Annamalai University
(Accredited with ‘A’ Grade by NAAC)

B.VOC (AQUACULTURE)
(Three – Year) Programme

Regulations & Curriculum
2019-2022

CAS in Marine Biology
FACULTY OF MARINE SCIENCES
These Academic regulations shall be called Annamalai University, Faculty of Marine Sciences “B.Voc Academic Regulations 2019” for obtaining Bachelor’s Degree in the Faculty of Marine Sciences. These Regulations are common to all the students admitted to the Three-Year Bachelor’s Programme in the Faculty of Marine Sciences from the academic year 2019-2022 onwards.

1. Definitions and Nomenclature

1.1 University refers to Annamalai University.

1.2 Department means any of the academic departments and academic centres at the University.

1.3 Discipline refers to the specialization or branch of knowledge taught and researched in the Marine Sciences.

1.4 Programme encompasses the combination of courses and/or requirements leading to a Degree. For example, B.Voc, B.Sc., B.A

1.5 Course is an individual subject in a Programme. Each course may consist of Lectures/Tutorials/Laboratory work/Seminar/Project work/Experiential learning/ Report writing/viva-voce etc. Each course has a course title and is identified by a course code.

1.6 Curriculum encompasses the totality of student experiences that occur during the educational process.

1.7 Syllabus is an academic document that contains the complete information about an academic Programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.

1.8 Academic Year refers to the annual period of sessions of the University that comprises two consecutive semesters.

1.9 Semester is a half-year term that lasts for a minimum duration of 90 days. Each academic year is divided into two semesters.

1.10 Choice Based Credit System A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree Programme.

1.11 Core Course is mandatory and an essential requirement to qualify for the Degree.

1.12 Elective Course is a course that a student can choose from a range of alternatives.

1.13 Value-added Courses are optional courses that complement the students’ knowledge and skills and enhance their employability.
1.14 **Credit** refers to the quantum of course work in terms of number of class hours in a semester required for a Programme. The Credit value reflects the content and duration of a particular course in the curriculum.

1.15 **Credit Hour** refers to the number of class hours per week required for a course in a semester. It is used to calculate the credit value of a particular class.

1.16 **Programme Outcomes (POs)** are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a Programme.

1.17 **Programme Specific Outcomes (PSOs)** are statements that list what the graduate of a specific Programme should be able to do at the end of the Programme.

1.18 **Learning Objectives also known as Course Objectives** are statements that define the expected goal of a course in terms of demonstrable skills or knowledge that will be acquired by a student as a result of instruction.

1.19 **Course Outcomes (COs)** are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.

1.20 **Grade Point Average (GPA)** is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3

1.21 **Cumulative Grade Point Average (CGPA)** is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters.

1.22 **Letter Grade** is an index of the performance of a student in a particular course. Grades are denoted by letters S, A, B, C, D, E, RA, and W.

2. Programmes Offered and Eligibility Criteria

<table>
<thead>
<tr>
<th>Faculty of Marine Sciences</th>
<th>B.Voc Aquaculture</th>
<th>A pass in HSC (Academic) / HSC (Vocational) from Tamilnadu state board or its equivalent thereto.</th>
</tr>
</thead>
</table>

2.1 In the case of SC/ST and Differently-abled candidates, a pass is the minimum qualification for the above Programme.

3. Reservation Policy

Admission to the various programmes will be strictly based on the reservation policy of the Government of Tamil Nadu.

4. Programme Duration
4.1 The Three Year Undergraduate Programme consist of three academic years.

4.2 Each academic year is divided into two semesters, the first being from July to November and the second from December to April.

4.3 Each semester will have 90 working days (18 weeks).

5. Programme Structure

5.1 The Three Year Undergraduate Programme consists of Core Courses, Elective Courses (Departmental & Interdepartmental) and Project.

5.2 Core courses

5.2.1 These are a set of compulsory courses essential for each Programme.

5.2.2 The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

5.3 Elective courses

5.3.1 Department Electives (DEs) are the Electives that students can choose from a range of Electives offered within the Department.

5.3.2 Interdepartmental Electives (IDEs) are Electives that students can choose from amongst the courses offered by other departments of the same faculty as well as by the departments of other faculties.

5.3.3 Each student shall take a combination of both DEs and IDEs.

5.4 Experimental Learning

5.4.1 Experimental Learning provides opportunities to students to connect principles of the discipline with real-life situation.

5.4.2 In-plant training / field trips / internships / industrial visits 3as applicable) fall under this category

5.4.3 Experimental learning is categorized as core

5.5 Project

5.5.1 Each student shall undertake a Project in the final semester.

5.5.2 The Head of the Department shall assign a Research Supervisor to the student.

5.5.3 The Research Supervisor shall assign a topic for research and monitor the progress of the student periodically.

5.5.4 Students who wish to undertake project work in recognised institutions/industry shall obtain prior permission from the University. The Research Supervisor will be from the host institute, while the Co-Supervisor shall be a faculty in the parent department.

5.6 Value added Courses (VACs)
5.6.1 Students may also opt to take Value added Courses beyond the minimum credits required for award of the Degree. VACs are outside the normal credit paradigm.

5.6.2 These courses impart employable and life skills. VACs are listed in the University website and in the Handbook on Interdepartmental Electives and VACs.

5.6.3 Each VAC carries 2 credits with 30 hours of instruction, of which 60% (18 hours) shall be Theory and 40% (12 hours) Practical.

5.6.4 Classes for a VAC are conducted beyond the regular class hours and preferably in the II and III Semesters.

5.7 Online Courses

5.7.1 The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

5.7.2 Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

5.8 Credit Distribution

The credit distribution is organised as follows:

<table>
<thead>
<tr>
<th>Core Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective courses</td>
<td>24</td>
</tr>
<tr>
<td>Project</td>
<td>12</td>
</tr>
</tbody>
</table>

| Total (Minimum requirement for award of Degree) | 90-95* |

*Each Department shall fix the minimum required credits for award of the Degree within the prescribed range of 90-95 credits.

5.9 Credit Assignment

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as
1 Lecture period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical/Project period of two or three hours (depending on the discipline) per week over a semester.

6 Attendance
6.1 Each faculty handling a course shall be responsible for the maintenance of *Attendance and Assessment Record* for candidates who have registered for the course.

6.2 The Record shall contain details of the students’ attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organization of lesson plan of the Course Instructor.

6.3 The record shall be submitted to the Head of the Department once a month for monitoring the attendance and syllabus coverage.

6.4 At the end of the semester, the record shall be duly signed by the Course Instructor and the Head of the Department and placed in safe custody for any future verification.

6.5 The Course Instructor shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

6.6 Each student should have at least 75% attendance in the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination. The student has to redo the semester in the next year.

6.7 Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC

7 Mentor-Mentee System

7.1 To help the students in planning their course of study and for general advice on the academic Programme, the Head of the Department will attach certain number of students to a member of the faculty who shall function as a Mentor throughout their period of study.

7.2 The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.

7.3 The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations, attend campus interviews and participate in extra-curricular activities.

8 Examinations

8.1 The examination system of the University is designed to systematically test the student’s progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).

8.2 There will be two CIA Tests and one ESE in each semester.

8.3 The Question Papers will be framed to test different levels of learning based on Bloom’s taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

8.4 Continuous Internal Assessment Tests
8.4.1 The CIA Tests shall be a combination of a variety of tools such as class test, assignment, seminars, and viva-voce that would be suitable to the course. This requires an element of openness.

8.4.2 The students are to be informed in advance about the assessment and the procedures.

8.4.3 The pattern of question paper will be decided by the respective faculty.

8.4.4 CIA Test – I will cover the syllabus of the first two Units while CIA Test – II will cover the last three Units.

8.4.5 CIA Tests will be for two to three hours duration depending on the quantum of syllabus.

8.4.6 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

8.5 End Semester Examinations (ESE)

8.5.1 The ESE for the first/third semester will be conducted in November and for the second/fourth semester in May.

8.5.2 A candidate who does not pass the examination in any courses of the first, second and third semesters will be permitted to reappear in such course(s) that will be held in April and November in the subsequent semester/year.

8.5.3 The ESE will be of three hours duration and will cover the entire syllabus of the course.

9 Evaluation

9.1 Marks Distribution

9.1.1 Each course, both Theory and Practical as well as Project/Internship/Field work/In-plant training shall be evaluated for a maximum of 100 marks.

9.1.2 For the theory courses, CIA Tests will carry 25% and the ESE 75% of the marks.

9.1.3 For the Practical courses, the CIA Tests will constitute 40% and the ESE 60% of the marks.

9.2 Assessment of CIA Tests

9.2.1 For the CIA Tests, the assessment will be done by the Course Instructor

9.2.2 For the Theory Courses, the break-up of marks shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test – I</td>
<td>10</td>
</tr>
<tr>
<td>Test – II</td>
<td>10</td>
</tr>
<tr>
<td>Seminar</td>
<td>03</td>
</tr>
</tbody>
</table>
9.2.3 For the Practical Courses wherever applicable, the break-up of marks shall be as follows:

<table>
<thead>
<tr>
<th>Marks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Test – I</td>
<td>15</td>
</tr>
<tr>
<td>Test – II</td>
<td>15</td>
</tr>
<tr>
<td>Viva-voce and Record</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
</tr>
</tbody>
</table>

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by both External and Internal examiners (Double Evaluation).

9.3.2 In case of a discrepancy of more than 10% between the two examiners in awarding marks, third evaluation will be resorted to.

9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines laid down by the University.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

9.4.3 CIA for Project will consist of a Review of literature survey, experimentation/field work, attendance etc.

9.4.4 The Project Report evaluation and Viva-voce will be conducted by a committee constituted by the Head of the Department.

9.4.5 The Project evaluation Committee will comprise the Head of the Department, Project Supervisor and a senior faculty.

9.4.6 The marks shall be distributed as follows:
9.5 Assessment of Value-added Courses

9.5.1 Assessment of VACs shall be internal.

9.5.2 Two CIA Tests shall be conducted during the semester by the Departments offering VAC.

9.5.3 A committee consisting of the Head of the Department, faculty handling the course and a senior faculty member shall monitor the evaluation process.

9.5.4 The grades obtained in VACs will not be included for calculating the GPA.

9.6 Passing Minimum

9.6.1 A student is declared to have passed in each course if he/she secures not less than 40% marks in the ESE and not less than 50% marks in aggregate taking CIA and ESE marks together.

9.6.2 A candidate who has not secured a minimum of 50% of marks in a course (CIA + ESE) shall reappear for the course in the next semester/year.

10. Conferment of the Bachelor’s Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the Programme and earned the minimum required credits shall be considered to have passed the Bachelor’s Programme.

11. Marks and Grading

11.1 The performance of students in each course is evaluated in terms Grade Point (GP).

11.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed from the first semester to the current semester.
11.3 The GPA is calculated by the formula

\[ \text{GPA} = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}} \]

Where ‘\(C_i\)’ is the Credit earned for the Course \(i\) in any semester;
‘\(G_i\)’ is the Grade Point obtained by the student for the Course \(i\) and
‘\(n\)’ is the number of Courses passed in that semester.

11.4 CGPA is the weighted average Grade Point of all the Courses passed starting from the first semester to the current semester.

