



UNIVERSITY OF CALICUT

Abstract

General and Academic IV- Faculty of Science -Rectified Syllabus of the BVoc Fish processing technology- University of Calicut -with effect from 2021 admission onwards - Implemented -Subject to ratification by Academic Council- Orders Issued.

G & A - I - F

U.O.No. 1444/2024/Admn

Dated, Calicut University.P.O, 29.01.2024

*Read:-*1)U.O No 9234/2022/Admn dated 27.04.2022

2)Letter from MES Asmabi College,Vemballur

3)Remarks dated 15.01.2024 from Chairperson,BoS in Aquaculture

4)Letter from Dean, Faculty of Science dated 20.01.2024

5)Orders of the Vice Chancellor dated 24.01.2024

ORDER

1. The syllabus of B.Voc Fish processing technology with effect from 2021 admission, under B.Voc Regulations 2021 in the university has been implemented vide paper read (1) above.
2. Dr.Sayana K.A,Head & Assistant Professor,MES Asmabi College vide paper read (2) above pointed out that no internal mark has been assigned to the term paper in the syllabus of Sixth semester B.Voc Fish Processing technology
3. The Chairman, Board of Studies in Aquaculture (Single Board) has considered the matter and forwarded the anomaly rectified syllabus of B.Voc Fish Processing technology (2021 admission onwards), vide paper read (3) above .
4. The recommendation of the Chairman, Board of Studies in Fish Processing technology (Single Board) has been approved by the Dean, Faculty of Science and by the Vice Chancellor subject to ratification by the Academic Council , vide paper 4th above.
5. Sanction has therefore been accorded the Vice Chancellor for implementing the anomaly rectified scheme and syllabus of B.Voc programme in Fish Processing Technology w.e.f 2021 admission onwards subject to the ratification of the Academic Council.
6. Orders are issued accordingly (anomaly rectified syllabus appended)

Ajayakumar T.K

Assistant Registrar

To

EX,

cc to PS to VC,PA to REG,PA to CE

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT



BVOC PROGRAMME IN FISH PROCESSING TECHNOLOGY SYLLABI

As per CBCSS VUG 2021

(2021 admission onwards)

Undergraduate Programme in Fish Processing Technology

(BVOOC Fish Processing Technology)

Calicut University Regulations for choice-based credit and semester system for vocational under graduate (B.VOC) curriculum – 2021 are to be followed for admission, registration, examinations, internal and external evaluation and grading.

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I. BVOC FISH PROCESSING TECHNOLOGY – AN OVERVIEW

Name of the programme	: BVOC Fish Processing Technology
Level	: Under graduate (UG)
Number of semesters:	: Six
Total credits	: 180
Credits for General Education	: 41
Components (GEC)	
Credits for Skill Development	: 139
Components (SDC)	

II. Eligibility and Index mark

Candidates who have passed (Eligible for Higher Studies) the HSE of the Kerala State Board of Higher Secondary Examination or any other examination recognised as equivalent thereto with a minimum 45% of the total for the subjects Biology, Physics & Chemistry are eligible for admission (U.O.No.GAI/J1/4040/1999 dated 12.11.2001). Relaxation in the minimum qualification for backward communities and reservation for SC and ST students as per the government of Kerala norms are applicable. A concession of (5%) will be given to OBC/OEC candidates. The SC/ST candidates need to get only a pass (Eligible for Higher Studies). Those awaiting results of their qualifying examination also can apply. But such candidate will be admitted provided they produce the mark sheets of the qualifying examination on or before the date prescribed for admission.

Index Mark: Total marks obtained for Part III + the marks obtained for the Biology, Botany and Zoology subject concerned. An additional 25 marks will be awarded for VHS pass out students + 15 marks to students of Vocational Higher Secondary Education of stream Fish Processing Technology.

Tie Break: If there is a tie priority must be given to the candidates who secure more marks in the main subject concerned. If there is a tie again the marks of compulsory subsidiary subjects and then the marks obtained for the second subsidiary subject are considered. Even after there is a tie the marks obtained in English, the Additional language/second language are considered and at last general conditions are applied.

III. Evaluation and Grading

A. Mark system is followed instead of direct grading for each question. For each course in the semester letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given in Annexure-I

B. Course Evaluation : The evaluation scheme for each course shall contain two parts internal assessment and external assessment.

