



UNIVERSITY OF CALICUT

Abstract

General and Academic - B.Voc Programme in Fish Processing Technology under modified B.Voc Regulations 2014 - Scheme and Syllabus - Approved - Implemented w.e.f 2018 Admissions - Orders issued.

G & A - IV - J

U.O.No. 1621/2019/Admn

Dated, Calicut University.P.O, 02.02.2019

*Read:-*1. U.O.No. 7404/2018/Admn dated 19.06.2018

2. Item No.1 in the minutes of the B.Voc Regulations Committee held on 13.09.2018
3. Request from the Convenor, B.Voc Regulations Committee dated 06.10.2018
4. Remarks of the Chairman Board of Studies in Aquaculture dated 02.11.2018
5. Item No.III in the Minutes of Faculty of Science held on 05.12.2018
6. Item No.II.F in the Minutes of Academic Council held on 18.12.2018

ORDER

The modified B.Voc Regulations has been implemented vide paper read as (1) and vide paper read as (2), the B.Voc Regulations Committee decided to place the syllabi of new B.Voc Programmes which are sanctioned by UGC, in various colleges under University of Calicut, before various Boards of Studies for approval.

The Convenor, B.Voc Regulations Committee vide paper read as (3), pointed out that UGC has directed to start the newly sanctioned programmes without delay and hence requested to initiate urgent steps to approve the syllabi of newly sanctioned B.Voc Programmes at various colleges with a suggestion to submit the syllabi to the Chairmen of Boards of Studies concerned with a request to approve the syllabi in circulation with other Board members (as provided under CUFS 1976) and the same has been approved by Vice Chancellor. Consequently the syllabus of B.Voc Programme in Fish Processing Technology was forwarded to the Chairman, Board of Studies in Aquaculture.

The Board of Studies in Aquaculture vide paper read as (4) approved the syllabus for B.Voc Programme in Fish Processing Technology. The Faculty of Science vide paper read as (5) and the Academic Council vide paper read as (6) approved the same. The Vice Chancellor has accorded sanction to implement the Academic Council decision.

Sanction has therefore been accorded for implementing the Scheme and Syllabus of B.Voc Programme in Fish Processing Technology under modified B.Voc Regulations 2014, in the University w.e.f 2018 admissions.

Orders are issued accordingly.(Syllabus is herewith appended)

Biju George K

Assistant Registrar

To
Principals of the Colleges offering Bvoc Programme in Fish Processing Technology

Copy to: PS TO VC/PA to R/PA TO CE/JCE VII/JCE 1/GA I F/Library/SF/DF/FC

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Section Officer

UNIVERSITY OF CALICUT

**B. Voc. PROGRAMME IN
FISH PROCESSING TECHNOLOGY
(2018 Admn onwards)**

1. PROGRAMME OBJECTIVES

The B. Voc courses are designed with the following objectives,

- a). To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- b). To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- c). To provide flexibility to the students by means of predefined entry and multiple exit points.
- d). To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- e) To provide vertical mobility to students coming out of 10+2 with vocational subjects

2. GENERAL PROGRAMME STRUCTURE

The B. Voc Programme is designed to bridge the potential skill gap identified. The curriculum in each of the years of the programme would be a suitable mix of general education and skill development components.

GENERAL EDUCATION COMPONENTS

- a. The general education component provides emphasis to Communication skill, Presentation skill, Health and Safety, Industrial Psychology, Environmental awareness, Entrepreneurship development and other relevant subjects in the field.
- b. An option for additional language should be provided which enhances the employability outside the state
- c. General Education Components should not exceed 40% of the curriculum
- d. All B.Voc Programme should follow the General education component pattern listed below

(Common English Courses and Additional language Courses of LRP programmes of CUCBCSSUG)

No	Semester	Course No	Course Code	Paper
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1.	1	1.1	GEC1EG01	A01 The Four Skills for Communication
2.	1	1.2	GEC1ML02 GEC1AR02 GEC1HD02	MAL1A01(2) Malayalam-Bhashayum Sahithyavum I ARB1A07(1) Arabic -Communication Skills in Arabic(Muvasalathwa Murasarath; Dr. Mohammed Haneefa P) A07- Communication Skills in Hindi.
3.	2	2.1	GEC2EG04	A02 Modern Prose & Drama
4.	2	2.2	GEC2ML05 GEC2AR05 GEC2HD05	MAL2A02(2)Malayalam-Bhashayum SahithyavumII ARB2A08(1)Literature In Arabic A09- Literature in Hindi
5.	3	3.1	GEC3EG07	A03 Inspiring Expressions
6.	4	4.1	GEC4EG10	A04 Readings on Society

SKILL DEVELOPMENT COMPONENTS:

- a. This component should match the skill gap identified.
- b. At least 50% of Skill Development Component should be allotted to practical and can grow up to 60% based on the nature of the course. The practical component can be carried out in the college and/or the industry partner premises.

3. LEVELS OF AWARDS

B. Voc is programme with multiple exits. Following table shows the various certificates and their duration.

Awards	Duration
Diploma	2 Semester
Advance Diploma	4 Semester
B. Voc Degree	6 Semester

1. Students are free to exit at any point in the duration of the programme
2. Only those students who successfully complete the courses and clear the examination are eligible for the certificate.

3. Separate certificate will be awarded for each year for successful candidates.
4. Students who fail in any course may be allowed to move the higher level but won't be eligible for any certificates until he/she clears previous courses.
5. B.Voc degree will confer to those whose successfully complete the diploma, higher diploma and internship.

5. CONDITIONS FOR ADMISSIONS

ELIGIBILITY

- The admission to B Voc programme will be as per the rules and regulations of the University for UG admissions.
- Basic eligibility for B.Voc is 10+2 and above in any stream (No age limit)
- The eligibility criteria for admission shall be as announced by the University from time to time.
- Separate rank lists shall be drawn up for reserved seats as per the existing rules.
- Grace Marks may be awarded to the students for meritorious achievements in co-curricular activities such as Sports/Arts/ NSS/NCC/ Student Entrepreneurship.
- Preferred subjects and index mark calculations will be decided by the respective Board of Studies.

DIPLOMA HOLDERS

Diploma holders (after 10+2) in the parent courses, approved by the University, who satisfies eligibility criteria can be admitted to the higher diploma(III semester) based on the availability of the seats and is under the sole discretion of the principal of the college/ B.Voc consortium.

RESERVATION/QUOTA

A maximum of 50 students can be admitted to one B.Voc programme. The students can be admitted only to the first semester (except for diploma holders). No students are admitted directly to the Third and Fifth semester in any circumstance except for diploma holders. Diploma holders may be permitted to third semester directly as mentioned above. The reservation rules for Government/Aided Colleges are as same as that of the regular UG programmes conducted in colleges affiliated to this university.

FEES STRUCTURE

1. The course fee and examination fee for the first three years will be decided by the University. The details of the fee structure for various courses are attached in the annexure 2.
2. The college can collect Caution deposit, PTA fund, special fees, university fees, sports fee etc according to the norms provided by the university at the time of admission.
3. After third year, with the consent of university/UGC, the college can conduct the same programme In self-financing mode (UGC not granting further funds). The course fee and examination fee (Regular/improvement/supplementary) structure in self-financing mode will be decided by the University.

6. REGISTRATION / REREGISTRATION

Every candidate should register for all subjects of the Semester End examinations of each semester. A candidate who does not register will not be permitted to attend the Semester End examinations; he/she shall not be permitted to attend the next semester. A candidate shall be eligible

to register for any higher semester, if he/she has satisfactorily completed the course of study and registered for the examination. He/she should register for the semester at the start of the semester before the stipulated date. University will notify the starting and closing dates for each semester.

REJOINING THE PROGRAMME

1. Rejoining the course will be allowed to only if the candidate has secured a minimum CGPA of 2.5.
2. The candidate should remit the fees prevailing that time.
3. B. Voc governing council will take the decision regarding the rejoining.

7. COURSE CALENDAR

The B. Voc programme conducted by the affiliated institutions follows a separate calendar from the conversional degree/ PG programme. The programme is distributed over six semesters and each semester constitute 90 working days inclusive of examination.

Note: Within a week after the commencement of classes of each semester, Head of each Institution should forward the list of students, details of faculty members allotted from the college and from industry partners along with their qualification and year of experience, to the University. Also, Head of each Institution shall ensure the availability of sufficient number of faculty members having experience and qualifications in the institution.