Where \(G_G\) is the Credit earned for the course \(G\) in any semester
\(G_G\) is the Grade point obtained by the student for the Course \(G\)
\(G\) is the number of courses passed in that semester
\(G\) is the number of semesters

11.5 Evaluation of the performance of the student will be rated as shown in the Table.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>10</td>
<td>90 and above</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>80-89</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>70-79</td>
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<tr>
<td>C</td>
<td>7</td>
<td>60-69</td>
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<td>D</td>
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<td>55-59</td>
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<td>E</td>
<td>5</td>
<td>50-54</td>
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<td>RA</td>
<td>0</td>
<td>Less than 50</td>
</tr>
<tr>
<td>W</td>
<td>0</td>
<td>Withdrawn from the examination</td>
</tr>
</tbody>
</table>

11.6 Classification of Results. The successful candidates are classified as follows:

11.6.1 For First Class with Distinction: Candidates who have passed all the courses prescribed in the Programme \(in the first attempt\) with a CGPA of 8.25 or above within
the Programme duration. Candidates who have withdrawn from the End Semester Examinations are still eligible for First Class with Distinction (See Section 12 for details)

11.6.2 For First Class: Candidates who have passed all the courses with a CGPA of 6.5 or above.

11.6.3 For Second Class: Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5

11.6.4 Candidates who obtain highest marks in all examinations at the first appearance alone will be considered for University Rank.

11.7 Course-Wise Letter Grades

11.7.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

11.7.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.

11.7.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

11.7.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

11.7.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit if it involves only rewriting/incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

12. Provision for withdrawal from the End Semester Examination

12.1 The letter grade W indicates that a candidate has withdrawn from the examination.

12.2 A candidate is permitted to withdraw from appearing in the ESE for one course or courses in ANY ONE of the semesters ONLY for exigencies deemed valid by the University authorities.

12.3. Permission to withdrawal from the examination shall be granted only once during the entire duration of the Programme.

12.4. Application for withdrawal shall be considered only if the student has registered for the course(s), and fulfilled the requirements for attendance and CIA tests.

12.5. The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations. Notwithstanding the mandatory prerequisite of ten days notice, due consideration will be given under extraordinary circumstances.

12.6 Withdrawal is not granted for arrear examinations of courses in previous semesters and for the final semester examinations.
12.7 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) when the course(s) are offered next.

12.8 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the candidate to qualify for First class with Distinction.

13. **Academic misconduct**

Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students’ work, removing/defacing library or computer resources, stealing other students’ notes/assignments, electronically interfering with other students’/University’s intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitised on issues of academic integrity and ethics.

14. **Transitory Regulations**

Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendation of the Head of the Department concerned.

15. Notwithstanding anything contained in the above pages as Rules and Regulations governing the Two year Master’s Programme at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendation of the Academic Council.
FIRST YEAR -FIRST SEMESTER

<table>
<thead>
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<th>Code</th>
<th>Subjects</th>
<th>Period / Week</th>
<th>Exam Duration</th>
<th>Marks</th>
<th>Total Marks</th>
<th>Credits</th>
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</thead>
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<td></td>
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<td>P</td>
<td>CA</td>
<td>FE</td>
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<td>AQCP 107</td>
<td>Practical II (Covering course AQCC 103)</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
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<tr>
<td>AQCP 108</td>
<td>Practical III (Covering course AQCC 104)</td>
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<td>0</td>
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<tr>
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<td>Practical IV (Covering course AQCC 105)</td>
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<td>0</td>
<td>6</td>
<td>3</td>
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<tr>
<td></td>
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<td>18</td>
<td>325</td>
<td>675</td>
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<th>Period / Week</th>
<th>Exam Duration</th>
<th>Marks</th>
<th>Total Marks</th>
<th>Credits</th>
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<tr>
<td></td>
<td></td>
<td>L  T  P</td>
<td>CA FE</td>
<td></td>
<td></td>
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<tr>
<td>AQCC 201</td>
<td>Soft Skill &amp; Personality development</td>
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<td>Brackish water Aquaculture and Mariculture</td>
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<td>100</td>
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<td>Hatchery Technology in Aquatic organisms</td>
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<td>3</td>
<td>25</td>
<td>100</td>
<td>3</td>
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<td>AQCC 204</td>
<td>Freshwater aquaculture</td>
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<td>Culture of Live fish Food Organisms</td>
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<td>Practical V (Covering course AQCC 201)</td>
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<td>40</td>
<td>100</td>
<td>2</td>
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<tr>
<td>AQCP 207</td>
<td>Practical VI (Covering course AQCC 202)</td>
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<td>100</td>
<td>2</td>
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<tr>
<td>AQCP 208</td>
<td>Practical VII (Covering course AQCC 203)</td>
<td>0  0  3</td>
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<td>40</td>
<td>100</td>
<td>2</td>
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<tr>
<td>AQCP 209</td>
<td>Practical VIII (Covering course AQCC 204)</td>
<td>0  0  3</td>
<td>3</td>
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<td>100</td>
<td>2</td>
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<tr>
<td>AQCT 210</td>
<td>Apprenticeship/ training</td>
<td>0  0  6</td>
<td>3</td>
<td>40</td>
<td>100</td>
<td>6</td>
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<tr>
<td></td>
<td>Total credit</td>
<td>16  0  18</td>
<td></td>
<td>325</td>
<td>1000</td>
<td>30</td>
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SECOND YEAR - THIRD SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Subjects</th>
<th>Period / Week</th>
<th>Exam Duration</th>
<th>Marks</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td>L  T  P</td>
<td>CA FE</td>
<td></td>
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<td>AQCC 301</td>
<td>Disaster Management</td>
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SECOND YEAR - FOURTH SEMESTER
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**THIRD YEAR –FIFTH SEMESTER**

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_Electives:_
1. Fish Immunology
2. Marine Biology
3. Aquaculture in Reservoir

### THIRD YEAR – SIXTH SEMESTER

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**Total credit**: 16 0 18 325 675 1000 30

**Elective Subjects**:
1. Fish Microbiology and Quality Assurance
2. Disease Management in Aquaculture
3. Fish Preservation Technology

**Note**:
1. Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available.
# Elective Courses

## Department Electives (DE)

<table>
<thead>
<tr>
<th>S.No.</th>
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<th>Marks</th>
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<td>2.</td>
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<td>3.</td>
<td>Aquaculture in Reservoir</td>
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<td>5.</td>
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<tr>
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## Inter Departmental Electives (IDE)

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<td>AQCC 201</td>
<td>Soft Skill &amp; Personality Development</td>
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Programme Outcomes

| PO1: | The Faculty of Marine Sciences will endeavor to continue a world class Bachelor vocational program in Aquaculture with experts in the subject areas being taught, including the recent research areas and are passionate when working with students in undergraduate and post graduate levels. |
| PO2: | The Marine Science faculty will continue to review, update and revise the curriculum to ensure the quality of syllabus in commendable level. |
| PO3: | Students graduating with a Bachelor degree in Aquaculture should be skilled in the advance level of marine sciences. |
| PO4: | Students graduating with a Bachelor degree in Aquaculture will be trained to involve in higher education and other job opportunities. |
| PO5: | Students graduating in Aquaculture with bachelor level dissertation work/pre research experience will ensure their future become a good Researcher and also Field Experts. |

Programme Specific Outcomes

At the end of the Programme, the student will be able to

| PSO1: | Impart the complete knowledge about the fundamentals of Marine Sciences including the Farm Engineering, Biology of Cultivable Species and Marketing techniques. |
| PSO2: | Explore the basics of Marine Biology along with aquaculture and also Disease management in Aquaculture, Fish Processing Technology. |
| PSO3: | Taught the Hatchery Technology in Aquaculture, Aquatic organisms in both Fresh and Marine Water, Culture of Live Fish food organisms and also Feed Management in Aquaculture. |
| PSO4: | Gain the knowledge about the taxonomy of marine organisms by using the conventional method and advanced level of molecular methods. |
| PSO5: | Prepare the students not only the biological information and train the various techniques/instruments viz., Samplers, different nets, Soil Sampler, pH meter, DO meter, Seichi disc, Spectrometer, Gel Doc, HPLC, FTIR etc. |
| PSO6: | Carry out the various experiments for water quality, enumerate the primary producers, different disease diagnostic techniques in Aquaculture, different types of feed and their palatability tests, probe development and microbial identification. |
| PSO7: | Practice the students with proficient in culture of marine organisms, utilization of marine resources to make as an entrepreneur and also to learn about Food technology aspects. |
Course Objectives

- To enhance communications skill of the learners
- To familiarize the essay writing and the construction of sentences
- To enhance capacity of the students on the letter writing skill

Learning Outcomes

- Communicative skills enhancement in real life situations.
- Students will equip with oral communication skills
- Communicative English in general will support the students with basic communication.

UNIT I READING

Definition of reading, Levels of reading- Requirements of Reading- Types of Reading- Techniques of reading- Academic reading tips- Exercise.

UNIT II WRITING


UNIT III LISTENING SKILLS

Types of Listening- Objectives- Active Listening- an Effective Listening Skill- Note Taking Tips- Barriers for Good Listening. Purpose of Listening, Outlines and Signposting- Gambits- Exercise.

UNIT IV COMMUNICATION SKILLS

Communication Skills- Speaking Skills, Definition- Barriers of Communication- Types of Communication- Exercise.

UNIT V APTITUDE

Verbal and Numerical aptitude- Notes to be made from listening short lectures. Adapting to corporate life- Corporate Etiquette- Grooming and Dressing- Organizing and Attending Meetings- Facing Interviews.

TEXT BOOKS


REFERENCE BOOK

**Course Outcomes**

At the end of the course, the student will be able to

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<th>To understand the definition of Reading, Different techniques in Reading, Levels of Reading and also Academic Reading.</th>
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<tbody>
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<td>CO2</td>
<td>To understand the Listening skills – Barriers to Listening, Signposting, Gambits.</td>
</tr>
<tr>
<td>CO3</td>
<td>To understand the different tips of writing like Essay writing, Thesis writing, Abstract writing, and also Linkage and Cohesion.</td>
</tr>
<tr>
<td>CO4</td>
<td>To understand the communication skills i.e. Speaking, different barriers of Speaking.</td>
</tr>
<tr>
<td>CO5</td>
<td>To understand the different Numerical and Verbal Aptitude. Grooming and Dressing – Attending meeting and how to face interviews.</td>
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**Outcome Mapping**

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<th>PO4</th>
<th>PO5</th>
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Course objectives
- To induce motivation, self-esteem and leadership quality among the learner.
- To enhance the individuals to set goals and handle depression, fear and failures.
- To develop an individual’s personality thereby making them optimistic.

Learning outcomes
- This study by the end will raise students with good leadership qualities.
- It increases positive thinking and strength in handling fear and failure.
- The person comes out with a strong vision towards life with a good personality.

UNIT I SELF ESTEEM AND PERSONALITY DEVELOPMENT

UNIT II POSITIVE THINKING
Right perception of life—emphasize good things—transform from soft to tough minded individuals—weak to strong men/women

UNIT III MOTIVATION AND GOAL SETTING
Concept of motivation—energizing and directing efforts for goal—enhance motivation desires and aspirations—different types of goals—importance of pursuit of personal goals setting, goals—striving for goals

UNIT IV COPING WITH DEPRESSION, FEAR AND FAILURE
Depression—nature—symptoms and causes—ways to overcome depression—types of failure—understanding failures—handling fear—overcoming failure and fear—understanding anger—hindering anger to achieve goals—coping with failures

UNIT V LEADERSHIP
Leadership—nature and types—characteristics of good leadership—leadership role—courage and confidence.

