Preferably 5 chapters with
 - Chapter 1** Introductio to the Topic
 - Chapter 2** Literature Review
 - Chapter 3** Materials and Methods/ Methodology

Chapter 4 Results/Relevant Findings

Chapter 5 Discussion, Conclusion, Suggestions etc.

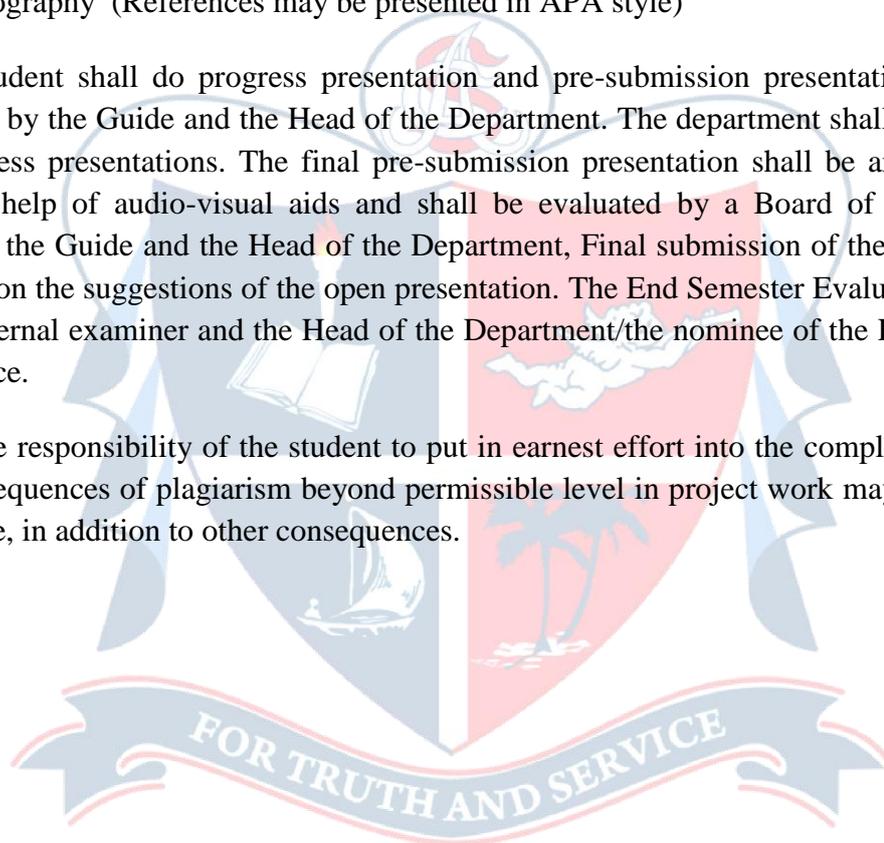
Guidelines regarding chapterisation are not absolute and may be altered according to topic/presentation convenience.

-Appendix (Questionnaire/Schedule , Secondary data used for analysis, Statistical calculation details etc)

-Bibliography (References may be presented in APA style)

8. The student shall do progress presentation and pre-submission presentations, which will be evaluated by the Guide and the Head of the Department. The department shall decide the dates of the progress presentations. The final pre-submission presentation shall be an open presentation with the help of audio-visual aids and shall be evaluated by a Board of Internal Examiners including the Guide and the Head of the Department, Final submission of the project report shall be based on the suggestions of the open presentation. The End Semester Evaluations shall be done by an external examiner and the Head of the Department/the nominee of the HoD. There shall be a viva voce.

9. It is the responsibility of the student to put in earnest effort into the completion of the project. The consequences of plagiarism beyond permissible level in project work may result in failure of the course, in addition to other consequences.