8. ASSESSMENT OF STUDENTS

Assessment of students for each subject will be done by internal continuous assessment and Semester End examinations. This dual mode assessment will be applicable to both Theory and Practical courses except for internship and project. Total marks in theory course reflect 80 marks external and 20 marks internal assessments. The mark divisions for practical courses are 20 marks internal and 80 marks external. For internship and project, there is no internal assessment. (Except for Broadcasting and Journalism, annexure attached)

SL. NO	Course	Internal	External
01.	Theory	20	80
02.	Practical	20	80
03.	Internship	0	100

INTERNAL

Internal assessment shall be conducted throughout the semester. It shall be based on internal examinations, assignments (such as homework, problem solving, group discussions, quiz, literature survey, seminar, team project, software exercises, etc.) as decided by the faculty handling the course, and regularity in the class. Assignments of every semester shall preferably be submitted in Assignment Book, which is a bound book similar to laboratory record. The mark distribution to award internal continuous assessment marks for theory subject should be as follows:

Assessment Mark

Assessment	Mark
Test papers (minimum two, best two out of three is preferred)	10

Assignments (minimum two) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term project, software exercises, etc.	5
Regularity in the class	5

The mark distribution to award internal continuous assessment marks for practical subjects should be as follows:

Assessment Type	Mark
Evaluation in the Field Report and Activity	10
End semester Test	4
Viva	1
Regularity	5

Note:-

1. No candidate will be permitted to attend the end semester practical examination unless he/she produces certified record.
2. Full credit for regularity in the class can be given only if the candidate has secured minimum 90% attendance in the subject. Attendance evaluation for each course is as follows

Attendance	Marks
90% and Above	5
85 to 89.9%	4
80 to 84.9%	3
76 to 79.9%	2
75 to 75.9 %	1

External

- Semester End examinations for theory and practical courses will be conducted by the University. There shall be University examinations at the end of each semester for both theory and practical. Failed or improvement candidates will have to appear for the Semester End examinations along with regular students.
- At the starting of each semester, Colleges should prepare question bank (containing maximum questions from each module of various types mentioned in section 13 pattern of question paper.) for the external theory/practical examinations for all courses during that semester and will be sent to the university. University will prepare the question papers and answer keys for each course and will

sent back to the college for conducting the examination.

- University will appoint a Chairman for each B.Voc. Programme. Chairman will monitor the University Practical Examinations and Evaluation of Theory and Practical papers.
- For the evaluation of theory papers, Chairman should form a team consisting of a chief and required additional Examiners for each course.
- At the starting of each semester, Colleges should prepare a panel of External examiners for conducting Practical examinations. Chairman/University will appoint examiners from the panel proposed by colleges.
- Practical Examinations can be conducted and evaluated from the college or the industry partner premises. The team for conducting and evaluating practical exams should include an examiner appointed from the approved panel of faculties, and an internal examiner.
- Head of Institution/ Chief of Examination of the college should take necessary steps to prevent any malpractices in the Semester End examinations. If any such instances are detected, they should be reported to the University without any delay.
- University will be issuing mark list, provisional/original certificates to the candidates.

INTERNSHIP, PROJECT AND PRACTICAL

Internship and the major project should be carried out in the industry, not necessarily with industry partner. The major idea for internship is to implement the things learned and to get a real life experience. The Evaluation process follows 100%external assessment.

1. There will be internship/project/practical at the end all semesters .
2. Every student will be assigned an internal guide, allotted from the parent department concerned or an expert available in the college appointed by the principal or the head of the department.
3. The student has to make regular discussions with the guide while choosing the subject/area and throughout the life time of the project.
4. At least three reviews should be conducted to evaluate the progress of work.
5. An evaluation team is constituted for conducting the evaluation. The team consists of external examiner, allotted by the university from the approved examination panel, representative from the industry and a faculty.
6. Students should submit a report of their work. A valid certificate from the organization should be produced as a proof that the work is carried out in the respective organization.
7. Students are required to demonstrate the working model of their work (if possible) to the panel of examiners. A viva will be conducted based on the report and students are supposed to clarify the queries regarding their work.
8. Mark distribution for internship assessment

Distribution	Marks
Content and relevance of Dissertation	50
Viva	20

Presentation	10

MINIMUM FORPASS

The successful completion of all the courses prescribed for the diploma/degree programme with E grade (40 %) shall be the minimum requirement for the award of diploma/degree.

Notes:

1. For Project/internship, the minimum for a pass shall be 50% of the total marks assigned to the respective examination.
2. A student who does not secure this pass marks in a subject will have to repeat the respective subject.
3. If a candidate has passed all examinations of B.Voc. Course (at the time of publication of results of last semester) except project/internship in the last semester, a re-examination for the same should be conducted within one month after the publication of results. Each candidate should apply for this 'Save A Year' examination within one week after the publication of last semester results.

IMPROVEMENT/SUPPLEMENTARY

Candidates shall be allowed to improve the grade of any two theory courses in a semester. This can be done only in the immediate subsequent chance. If the candidate gets more than 10% mark variations in the improvement chance, marks scored in the improvement chance will be considered for grading of the course; Otherwise marks scored in the first attempt will be retained. No candidate shall be permitted to improve the marks scored in practical examinations and internal continuous assessment.

9. ATTENDANCE

A candidate shall be permitted to appear for the Semester End examinations only if he/she satisfies the following requirements:

- (a) He/she must secure not less than 75% attendance in the total number of working hours in each semester.
- (b) He/she must earn a progress certificate from the head of the institution stating that he/she has satisfactorily completed the course of study prescribed in the semester as required by these regulations.
- (c) His/her conduct must be satisfactory .It shall be open to the Vice Chancellor to grant condonation of shortage of attendance on the recommendation of the head of the institution in accordance with the following norms.
 - The shortage shall not be more than 10%
 - Shortage up to 20% shall be condoned once during the entire course provided .such shortage is caused by continuous absence on genuine medical grounds. • Shortage shall not be condoned more than twice during the entire course. Candidate who is not eligible for condonation of shortage of attendance shall repeat the semester as per university norms.

10. PATTERN OF QUESTION PAPERS

The question papers of Semester End examinations of theory subjects shall be able to perform achievement testing of the students in an effective manner. The question paper shall be prepared

- (a) Covering all sections of the course syllabus and total marks from each module should be approximately same.
- (b) Unambiguous and free from any defects/errors
- (c) Emphasizing knowledge testing, problem solving & quantitative methods

(d) Containing adequate data/other information on the problems assigned

(e) Having clear and complete instructions to the candidates.

Duration of Semester End examinations will be 3 hours. The pattern of questions for theory subjects shall be as follows:

Section	Total No: of Questions	No :of Questions to be answered	Marks for each questions	Total
A	Very short/ Objective- 10	10	1	10
B	Short answer- 12	8	2	16
C	Short Essay - 9	6	4	24
D	Essay - 4	2	15	30
Total				80

And for Practical

Marks Distribution	Total marks
Theory/ Content	20
Implementation	30
Result/Output	10
Record/Report	10
Viva	10
Total	80

11. CREDIT SYSTEM

Each subject shall have a certain number of credits assigned to it depending upon the academic load and the nature and importance of the subject. The credit associated with each subject will be shown in the prescribed scheme and syllabi. Each course shall have an integer number of credits, which reflects its weightage.

a) One Credit would mean equivalent of 15 periods of 60 minutes each, for theory, workshops/IT and tutorials;

- b) For internship/field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops;
- c) For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

12. INDIRECT GRADING SYSTEM

- Indirect Grading System based on a 7 point scale is used to evaluate the performance of students.
- Each course is evaluated by assigning marks with a letter grade (A+, A, B, C,D, E or F) to that course by the method of indirect grading.
- An aggregate of E grade with 40 % of marks (after external and internal put together) is required in each course for a pass and also for awarding a degree/diploma.
- Appearance for Internal Assessment and End Semester Evaluation are compulsory and no grade shall be awarded to a candidate if she/he is absent for Internal Assessment / End Semester Evaluation or both.
- For a pass in each course 40% marks or E grade is necessary.
- A student who fails to secure a minimum grade for a pass in a course is permitted to write the examination along with the next batch.
- After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below.
For the successful completion of a semester, a student should pass all courses. However, a student is permitted to move to the next semester irrespective of SGPA obtained.

- SGPA of the student in that semester is calculated using the formula

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

- The Cumulative Grade Point Average (CGPA) of the student is calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students. CGPA can be calculated by the following

$$\text{CGPA} = \frac{\text{Total credit points obtained in six semesters}}{\text{Total credits acquired (180)}}$$

- SGPA and CGPA shall be rounded off to two decimal places. CGPA determines the broad academic level of the student in a programme and is the index for ranking students (in terms of grade points).
- An overall letter grade (Cumulative Grade) for the entire programme shall be awarded to a student depending on her/his CGPA.

Marks scored	Grade	Remarks
90 and Above	A+	Outstanding
80 to 89	A	Excellent
70 to 79	B	Very Good
60 to 69	C	Good

50 to 59	D	Satisfactory
40 to 49	E	Adequate
Below 40	F	Failure

13. GRADE CARDS

The University shall issue to the students grade/marks card (by online) on completion of each semester, which shall contain the following information:

- Name of University
- Title of B.Voc Programme
- Semester concerned
- Name and Register Number of student
- Code number, Title and Credits of each course opted in the semester
- Internal marks, External marks, total marks, Grade point (G) and Letter grade in each course in the semester
- The total credits, total credit points and SGPA in the semester (corrected to two decimal places)
- Percentage of total marks

The final Grade/mark Card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. However, as already mentioned, for the computation of CGPA only the best performed courses with maximum grade points alone shall be taken subject to the minimum credits requirements (180) for passing a specific degree. The final grade card shall show the percentage of marks, CGPA (corrected to two decimal places) and the overall letter grade of a student for the entire programme. The final grade/mark card shall also include the grade points and letter grade of general course and skill developmental courses separately. This is to be done in a seven point indirect scale.

14. MONITORING CELLS/COMMITTEES

EXAMINATION MONITORING CELL

Head of the each institution should formulate an Examination Monitoring Cell at the institution for conducting and supervising all examinations including the internal examinations. The structure and their collective responsibilities will be as per the university norms.

GRIEVANCE CELL

Each college should setup a Grievance Cell with at least four faculty members to look into grievances of the students, if any

ANTI-RAGGING CELL

Head of Institution shall take necessary steps to constitute antiragging Committee and squad at the commencement of each academic year. The committee and the squad shall take effective steps as specified by the Honorable Supreme Court of India, to prevent ragging.