TEXT BOOK

REFERENCE BOOKS
**Course Outcomes**
At the end of the course, the student will be able to

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<th>To understand the Self Esteem and Personality development Strengths and Weaknesses. Dos and Don’ts to Develop.</th>
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<tbody>
<tr>
<td>CO2</td>
<td>To understand the perception of life transforming from soft to tough mind and also Weak to Strong men/women.</td>
</tr>
<tr>
<td>CO3</td>
<td>To understand the Concept of goals, goals setting and striving for goals.</td>
</tr>
<tr>
<td>CO4</td>
<td>To understand how to cope with depression, fear and failure.</td>
</tr>
<tr>
<td>CO5</td>
<td>To understand the leadership qualities and the courage of a good leader.</td>
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**Outcome Mapping**

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<th>CO/PO</th>
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**Semester I**

**AQCC 103 INTRODUCTION TO COMPUTER**

**Credits:** 3

**Hours:** 3
Course Objective

- To familiarize the students with Fundamentals of Computer and IT applications
- To expose the students to various operating systems and its working.
- To enlighten the students on basic technological tools used related to biology.

Learning Outcomes

- Students enhance their programming fundamentals
- Familiarizing with MS Office
- Handle various trends in computer communication

UNIT I INTRODUCTION TO COMPUTERS


UNIT II COMPUTER ACCESSORIES

Input Devices: Mouse, Keyboard, Light pen, Track Ball, Joystick, MICR, Optical Mark reader and Optical Character reader. Scanners, Voice system, Web, Camera.


Memory and Mass Storage Devices; Characteristics of Memory Systems; Memory Hierarchy; Types of Primary Memory; RAM and ROM; Secondary and Back-up; Magnetic Disks, Characteristics and classification of Magnetic Disk, Optical Disk, Magnetic Tape.

UNIT III MS WORD


UNIT IV MS EXCEL & POWER POINT


Presentation using MS-PowerPoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

UNIT V COMPUTER COMMUNICATIONS

Introduction, Objectives. Basic of Computer Networks: Local Area Network (LAN), Wide Area Network (WAN). Internet: Concept of Internet, Applications of Internet, Connecting to the Internet, Troubleshooting, World Wide Web (WWW), Web Browsing Software, Popular Web Browsing Software.
Basics of E-mail: What is an Electronic Mail, Email Addressing, Using E-mails: Opening Email account, Mailbox: Inbox and Outbox, Creating and Sending a new E-mail, Replying to an E-mail message, forwarding an E-mail message, Sorting and Searching emails.

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

<p>| CO1: | To understand the Basics of Computers like Introduction to computers, Input and Output devices, Applications of Computers. |
| CO2: | To understand the techniques of MS Word Creating and Editing Document and also different shortcuts, Mail merge, Macros etc. |
| CO3: | To understand the MS Excel and MS Power point i.e. different formulas in Excel and also creating tables, and also slide presentation. |
| CO4: | To understand the different accessories used in computers i.e. Light pen, Mouse etc. |
| CO5: | To understand the communication in Computers LAN, WAN, MAN and also Internet, E-mail. |</p>
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Semester I  AQCC 104 BIOLOGY OF CULTIVABLE SHELL AND FIN FISHES

Credits: 3
Hours: 3

Course Objectives

- Ensure active student participation in activities connected with basic aquaculture practices.
Provide basic understanding of biological, chemical and environmental concepts pertaining to aquatic environment.

Acquaint students with various fisheries institutions and their activities.

Learning Outcomes

- At the end of the study students will be equipped with basic aquacultural practices.
- Acquire clear knowledge about the taxonomy of the culturable fishes
- Knowledge on the biology and feeding habits of the species would be learnt by the students

UNIT I GENERAL CHARACTERISTICS AND TAXONOMY OF FISHES


UNIT II FEEDING AND GROWTH

Feed and feeding habits – herbivores, carnivores and omnivores. Feeding adaptations methods employed in the study of gut content analysis volumetric, gravimetric etc. Age and growth – Techniques used in the study: use of scales and otoliths, length frequency analysis. Length weight relationship. Equations used for deriving growth rates.

UNIT III DIGESTION, RESPIRATION AND CIRCULATION


UNIT IV REPRODUCTION


UNIT V MIGRATION


TEXT BOOKS

4. S.S. Khanna. An Introduction to Fishes, Surjeet Publications was launched in 1976 by the enterprising Surjeet Singh Chhabra.

REFERENCE BOOKS
1. Francis Day, The fishes of India, publication info: London B Quaritch, 1876.

Course Outcomes
At the end of the course, the student will be able to
Course Objectives

To understand the general characters and classification of Fishes, Crustaceans and Molluscs.

To understand the different food and feeding habitats, Age and growth determination in Fishes.

To understand the different metabolic activities like digestion, respiration and excretion in fishes, Crustaceans and Molluscs.

To understand the Maturation, Spawning and Fecundity in Fishes.

To understand the Parental care, Breeding and Migration in Fishes.

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Semester I

AQCC 105 PRINCIPLES AND METHODS IN AQUACULTURE

Credits: 3
Hours: 3

Course Objectives
➢ To understand the principles involved in Aquaculture.
➢ To familiarize the various methods employed in the field of Aquaculture
➢ Basic knowledge about the pond ecology, types of ponds and Mariculture practices exists both in India and also in the world.

Learning Outcomes

✓ The learner will gain a thorough knowledge on the principles and methods involved in aquaculture.
✓ Students will acquire clear knowledge about the methods employed in aquaculture systems
✓ The controlled ecosystem dynamics would be clear to the students

UNIT I INTRODUCTION

History, definition, scope and significance of aquaculture, comparison of aquaculture with Agriculture and commercial fisheries. Different aquaculture system. Aquaculture – Global and Indian Scenario.

UNIT II POND ECOLOGY

General concepts of ecology, productivity, carrying capacity, food chain and food web. Ecology of culture ponds. Nutrient cycles--Nitrogen Phosphorous and carbon. Laws of limiting factor. Fertilization and manuring. Liming and application of fertilizers and manures, role of nutrients, the NPK contents of various fertilizers and manures, rate and precautions in the application of fertilizers and manures. Significance and important groups of phytoplankton, zooplankton and benthos in culture ponds. Nutrient dynamics, algal blooms. Selection of site, physico-chemical conditions of soil and water optimum for culture. Management of water and soil quality parameters. Correction of pH, measures for increasing the concentration of oxygen and reducing the concentration of ammonia and hydrogen sulphide.

UNIT III TYPES OF PONDS

Types of ponds – hatching, nursery, rearing, stocking and brood stocks – construction and management of culture system. Size and depth of ponds, maintenance of ponds – positioning of different types of ponds in a fish farm.

UNIT IV CULTIVABLE FRESHWATER FISHES

Criteria for the selection of species. Cultivable freshwater fishes- carps, air breathing fishes, tilapia, freshwater prawn.

UNIT V BRACKISH WATER CULTURE AND MARICULTURE

Brackishwater resources and fishes of commercial importance – Milk fish, mullet, pearl spot, Seabass, shrimps, crabs; selection of site. Major brackish water culture system in India. Different organisms in Mariculture – mussel, edible oyster, pearl oyster and sea weeds.

TEXT BOOKS

Course Outcomes
At the end of the course, the student will be able to
| CO1: To understand the History, Significance and Scope of Aquaculture, different Aquaculture Practices. |
| CO2: To understand the general concepts of Ecology, Biogeochemical cycles, Fertilization and manuring, physico chemical parameters of Soil and water. |
| CO3: To understand the different types of ponds, positioning and maintenance of ponds. |
| CO4: To understand the criteria for selection of species and cultivable fresh water fishes. |
| CO5: To understand the brackish water and marine water cultivable fishes and culture practices. |

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Semester-I AQCP 106 Practical – I (Covering course AQCC 101&102)

Credits: 2
Hours: 3
1. Improving pronunciation through tongue twisters.
2. Just a minutes session: Speaking Extempore for one minutes on given topics
3. Conversation classes on contemporary issues
4. Reading aloud of newspaper headlines and important articles.
5. Mannerism or Etiquette.
6. Group Discussion
7. Letter drafting
8. Report writing on a topic
9. Writing of corporate CVs
10. PPT presentation on selected issues
11. Tips to face the interviews
12. Mock Interview sessions

Semester-I AQCP 107 PRACTICAL – II (Covering course AQCC 103)

1. Different components of Taskbar
2. Create Desktop icons & Folder and Files on Desktop
3. Run Application such as Notepad, MS Paint
4. Change Mouse properties in Windows
5. Connecting to the Internet, applying browsers software such as chrome, Internet Explorer
6. Applying software download
7. Create E-mail ID in a mail server, sending E-mail and working with Inbox
8. Create Bio data in word
9. Formatting text in Word
10. Create excel database, apply auto sum
11. Create presentation file with multiple slides
12. Apply slide transition and animation
13. Importing and exporting of files
14. Conversion of file from one format to other (.doc to pdf, .jpeg to pdf, etc.)

Semester-I AQCP 108PRACTICAL – III (Covering course AQCC 104)

Practical

Semester-I AQCP 109 PRACTICAL - IV (Covering course AQCC 105)

Soil characteristics: texture – soil trigon method, total organic carbon, soil pH, npk, hydrogen sulphide content, bulk density, water quality parameters analysis: do, salinity, bod, ammonia, h2s, ph, hardness, alkalinity, nitrate, nitrite; plankton – collection, identification and estimation of primary productivity, farm equipment/instruments – pumps, aerator, feeding tray, refractometer, handheld phenosecchi disc, cast net, cast net efficiency, identification of commercially important phytoplankton and zooplankton, identification of cultivable and commercially important fresh, brackish and marine water fin and shell fishes, identification of aquatic weeds, pellet feeds – types and formulation, types of lime used in aquaculture practice.

Semester II AQCC 201 SOFT SKILL AND PERSONALITY DEVELOPMENT

Credits: 3
Hours: 3
Course Objective
➢ To enhance holistic development of students and improve their employability skills.

Learning Outcomes
✓ Enhance the students Communication ability
✓ Developing the professionals with idealistic, practical and moral values.
✓ Enhance their interpersonal skills and be an effective goal oriented team player.

UNIT I LISTENING SKILLS
Barriers to listening; effective listening skills; feedback skills. Attending telephone calls; note taking. Activities: Listening exercises - Listening to conversation, News and TV reports. Taking notes on a speech / lecture.

UNIT II SPEAKING AND CONVERSATIONAL SKILLS
Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics. The study of sounds of English, stress and intonation. Situation based Conversation in English.

UNIT III ESSENTIALS OF SPOKEN ENGLISH
Activities, Making conversation and taking turns, Oral description or explanation of a common object, situation or concept, giving interviews.

UNIT IV PRESENTATION SKILL
Oral Presentation with/without audio visual aids. Group Discussion. Listening to any recorded or live material and asking oral questions for listening comprehension.

UNIT V PERSONALITY DEVELOPMENT

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to
CO1: To understand the skills of Listening and Barriers to Listening, effective listening skills.
CO2: To understand the Speaking and Conversation skills, components of a full conversation.
CO3: To understand the essentials of Spoken English and giving interviews.
CO4: To understand the Presentation skills, oral presentation and asking questions.
CO5: To understand the personality development like attitude, Motivation etc.