EVALUATION CRITERIA

PROJECT EVALUATION

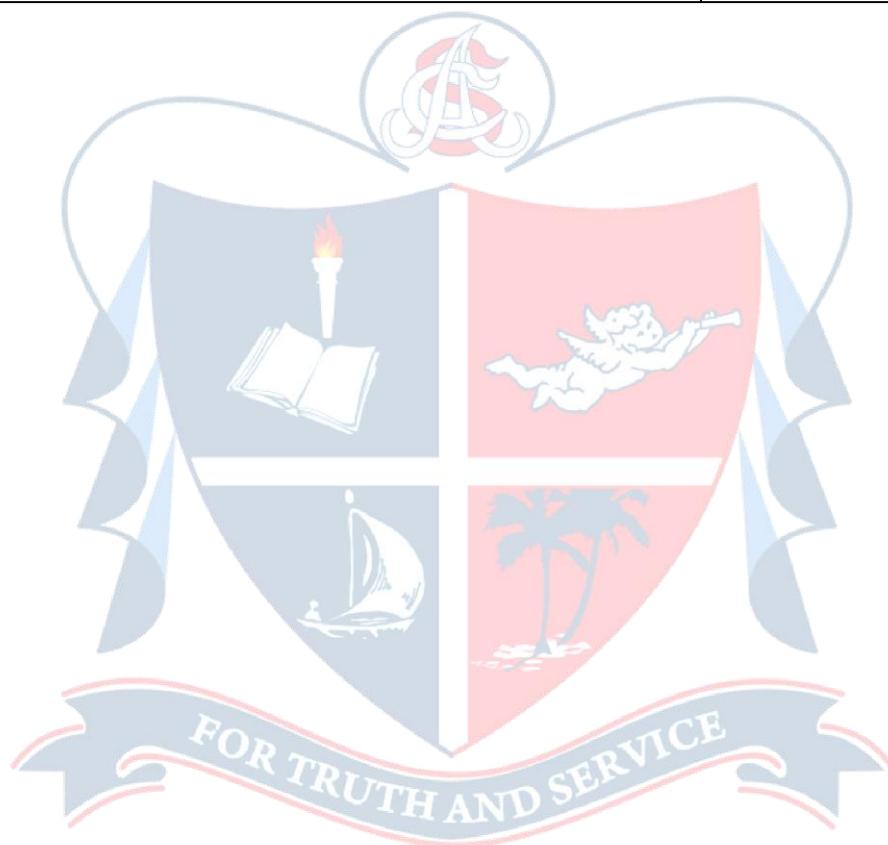
1. Project with 12 Credits (200 marks)

1. Internal Evaluation (60 marks)		
i)	Initiative and Independence	10 Marks
ii)	Technical Skill	10 Marks
iii)	Communication Skills	10 Marks
Iv	Professionalism	10 Marks
v)	Presentation	20 Marks
If the student is doing the project in an external Institution, the internal marks may also be obtained from the Project Supervisor		
2. Final Evaluation (140 Marks)		
i)	Abstract	5 Marks
ii)	Novelty of the work	5 Marks
iii)	Experimental/Project Design	25 Marks
iv)	Literature Survey	10 Marks
v)	Results and Discussion	40 Marks
vi)	Presentation of the work	40 Marks
vii)	Viva - voce	15 Marks