1) Internal Assessment

- a) 20% of the total marks in each course are for internal examinations. The marks secured for internal assessment only need to be sent to University by the colleges concerned.
- b) The internal assessment shall be based on a predetermined transparent system involving written tests, Class room participation based on attendance in respect of theory courses and lab involvement, records and attendance in respect of Practical Courses.
- c) Internal assessment of the project will be based on its content, relevance, method of presentation, final conclusion and orientation to research aptitude.
- d) Components with percentage of marks of Internal Evaluation of Theory Courses are-

Theory		Practical	
Test paper	40%	Record	40%
Assignment	20%,	Lab Involvement	60%
Seminar	20%		
CRP based on attendance	20%.		

For the test paper marks, at least two test paper should be conducted. If more test papers are conducted, the mark of the best two should be taken. To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be notified on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal marks. The course teacher(s) shall maintain the academic record of each student registered for the course, which shall be forwarded to the University by the college Principal after obtaining the signature of both course teacher and Head of the Department.

The Split up of marks for Test paper and Class Room Participation (CRP) for internal evaluation are as follows.

Split up of marks for test papers

Range of Marks in test paper	Out of 8 (Maximum internalmarks is 20)	Out of 6 (Maximum internalmarks is 15)
Less than 35%	1	1
35%-45%	2	2
45% - 55%	3	3
55% - 65%	4	4
65% -85%	6	5
85% -100%	8	6

Split up of marks for Classroom Participation (CRP)

Range of CRP	Out of 4 (Maximum internal Marks is 20)	Out of 3 (Maximum internalMarks is 15)
50% ≤CRP <75%	1	1
75% ≤CRP <85%	2	2
85 % and above	4	3

2) External Evaluation

- a) External evaluation carries 80% of marks.
- b) All question papers shall be set by the University.
- c) The external question papers may be of uniform pattern with 80/60 marks The general components taken from other UG Programmes with 2/3 credits will have an externalexamination of 2 hours duration with 60 marks and courses with 4/5 credits will have an externalexamination of 2.5 hours duration with 80 marks.
- d) The external examination in theory courses is to be conducted by the University with question papers set by external experts. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation and answer keys shall be provided by the University.

- e) The external examination in practical courses shall be conducted by two examiners – one internal and an external, the latter appointed by the University. No single Examiner is given the charge of conducting the examination. Both the internal and external examiners are equally responsible for the examination work; however evaluation and viva-voce shall be done by the external examiner. The practical board meeting should be conducted before conducting the external practical examination with the concerned examiners. The instructions for conducting the practical examinations, the mark distribution, question paper distribution and related matters should be discussed in the practical examination board meeting. The scheme of valuation must be strictly followed so as to ensure uniformity.
- f) After the external evaluation only marks are to be entered in the answer scripts. All other calculations including grading are done by the University.

C. Revaluation:

In the new system of grading, revaluation is permissible. The prevailing rules of revaluation are applicable to CBCSS VUG 2021. Students can apply for photocopies of answer scripts of external examinations. Applications for photocopies/scrutiny/revaluation should be submitted within 10 days of publication of results. The fee for this shall be as decided by the University.

D. Internship and Project

- a) Internship or the mini/main 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.
- b) The Evaluation process follows 20% internal assessment & 80% external assessment.
- c) There will be internship/project at the end of 2nd and 4th semesters.
- d) The sixth semester includes one internship and project for the whole semester along with a term paper. Every student shall undergo one internship for the whole semester and along with that they should do a project based on their internship. At the end of the semester they should submit internship report and project.
- e) 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. The student has to make regular discussions with the guide while choosing the subject/area and

throughout the life time of the project.