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Semester II  AQCC 202 BRACKISH WATER AQUACULTURE AND MARICULTURE

Credits: 3
Hours: 3

Objectives

- To provide basic biology of the species used for brackish water aquaculture and Mariculture.
- To give an introduction to brackish water aquaculture practices.
- To provide a basic idea about various Mari culture practices.
Learning Outcomes

✔ Knowledge on the biology and biological cycle of the brackish water & marine cultivable species will be learnt.
✔ Knowledge on the brackish water culture practices will be learnt by the student.
✔ Knowledge on the Mari culture will be learnt by the student.

UNIT I INTRODUCTION
Introduction, history, development and present status of Brackishwater farming in India. Brackishwater as a medium for aquaculture, ecological factors – abiotic and biotic factors. Selection of site, general planning and design of brackish water farms. Aquaculture systems: traditional (pokkali, bheries, gazanis, khazans), semi-intensive, intensive aquaculture

UNIT II BRACKISHWATER
Finfish Culture Selection of cultivable species in brackish water systems, their biology and culture practices – monoculture and polyculture of – Chanoschanos, Mugilcephalus, Latescalcarifer. Nursery, rearing and grow out in ponds, cages and pens.

UNIT III CRUSTACEAN CULTURE
Species of shrimps cultured in Brackishwater and their biology – Penaeusmonodon, Penaeusindicus, Litopenaeusvannamei. Extensive, semi-intensive and intensiveshrimp farming practices. Crab culture (Scylla serrata, Scylla oceamica and Charybdis sp.): Pond design, management of crab farm, fattening process of crab, economics-cage culture and pen culture

UNIT IV MOLLUSCS AND SEAWEED CULTURE
Culture of clams, cockles, edible oyster, pearl oyster and mussel, economic importance of mollusks- Seaweeds Culture, criteria for selection of candidate species in India, biology – life history, growth, reproduction of Ulva, Laminaria, Gracilaria and other economically important of seaweeds.

UNIT V MARICULTURE

TEXT BOOKS
Course Outcomes
At the end of the course, the student will be able to

<p>| CO1: | To understand the Introduction to Brackish water aquaculture and different types of Aquaculture systems. |
| CO2: | To understand the different species cultured in Brackish water aquaculture and their culture practices. |
| CO3: | To understand the Crustacean species cultured in Aquaculture, their Biology and their |</p>
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Semester II  AQCC 203 HATCHERY TECHNOLOGY IN AQUATIC ORGANISMS

Credits: 3
Hours: 3

Course Objectives
- To understand the current methodology and various techniques of commercial seed production.
- To develop basic knowledge on the spawning, larval rearing and feeding of the commercially important species.
- Hatchery management strategies.

Learning Outcomes
Knowledge on the biology and biological cycle of the brackish water & marine
cultivable species will be learnt.
Knowledge on the brackish water culture practices will be learnt by the student.
Knowledge on the Mari culture will be learnt by the student.

UNIT I FIN AND SHELL FISH BREEDING
Fresh water and marine fish seed resources. Natural breeding of finfishes. Selection of
riverine spawn collection sites, gears used and methods of collection. Study of maturity
stages in fish. Calculation of fecundity. Brood stock maintenance and selection of fin and
shell fish brooders. Natural seed resources, site selection and collection methods. Life cycle
of important shellfish (Penaeus monodon, P. indicus, Macrobrachium rosenbergii, Scylla
serrata, lobster, edible, oyster, pearl oyster, fresh water mussel.

UNIT II CARP HATCHERY
Hatchery management-seed production of carps. Hypophysation of Indian major carps and
exotic carps, history of hypophysation. Pituitary gland. Collection and preservation of
gland. Other ovulating agents. Brood stock management, sexing, dosage for injection,
mechanism of ovulation. Development of carp eggs, different carp hatcheries. Nursery
rearing of carp seed.

UNIT III CARP PRODUCTION SYSTEM AND SEED PRODUCTION OF OTHER FISHES
Production of common carp seeds, breeding techniques. Sundanese, Tjimindi, Rantjapaku
and Central Sumatra methods. Methods followed in China and India. Transport of fish
seed and brood fishes. Causes of mortality during transport, techniques of transport, open
and closed systems, methods of transportation, use of anesthetics. Carp seed resources in
major rivers. Bundh breeding, types of bundh breeding techniques. Problems of
bundh breeding. Seed production and nursery rearing of Clarias batrachus, Mugil cephalus,
Lates calcarifer.

UNIT IV SEED PRODUCTION OF CRUSTACEANS AND MOLLUSKS
Seed production and nursery rearing of Penaeus indicus, Penaeus monodon and
Macrobrachium rosenbergii. Hatchery operations of pearl oysters, clams, crabs, lobster.

UNIT V HATCHERY MANAGEMENT AND DESIGN OF SHRIMP HATCHERIES
Components and general design of hatcheries. Selection criteria for broodstock and brood
stock management. Water quality monitoring and management. Quarantine and disease
management in hatcheries. Various components, equipment's and infrastructure facilities
required in hatchery. Mechanical and biological filters.

TEXT BOOKS
5. Jhingran, V.G. Fish and Fisheries of India. Hindustan Publishing CorporationIndia,
   1982


REFERENCE BOOK

Course Outcomes
At the end of the course, the student will be able to

| CO1: | To understand the Breeding of Fin and Shell fishes. |
| CO2: | To understand the seed production and Hatchery management of Carps. |
| CO3: | To understand the production of Common carp seeds and other fishes, their breeding techniques. |
| CO4: | To understand the seed production of Crustaceans and mollusks and also hatchery operations. |
| CO5: | To understand the hatchery management and the design of shrimp hatcheries. |

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Course Objectives

- To understand the techniques involved in freshwater aquaculture practices.
- To get a detailed information about freshwater aquaculture.
- To provide a basic idea about the importance of live feed in culture systems.

Learning Outcome

✓ The learners will be aware of all the techniques involved in freshwater aquaculture.
✓ At the end of the course student can able to gain the knowledge on the fresh water aquaculture practices
Knowledge on the culture systems will be learnt by the student

UNIT I FRESHWATER FISH CULTURE
Various freshwater organisms used for aquaculture in India. Culture of Carps - Nursery rearing and stocking ponds – composite fish culture, Preparation of ponds – different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting. Culture of air breathing fishes – Channa, Heteropneustes, Clarias, Anabas. Culture of Cold water fishes in India.

UNIT II CULTURE OF PRAWNS, MOLLUSCS AND FROG
Cultivable species of freshwater prawns and their biology – culture of Macrobrachium rosenbergii. Freshwater pearl culture – present status of freshwater pearl culture and production in India.

UNIT III AQUACULTURE FOR STABLE ENVIRONMENT
Sewage fed fish culture, sewage treatment, - Sewage cum fish culture in India. Fish in relation to public health- Larvivores fishes and mosquito eradication using fishes.

UNIT IV RESERVOIR FISHERIES
Major reservoirs in India, measures for increasing production from reservoirs in India and abroad, Game fishery.

UNIT V INTEGRATED FARMING
Recent development in integrated farming - Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and pig cum fish culture. Organic aqua farming. Fish culture in cages and pens. Running water fish culture. Fish culture in cages and pens, race way, indoor tanks, canals, silo culture and Aqua ponics. Monoculture, polyculture, composite fish culture.

TEXT BOOKS
5. A.B. Chaudhuri – Aquaculture, Limnology, and Ichthyology, Daya Publishing House, Year 2009

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

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<th>To understand the different fresh water organisms and their culture practices.</th>
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Semester II  AQCC 205 CULTURE OF LIVE FISH FOOD ORGANISMS

Credits: 3  Hours: 3

Course Objectives
- To provide basic biology of the species used for brackish water aquaculture and mariculture.
- To give an introduction to brackish water aquaculture practices.
- To provide a basic idea about various Mari culture practices.

Learning Outcomes
- Knowledge on the biology and biological cycle of the brackish water & marine cultivable species will be learnt.
Knowledge on the brackish water culture practices will be learnt by the student.
Knowledge on the Mari culture will be learnt by the student.

UNIT I
Candidate species of Bacterioplankton, phytoplankton and zooplankton as live food organisms for fresh, brackish and marine fin and shell fishes.

UNIT II

UNIT III
Biology- reproduction and feeding habits of zooplankton-culture requirements of important live feed organisms- infusoria-rotifers-cladocerans-tubifex, copepods, oligochaetes, and insect larvae.

UNIT IV

UNIT V
Culture of chironomids-Culture of Earthworms-Bait fish and forage fish- Tropic potentials of different fish food organisms- Maggot production - proximate composition of fresh water and marine species of live feed.

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

| CO1: | To understand the different live food organisms for the culture of Fresh, Brackish water and marine fishes. |
| CO2: | To understand the mass culture of diatoms, dianoflagellates and periphyton. |
| CO3: | To understand the Biology, reproduction and feeding habits of Zoo plankton. |
| CO4: | To understand the biology and economic significance of Artemia, biology and mass culture of Polychaetes. |
| CO5: | To understand the culture of Earthworms, Bait fish and Forage fish, Chironomids. |

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Semester-IIAQCP 206 PRACTICAL- V (Covering AQCC 201)

Credits: 3
Hours: 6

1. Classroom technique to improve the soft skills
2. Surprise writing on current issues
3. General grooming sessions to face the interview
4. Group discussions
5. Motivational classes to improve communication and confidence power
6. Team project on personality development
7. Presentation through visual aids
8. News reading
9. Dialogue delivery
10. Change project

Semester-II AQCP 207 PRACTICAL - VI (Covering AQCC 202)

Credits: 3
Hours: 6

Semester-II AQCP 208 – Practical – VII (Covering AQCC 203)

Credits: 1
Hours: 2

Semester II AQCP 209 – Practical – VIII (Covering AQCC 204)

Credits: 1
Hours: 2

Semester II AQCP 209 – Practical – VIII (Covering AQCC 205)

Credits: 1
Hours: 2

Methods of isolation and identification of different live feed organisms (Bacterioplankton, microalgae, phytoplankton, zooplankton. Blue green algae - spirulina - green algae - diatoms - flagellates, bio-film, peri-phyton and bio-flock. Laboratory scale culture (batch and continuous) selected live feed organism - Evaluation of live feed organisms - Decapsulation technique and hatching method of brine shrimp cysts. Infusoria-rotifers-cladocerans-tubifex, copepods, oligochaetes, and insect larvae. chironomids- Culture of Earthworms-Bait fish culture, maggot culture

Semester III AQCC 301 DISASTER MANAGEMENT

Credits: 3
Hours: 3

Course Objectives

➢ To understand disaster risk, improving disaster risk governance and mitigation
➢ Disaster reduction and disaster preparedness, early warning and restoration in the aftermath of a disaster.
➢ To enlighten the learner with relief, restoration and rehabilitation which lies as the basic of disaster management.

Learning Outcomes
Knowledge about the disaster in the coastal region and its mitigation measures
Knowledge about the coping mechanisms
Knowledge about the relief restoration and rehabilitation in the affected regions

UNIT I BASIC CONCEPTS
Basic concepts: Hazard, risk, vulnerability, disaster, capacity building. Multi-hazard and disaster vulnerability of India.

UNIT II VARIOUS DISASTERS
Types of natural and manmade hazards in fisheries and aquaculture - cyclones, floods, droughts, tsunami, El-nino, algal blooms, avalanches, pollution, habitat destruction, over fishing, introduction of exotic species, landslides, epidemics, loss of bio-diversity etc. Causes, characteristics and impact of various disasters.