2. Project with 8 Credits (100 Marks)

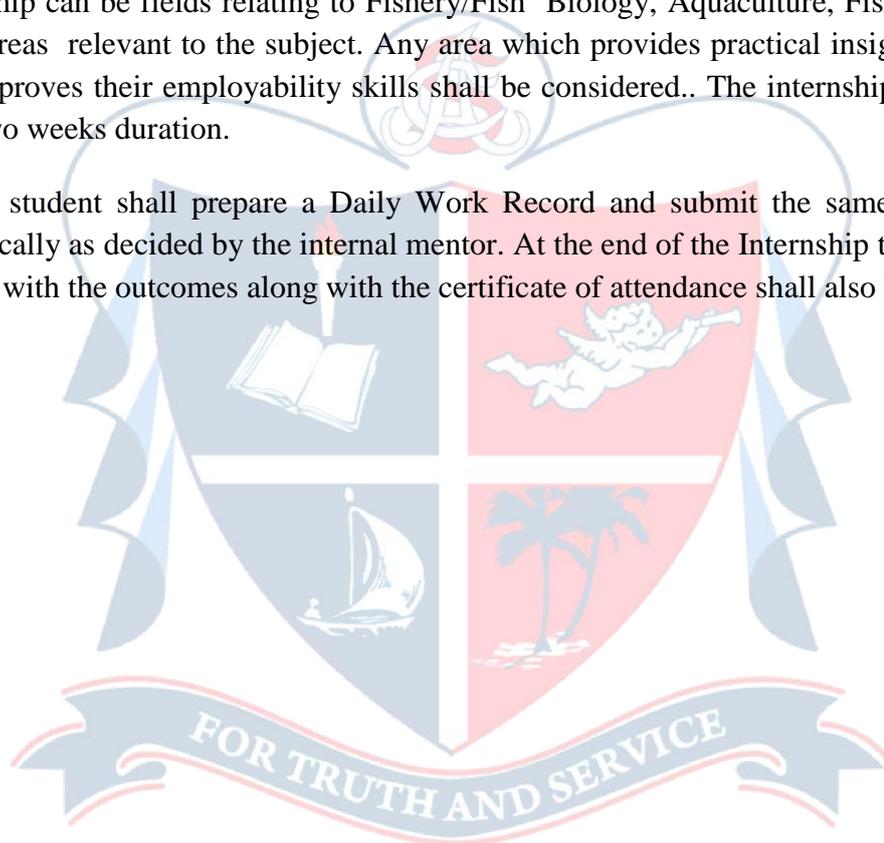
1. Internal Evaluation (30 marks)		
i)	Initiative and Independence	5 Marks
ii)	Technical Skill	5 Marks
iii)	Communication Skills	5 Marks
Iv	Professionalism	5 Marks
v)	Presentation	10 Marks
If the student is doing the project in an external Institution, the internal marks may also be obtained from the Project Supervisor		

2. Final Evaluation (70 Marks)		
i)	Abstract	10 Marks
ii)	Novelty of the work	5 Marks
iii)	Experimental/Project Design	10 Marks
iv)	Literature Survey	10 Marks
v)	Results and Discussion	10 Marks
vi)	Presentation of the work	15 Marks
vii)	Viva - voce	10 Marks



INTERNSHIP EVALUATION GUIDELINES

1. 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 after completion of the fourth semester.
2. The Department shall approve the institution/organisation where every student is planning for internship. Internal mentors shall be assigned to the students for necessary guidance.
3. The nature of the work shall depend on the type of organisation selected. The area of internship can be fields relating to Fishery/Fish Biology, Aquaculture, Fish Processing or any other areas relevant to the subject. Any area which provides practical insights for the students and improves their employability skills shall be considered.. The internship will be of not less than two weeks duration.
4. The student shall prepare a Daily Work Record and submit the same to the department periodically as decided by the internal mentor. At the end of the Internship tenure, an Internship Report with the outcomes along with the certificate of attendance shall also be submitted.



EVALUATION SCHEME (Total 50 Marks)**1. Internal Evaluation (15 Marks)**

(Internal marks may be obtained from the organization/Institution , where the student is doing internship in the following format.*

B.Sc. Aquaculture Student Evaluation form for Internship**Internship Details**

Student Name:

Date of Evaluation:

Duration of Internship:

Mentor Name:

Instructions: Please rate the student's performance based on their abilities, skills and behavior during the Internship.