- f) At least three reviews should be conducted to evaluate the progress of work.
- g) Since Internship and Project is considered as a single course having a common course code and course name, external examination is also conducted as single. But the evaluation (internal as well as external) should be done separately for internship and project. In the mark sheet and Grade Card, the split up mark is to be shown.
- h) An evaluation team is constituted for conducting the evaluation. The team consist of external examiner, allotted by the university from the approved examination panel and a faculty from the institution. If necessary,representatives from the industry can also be added to the panel.
- i) Students should submit a report of their work. A valid certificate of internship from the organization should be produced as a proof that the work is carried out in the respective organization. Attendance statement also should be produced.
- j) Students are required to make the presentations of their work to present before the panel of examiners. A viva will be conducted based on the report and students are supposed to clarify the queries regarding their work

Mark distribution for internship

Distributio n	External	Intern al
Report	100	30
Viva	60	10
Total	160	40

Mark distribution for Project

Marks Distribution	External	Internal
Theory/ Algorithm/Flow diagram	40	5
Implementation	80	20
Result/Output	20	5
Record	10	5
Viva	10	5
Total	160	40

E. Evaluation of Audit courses: The examination shall be conducted by the college itself from the Question Bank prepared by the University. The Question paper shall be of 100 marks of 3 hour

duration. For SDE/Private students it may be of MCQ/ fill in the blank type questions or online question paper may be introduced.

F. Evaluation of Term Paper: The term paper shall be in the sixth semester along with internship and project. It should be in the standard format which is eligible for publishing. It has no external evaluation but only internal assessment. The concerned Board of Studies shall include necessary guidelines for the evaluation of term paper.

G. Minimum for pass

The successful completion of all the courses prescribed for the diploma/degree programme with P grade 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. A student who does not secure this pass marks in a subject will have to repeat the respective subject.
2. If a candidate has passed all examinations of B.Voc. Programme (at the time of publication of results of last semester) except Internship and Project 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.

IV. Method of Indirect Grading

- a. Indirect grading System based on a 10-point scale is used to evaluate the performance of students.
- b. Each course is evaluated by assigning marks with a letter grade (O, A+, A, B+, B, C, P, F, I or Ab) to that course by the method of indirect grading. (Annexure I).
- c. An aggregate of P grade (after external and internal put together) is required in each course for a pass and also for awarding a degree (A minimum of 20% marks in external evaluation is needed for a pass in a course. But no separate pass minimum is needed for internal evaluation). No separate grade/mark for internal and external will be displayed in the grade card; only an aggregate grade will be displayed. Also the aggregate mark of internal and external are not displayed in the grade card.
- d. 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

SGGPA 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 formula.

$$\text{CGPA} = \frac{\text{Total credit points obtained in six semesters}}{\text{Total credits acquired (120)}}$$

SGPA and CGPA shall be rounded off to three 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.

Evaluation (both internal and external) is carried out using Mark system. The Grade on the basis of total internal and external marks will be indicated for each course, for each semester and for the entire programme.

Indirect Grading System in 10 -point scale is as below:

Ten Point Indirect Grading System

Percentage of Marks (Both Internal & External puttogether)	Grade	Interpretation	Grade point Average (G)	Range of grade points	Class
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95 and above	O	Outstanding	10	9.5 -10	First Class with Distinction
85 to below 95	A+	Excellent	9	8.5 -9.49	
75 to below 85	A	Very good	8	7.5 -8.49	
65 to below 75	B+	Good	7	6.5 -7.49	FirstClass
55 to below 65	B	Satisfactory	6	5.5 -6.49	
45 to below 55	C	Average	5	4.5 -5.49	SecondClass
35 to below 45	P	Pass	4	3.5 -4.49	Third Class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

V. Question paper Type (theory papers)

Question paper Type 1

Scheme of Examinations:

The external QP with 80 marks and Internal examination is of 20 marks. Duration of each external examination is 2.5 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A&B. But there shall be ceiling in each section.

Section A

Short answer type carries 2 marks each - 15 questions Ceiling - 25

Section B

Paragraph/ Problem type carries 5 marks each - 8 questions Ceiling - 35

Section C

Essay type carries 10 marks (2 out of 4) 2X10 = 20

Total 80

Question paper type 2

Scheme of Examinations:

The external QP with 60 marks and Internal examination is of 15 marks. Duration of each external examination is 2 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A & B. But there shall be Ceiling in each section.