UNIT III DISASTER MANAGEMENT STRATEGIES
Management strategies: pre-disaster, during disaster and post-disaster. Pre-disaster: prevention, preparedness and mitigation; different ways of detecting and predicting disasters; early warning, communication and dissemination, community based disaster preparedness, structural and non-structural mitigation measures.

UNIT IV RESPONSE AND RECOVERY SYSTEMS
During disaster: response and recovery systems at national, state and local, coordination between different agencies, international best practices. Post-disaster: Methods for assessment of initial and long term damages, reconstruction and rehabilitation.

UNIT V AGENCIES IN DISASTER MANAGEMENT
Prevalent national and global management practices in disaster management. Agencies involved in monitoring and early warnings at district, state, national and global levels. Sea safety and health.

TEXT BOOKS

Course Outcomes
At the end of the course, the student will be able to:

| CO1 | To understand the Basic concepts of Disaster. |
| CO2 | To understand the various types of Disaster – Natural and manmade hazards in Aquaculture and fisheries. |
| CO3 | To understand the Disease management strategies. |
| CO4 | To understand the response and recovery systems during the disaster. |
**Course Objectives**

- To provide a basic understanding about fish nutrition.
- Provide the knowledge on the Fish feeding physiology, nutritional requirements.
- Providing the basic knowledge on the feed composition, formulation of nutritionally balanced feed, production and use of live feed for optimal production.

**Learning Outcomes**

- Clear knowledge about the fin and shell fish nutrition.
- Knowledge about the feed ration and ratio in aquaculture system.
 Knowledge on the physiology of fish feeding and nutritional requirements will be learnt by the students.

UNIT I BASIC PRINCIPLES OF NUTRITION
Basic principles of nutrition for fishes and shrimps. Natural foods and artificial feeds, comparison between the feeding of terrestrial animals and fish and prawns.

UNIT II NUTRITIONAL REQUIREMENTS
Nutritional requirements of cultivated fishes and shrimps; energy, proteins, carbohydrates, fats, fiber, minerals and vitamins. Digestion, assimilation and conversion of feed: FCR, biological value etc.

UNIT III FEED FORMULATIONS
Feed formulations, feeds for fish and prawn larval stages, juveniles, grow out stages, brood stock etc., pelleted feeds, additives, preservatives, attractants and Probiotics and feed production.

UNIT IV FEED PRESERVATION AND FEEDING MANAGEMENT
Feed storage, Methods of Feeding- Feeding Devices-Demand feeder- Electrically operated automatic feeders- Pneumatic-type automatic feeders- Hydraulic - type automatic feeders- Feeding carts- Feeding boats- Feeding devices for wet or moist feeds. Feeding techniques, rations for cultivated fish and prawns, feed management aspects, nutritional pathology.

UNIT V TYPES OF FEEDS
Different Forms of Feeds - Feeds based on life-cycle of fish- Product quality feeds- Larval feeds- Flakes- Farm-made feeds -Feed additives- Binders- Antioxidants-Enzymes-Pigments- Growth promoters -Feed stimulants- Immunostimulants- Non-conventional feed ingredients and anti-nutritional factors- Digestive enzyme, digestibility and factors affecting digestibility- Protein digestion- Fat digestion- Carbohydrate Digestion- Microbial digestion- Factors affecting digestibility.

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

| CO1: To understand the basic principles of Nutrition for Fishes and Shrimps. |
| CO2: To understand the nutritional requirements of Cultivable fishes and shrimps |
| CO3: To understand the feed formulations. |
| CO4: To understand the feed preservation and feed management. |
| CO5: To understand the different types of feeds. |

Outcome Mapping

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### Course Objectives

- To introduce the learner to various types of fisheries
- To study the riverine, reservoir and estuarine fishery resources
- To understand pelagic and demersal marine fishery resources

### Learning Outcome

- At the end of the study the learners will be highly equipped with various types of fishery.
- Student learns the knowledge on the inland fishery resources.
- Student learns the knowledge on the pelagic and demersal fishery resources.

### UNIT I RIVERINE AND COLDWATER FISHERIES
Inland fish production in India- Riverine fisheries – major river systems in India, capture fisheries, fishing methods, recent statistics of catches, problems encountered in fisheries development of major rivers. Cold water fisheries- major rivers and species – problems encountered in fisheries development of rivers supporting cold water fisheries.

UNIT II RESERVOIR AND ESTUARINE FISHERIES

UNIT III MARINE FISHERIES- PELAGIC RESOURCES
Marine fishery resources in India- important fishing zones including Wadge bank, maritime states. Major pelagic resource groups- sardines, mackerel, anchovies, ribbon fishes, tuna and seer fishes. Methods of fishing - Recent catch statistics of pelagic fisheries.

UNIT IV MARINE FISHERIES- DEMERSAL RESOURCES
Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources. Methods of fishing, recent catch statistics. Fishery of mud banks.

UNIT V MARINE FISHERIES - DEEP SEA RESOURCES

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

| CO1 | To understand the riverine ad cold water fisheries. |
| CO2 | To understand the Reservoir and Estuarine fisheries. |
| CO3 | To understand the Pelagic resources in the Marine Environment. |
CO4: To understand the Demersal resources in the Marine Environment.
CO5: To understand the Deep sea resources in the Marine Environment.

Outcome Mapping

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Learners will have a detailed knowledge on the aquatic environment, its structure and function.
Determinative familiarity with the biotic and abiotic components will be gathered.
Information on biodiversity, pond ecosystem and its interactions will be obtained.

UNIT I ECOLOGY
Definition; Ecological Hierarchy; Subdivisions of Ecology, Ecosystem: Principles and concepts; Examples of Ecosystems: Ponds, Lakes, Rivers, Estuary, mangrove, corals,
UNIT II STRUCTURE AND FUNCTION OF ECOSYSTEMS

Energy flow: Definition; Laws of Thermodynamics; Energy Environment; Concepts of Productivity; Measurement of primary productivity; Trophic Levels, and Examples; Ecological Pyramids. Biogeochemical Cycles: Patterns and Basic types, cycling of Organic nutrients; Pathways, limiting factors and governing laws. Ecological Indicators.

UNIT III COMMUNITY ECOLOGY:

The biotic community, Concepts of habitat and ecological Niche; Natural Selection; Ecological Dominance; community analysis; species diversity in communities; patterns in communities, ecotones, Population ecology: population group properties, population density and indices of relative abundance. Types of interaction - animal Association-Symbiosis, commensalisms, parasitism, etc.

UNIT IV COASTAL ECOSYSTEMS

Coastal Zone and its classification. Estuaries - classification; physico-chemical factors; biota and productivity; example of some Indian estuaries. Mangroves-definition, mangrove plants, factors affecting distribution. Mangrove flora and fauna.
The sea shore: The Inertial Zone, factors affecting life on shore, nature of substratum, physical factors, zonation, fauna and flora on a rocky shore, sandy shore, and muddy shore.

UNIT V CONSERVATION OF HABITATS


TEXT BOOKS


REFERENCE BOOKS


Course Outcomes

At the end of the course, the student will be able to

| CO1: | To understand the definition of Ecology and Ecosystem. |
| CO2: | To understand the structure and components of Ecosystem. |
| CO3: | To understand the ecology of different communities. |
| CO4: | To understand the different coastal ecosystems. |
CO5: To understand the conservation of Habitats – Endangered species.

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Semester III AQCC 305 SOIL AND WATER QUALITY MANAGEMENT

Credits: 3
Hours: 3

- To study the aquaculture pond dynamics
- To understand the pond soil and water characteristics and their optimum requirements to increase the productivity of the ponds.

Learning Outcomes
- Clear knowledge about the water quality parameters required for the different aquaculture system
- By the end learners will get acquainted with the aquaculture pond dynamics.
- Knowledge about the pond bottom soil quality and its management

UNIT I HYDROLOGY
Water temperature, turbidity, pH, conductivity, Salinity, chlorinity, dissolved oxygen, free carbon dioxide, alkalinity, hardness, nitrates, nitrites, phosphates and ammonia etc.

UNIT II ANALYTICAL METHODS

UNIT III SOIL CHARACTERISTICS

UNIT IV SOIL MANAGEMENT
Properties of water logged soils, acidic and alkaline soils, amelioration of problem soils, and management of water and soil quality for aquaculture.

UNIT V SOIL AND WATER AMENDMENTS

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

| CO1 | To understand the different parameters of Water – Temperature, pH, Turbidity, Chlorinity etc. |
| CO2 | To understand the analytical methods of water quality parameters. |
| CO3 | To understand the different characteristics of soil |
| CO4 | To understand the soil management. |
| CO5 | To understand the amendments of soil. |

Outcome Mapping

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Semester-III AQCP 306 – Practical – IX(Covering AQCC 302)

Credits: 3

Hours: 6


Semester-IIIAQCP 307 – Practical – X(Covering AQCC 303)

Credit: 1

Hours: 2

Demonstration of laboratory glassware, equipment and analytical instruments. Preparation of solutions, collection, preservation and analysis of water samples. Measurement of temperature, turbidity, pH, Salinity chlorinate, dissolved oxygen, free carbon dioxide, total
alkalinity, total hardness, nitrates and phosphates. Collection and processing of soil samples; analysis of soil conductivity, soil texture, soil pH, organic carbon, available and total nitrogen, available phosphorus and lime requirement.

Semester-III AQCP 307 – Practical – XI (Covering AQCC 303)
Credit: 1
Hours: 2
Visit to inland and marine fish landing centres; sampling, collection and familiarization of commercially important groups viz., marine and freshwater teleost, elasmobranchs, crustaceans, mollusks and seaweeds; observation and analysis of marine catches by major crafts and gears; observation and analysis of species composition of commercial inland fish catches at landing and assembling centres; observation and experimental operations of selected fishing gears in inland / estuarine waters; Maintenance of records of marine and inland fish catch data; GIS and Remote Sensing in capture fishery.

Semester-III AQCP 307 – Practical – XII (Covering AQCC 304)
Credit: 1
Hours: 2
Course Objectives

- To introduce the accounting and financial aspects of aquaculture
- To study the aquaculture marketing strategy
- To study the knowledge centres and its role in the access to the aquaculture

Learning Outcomes

- Knowledge about the financing in fisheries and aquaculture sector
- Students will gather interest and knowledge on marketing strategy and entrepreneurship
- Clear knowledge about the entrepreneurial nuances of fishery and allied sectors

UNIT I ACCOUNTING AND FINANCE

Taking decision on starting a venture; Assessment of feasibility of a given venture/new venture; Approach a bank for a loan; Sources of financial assistance; Making a business proposal/Plan for seeking loans from financial institution and Banks; Funds from bank for
capital expenditure and for working; Statutory and legal requirements for starting a
cOMPANY/VENTURE;

UNIT II MARKETING & NEGOTIATIONS/STRATEGY

Assessment of market demand for potential product(s) of interest; Market conditions,
segments; Prediction of market changes; Identifying needs of customers including gaps in
the market, packaging the product; Market linkages, branding issues; Developing
distribution channels; Pricing/Policies/Competition; Promotion/ Advertising; Services
Marketing

UNIT III INFORMATION TECHNOLOGY

How to use IT for business administration; Use of IT in improving business performance;
Available software for better financial management; E-business setup, management.

UNIT IV HUMAN RESOURCE DEVELOPMENT (HRD)

Leadership skills; Managerial skills; Organization structure, pros & cons of different
structures; Team building, teamwork; Appraisal; Rewards in small scale set up.