1. Technical Skills and Problem Solving : 3 Marks
2. Communication Skills and Collaboration : 3 Marks
3. Professionalism : 3 Marks
4. Adaptability : 3 Marks
5. Overall Performance : 3 Marks

Total (out of 15)

Comments and Recommendations: (Provide specific comments on the student's strengths, areas for improvement and any additional feedback or recommendation for their future development)

Mentor Signature: (Insert Mentor's Signature)

Date: (Insert date of Evaluation)

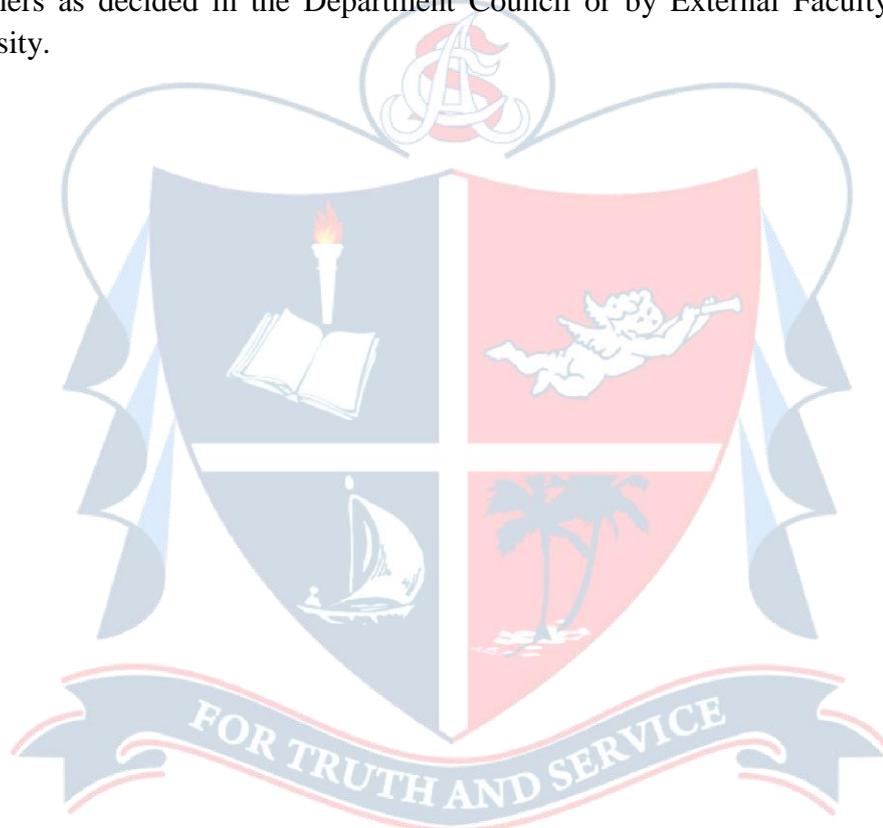
* In case, it is not possible to get an evaluation report from the organization/Institution, where the internship is done, the CCA or Internal Evaluation shall be based on the Daily Work Record and Attendance. It shall be evaluated by the Internal Mentor and Head of the Department.

2. End Semester Evaluation (35 Marks)

1. Internship Report Evaluation – 15 Marks

2. Presentation and Viva - 20 Marks

The evaluation of the report and presentation/viva shall be done by a Board of Internal Examiners as decided in the Department Council or by External Faculty as decided by the University.



STUDY TOUR

A Study Tour of minimum three days duration is recommended by the Board of Studies, during the third year of the B.Sc. Honours programme. The Tour may be undertaken to public Aquariums, Aquaculture farms, Fish Processing and Aquaculture related enterprises/Industries/locations or to reputed Government/ Private institutions/organizations related to the subject. The objectives of the study Tour are

- 1. Enhancing learning:** Study tours can bring classroom concepts to life by allowing students to see and experience them firsthand. This can lead to a deeper understanding of the material and a stronger memory of what is learned
- 2. Developing critical thinking:** Being exposed to new environments and cultures can challenge students to think outside the box and consider different perspectives.
- 3. Building practical skills:** Study tours can provide opportunities for students to develop practical skills that may be difficult to learn in a classroom setting, such as communication, teamwork, and problem-solving.
- 4. Increasing engagement:** A change of scenery from the traditional classroom can boost student engagement and motivation.

A study tour can be valuable learning experiences that complements classroom instruction and helps students develop a well-rounded understanding of the subject matter.