CLASS COMMITTEE

Head of institution shall take necessary steps to form a class committee for each class at the start of classes of each semester. This class committee shall be in existence for the semester concerned. The class committee shall consist of the Head of Department, Staff Advisor of the class, a senior faculty member of the department, a faculty member from another department, and three student representatives (one of them should be a girl). There should be at least two meetings of the class committee every semester; It shall be the responsibility of the Head of Department to convene these meetings. The decisions of the Class Committee shall be recorded in a register for further reference. Each class committee will communicate its recommendations to the Head of Institution. The responsibilities of the class committee are:

- a) To review periodically the progress and conduct of students in the class.
- b) To discuss any problems concerning any courses in the semester concerned.
- c) To identify weaker students of the class and suggest remedial measures.
- d) To review teaching effectiveness and coverage of syllabus.
- e) Discuss any other issue related to the students of the class.

15. COLLEGE TRANSFER

College transfer is not allowed in any circumstances.

B.Voc degree is equal to any degree approved by University of Calicut

16. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Vice Chancellor has the power to provide by order that these regulations shall be applied to any program with such necessary modification.

Details of the proposed skills specialisations in the B. Voc. Programme

Programme	Name of the specialisation	Job Roles proposed to be covered in each year (Along with NSQF level)			Proposed intake of students (Annually)
		Year 1	Year 2	Year 3	
B. Voc. in Fish Processing Technology	Quality assurance of seafoods	Supervisor in seafood processing plants	Quality controller in seafood processing plants	Quality assurance manager in seafood processing plants	34
	Quality control of seafoods	NSQF LEVEL 5 (Diploma)	NSQF LEVEL 6 (Advanced Diploma)	NSQF LEVEL 7 (Degree)	34
	Management of seafood plants				

**B. Voc. PROGRAMME IN FISH PROCESSING TECHNOLOGY
SYLLABUS SUMMARY**

	Course No.	Course Code	Title	Credits	Hours	Marks		
						Internal	External	Total
Semester I	1.1	GEC1EG01	A01	4	72	20	80	100
	1.2	GEC1ML02	MAL1A01(2)	4	72	20	80	100
		GEC1HD02	(A07)	4	72	20	80	100
		GEC1AR02	ARB1A07(1)	4	72	20	80	100
	1.3	GEC1PH01	Fish Physiology & Taxonomy	4	72	20	80	100
	1.4	SDC1AQ01	Fish Harvesting Technology	4	72	20	80	100
	1.5	SDC1 AQ02	Fish Nutrition	5	90	20	80	100
	1.6	SDC1 AQ03	Technology of Food Preservation	5	90	20	80	100
1.7	SDC1 AQ04 (P)	Taxonomy, Fisheries and Fishing Technology	4	72	20	80	100	
Semester II	2.1	GEC2EG04	A02	4	72	20	80	100
	2.2	GEC2ML05	MAL2A02(2)	4	72	20	80	100
		GEC2AR05	ARB2A08(1)	4	72	20	80	100
		GEC2HD05	(A09)	4	72			
	2.3	GEC2 FM02	Food Microbiology	4	72	20	80	100
	2.4	SDC2 AQ05	Food Safety in Seafood Industry	5	90	20	80	100
	2.5	SDC2 AQ06	Fish Biochemistry & Spoilage	5	90	20	80	100
	2.6	SDC2 AQ07	Post Harvest Handling of Fish	4	72	20	80	100
	2.7	SDC2 AQ08 (PJ)	Utilization of Shellfish Waste/Water Quality Status in Ice Plants	4	72	20	60+20	100
Semester	3.1	GEC3EG07	A03	4	72	20	80	100
	3.2	GEC3 EFI 03	Entrepreneurship in Food Industries	4	72	20	80	100
	3.3	GEC3 GI 03	General Informatics	4	72	20	80	100
	3.4	SDC3 AQ09	Freezing Technology in Seafood Plants	4	72	20	80	100

III	3.5	SDC3 AQ10	Thermal Processing of Fishery Products	5	90	20	80	100
	3.6	SDC3 AQ11	Operation Management in Fish Processing Plants	5	90	20	80	100
	3.7	SDC3 AQ12 (P)	Food Microbiology	4	72	20	80	100
Semester IV	4.1	GEC4EG10	A04	4	72	20	80	100
	4.2	GEC4 FB04	Food Biotechnology	4	72	20	80	100
	4.3	GEC4 FPD04	Food Product Development & Analysis	4	72	20	80	100
	4.4	SDC4 AQ13	Economics & Marketing in Seafood Trade	5	90	20	80	100
	4.5	SDC4 AQ14	Fishery Byproducts & Value Addition	5	90	20	80	100
	4.6	SDC4 AQ15	Quality Control, Inspection & Certification in Seafood	4	72	20	80	100
	4.7	SDC4 AQ16 (PJ)	Traditional Methods of Fish Preservation/ Development of Value Added Products	4	72	20	60+20	100
Semester V	5.1	GEC5 NFF05	Nutraceuticals and Functional Foods	4	72	20	80	100
	5.2	GEC5 ME05	Marine Ecology	4	72	20	80	100
	5.3	SDC5 AQ17	Cured & Dried Fishery Products	4	72	20	80	100
	5.4	SDC5 AQ18	Packing & Labeling of Fish & Fishery Products	5	90	20	80	100
	5.5	SDC5 AQ19	Storage & Transportation of Fishery Products	5	90	20	80	100
	5.6	SDC5 AQ20	Instrumentation in Fish Processing & Analysis	4	72	20	80	100
	5.7	SDC5 AQ21(P)	Fish Processing Technology and Quality Control	4	72	20	80	100
Semester VI	6.1	SDC6 AQ22	Six months internship (900 hrs)	30	900	20	60+20	100

GEC1 PH01- FISH PHYSIOLOGY & TAXONOMY

CREDITS: 4

(72 Hrs)

Module 1: (20 Hrs)

Digestion, Respiration and Circulation- Digestive system – General morphological feature of digestive system in fishes, Digestive system and process of digestion in prawn and mussel. Respiratory system – general description, aquatic respiration, respiratory gases, gaseous exchange, oxygen transport. Adaptations for air breathing in fishes.

Module II: (20 Hrs)

Respiration in crustaceans and mollusks. Cardiovascular system – General features of heart and blood circulation, circulatory system and oxygen transport in fishes crustaceans and molluscs.

Module II: (20 Hrs)

Endocrinology and Excretion- Endocrine organs in fishes. Hormones and their role in control of reproduction in fishes. Endocrine system in crustacean and molluscs. Role of hormones in reproduction and moulting in crustacean. Excretion and osmoregulation. Nitrogenous excretion freshwater and marine fishes. Water and salt balance.

Module III: (12Hrs)

Taxonomy- Principles of zoological classifications, binomial nomenclature of commercially important fishes, crustaceans and molluscs.

References:

1. Moyle, P.B. and Cech, J.J. Fishes – An Introduction to Ichthyology
2. Norman, J.R.- A History of Fishes.
3. Nicholski, G.V.- Ecology of Fishes.
4. Lagler. - Ichthyology.
5. Francis Day. Fishes of India.
6. Munro, I.S.R.- The Marine and Freshwater Fishes of Ceylon.
7. CMFRI-. The Commercial Molluscs of India.
8. Purchon, R.D. - The Biology of Mollusca.
9. Dorothy E Bliss. - The Biology of Crustacea.
10. Nelson, J.S.- Fishes of the World.
11. Berg, L.S- . Classification of Fish Both Recent and Fossil.

SDC1 AQ 01- FISH HARVESTING TECHNOLOGY

Credits: 4

(72 Hrs)

Module I (18 Hrs)

Fisheries resources of India, potential and trends in fish production. PFZ, EEZ and FAO's code of conduct of responsible fisheries. Marine capture fisheries, fishery of commercially important pelagic and demersal fishes, crustaceans and molluscs.

Module II (18 Hrs)

Oceanic and deep sea fisheries resources. Inland capture fishery resources and production in India. Fisheries in major riverine systems, estuaries, reservoirs and lakes of India. Cold water fisheries of India.

Module III (20 Hrs)

Fishing Crafts and Gears: Classification of fishing crafts; Dimensions and design of boats; Safety and stability of fishing boats; Care and maintenance of boats; Fishing accessories and deck equipments; Types of marine engines.

Module IV (16 Hrs)

Fishing methods of India. Modern commercial fishing methods- trawling, purse seining, gill netting and long lining. Classification of gears. Preservation of fishing gears.

References:

1. Balachandran, K.K, Post-Harvest Technology of fish and fish products.
2. Shahul Hameed, M, Boopendranath M. R, Modern fishing gear technology.
3. Sen DP, Advances in Fish Processing Technology.
4. Jhingran V.G., Fish and Fisheries of India.
5. Jhingran V.G. and Talwar S.K., Fisheries of India (Vol 1 &2).
6. Bal J and Rao S.R., Fishes of India.
7. Santhanam S., Fisheries Science.
8. Bensam K., Development of marine Fisheries Science in India.

SDC1 AQ 02- FISH NUTRITION

Credits: 5

(90 HRS)

Module I (14 Hrs)

Nutritional physiology. Principles of nutrition. Adaptations to various types of feeding in finfish, crustaceans and molluscs. Mechanism of food capture, nutritional bioenergetics in finfish and shellfish.