UNIT V FUNDAMENTALS OF ENTREPRENEURSHIP & ROLE OF KNOWLEDGE CENTRE
AND R&D

Support mechanism for entrepreneurship in India, Knowledge centres like universities and
research institutions; Role of technology and up gradation; Assessment of scale of
development of Technology; Managing Technology Transfer; Regulations for transfer of
foreign technologies; Technology transfer agencies.

TEXT BOOKS

   International Perspective- Concepts, Theories and Cases, Edward Elgar Publishing
   Limited.

   media LLC, 294pp.

Course Outcomes
At the end of the course, the student will be able to

| CO1: | To understand the Accounting and Finance, starting a venture. |
| CO2: | To understand the Marketing and Negotiations/ strategies. |
| CO3: | To understand the Information technology for Business administration, Importance of IT. |
| CO4: | To understand the leadership qualities, Team work qualities, managerial skills. |
| CO5: | To understand the Fundamentals of Entrepreneurship, Role of Knowledge center, R&D. |

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Course Objectives

- To acclimatize the students to the basic concepts of genetics and biotechnology.
- To provide basic idea about the principles of genetics and depict the hereditary mechanism in cultured species.
- To acquaint with the state of the art techniques in biotechnology and its application in aquaculture sector.

Learning Outcomes

- Knowledge on heredity determination will be learnt.
- Principles of Biotechnology and its applications in the aquaculture will be learnt
- Student will learn the concept of Mendelian genetic principles.

UNIT I BASIC GENETICS


UNIT II BREEDING AND QUARANTINE

UNIT III HYBRIDIZATION
Cryopreservation of gametes. Cross breeding (hybridization) – types of cross breeding, heterosis and design of cross breeding programmes, hybridization in different fishes.

UNIT IV GENETIC MANIPULATION

UNIT V BIOTECHNOLOGY

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

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Course Objectives

- To understand the various types of diseases among the cultivable fin and shell fishes
- To learn and apply methods to control and disease preparedness strategy in the field
- To understand recent tools for diagnosis and disease management strategies.
- To understand the role of environment as an important player in infectious diseases in the controlled environment

Learning outcomes

- Knowledge on the aquatic diseases will be obtained.
- Students will have an idea on precautionary measures to be adopted in case of infection to prevent the spread of the disease.
- Students will gain knowledge on the disease diagnostic tools.

UNIT 1: PATHOLOGY AND PARASITOLOGY

UNIT II FUNGAL AND VIRAL DISEASES
Fungal diseases (finfish) – Saprolegniosis, brachiomycosis, ichthyporous diseases. Lagenidium diseases – Fusarium disease Viral diseases (finfish) – IPN, IHN, Viral Hemorrhagic Septicaemia, Spring Viremia of carps – Major CCVD, Carp lymphocytes. Major shrimp viral diseases – Baculoviruspenaeii, MonodonBaculovirus, Bacculoviral midgut necrosis, IHNV, Hepatopancreatic parvo like virus, Yellow head bacculovirus, white spot bacculovirus.

UNIT III BACTERIAL, PROTOZOAN AND METAZOAN DISEASES
Common bacterial diseases (Enteric red mouth disease, Bacterial cold water disease furunculosis, vibriosis, dropsy and Gill and fin rot) their diagnosis and treatment. Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis. Metazoan Diseases- diseases caused by annelids, helminthes, crustaceans and molluscs.

UNIT IV NUTRITIONAL DISEASES AND IMMUNOLOGY

UNIT V FISH HEALTH MANAGEMENT

TEXT BOOKS


REFERENCE BOOKS


Course Outcomes

At the end of the course, the student will be able to

| CO1: | To understand the Introduction to pathology and parasitology – Fish diseases. |
| CO2: | To understand the different types of Fungal and diseases in Fin fishes in Aquaculture. |
| CO3: | To understand the Bacterial, Protozoan and Metazoan diseases in Aquaculture. |
| CO4: | To understand the Nutritional diseases and Immunology. |
| CO5: | To understand the Management of Fish diseases. |

Outcome Mapping

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Course Objectives

- To empower students with present day technologies involved in fish processing and to provide a firm understanding on the various quality requirements in seafood processing
- To understand the preservation technology available in the field
- To provide information about the various value added marine food products in the market and also its processing technology

Learning Outcomes

- The ultimate outcome of the study is that the students will get an updated knowledge on fish processing technology
- Knowledge on quality requirements in seafood processing and preservation technology will be learned.
- Students will get to know about the value added marine food products in the market and its processing techniques.
UNIT I INTRODUCTION OF FISH PROCESSING AND FREEZING

UNIT II PRESERVATION TECHNIQUES OF FINFISH/SHELL FISH PROCESSING

UNIT III FISH BY-PRODUCTS
Fish meal. Dry reduction and wet reduction methods - specification - packaging and storage. Fish oil - body oil - liver oil - extraction - purification - preservation - storage - application. Shrimp wastes - chitin - chitosan - production - uses. Fish protein concentrate. Fish hydrolysate, partially hydrolyzed and deodorized fish meat, functional fish protein concentrates and their incorporation to various products.

UNIT IV VALUE ADDED BY-PRODUCTS
Fish silage - acid silage - fermented silage - application. Fish maws, shark leather fish glue, fish gelatin, isinglass, pearl essence, shark fin rays, beach - de - mer. Biochemical and pharmaceutical products. Utilization of seaweeds: agar agar, algin, carrageenan.

UNIT V QUALITY CONTROL

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes

At the end of the course, the student will be able to

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Semester-IV        AQCC 405ANATOMY OF FIN FISH AND SHELL FISH

Credits: 4
Hours: 4

Course Objectives

- To introduce the learner to general morphology and anatomy of fin & Shell fishes
- To study the physiological characteristics of fin & shell fishes
- To provide the knowledge on the anatomy characteristics of the fin & shell fishes

Learning objectives

✓ By the end of the course the students will be equipped with the knowledge of
  morphology and anatomy of fin & Shell fishes.
✓ Knowledge on the physiological characteristics of fin & shell fishes will be learnt by
  the student.
✓ Students will gain knowledge on the anatomical characteristics of the fin and shell
  fish.

UNIT I EXTERNAL ANATOMY

Oral region and its associated structure; Digestive system and its associated glands - Cell
structure, tissue and body organization - External anatomy of teleost; elasmobranch;
crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve
(Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish) - Oral region and its associated

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structures; digestive system and associated digestive glands of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish)

UNIT II CIRCULATORY SYSTEM
Circulatory system of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish)

UNIT III RESPIRATORY AND SKELETAL SYSTEMS
Respiratory system of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish) - Skeletal system of teleost / elasmobranch.

UNIT IV REPRODUCTIVE & EXCRETORY SYSTEMS
Urino-genital system and Endocrine system - Reproductive and Excretory systems (Urino-genital system) of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish) - Endocrine systems of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish).

UNIT V NERVOUS SYSTEM AND SENSE ORGANS
Nervous system of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish) - Sense organs of teleost; elasmobranch; crustacean (Eg. Palaemon prawn / penaeid shrimp), gastropod (Eg. Apple snail), bivalve (Eg. Freshwater mussel) and cephalopod (Eg. Cuttlefish).

TEXT BOOKS

REFERENCE BOOKS

Course Outcomes
At the end of the course, the student will be able to

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Semester-IV                AQCP 406 – Practical – XIII(Covering AQCC 402)

Credit: 1

Hours: 2

1. Collection of fish blood and its analysis.
2. PCR, ELISA and Agarose Gel Electrophoresis.
4. Quantitative and qualitative determination of fish gametes like sperm motility, viability, counts.
6. Demonstration of protocol of androgenesis, gynogenesis and polyploidy.
7. Cryopreservation protocols, Quality evaluation of fish milt.

Semester-IV                AQCP 407 – Practical – XIV(Covering AQCC 403)

Credit: 1

Hours: 2

Collection preservation, Identification of disease causing agents. Preparation of media for culture, Familiarization with techniques of bacterial culture and identification, fungal isolation, characterization. Preparation of the list of chemicals and drugs used to control the diseases and medicines, visit to fish and shrimp farms and Disease diagnostic centers. Collection, preservation and identification of parasites, preparation of case studies of diseased fish and prawns. Study of life-cycle stages. Estimation of dose and administration of various chemicals and drugs. Visit to fish farms. Shrimp farms and diagnosis of diseases.
Semester-IV  AQCP 408 – Practical – XV(Covering AQCC 404)  
Credit: 1  
Hours: 2

Preparation of fish meal, fish liver oil, Agar-agar, fish skin, fish glue, pearl essence, fish sauce, fish and prawn pickles, fish and prawn wafers, fish soup powder, fish cutlets, fish and prawn breaded and battered products, fish protein concentrate, and fish burger. Techniques of fish preservation, Smoking, canning, freezing. HACCP & GMP with SSOP.

Semester-IV  AQCP 409 – Practical – XVI(Covering AQCC 405)  
Credit: 1  
Hours: 2

Dissection of different shellfishes and finfishes to understand their internal organs—digestive, respiratory, excretory, nervous, circulatory and skeletal systems and also on sensory organs. Structure of endocrine glands.

Semester-V  AQCC 501 LIMNOLOGY  
Credits: 4  
Hours: 4

Course Objectives

➢ To learn the ecological functions of inland water bodies
➢ To study the importance of primary productivity and its importance in fresh water bodies
➢ To familiarize the lotic and lentic water bodies and its ecological importance

Learning Outcomes

✓ Clear knowledge on the ecological functions of inland water bodies
✓ Detailed knowledge on primary productivity and its importance in fresh water bodies
✓ Complete knowledge on lotic and lentic water bodies

UNIT I INTRODUCTION TO LIMNOLOGY:
Inland water types, their identities and distribution; ponds and lakes; streams and rivers; dynamics of lentic and lotic environments. Lakes - their origin and diversity. Famous lakes of the world and India; nature of Lake Environment; morphometry, physical and chemical conditions and related phenomena; biological relations: influence
of physical and chemical conditions on living organisms in inland waters.

UNIT II PLANKTON
Planktonic organisms; classification of plankton; distribution of plankton: geographic, vertical, horizontal and seasonal distribution of phytoplankton and zooplankton; seasonal changes of body form in planktonic organisms; food of planktonic organisms. Primary productivity; Aquatic plants: character, classification, zonation, seasonal relations, quantity produced chemical composition distribution in different waters, limnological role.

UNIT III NEKTON:
Composition, distribution, movements. Benthos: classification; periphyton; zonation; distribution; movements and migration; seasonal changes in benthos, profundal bottom fauna.

UNIT IV PRODUCTIVITY
Circulation of food material; classification of lakes based on productivity; laws of minimum; biotic potential and environmental resistance; quantitative relationships in a standing crop; trophic dynamics; successional phenomena; indices of productivity of lakes; artificial enrichment.

UNIT V LOTIC ENVIRONMENTS
Running waters in general; physical conditions; classification of lotic environments, biological conditions; productivity of lotic environments. Influence of currents; plant growth; plankton; nekton; benthos; temporary and head waters streams; ecological succession.

TEXT BOOKS


REFERENCE BOOKS


Course Outcomes

At the end of the course, the student will be able to

| CO1 | To understand the different inland water types: Streams, rivers, lakes and ponds. |
| CO2 | To understand the Plankton, types of plankton and distribution of plankton and Primary production. |
| CO3 | To understand the Nekton – Benthos and Periphyton composition and classification. |
CO4: To understand the classification of lakes and production of lakes.
CO5: To view the different lotic environments.