Module II (20 Hrs)

Nutritional requirements: Gross protein requirements, nitrogen balance; essential and non-essential amino acids and their quantitative requirements, protein quality and sources; lipids, their functions; essential fatty acids, phospholipids and sterol requirements; protein sparing action of lipids, negative aspects of lipids, carbohydrates; their sources and utilization.

Module III (12 Hrs)

Water and fat soluble vitamins; their positive functions, minerals, recommended dietary allowances, deficiency and hyper dosage syndromes.

Module IV (12Hrs)

Feed ingredients Classification of feed stuff. Anti-nutritional factors in feed ingredients and their effect on finfish and shell fish. Additives in fin fish and shell fish feed.

Module IV (20 Hrs)

Feed formulation strategies and methods. Feed manufacture process; storage and quality control of feeds. Larval nutrition-Nutritional requirements of finfish, crustacean and molluscan larvae. Nutritive value of phytoplankton and their mass culture. Nutritive value of cladocerans and rotifers; their mass culture. Live and artificial feed, nutritive value of artemia; their mass culture and cyst production; micro diets for larvae. Recent advances in larval nutrition.

Module V (12 Hrs)

Feed management. Feeding strategies. Chemical methods of evaluation; biological methods of evaluation. PER, BV, NPU, NPR, FCR/FCE. Feed dispensing methods.

References

1. Dr. Snahotra, M.K, Shrimp Feed Formulation and Feed management, CMFRISpl Pub.
2. Tom Ovell (1934), Nutrition and Feeding of Fishes, Van No Strand Reinhold, New York.
3. Lakesh and Syed Ahamadhali (1985) Nutritional Quality of Live Food Organism and their enrichment, CMFRISpl Pub.
4. Seno. S. De Silva and Trevor Anderson, Fish Nutrition in Aquaculture, Chapman and Hall, Pub.

5. Verreth,J. Fish Larval Nutrition , Chapman and Hall ,Pub.
6. Stephen Goddard ,1996 Feed Management in Intensive Aquaculture .
7. Farm-made Aquafeeds ,FAO , Fisheries Technical Paper 343.
8. Devadasan .K.(Ed.) 1994,Fish Nutrition and Bioactive substances in Aquatic Organism.
9. KalyerJoh.e.(1972), Fish Nutrition , Academic Press,London.
10. Halyer John .E and Tiews Klaus (1979) Finfish Nutrition and Fish Feed Technology Heinemann, Berlin.
11. HopherBallour (1988) Nutrition of Pond Fishes , Cambridge University Press .
12. Tyler Peter and Callow Peter ,(1985) , Fish Energetic , Croom Helin ,London.
13. Winbrege, (1960)Rate of Metabolism and Food Requirements in Fishes .Fisheries Research Board of Canada.
14. ShimenoSadao,(1982) Studies on Carbohydrate Metabolism in Fish Amerind Publishing Company, New Delhi.
15. Cowey, C. B. et al. (Eds)(1985), Nutrition and Feeding in Fishes ,Academic Press,London.

SDC1 AQ 03 - TECHNOLOGY OF FOOD PRESERVATION

Credits: 5

(90 hours)

Module 1 (25 Hrs)

Food Microbiology- Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of micro-organisms. Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, semi perishable foods, shelf-stable foods.

Module II (18Hrs)

Food Preservation by Low temperature- Freezing and Refrigeration :Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

Module III (12 Hrs)

Food Preservation by high temperature - Thermal Processing- Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching.

Module IV (23Hrs)

Food Preservation by Moisture control- Drying and Dehydration - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry. Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry.

Module V (12 Hrs)

Food Preservation by Irradiation - Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization.

References

1. B. Srilakshmi, Food science, New Age Publishers, 2002
2. Meyer, Food Chemistry, New Age, 2004
3. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi.

GEC2 FM 02 - FOOD MICROBIOLOGY

Credits: 4

(72 Hrs)

Module I (8 Hrs)

Introduction to Food Microbiology- History and Development of Food Microbiology. Definition and Scope of food microbiology. Inter-relationship of microbiology with other sciences.

Module II (8 Hrs)

Characteristics of Microorganisms in Food- Types of microorganisms associated with food, their morphology and structure. Significance of spores in food microbiology

Module III (8 Hrs)

Microbial Growth in Food- Bacterial growth curve and microbial growth in food. Factors affecting the growth of micro-organisms in food.

Module IV (10 Hrs)

Microbial Food Spoilage - Sources of Microorganisms in foods. Some important food spoilage microorganisms. Spoilage of specific food groups- Milk and dairy products, meat, poultry and seafoods, Cereal and cereal products, Fruits and vegetables and Canned products

Module V (10 Hrs)

Food Fermentations – definition and types. Microorganisms used in food fermentations. Dairy Fermentations- starter cultures and their types, concept of probiotics, Fermented Foods- types, methods of manufacture.

Module VI (6 Hrs)

Foodborne Diseases- Types – foodborne infections, foodborne intoxications and toxicoinfection. Common and recent examples.

Module VII (6 Hrs)

Cultivation of Micro-organisms - Pure culture technique. Methods of isolation and cultivation. Enumeration of Microorganisms- qualitative and quantitative.

Module VIII (12 Hrs)

Control of Microorganisms in Foods - Principles and methods of preservation. Physical Methods of Food Preservation- Dehydration, Freezing, Cool Storage, Heat Treatment, Irradiation, Biopreservatives. Introduction to Hurdle concept and Non Thermal methods

Module IX (4 Hrs)

Trends in Food Microbiology- Rapid Methods of Detection. Recent Advances.

References:

1. Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
 2. Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi,2000
 3. Garbutt, John. Essentials of Food Microbiology, Arnold, London,1997
 4. Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 19.
-

SDC2 AQ 05 - FOOD SAFETY IN SEAFOOD INDUSTRY

Credits: 5

(90 Hrs)

Module I (20 Hrs)

Microbiological standards in seafood industry. Source of microorganism to fish-Sanitary measures adopted to reduce microbial load in fish. Intrinsic and extrinsic parameters that affect microbial growth. Food borne non- bacterial infections and intoxications: Aflatoxins, patulin, ochratoxin and other fungal toxins found in food.

Module II (18 Hrs)

Food borne pathogens: Emerging food-borne pathogens. Water borne diseases. Bacteria of public health significance in fish/fishery products/environments *Salmonella*, *Clostridia*, *Staphylococcus*, *E. coli*, *Vibrio*, *Listeria*. Methods for Detection: Rapid detection and indirect detection methods of pathogens and parasites.

Module III (18 Hrs)

Total plate count Coliforms-concept- indicator organism-MPN estimation-isolation and identification-faecal coliforms. *Salmonella*-Isolation and identification. *Vibrio*- Isolation and identification. *Streptococcus*-Isolation and identification. *Listeria* spp. isolation and identification.

Module IV (18 Hrs)

Quality control of Laboratories. Good Laboratory Practices (GLP). General requirements for a food laboratory. (Lay out, Environmental requirements, Safety requirements etc) Food borne diseases-Food infection and food intoxication. Botulism. Typhoid and Paratyphoid, *Clostridium perfringens*, Listeriosis. Sources and transmission of bacteria in foods: human, animal, environmental reservoirs; cross-contamination.

Module V (16Hrs)

Packaging and modified atmosphere on the microbiology and shelf life of fishery products. Norms for using antimicrobial systems in food processing and preservation. Food Safety, Risk analysis. Potential health hazards and risks associated with fish products.

References:

1. Chincheste, C.O and Graham, H.D, Microbial safety of Fishery products.
2. Frasier, W.C and Westhoff, D.C, Food Microbiology.
3. Jay, J.M. Van Nostrand. D., Modern Food Microbiology.

4. Amerine, M.A, Pangborm, R.M, Principles of sensory evaluation of food.
5. Connell. J.J, Control of fish Quality.
6. Sali A.J., Fundamental Principles of Bacteriology.
7. Schlegel, General Microbiology.
8. Cary. J.W., Linz, J.E. & Bhatnagar, D., Microbial Food Borne Diseases.
9. William, C.F & Dennis C.W., Foodmicrobiology.

SDC2 AQ 06 - FISH BIOCHEMISTRY AND SPOILAGE

Credits: 5

(90 Hrs)

Module I (15 Hrs)

Biochemical constituents of fish, crustaceans and molluscs. Biochemistry of fish proteins, structure of fish muscles, effect of processing on proteins. Non-protein nitrogenous compounds in fishes. Classification. Sarcoplasmic proteins, Myofibrillar proteins and Stromaproteins .

Module II (15 Hrs)

Fatty acid composition of fish liver and body oils, auto-oxidation of fatty acids, rancidity, lipasas and phospholipases, pro- and anti-oxidants, oxidation indices, lipid-protein interactions, oxidized lipids-protein interactions and their impact on quality.

Module III (20 Hrs)

Definition, classification and biological significance of carbohydrates; Chemical reactions; stereoisomerisms and mutarotation, structure and properties of monosaccharides, disaccharides, polysaccharides and mucopolysaccharides. Structure, functions and properties of nucleic acids; Structure of purines, pyrimidine; DNA and RNA; Flavour and pigments; amines, volatile fatty acids, carbonyls, sulphur containing compounds, carotenoids, isoprenoids in fish.

Module IV (10 Hrs)

Factors affecting spoilage of fish, principles of fish preservation. spoilage of fish during transportation, onboard handling of fish, sanitary and phyto-sanitary requirements for maintenance of quality grading of fish, whole fish quality evaluation. Microbial spoilage of fish.

Module V (15 Hrs)

Post mortem changes occurring in fish muscle. Chemical, microbial and enzymatic action during fish spoilage Stages of fish spoilage- Rigor mortis, Autolysis, microbial changes, Belly burst, Rancidity. Causative agents for fish spoilage. Role of bacteria in fish spoilage, Effect of temperature, pH, Oxygen, Salinity etc. on bacterial growth, methods of controlling spoilage. Spoilage of canned and dried food, Role of moulds in spoilage of cured processed fish products.

Module VI (15 Hrs)

Principles and methods involved in the separation and analysis of fish muscle constituents: thin layer, paper & column chromatography, spectrophotometry, colorimetry, flame photometry, atomic absorption spectrophotometry, gel electrophoresis. Assessment of fish spoilage. Organoleptic evaluation on fish and shellfish and organoleptic tests for detection of spoilage. Instruments used for assessment for quality of fish, electronic nose, rapid assay kits.

References:

1. George, M.P. & Barbec, W.T., Seafood effects of Technology and Nutrition.
2. Joe, M. R. & Carrie,E.R, Food proteinchemistry.
3. Lehninger, A.L., Principal of Biochemistry.
4. Michael Eskin N.A., Biochemistry of foods.
5. Owen,R.F., Foodchemistry.
6. Pare J.R.J. &BelangerJ.M.R., Instrumental Methods in Food Analysis.
7. Pomeranz, Y. &Meloan, C.E., Food Analysis Theory and Practice.
8. Ranganatha Rao, Textbook of Biochemistry.
9. Regenstein, J. M. & Regenstein C.E., Food Protein Chemistry.
10. Robert,G.A., Marine, Biogenic Lipids Fats and oils Vol.II.
11. Roy, E. M. & George, J.F., The sea food industry.
12. Roy, E.M., Geroge, J.F. & Donn, R.W., Chemistry and Biochemistry of marine food.
13. Smith, E.L.,*et al.*, The principles of Biochemistry.
14. StewartK.K., Modern Methods of Food Analysis.
15. Whitaker, J.R. & Tannenbaum, Food Proteins, AVI Publishing Company.
16. Balachandran K.K., Post Harvest Technology of Fish & Fishery Products.
17. Govindan T.K., Fish Processing Technology.
18. Chicheste C.O. and Graham H.D., Microbial Safety of fishery Products.

SDC2 AQ07 - POST HARVEST HANDLING OF FISH

Credits: 4

(72 Hrs)

Module I (20 Hrs)

Hygienic handling of fish on board fishing vessel and on shore, Manufacture and storage of ice, Quality of ice, Use of ice for handling, transportation and processing of fish, Quality of water to be used in fish processing, Chlorination of water, Refrigerated sea water for fish preservation. Insulated containers for fresh fish transportation.

Module II (16Hrs)

Pre-treatment of fish-washing, gutting, filleting, beheading, peeling, deveining etc.Simple mechanical refrigeration systems.

Module III (18 Hrs)

Freezing, slow freezing, quick freezing, types of freezers, freezing time, freezing of fish and shell fish. Anti-oxidant treatment-Glazing of fish Packaging and packaging materials for frozen fish and shrimps. Storage life, transportation and marketing.

Module IV (18Hrs)

Sanitary and phytosanitary requirements for maintenance of quality during post-harvest handling of fish. Quality management of fish and fishery products. Waste management. Sanitation in processing plants.

References:

1. Connell,J.J, Control of fish quality.
2. Fennema, K, Powrie, W.D & Marth, E.H., Low Temperature Preservation of Foods and Living Matter.
3. Gopakumar K., Text Book of Fish Processing Technology.
4. Hall, G.M, Fish Processing Technology..
5. Hui, YH., Pierson MD, & Gorham RJ., Food borne Disease Handbook. Seafood and Environmental Toxins.

GEC3 EFI 03 - ENTREPRENEURSHIP IN FOOD INDUSTRIES

Credits: 4

(72 Hrs)

Module I

Entrepreneurship in food service- Definition and meaning of entrepreneurship-Types, Classification and trends of Entrepreneurial ventures in foods and nutrition- Qualities and skills of an entrepreneur. Resources required for a business- Project formulation, evaluation and feasibility analysis.

Module II

Idea generation- Market research- Project selection- Project evaluation using appropriate industry standards-Business planning-Importance, purpose and efficiency of a plan-Business acquisition, franchising and outsourcing-Legal, ethical and environmental considerations of the entrepreneurial venture-Overview of business regulation by the government-Inspection, Licensing-Patent, trademark and intellectual property rights registration and accreditations.

Module III

Financial considerations of entrepreneurship funding for the business proposal-Government and non-government opportunities for funds and resources. Franchising opportunities. Product pricing and profit generation-Tools of analysis of costing, cost control and budgeting. Investing resources into the business

References:

1. Kotler,P.(2003)Marketingmanagement11thed.PearsonEducation(Singapore)Pte.Ltd.Delhi.
2. Agarwal,T.(2007)StrategichumanresourcemanagementOxfordUniversityPress–NewDelhi.
3. Aswathappa, K. (2005). Human resource and personnel management – Text and Cases Tata McGraw – Hill Publishing Co. Ltd. NewDelhi.
4. Boyd, H.W., Walker, O.C. and Larreche, J. (1995) Marketing management – A strategic approach with a global orientation 2nd ed. IrwinChicago.
5. Cartwright, R., Collins, M., Green, G. and Candy, A. (2001). The handbook for managing resources and information Infinity books, NewDelhi.
6. Ivancevich, J.M., Donnelly, J.H. and Gibson, J.L. (1996). Management – principles and functions (4th ed.) All India Traveller Bookseller.Delhi.
7. Kale, N.G. (2003) Principles and practice of marketing. Vipulprakashan –Mumbai.
8. Rao, V.S.P. (2005) Human resource management – text and cases (2nd ed.) Excel Books. NewDelhi.
9. Shookla, M.S. (2004). A handbook of human relations (with structured experiences and instruments). Macmillan India Ltd.Delhi.

10. Singh, P.N. (1998). Developing and managing human resources (3rd ed.)
SuchandraPublications,Mumbai.

GEC3 GI 03 - GENERAL INFORMATICS

Credits:

4 (72 Hrs)

Module I:

General Introduction- Outline history of the development of computers – Types of computers– PC/Workstations-Laptops- Palmtops – Mobile Devices – Notebooks-Mainframes – Supercomputers – Significance of IT and the Internet.

Module II :

Introduction to basic hardware- Monitor – CRT and LCD – issues – CPU –mouse-keyboard-processor types – Ports – USB 2.0- Input-output devices – Printers-scanners-graphic tablet-thumb drive-modems-digitalcameras- microphones-speakers. Bluetooth devices

Module III:

Introduction to software- Operating Systems – Windows- Windows versions-Linux – Linux distributions- Free software- software licenses – Software Tools (applications) – Windows software tools- Word, PowerPoint, Excel – Linux tools – Open Office – Security issues-viruses- antivirus tools

Module IV:

Introduction to networking and the internet- What is Networking – LAN – WAN – Wireless networks – Benefits of Networking – file sharing – sharing of printers – examples – networking in an office – in an internet cafe. The Internet-HTML- websites – blogs – search engines –e-mail chat – social networking – Security issues – Hacking – Phishing.

Module V:

Knowledge resources on the internet- Encyclopedias – libraries – book sites – journals – content repositories – online education – other information sites – internet directories – other information sources – websites of universities and research institutions – Online courses and Virtual Universities

Module VI:

Computer localization- What is localization – using computers in the local languages in India – language packs for operating systems and programs – fonts – Unicode – ASCII – keyboard layout issues – software tools for typing local languages – TDILproject.

References:

1. Fundamentals of Computers – Rajaraman: PHI PUBLICATIONS
2. Introduction to Computers: Peter Norton.
3. Informatics: VijayaKumaran Nair, Vinod Chandra: PHI Publications.

SDC3 AQ09 - FREEZING TECHNOLOGY IN SEAFOOD PLANTS

Credits: 4

(72 Hrs)

Module I (12 Hrs)

Freezing: Structure of water and ice, Influence of solutes on the structure of water and ice, freezing curve for fish. Determination of freezing points from time- temperature plots, calculation of freezing time, Crystallization, super cooling, crystal growth, eutectic point, location of ice crystals in tissue, physical changes during freezing.

Module II (12 Hrs)

Technological aspects of freezing. Different freezing methods, freezing of fishery products and the steps involved. Slow freezing vs Quick freezing. Different types of freezers- Air-blast freezers, Contact plate freezers, Spray and Immersion freezers, Other types of freezers, Freezing time and freezer operating temperatures.

Module III (12 Hrs)

Chemical treatment prior to freezing: antioxidants, cryoprotectants and other additives, theories of cryopreservation, glazing. Frozen storage: Physical and chemical changes - freezer burn and recrystallisation, different types of recrystallisation.

Module IV (12 Hrs)

Chemical changes in lipids, proteins and nucleotides, freeze denaturation and theories on denaturation, changes in pH, bacterial changes, sensory changes, texture, taste, odour, effect of post-mortem condition on sensory qualities.

Module V (12 Hrs)

Filleting of fish, treatments, glazing, packaging and freezing. Processing of prawns, lobster, squid, cuttle fish, crab etc. for freezing. Freezing of shrimps in different styles like whole, HL, PD, PUD, CPD, Block and IQF products.