## Outcome Mapping

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Course Objectives

➢ To learn the biology of commercially important molluscs
➢ To study the molluscan seed resources and production
➢ To familiarize the seaweed culture technology

Learning Outcomes

✓ Detailed knowledge on biology of commercially important molluscs
✓ Clear knowledge on molluscan seed resources and production
✓ Complete knowledge on seaweed culture technology

UNIT 1 BIOLOGY OF MOLLUSKS
Biology of cultivable molluscs – life history, food and feeding, age and growth and reproduction.

UNIT 2 MOLLUSCAN SEED RESOURCES
Seed from Nature Natural seed resources, utilization, and ideal condition for seed fall in nature, distribution of seed, time of seed abundance, seed collection techniques for different species, transportation, seed quality and selection.

UNIT 3 MOLLUSCAN SEED PRODUCTION
Hatchery production of molluscan seed - need for hatcheries for molluscs, brood stock management, induced maturation and spawning, larval rearing & microalgal culture for
feeding spat settlement, ideal spat collectors, rearing of juveniles to stockable size, water quality management, transportation.

UNIT 4 MOLLUSK CULTURE
Culture technology – culture operations, rearing, transportation, monitoring of growth, monitoring of environmental parameters, causes of mortality, different culture techniques and various steps involved in detail and problems encountered on the culture of clams, cockles, edible oyster, pearl oyster and mussel, economic importance of molluscs.

UNIT 5 SEAWEED CULTURE
General introduction to seaweeds – criteria for selection of candidate species in India, biology – life history, growth, reproduction of Ulva, Laminaria, GracilariaKappaphycus. Seaweed culture – technology for higher yields, products from seaweeds (agar, algin and carageenan) and extraction methods.

REFERENCE BOOKS


Course Outcomes

At the end of the course, the student will be able to

| CO1: | To understand the biology of Molluscs, life history, food and feeding, age and growth. |
| CO2: | To understand the Molluscan seeds from natural resources, collection of seeds and transport. |
| CO3: | To understand the hatchery production of Molluscan seed, breeding and spat collection. |
| CO4: | To understand the culture practices of Molluscs. |
| CO5: | To view the culture practices of Seaweeds. |
Outcome Mapping

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Semester-V  AQCC 503 AQUACULTURE ENGINEERING

Credits: 4

Course Objectives

- To understand the knowledge about fish farm survey and measurements
- To learn about the pipes, pumps and water flow
- To familiarize soil character, types and budgeting

Learning Outcomes

✓ Detailed knowledge on fish farm survey and measurements
✓ Clear knowledge on pipes, pumps and water flow
✓ Complete knowledge on soil character, types and budgeting

UNIT I LAND SURVEY
Area calculation of plain surface of regular and irregular shape as applied to measurement of land, trapezoidal rule, Simpson’s rule, volume of regular and irregular shape as applied to the volume of stacks, sheds and heaps.

UNIT II FARM-TYPES
Fresh water and coastal aquafarms. Preliminary survey, site selection, topography. Land survey - chain surveying, compass surveying, leveling, plane table surveying and contour surveying

UNIT III WATER
Introduction – Pipe and pipe parts; Water flow and head loss in channels and pipe systems. Pumps – Types of pumps; Pumping of water requires energy; Centrifugal and propeller pumps; Changing of water flow of pressure; Regulation of flow from selected pumps. Increased focus on water quality; Inlet water; Outlet water; water treatment.
budgeting. Water control structure - types of inlets and outlet. Main feeder channel, drainage channel

UNIT IV AERATION AND RECIRCULATION
Principles, classification and placement. Pumps - types, total head and horse power. Filters - types and construction. Design and construction of aerators - Basic principles; Evaluation criteria; Types of aerator; Oxygenation of water. Recirculation and water use systems - Definitions - Degree of re-use; water exchange in relation to amount of fish; Degree of purification. Components in a re-use system; Instruments and monitoring – Measuring water quality; measuring physical conditions; counting fish; measuring fish size and total fish biomass.

UNIT V SOIL

REFERENCE BOOKS


Course Outcomes

At the end of the course, the student will be able to
CO1: To understand the Land Survey.
CO2: To understand the Fresh water and Coastal Aqua farm types.
CO3: To understand the flow of water, water pipes, types of water pipes, feeding channels.
CO4: To understand the types of Aerators used in Aquaculture.
CO5: To view the types of soils and the characteristics of soil.

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Semester- V AQCP 506 – Practical – XVII(Covering AQCC 501) 
Credit: 1

Hours: 2

1. Determination of physical characteristics of lentic water bodies.
2. Determination of chemical characteristics of lentic water bodies.
3. Determination of physical characteristics of lotic water bodies.
4. Determination of chemical characteristics of lotic water bodies.

Semester- V AQCP 507 – Practical – XVIII(Covering AQCC 502) 
Credit: 1

Hours: 2

2. Identification of commercially important and cultivable molluscs of fresh, brackish and marine waters
3. Farm visit to witness seeding, growth, measurement, thinning, harvesting and in situ measurements of production.
4. Induction of spawning by physical, chemical and biological techniques.
5. Identification of commercially important and cultivable seaweeds.
6. Demonstration of algin and agar extraction.
7. Field visit to observe the culture of seaweeds and the technique of harvest.
8. Submission of field report.

Semester- V AQCP 508 – Practical – IX(Covering AQCC 503)

Credit: 1
Hours: 2
1. Evaluation of potential site for aquaculture.
2. Land survey - chain, compass, level, plane table, and contouring; soil analysis for farm construction.
4. Design and layout of freshwater and brackish water farms and hatcheries.
5. Design of farm structure: ponds, dykes, sluices and channels.
7. Pumps: design and operation.
8. Design and operation of filters and aerators.
9. Visit to different types of farms.

Semester- V AQCP 509 – Practical – XX (Covering AQCC 504 & 505)

Credit: 1
Hours: 2

*Any two practical based on Electives*

**PRACTICALFISH IMMUNOLOGY**


**PRACTICAL MARINE BIOLOGY**

Study of common instruments used for collection of phytoplankton, zooplankton and benthos. Collection, preservation and analysis of phytoplankton, zooplankton, sea weeds, sea grasses, nekton and benthos.

**PRACTICAL AQUACULTURE IN RESERVOIR**

1. Preparation of charts on the present situation of reservoirs.
2. Estimation of reservoir fisheries productivity and diversity
3. Detailed case studies of selected reservoirs

4. Analysis of data on reservoir fisheries.

5. Sustainable development plan for reservoir fisheries.

6. Designs, construction and types of cages and pens

6. Case studies on cage and pen culture in reservoirs.

7. Field visit to a ‘cage culture unit’.

9. Field visit to a ‘pen culture unit’.

10. Identification of candidate species for cage and pen culture.

ELECTIVE - 1 FISH IMMUNOLOGY

Course Objectives

➢ To understand the general concepts of immunology
➢ To study the immune mechanism and the immune-globulins
➢ To acquire knowledge on the immune response and the vaccine development

Learning Outcomes

✓ Clear understanding of immunology
✓ Clear knowledge on immune mechanism and the immune-globulins
✓ Complete knowledge on immune response and the vaccine development

UNIT 1 - GENERAL CONCEPTS IN IMMUNOLOGY
Evolution of immune system in invertebrates and vertebrates. Non-specific defence mechanism in fish - surface barriers, non-specific humoral and cellular factors.

UNIT 2 - IMMUNE DEFENSE MECHANISMS

UNIT 3 - IMMUNOGLOBULIN

UNIT 4 - IMMUNE RESPONSE

UNIT 5 - DEVELOPMENT OF VACCINES
TEXT BOOKS

REFERENCE BOOKS

ELECTIVE - IIMARINE BIOLOGY

Course Objectives

➢ To understand the divisions in marine environment
➢ To study the primary producers and benthic ecosystem of ocean
➢ To study the diversity of nektons and marine mammals

Learning Outcomes

✓ Detailed knowledge on divisions in marine environment
✓ Clear knowledge on primary producers and benthic ecosystem of ocean
✓ Complete knowledge on diversity of nektons and marine mammals

UNIT I INTRODUCTION:
Divisions of marine environment- pelagic, benthic, euphotic, aphotic divisions and their subdivisions. Life in oceans - general account of major groups of phytoplankton and zooplankton and sea weeds. Environmental factors affecting life in the oceans - salinity, temperature, light, currents, waves, tides, oxygen, and carbon dioxide.

UNIT II PLANKTON

UNIT III BENTHOS

UNIT IV NEKTON
UNIT V MARINE MAMMALS

Biology, significance and classification in mammals, adaptation in pinnipids and cetaceans for breeding. Whales- their different community and their characteristic features. Adaptations in marine mammals for conserving body heat and submersion for long dive.

TEXT BOOKS


REFERENCE BOOKS


ELECTIVE - III AQUACULTURE IN RESERVOIR

Course Objectives

➢ To understand the reservoirs of India
➢ To study the fish production and its management in reservoirs
➢ To study the cage, pen and essential infrastructures required for the aquaculture interventions in reservoir

Learning Outcomes

✓ Detailed knowledge on reservoirs and its characters
✓ Clear understanding of fish production trends and its management strategies
✓ Complete knowledge on cage, pen and infrastructures facilities for the interventions

UNIT I INTRODUCTION

Definition of reservoirs in India; nature and extent of reservoirs, topography and species diversity; importance of morpho-edaphic index in reservoir productivity and classification; factors influencing fish production; trophic phases in reservoir; pre-impoundment and post-impoundment stages and their significance in establishment of reservoirs fisheries.

UNIT II FISH PRODUCTION

Salient features of reservoir limnology and their significance to fisheries development; management of small, medium and large reservoirs; present status and future prospects in reservoirs fish production.

UNIT III FISHEIRES MANAGEMENT
Fisheries of some important reservoirs; recent advances in reservoir fisheries management; conservation measures in reservoir fisheries. Fish stocking in Reservoirs

UNIT IV CAGE AND PEN CULTURE
Role of cage and pen culture in enhancement of fish production from reservoirs; history of cage culture, advantages of cage culture; selection of suitable site of cage culture; cage materials, designs, shape, size and fabrication; cage frames and supporting system. Integration of cage culture with other farming systems.

UNIT V INFRASTRUCTURE
History of pen culture, pen materials, fabrication; breeding of fish in pen; rearing of spawn in pen; grow-out from pens. Suitable species for culture in cages and pens; constraints in cage and pen culture; economics of cage and pen culture.

REFERENCE BOOKS

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Semester-VIAQCC 601 ORNAMENTAL FISH BREEDING AND CULTURE

Credits: 4

Hours: 4

Course Objectives

- To give overview on the potential ornamental fishes and their breeding biology
- To develop deep understanding about the various management practices for breeding and rearing of ornamental fishes
- To have a basic understanding of aquarium setting and aquarium infrastructures needed

Learning Outcomes

- Knowledge on the ornamental fish breeding
- Management practices of ornamental fishes
- Knowledge on the aquarium maintenance and accessories

UNIT I INTRODUCTION

UNIT II AQUARIUM MANAGEMENT
Setting up of aquarium – under gravel filter, pebbles, plants, drift wood, ornamental objects and selection of fishes, Quarantine measures. Aquarium maintenance and water

UNIT III FRESHWATER ORNAMENTAL FISHES
Species of ornamental fishes; their taxonomy and biology. Live bearers, Gold fish and koi, Gourami, Barbs and Tetras, angel fish, cichlids. Maturation, secondary sexual characters, breeding habits, spawning, parental are fertilization and development of eggs. Hatching, larval rearing and their health. Freshwater plants – their taxonomy and morphology, multiplication of aquarium plants – different methods.

UNIT IV MARINE ORNAMENTAL FISHES

UNIT V ORNAMENTAL FISH DISEASE MANAGEMENT
Common parasites infecting ornamental fishes. Bacterial, viral, fungal diseases of ornamental fishes and their control and prophylaxis.

REFERENCE BOOKS


Course Outcomes
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Outcome Mapping
Semester-VIAQCC 602 AQUACULTURE EXTENSION AND ECONOMICS

Credits: 4

Hours: 4

Course Objectives

➢ To give overview on the potential ornamental fishes and their breeding biology
➢ To develop deep understanding about the various management practices for breeding and rearing of ornamental fishes
➢ To have a basic understanding of aquarium setting and aquarium infrastructures needed

Learning Outcomes

✓ Knowledge on the ornamental fish breeding
✓ Management practices of ornamental fishes
✓ Knowledge on the aquarium maintenance and accessories

UNIT I INTRODUCTION
Extension education, capture fisheries and culture fisheries extension - concepts, objectives and principles; extension education, formal and informal education; History and role of capture and culture fisheries extension in fisheries sector development.

UNIT II EXTENSION STRATEGIES AND METHODS
Basic concepts in rural sociology and psychology and their relevance in fisheries extension; social change, social control, social problems and conflicts in fisheries; gender issues in fisheries; theories of learning, learning experience, learning situation. Culture and capture fisheries extension methods - individual, group and mass contact methods and their effectiveness, factors influencing their selection and
use.

UNIT II TECHNOLOGY TRANSFER
Characteristics of technology, transfer of technology process; important TOT programs in fisheries; role of BFDA, FFDA, MPEDA, CAA, NGOS and SHGs in fisheries; Fisheries co-management; Adoption and diffusion of innovations, adoption and diffusion process, adopter categories and barriers in diffusion of fisheries innovations.

UNIT IV MARKETING

UNIT V ECONOMICS
Definition, subject matter and scope of economics. Law of diminishing returns, laws of increasing, constant and decreasing utility and returns. Law of equi-marginal returns. Importance of economics in aquaculture development. GDP from fisheries and aquaculture sector, foreign exchange earnings and employment potential of fishery and aquaculture industry.

TEXT BOOKS

REFERENCE BOOKS

2. Scott M. 2001. Distance Education and Distance Learning: A Framework for the Food and Agriculture Organization of the United Nations. Sustainable Development Department, FAO.

Course Outcomes

At the end of the course, the student will be able to

| CO1: | To understand the Introduction to Extension Education. |
| CO2: | To understand the Extension strategies and methods. |
| CO3: | To understand the characteristics of Technology Transfer FFDA, BFDA. |
| CO4: | To understand the Markets and their kinds, importance of MPEDA in Exports and Imports. |
| CO5: | To view the definition and strategies of economics, Law of demand etc. |

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1. Identification of common Fresh water aquarium fishes (20 Nos).
   Construction of aquarium.
3. Setting up of aquarium (maintained by students can be evaluated after one month).
   Water quality management in aquariums.
4. Aquarium plants and décor materials.
5. Air pump and biological filter.
7. Breeding of egg layers- gold fishes

Collection of socio-economic data from fishing villages; study of social
issues/problems through participatory and rapid rural appraisal techniques, stake
holders analysis and needs assessment; assessment of development needs of
community and role of formal and non-governmental organizations through
stakeholder analysis; case studies on social / gender issues and social conflicts in
fisheries. Case studies on extension programs and Success stories Practical exercises on
conducting fish farmers meet. Visit of fishermen co-operative society. Visit to aquaculture

Semester- VI

AQCP 606– Practical – XXIII (Covering AQCC 603 & 604)

Credit: 1

Hours: 2

*Any two practical based on Electives*

**PRACTICAL  FISH MICROBIOLOGY AND QUALITY ASSURANCE**


**PRACTICAL DISEASE MANAGEMENT IN AQUACULTURE**

fish seed identification. Probiotics, Antibiotics, disinfectants, limes, medicated feeds, Antibacterial, antiviral and antifungal drugs in the market. Aqua-shop visit.

PRACTICAL FISH PRESERVATION TECHNOLOGY

1. Determination of moisture content in fish and fishery products
2. General description – freezing
3. Processing of shrimp
4. Filleting of fish
5. Drying of fish
6. Organoleptic analysis of fish
7. Preparation of fishery by products
8. Preparation of shark fin rays fish maws, chitin, fish wafer
9. Fish pickling
10. Value added fishery products, fish curry, cutlets fish finger.
11. Preparation of surimi

ELECTIVE-I FISH MICROBIOLOGY AND QUALITY ASSURANCE

Course Objectives

➢ To give overview on the history and importance of microorganisms in fish foods
➢ To develop deep understanding on intrinsic, extrinsic and food borne pathogens
➢ To have a basic understanding of fish spoilage and fish processing plant sanitation

Learning Outcomes

✓ Knowledge on the history and importance of microorganisms in fish foods
✓ Detailed knowledge on intrinsic, extrinsic and food borne pathogens
✓ Knowledge on fish spoilage and fish processing plant sanitation

UNIT I INTRODUCTION
History of micro-organisms in foods; role and significance of micro-organisms in nature and in foods.

UNIT II MICRO-ORGANISMS IN FISH
Intrinsic and extrinsic parameters of fish that affect microbial growth. Psychrophiles, halophiles and thermophiles, their role in spoilage and food poisoning.

UNIT III FOOD BORNE HUMAN PATHOGENS
Vibrio, E coli, Salmonella, Listeria, Clostridia, Campylobacter, Streptococcus, Faecal Streptococcus, etc. Study of micro-organisms in food by conventional and rapid techniques. Encapsulation - endospores, formation of cell aggregates, Microbial principles of fish preservation and processing. Study of food pathogens, infections, intoxication and other biological hazards like mycotoxins, parasites, viruses, marine toxins, etc.

UNIT IV FISH SPOILAGE
Types of spoilage of fish, semi processed and processed fishery products, Indices of fish sanitary quality, Concept of Quality Management; TQM, SSOP, GMP; ISO and Codex Alimentarius; HACCP, Microbiological standards and criteria, BIS and codex standards

UNIT V FISH PLANT SANITATION
Disinfectants, detergents and cleaning schedule. CIP, Water management in fish processing industries.

TEXT BOOKS

REFERENCE BOOKS

ELECTIVE-I DISEASE MANAGEMENT IN AQUACULTURE

Course Objectives

- To give overview on diseases in aquaculture and its mechanisms
- To develop deep understanding on protozoan, bacterial, viral and fungal diseases in aquaculture system
- To have a basic understanding on the nutritional, parasitic and its preventive measures

Learning Outcomes

- Detailed insights in to diseases in aquaculture and its mechanism
- Clear knowledge on protozoan, bacterial, viral and fungal diseases in aquaculture system
- Knowledge on nutritional, parasitic and its preventive measures

UNIT I FISH DISEASE IN AQUACULTURE

Significance of fish diseases in relation to aquaculture. Disease development process in fish and shellfish. Defense mechanism in finfish and shellfish- specific and non specific immune system. Role of stress and host defense mechanism in disease development. Host, pathogen and environment interaction. Zoonotic diseases. OIE

UNIT II PROTOZOAN AND BACTERIAL DISEASES


UNIT III Fungal and Viral Diseases
Fungal diseases (finfish) – Saprolegniosis, brachiomycosis, ichthyophorus diseases –
Lagenidium diseases – Fusarium disease Viral diseases (finfish) – IPN, IHN, Viral
Hemorrhagic Septicemia, Spring Viremia of carps – Major CCVD, Carp lymphocytes –
Major shrimp viral diseases – Bacculoviruspenaeii, MonodonBacculovirus, Bacculoviralmidgut necrosis, IHHNV, Hepatopancreaticparvo like virus, Yellow head
bacculovirus, white spot bacculovirus and , White faeces syndrome.
Loose shells syndrome
UNIT IV NUTRITIONAL AND PARASITIC DISEASES
Nutritional pathology – lipid liver degeneration, deficiency diseases due to vitamin
A,D,E,K, B-Complex, C, pantothenic acid, folic acid, biotin, choline, minerals. Aflatoxin
and dinoflagellates.Antibiotic and chemotherapentants.Nutritional cataract.Genetically
and environmentally induced diseases, loose shells syndrome.Morphology, biology and life
cycle of parasites (Isopods, copepods, Parasitic diseases (Isopod, copepod, nematode,
Trematode, Acanthocephalans) - General characteristics, Epizootiology, Diagnosis, Life
cycle, Prevention and treatment.
UNIT V DISEASE MANAGEMENT AND PREVENTION
Microscopical, microbiological, histopathological and biochemical methods. Antibody
and nucleic acid based rapid diagnostics. Case history and clinical sign in
diagnosis.Conventional and rapid diagnostic techniques. Drugs, chemicals,
antibiotics, prebiotics and probiotics used in aquaculture and their mode of
action. Principles and methods of vaccine production and fish immunization. Crop rotation,
Immunostimulants, bioremediation and polyculture as strategies for health
management. Bio-floc based aquaculture. General preventive methods and prophylaxis
against the occurrence of diseases. Good pond management practices- Eco-friendly and
sustainable aquaculture. Production of disease-free seeds. Zero water exchange.
Quarantine and health certification in aquaculture..SPF and SPR seeds and brooders.

TEXT BOOKS
Salamander Books.
2nd Ed. Academic Press.
Diagnosis and Health Management Fisheries College and Research, Institute, T. N.
Veterinary and Animal Sciences University. Thoothukkudi.
Quarantine and Health Certification in Asia. FAO Publ.

REFERENCE BOOKS
2. Iwama G and Nakanishi T. (Eds.). 1996. The Fish Immune System Organism,
Publ.
ELECTIVE III FISH PRESERVATION TECHNOLOGY

Course Objectives

➢ To familiarize fish handling, chilling and freezing
➢ To develop deep understanding on drying, smoking, canning and freeze drying
➢ To have a basic understanding on quality control, by-product, packing and export of fish foods

Learning Outcomes

✓ Detailed insights into fish handling, chilling and freezing
✓ Clear knowledge on drying, smoking, canning and freeze drying
✓ Knowledge on quality control, by-product, packing and export of fish foods

UNIT I FISH HANDLING, CHILLING AND FREEZING
Common fishes, shrimps and molluscs landed and processed in Kerala. Handling of fish on board, in the landing center and processing center. Design and layout of preprocessing and processing centers. Icing of fish, different types of ice, quality of ice. Fundamental principles involved in chilling and freezing of fish and fishery products. Various freezing methods. RSW/CSW systems. Changes during freezing and frozen storage.

UNIT II DRYING, SMOKING, CANNING AND FREEZE-DRYING

UNIT III QUALITY CONTROL IN SEA FOOD PROCESSING
Concept of quality in fish and fishery products. Organoleptic analysis of fish and fishery products. Microbiological analysis of fish and fishery products. TPC and MPN of coliforms in
sea food. *Salmonella, Vibrio, Staphylococcus* and *E. coli* in sea food. Quality standards for sea food.

**UNIT IV FISHERY BY-PRODUCTS**


**UNIT V PACKING, COLD STORAGE AND EXPORT OF FISHERY PRODUCTS**


**TEXT BOOKS**


**REFERENCE BOOKS**

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