Module VI (12 Hrs)

Arrangements within a cold storage, handling and stacking systems, space requirement, precautions to reduce temperature increase in a cold storage. Different methods of thawing frozen fish, advantages and disadvantages. Recent advances in fishthawing.

References:

1. Balachandran, K.K., Post-harvest Technology of fish and fish products.
 2. Cleland C Andrew, Food Refrigeration Processes.
 3. Clucas, I.J., Fish Handling, Preservation and Processing in the Tropics.
 4. Fennema, K. *etal.*, Low Temperature Preservation of Foods and Living Matter.
 5. Fennema, O.R., Principle of Food Science.
 6. Gopakumar K., Text Book of Fish Processing Technology.
 7. Hall G.M., Fish Processing Technology.
 8. Sen D.P., Advances in Fish Processing Technology.
 9. Rudolf, K., Freezing and irradiation offish.
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SDC3 AQ10 - THERMAL PROCESSING OF FISHERY PRODUCTS

Credits: 5

(90 Hrs)

Module I (20 Hrs)

Principles of thermal processing. Mechanism of heat transfer: conduction, convection, radiation and dielectric and microwave heating, heat resistance of bacteria and spores, decimal reduction time, thermal death time, "Z" and "F" values, 12D concept, heat penetration, cold point, determination of process time. F_0 value, cook value, D value, integrated F value and their inter-relationship. Heating equipment.

Module II (10 Hrs)

Classification of foods: low acid, medium acid and acidic foods, absolute sterility, statistical sterility, commercial sterility, pasteurisation and sterilisation.

Module III (12 Hrs)

Canning process, steps involved, process flow, additives, HTST processing and aseptic canning, principles and process details, value added and ready to use canned products.

Module IV (16Hrs)

HACCP and Safety of canned foods and unreliability of post process sampling of canned foods to ensure sterilization. Thermo-bacteriology, death of bacteria, autosterilisation bacteriology of canned/heat processed fishery products, examination of cans and seams.

Module V (20Hrs)

Hurdle technology: Combination with heat, heat and hydrostatic pressure, heat and low pH, heat and NaCl and nitrite, combination with ionising radiation, irradiation and hydrostatic pressure, irradiation and NaCl, irradiation and other adjuncts, heat and irradiation, irradiation and low temperature, low pH and specific acids, low a_w and adjuncts like Nisin to reduce severity of heat processing.

Module VI (12 Hrs)

Irradiation: Radiation sources, units, dose levels, radappertization, radacidation, radurization, effects of irradiation on protein, lipids, vitamins, bacteriological aspects, physical properties, shelf life and irradiated fish products.

References:

1. Balachandran, K.K., Fish Canning Principles and Practices.
2. Gopakumar K., Text Book of Fish Processing Technology.
3. Hall, G.M., Fish Processing Technology.
4. Hersom, A. C &Hull and, E.D., Canned Foods.
5. Larousse, J & Brown,B.E., Food Canning Technology.
6. Stumbo, Thermo Bacteriology in Food Processing.
7. Thorne,S., Food Irradiation.
8. Venugopal, V., Seafood Processing.
9. Warne,D., Manual on Fish Canning.
- 10.Zeathen, P., Thermal processing and quality of foods.

SDC3 AQ11 - OPERATION MANAGEMENT OF FISH PROCESSING PLANTS

Credits: 5

(90 Hrs)

Module I (16 Hrs)

Plant design: Fundamentals of processing plant design: Site selection, design and preparation of layout of processing plants - freezing plant, cold storage, canning plant, dryers etc. Site building, water supply, equipments and clothing.

Module II (18 Hrs)

Functions and construction of refrigeration system: Tests and inspection, Operation and handling, P-H diagram and basic calculation Preventive maintenance of machinery and equipment of fish processing plants, IQF, Canning plant, sausage plant, artificial dryers, smoking chambers etc., safety controls for freezing and canning plant.

Module III (20 Hrs)

Effluent treatment: Legislation and standards of effluent discharge, water pollution control measures in the food industry, waste water treatment process; dissolved air floatation, sedimentation, chemical treatment, biological treatment, aeration, carbon adsorption, granular media filtration and sludge handling. Boilers - Classification and selection of boilers, Boiler mounting and accessories.

Module IV (20 Hrs)

Measurement techniques; Sensors, active and passive sensors, characteristic of sensors for the measurement of temperature, relative humidity, a_w value, gel strength, moisture, freshness, pH, conductivity, DO, redox potential, salinity, air velocity, solar energy and brine concentration. Instrumentation techniques: General configuration of instrumentation system. Instrumentation for measurement of a_w value, temperature, pH, freshness, gel strength, salinity, brine concentration. Thermometers: Different types of thermometers, characteristics and application.

Module V (16 Hrs)

Principles of fisheries extension. Mechanisms and modes of extension and their impact on capture fisheries and fisher livelihoods. National and international organisation, institutions and agencies in fisheries extension. Seafood export promotion and organisations involved. Role of co-operatives in fisheries.

References:

1. Chupakhim and Dormenko., Fish processing equipments. MIRPublishers.
2. Heid & Joslyn., Food processing operations.
3. Slade., Food processing plants. Wheaton & Lawson., Processing Aquatic Food Products.

GEC4 FB04 - FOOD BIOTECHNOLOGY

Credits: 4

(72 Hrs)

Module I (18 Hrs)

Importance of Biotechnology in food processing and preservation-Recombinant DNA Techniques, Plant and Animal Biotechnology, Cell and Tissue culture, Plant Breeding, Genetically modified plants and animals- Applications in Food Production.

Module II (18 Hrs)

Microbial biotechnology- Genetically modified microorganisms.

Fermentation Technology- Use of microbes in the production of alcohols (Beer, Wine), bread, Yogurt, Organic acids (Acetic acid, Lactic acid, Citric acid), Vitamins, Pigments, Bacteriocins, Amino acids, Flavors, sweeteners.

Module III (18 Hrs)

Enzyme Technology-Use of Biotechnology for the production of enzymes- Amylases, Proteases, Lipases, Cellulases, Pectinases. Applications of these enzymes in food processing Applications of Biotechnology in food waste management and development of value added products.

Module IV (18 Hrs)

Nanobiotechnology-Use of nanoparticles for delivery of bioactive constituents, nanoencapsulation, nanopackaging, nanosensors for detection of pesticides & pathogens.Applications of Nutrigenomics in the food industry.Ethical Concerns, Safety and Regulatory Issues of biotechnological products.

References:

1. Anthony Pometto (2005). Food Biotechnology, 2nd Edition. CRC Press
2. Byong H Lee (2014). Fundamentals of Food Biotechnology, 2nd Edition, Wiley-Blackwell.
3. Sinosh Skariyachan & Abhilash M. Introduction to Food Biotechnology, CBS Publishers & Distributors Pvt Ltd.
4. Vinod K Joshi and R S Singh. Food Biotechnology: Principles and Practices, IK International Publishing House.
5. Ravishankar Rai V. Advances in Food Biotechnology, Wiley-Blackwell; 1 edition.

GEC4 FPD04 - FOOD PRODUCT DEVELOPMENT AND ANALYSIS

Credit: 4

(72 Hrs)

Module 1 (20 Hrs)

Food Product Development-Hypothetical proposal for new product development using the concepts of Enrichment, Fortification Waste Utilisation, Cost Effectiveness or Value Addition; Categories Lifecycle Stage (Childhood, Adolescence, Pregnancy, Lactation, Adulthood, Old Age)/ Low Cost Products/ Therapeutic Products (Osteoporosis, Anemia, Constipation, Diabetes); MarketSurvey/Research; Consumer FocusGroups; Devise a product and carry out preliminary standardization.

Module II (16Hrs)

Sensory evaluation of foods - Threshold concentrations of primary tastes, Effect of Temperature on taste, Identification of samples through Difference, Descriptive and Affective testing, Determination of sensory evaluation methods for evaluating quality, Developing score card as an evaluation tool.

Module III (18Hrs)

Food Product Development laboratory trials-Development of the product and modifications for innovation; Preparing a flow chart indicative of the operational processes; Understanding the concept of scale up; bulk cookery; Identifying suitable packaging material; Developing score card as an evaluation tool.

Module IV (18 Hrs)

Nutritive value estimation by biochemical methods (Protein, Fat, Crude Fibre, Iron, Calcium, Vitamin C, Potassium and other relevant micronutrients; Microbial Shelf Life Studies at various altered conditions Estimation of physiochemical changes pH, acidity, color, odor etc.

References:

1. Jameson K. (1998). Food Science – A Laboratory Manual, New Jersey:Prentice HallInc.
2. Lawless, H. and Heymann, H. (1998).Sensory Evaluation of Food – Principles and Practices, Kluwer Academic/Plemer Publishers.
3. McWilliam, M.(2001). Foods – Experimental Perspectives (4th Ed.), New Jersey: Prentice Hall Inc. USA: CRC PressInc..
4. Weaver, C. (1996), Food Chemistry Laboratory – A manual for Experimental Foods.

SDC4 AQ13 - ECONOMICS AND MARKETING IN SEAFOOD TRADE

Credits: 5

(90Hrs)

Module I (16 Hrs)

Fishery economics: Definition, scope and role. Production economics catch and effort studies – methodological issues in the estimation of fish catch and fishing effort – dimensions of fishing effort – costs of and returns from fishing – cost components – employment and earnings of fishermen in relation to technological options – production function in marine capture fisheries

Module II (13 Hrs)

Economic theories and growth models of fish resource development and exploitation; Fishery resource management; Maximum Sustainable Yield (MSY), Maximum and Net Economic Yield (M/NEY), Optimum Sustainable Yield (OSY), Static Maximum Economic Yield (SMEY), Dynamic Maximum Economic Yield (DMEY)

Module III (17 Hrs)

Fisheries Marketing definition and scope, functions of fish marketing, Markets and market structure, Government and Co-operative in fisheries marketing, integration, marketing efficiency, marketing cost and price spread, marketing planning, marketing strategy, marketing research, Marketing infrastructure, Marketing regulations, constraints and approaches to fish marketing development.

Module IV (13 Hrs)

Supply Chain Management Concepts and Evolution, value addition in fish marketing. Constraints and approaches to SCM in fisheries sector. Vertical integration and its effect on price determination. Domestic and external markets for fisheries products. Indian fisheries intervention.

Module V (16 Hrs)

Developing marketing strategies. Advanced studies of marketing information system and e-marketing, fish-business. Dynamics and innovations in fisheries marketing system. Applications of econometric methods of analysis for the study of market behaviours. Computer application in marketing management: Market intelligence, its need, analysis and dissemination

Module VI (15 Hrs)

Principles of price determination. Price difference and variability, price analysis, price elasticities, Price determination of fish and fishery products, characteristics of demand and supply of fish and fishery product, supply responses, seasonality, future trading, price support measures. Price stabilization policies.

References:

1. Phillip Kotler, Marketing Management.
2. Robert E Branson & Norvel,, Introduction to Agricultural Marketing
3. Ian Chaston,, Marketing.
4. Dennis Adeock, *et al.*, Marketing Principles and Practice.
5. Jolson,M.A., Marketing Management,
6. Amarchand & Varadharajan, B., An introduction to marketing,
7. Phillip Kotler& Gary Armstrong, Principles of Marketing.
8. G.E. Shephard., Agricultural Price Analysis.

SDC4 AQ14 - FISHERY BY-PRODUCTS AND VALUE ADDITION

Credits: 5

(90 Hrs)

Module I (12 Hrs)

Nutritional importance of fish meal and quality requirements -Raw material quality and changes during processing and storage. Production of fish meal - dry and wet process, machinery, control of quality of products, specifications, packaging and storage.

Module II (13 Hrs)

Fish body and liver oils. Nutritional importance of fish oil and methods to impart stability to fish oils on storage, Unsaponifiables in fish liver oils. Enzyme hydrolysis of fish, fish hydrolysates, fish peptones, hydrolysates enriched food beverages.

Module III (13 Hrs)

Shrimp waste, crab shell and squillautilisation: Resources and composition, conventional uses, feeds and manure, conversion to useful materials like chitin, chitosan, glucosamine hydrochloride, shrimp extract, commercial production, production and use of protein isolates from squilla and shrimpwaste.

Module IV (10 Hrs)

Fish protein concentrate: Different methods of production, functional properties, different types of FPC, texturised products and comparison of FPC to fish meal. Production of fish flour, quality standards and applications

Module V (13 Hrs)

Fish silage: Acid silage and fermented silage, advantages over fish meal, nutritional value of silage. Fish hydrolysates: Production and utilisation, biochemical composition and importance in food and nutrition.

Module VI (14 Hrs)

Miscellaneous by-products: Fish maws, shark liver oil, squalene, ambergris, shark skin, shark cartilage, isinglass, pearl essence, fertilizer, beche-demer, fish glue, agar agar, alginic acid, carrageenan. Extraction of collagen from fish processing wastes, properties and application. Preparation of biological membranes using collagen and chitosan for biomedical applications.

ModuleVII (15 Hrs)

Value Added Products: Present market trends, scope of value addition, Types of value addition,

Important value added products. Coated products – Principles and type of coating, Coating functions, in gradients, Batter classification, Mechanical properties of batter, Bread crumbs, Flavorings, Seasonings and Hydrocolloids in coatings, Fat and oils in coated food, Application of batters and breading to seafood.

References

1. Balachandran, K.K., Post Harvest Technology of fish and fish products.
2. Gopakumar K., Text Book of Fish Processing Technology.
3. Hall, G.M., Fish Processing Technology.
4. Hui, Y.H., M.D. Pierson & J.R. Gorham Food borne Disease
5. Sen D.P., Advances in Fish Processing Technology.
6. Wheaton & Lawson, Processing Aquatic Food Products.
7. Windsor, M. & Barlow, Introduction to Fishery Byproducts, Fishing.

SDC4 AQ15 - QUALITY CONTROL, INSPECTION AND CERTIFICATION IN SEAFOOD

Credits: 4

(72 Hrs)

Module I (8 Hrs)

Introduction to quality control in food processing. Necessity of quality control. Food laws in India, integrated food law.

Module II (16 Hrs)

Quality management, total quality concept and application in fish trade. Quality assessment of fish and fishery products - physical, chemical, organoleptic and microbiological quality standards. - sensory evaluation of quality, general testing conditions, different sensory tests.

Module III (10 Hrs)

HACCP and Good manufacturing practices. HACCP principles, practical aspects of planning and implementation, verification, validation and audit. HACCP based quality control systems in India.

Module IV (18 Hrs)

Quality evaluation techniques for seafood: Physical, chemical, bacteriological and Instrumental methods of quality evaluation. Sensory evaluation. Quality standards: National and International – Codex, USFDA, EU norms, ISO, BIS etc. Standards for fish and fishery products.

Module V (20 Hrs)

Seafood certification systems, IDP and SAT formations in certification of export worthiness of fish processing units, regulations for fishing vessels, pre-processing and processing plants, EU regulations. ISO 22000:2006. Marine Stewardship Council, Green certification. Microbial quality standards for major importing countries like USA, Japan, EEC.

References:

1. Amerien M.A.*et.al*, .Principles of sensory evaluation of Food.
2. Anthony T.Tu., Handbook of Natural toxins. Marine Toxins and Venom.
3. Balachandran, K.K., Post- Harvest Technology of fish and fish products.
4. BrodyJ., Fishery Byproduct Technology.
5. Chicheste C.O. & Graham H.D., Microbial Safety of fish Products.
6. Connel J.J., Control of Fish Quality.
7. Desrosier N.W. & Treasler D.K, Fundamentals of Food Freezing.
8. Gopakumar K., Text Book of Fish Processing Technology.
9. Govindan T.K., Fish Processing Technology.

10. Hall, G.M., Fish Processing Technology.
11. Hui, Y.H .*et al.*, Food borne Disease.
12. Huss, H. H.*etal.*, Quality assurance in the fish industry.
13. John, D.E.V., Food safety and toxicity.
14. Krenzer, R., Fish inspection and quality control.
15. Moorjani M.N., Fish Processing in India.
16. Sen D.P., Advances in Fish Processing Technology.
17. Vincent K. O. & Joel E. Ross., Principles of Total Quality.

EC5 NFF05 - NUTRACEUTICALS AND FUNCTIONAL FOODS

Credits: 4

(72 Hrs)

Module I (30 Hrs)

Introduction to Functional foods and Nutraceuticals: Definitions, Current trends in the use of functional foods and nutraceuticals, Regulations and Health claims. Specific Functional Foods and their bioactive constituents. Role in health and disease- Cardiovascular disease, Obesity, Diabetes Mellitus, Cancer, Bone Health, Menopause, Cognitive function, Immune stimulation, Infection, Cereals grains (Fibre, Polyphenolic compounds), Soybean (Oligosaccharides, Isoflavones, Phytosterols), Fruits and vegetables (Fibre, Lycopene, Lutein, zeaxanthin, Isothiocyanates), Fish/ Fish oils (PUFAs, Omega-3 fattyacids), Flaxseeds (Lignans, phytosterols, Omega-3 fattyacids), Tea (Polyphenolic compounds).

Module II (25 Hrs)

Prebiotics, Probiotics and synbiotics- Definition- Food Sources- Prebiotics [Dietary fibre, Oligosaccharides (Galactooligosaccharides, Fructooligosaccharides), Resistant Starch, Sugar alcohols], Traditional Fermented Foods as sources of Probiotics, strains of microorganisms used as probiotics, substrate Utilization in the colon, role in Health and Disease, Mechanism of Action, Levels of Probiotics required for therapeutic efficacy.

Module III (17 Hrs)

Nutraceuticals- Forms in which used, major nutraceuticals and their health applications- Bioactive peptides, Curcumin, Resveratrol, Coenzyme Q10, Conjugated Linoleic acid, Chondroitin, Glucosamine, Carnitine, Creatine, safety and adverse effects associated with the consumption of functional foods and nutraceuticals.

References:

1. Goldberg, I 1994. Functional Foods: Designer Foods, Pharma foods, Nutraceuticals Chapman & Hall.
2. Gibson, GR and William, CM. 2000. Functional foods - Concept to Product. Woodhead publishing.
3. Aluko, R.E. (2012). Functional Foods and Nutraceuticals. Springer.

GEC5 ME05 - MARINE ECOLOGY

Credits: 4

(72 Hrs)

Module I (16 hours)

Marine environment -ecological factors, light, temperature, salinity, pressure. Classification of marine environment- pelagic environment, planktonic and nektonic adaptations, benthic environment-intertidal, interstitial and deep sea adaptation. Other coastal environments coral reefs, estuaries, mangroves, seagrass beds, kelp forests, polar seas and hydrothermal vents.

Module II (14 hours)

Animal association in marine environment- endocism, inquilinism- phoresis-epizoism - mutualism- communalism- symbiosis- parasitism. Marine zoogeography with reference to Indian Arctic and Antarctic Oceans.

Module III (14 hours)

Population Ecology- group attributes, population growth, density variations, concept of carrying capacity. Dispersal, prey-predator relationship- density dependant- density independent factors.

Module IV (14 hours)

Structure and composition, diversity and stability, concept of niche, succession, community - wise adaptation, e.g. fouling and boring community.

Module V(14 hours)

Marine Ecosystems concepts- principal components- marine food chains-trophic structure food web- ecological pyramids- energy flow- evolution and management- system ecology and modeling.

References:

1. Barnes R. S. K , 1999, Introduction to Marine Ecology, Blackwell Science.
2. Jeffery S. Levinton 2000 Marine Ecology, Biodiversity and Function. Oxford University Press.
3. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology Sinauer Associates.
4. Gage. J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press, Cambridge.
5. Balakrishna Nair, N. and D.M. Thampy, 1980, A text Book of Marine Ecology, The Macmillan Co. of India Ltd., New Delhi.
6. Crowder William, 1991 Seashore Life between the Tides, Dover Publication.

SDC5 AQ17 - CURED AND DRIED FISHERY PRODUCTS

Credits: 4

(72 Hrs)

Module I (18 Hrs)

Free and bound water in foods, water activity and sorption behaviours of foods, storage characteristics, microbial spoilage, effects of water activity on chemical deterioration, enzymatic reaction, non-enzymatic browning, lipid oxidation, reaction between lipids and proteins, dry fish, control of micro-organisms.

Module II (16 Hrs)

Principles of drying and dehydration. Natural drying, solar drying and mechanical drying. Different types of dryers: tunnel drier, vacuum drier, drum drier, solar drier etc. Freeze drying, preparation and its nutritive value. Dehydration of fish products: dehydration ratio, precautions to be taken in fish drying; denaturation of fish protein.

Module III (11 Hrs)

Cured fish, types of salt curing, use of salt, factors affecting salt uptake by fish, lean and fatty fish, whole, gutted or split open, type and size of salt crystals, source of salts and impurities in salts, effect of impurities on salt penetration, temperature of salting.

Module IV (11 Hrs)

Smoke curing, chemistry of smoke, composition and properties, smoking methods: cold and hot method, use of smoke liquids, production of smoke, type of wood used, methods of smoke generation, carcinogens in smoke, smokekilns.

Module V (16 Hrs)

Fermented products: different methods of fermentation, indigenous products and their principles of preservation. Marinades: Principles; processing of cold, cooked and fried marinades, shelf life and spoilage. Fish and shellfish pickles: production, shelf life Packaging requirements for dry, cured and fermented products.

References:

1. Gopakumar K., Text Book of Fish Processing Technology
2. Hall, G.M., Fish Processing Technology.
3. Hui, Y.H., Merle D.P., & J R., Gorham Food borne Disease Handbook.
4. Oefjen, G.W., Haseky & Peter, Freezedrying.
5. Sen D.P., Advances in Fish Processing Technology.
6. Wheaton & Lawson, Processing Aquatic Food Products.

SDC5 AQ18 - PACKING AND LABELLING OF FISH AND FISHERY PRODUCTS

Credits: 5

(90 Hrs)

Module I (20 Hrs)

Food packaging, its purposes and procedures; technological aspects of packaging fishery products; packing of fresh and frozen fish for consumers; packaging for transport, shipping and institutional supplies; packaging standards for domestic and international trade.

Module II (5 Hrs)

Packaging materials; basic films and laminates, their manufacture and identification; resistance of packaging materials; development of protective packaging for fishery products.

Module III (18 Hrs)

Methods of testing for packaging materials for their physical properties; containers and their testing and evaluation; package designs; resistance of packages to hazards in handling; transport and storage.

Module IV (9 Hrs)

Modified atmosphere packaging, controlled packaging and aseptic packaging. Flexible packing, retort pouch processing of fish and fishery products principles and techniques. Combination and synergistic effects.

Module V (20 Hrs)

Labelling and printing of packaging materials. Labeling requirements - national and international, legislation on labeling. Labeling for product traceability. Type of labeling for organic foods, specific foods like organic foods, GM foods, irradiated foods, vegetarian and non- vegetarian foods. Label design specification – size, colour.

Module VI (18 Hrs)

Nutritional labelling and education act. The US/ International labelling requirements (Codex/ Indian standards for labelling). Food grade packaging materials. Major nutrients Minor nutrients, Essential nutrients. Antinutritional factors.

References:

1. Balachandran K.K., Post Harvest Technology of Fish and Fishery Products.
2. Desrosier N.W. and Treasler D.K, Fundamentals of Food Freezing.
3. Govindan T.K., Fish Processing Technology.
4. Moorjani M.N., Fish Processing in India.
5. BrodyJ., Fishery Byproduct Technology.

6. Chicheste C.O. and Graham H.D., Microbial Safety of fishery Products.
7. AmerienM.A.*et.al.*, Principles of sensory evaluation of Food.
8. Connel J.J., Control of Fish Quality.

SDC5 AQ19 - STORAGE AND TRANSPORTATION OF FISHERY PRODUCTS

Credits: 5

(90 Hrs)

Module I (20 Hrs)

Fish as raw material for processing: Body structure, physical properties, shape, specific weight, bulk weight, angle of slip, weight composition. Factors affecting quality of fresh fish: intrinsic and extrinsic factors. Post-harvest Fishery losses, Methods to reduce losses during storage and transportation.

Module II (15 Hrs)

Changes in Fish muscle during freezing and in the cold storage- ice crystal formation, shrinkage, drip loss, organoleptic changes, freezer burn, texture, protein denaturation, nutritional changes, enzyme denaturation, declining of bacterial load, discolouration.

Module III (20 Hrs)

Layout and factors to be considered during storage- Chute, raw material receiving room, chill room, processing hall, working table and utensiles, freezers, cold storage, machinery, ventilation, measures for controlling flies and animals, lighting, potable water and ice, toilet facilities, laboratory etc.

Module IV (20 Hrs)

Types of fish storage. Functions of cold storage, Types of cold storage. Chill storage and frozen storage. Heat load calculation, storage methods. insulated boxes and insulation thickness, different types of ice, physical, chemical, microbiological and sensory changes during chill storage, iced storage shelf life, cold shock, physical, chemical and sensory methods of analysis.

Module V (15 Hrs)

Various types of fish transport systems. Transportation: Live fish/shell fish, Transportation of raw fish to local markets and processing centres, Improvements needed in transportation, Refrigerated transport systems, Classification of transport vehicles, Coldchain.

References:

- Aitken, A. *et al.*, Fish handling and processing.
- Balachandran, K.K., Post harvest technology of fish and fish products.
- Connell, J.J., Advances in fish sciences and technology.
- George, M.Hall., Fish processing technology.

Gopakumar K., Text Book of Fish Processing Technology.
Sen D.P., Advances in Fish Processing Technology.

SDC5 AQ20 - INSTRUMENTATION IN FISH PROCESSING AND ANALYSIS

Credits: 4

(72 Hrs)

Module I (14 Hrs)

Microscopy-Working principles of light microscopes (dark field and light field), fluorescent microscope, phase contrast microscope, and electronic microscope (TEM, SEM)

Module II (14 Hrs)

pH meter, oxygen temperature probes, refractometer, Spectrophotometry- UV-visible, Flame Photometry and Atomic Absorption Spectrophotometry.

Module III (16 Hrs)

High performance liquid chromatography and Chromatographic separation methods. Electrophoresis, isoelectric focusing. Immuno electrophoresis

Module IV (14 Hrs)

Blotting techniques - Southern and northern blotting. ELISA- Indirect ELISA

Module V (14 Hrs)

PCR-Principles and application in Fisheries for disease diagnosis. Microarrays- Principles

References:

1. Macleod A.J., Instrumental methods of food analysis.
2. Anand C., Instrumental methods of chemical analysis.
3. Dtermann H., Gel Chromatography.
4. CRC series (vol I-III), Thin Layer Chromatography.
5. Connell J.J., Advances in Fishery Sciences and Technology.
6. Jones A, Read R and WeyersJ, Practical Skills in Biology.
7. Choudhary R., Biochemical Techniques.

SDC6 AQ22- INTERNSHIP

Credits:30

(900 Hrs)

Six months internship preferably in two phases i.e. (1) in-plant training in established seafood processing firms and (2) advanced training in seafood product development, quality evaluation etc. in reputed research institutes of central/state governments.

The evaluation of the Internship report will be done by an External Examiner appointed by the University. Distribution of marks will be in the following pattern: Internal Marks- 20, Internship Project- 40, Viva voce-20.

If any student fails to do the Internship will be withheld until the internship requirement is met within 12 months from the completion of the course.

PRACTICALS & PROJECTS

Semester I

Practical Paper – SDC1 AQ04(P) Taxonomy, Fisheries and Fishing Technology

Semester II

Project – SDC2 AQ08 (PJ) Utilization of Shellfish Waste/Water Quality Status in Ice Plants.

Semester III

Practical Paper- SDC3 AQ12(P) Food Microbiology

Semester IV

Project – SDC4 AQ16 (PJ) Traditional Methods of Fish Preservation/ Development of Value Added Products.

Semester V

Practical Paper- SDC5 AQ21 (P) Fish Processing Technology and Quality Control.