Section A

Short answer type carries 2 marks each - 12 questions Ceiling - 20

Section B

Paragraph/ Problem type carries 5 marks each - 7 questions Ceiling - 30

Section C

Essay type carries 10 marks (1 out of 2) 1X10= 10

Total 60

VI. Details of the proposed skills specializations in the Programme

Programme	Name of the specialization	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	50
	Quality control of seafoods				
	Management of seafood plants	NSQF LEVEL 5 (Diploma)	NSQF LEVEL 6 (Advanced Diploma)	NSQF LEVEL 7 (Degree)	

VII. PROGRAMME OUTCOMES (POs)

- PO.1.** Create scientific knowledge and skills
- PO.2.** Create ability for critical thinking
- PO.3.** Able to systematic problem solving
- PO.4.** Environmental awareness and social commitment
- PO.5.** Human values and friendliness
- PO.6.** Experience a comprehensive range of scientific and systematic techniques.
- PO.7.** Supplement trained manpower in fisheries sector
- PO.8.** Able to impart technical skill necessary in fishery industry
- PO.9.** Create local and global solutions for the challenges in fishery sector

VIII. PROGRAMME SPECIFIC OUTCOMES (PSOs)

- PSO.1.** Develop a mix of skills relating to a profession and appropriate content of General Education
- PSO.2.** Able to achieve fisheries (food) sector opportunities at graduate level
- PSO.3.** Graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- PSO.4.** Students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- PSO.5.** Emphasis to Communication skill, Presentation skill, Health and Safety, Industrial Psychology, Environmental awareness, Entrepreneurship development and other relevant subjects in the field.
- PSO.6.** Language skills enhances the employability outside the state
- PSO.7.** Computer and network awareness helps to keep updated in the fisheries field

Abbreviations used in course outcome:

CL – Cognitive level; U – understand; Ap – apply; An – analyze; C – create
KC – Knowledge category; C – conceptual; F – factual; P – procedural

IX. PROGRAMME STRUCTURE - B. Voc. PROGRAMME IN FISH PROCESSING TECHNOLOGY

	C o u r s e N o	Course code	Title	Cr e d i t s	H o u r s/ W e e k	Marks		
						In t e r n a l	Ext e r n a l	Tot a l
Semester I	1.1	A01	ENG1 A01	3	4	15	60	75
	1.2	A02	ENG1A02	3	4	15	60	75
	1.3	A07	MAL1A07(3)	4	4	20	80	100
			HIN 1A07 (3)	4	4	20	80	100
			ARA1A07(3)	4	4	20	80	100
	1.4	SDC1FI01	Fish Harvesting Technology	4	3	20	80	100
	1.5	SDC1FI02	Basic microbiology	4	4	20	80	100
	1.6	SDC1FI03	Technology of Food Preservation	4	4	20	80	100
	1.7	SDC1FI04(P)	Taxonomy, Fisheries and Fishing Technology	4	3	20	80	100
1.8	SDC1FI05(P)	Basic microbiology	4	4	20	80	100	
Semester II	2.1	A03	ENG2A03	4	4	20	80	100
	2.2	A04	ENG2A04	4	4	20	80	100
	2.3	A08	MAL2A08 (3)	4	4	20	80	100
			HIN 2A08 (3)	4	4	20	80	100
			ARA2A08(3)	4	4	20	80	100
	2.4	SDC2FI06	Fish Biochemistry and Spoilage	3	4	15	60	75
	2.5	SDC2FI07	Post-Harvest Handling of Fish	3	3	15	60	75
	2.6	SDC2FI08	Food Safety in Seafood Industry	4	4	20	80	100
	2.7	SDC2FI09(P)	Fish biochemistry	4	4	40	160	200
2.8	SDC2FI10(PJ)	Utilization of Shellfish Waste/Water Quality Status in Ice Plants	4	3	40	160	200	
Semester III	3.1	A11*	Biodiversity – scope and relevance	4	4	20	80	100
	3.2	A12*	Research methodology	4	4	20	80	100
	3.3	SDC3FI11	Fishery microbiology	3	3	15	60	75
	3.4	SDC3FI12	Freezing Technology in Seafood Plants	4	4	20	80	100
	3.5	SDC3FI13	Fishery By-products and Value Addition	4	4	20	80	100
	3.6	SDC3FI14(PJ)	Project work/Field Visit/Study Tour	3	3	15	60	75
	3.7	SDC3FI15	Operation Management in Fish Processing Plants	4	4	20	80	100
	3.8	SDC3FI16(P)	By-products and value-added products	4	4	20	80	100

			development					
Semester IV	4.1	A13*	Natural resource management	4	4	20	80	100
	4.2	A14*	Intellectual Property Rights	4	4	20	80	100
	4.3	SDC4FI17	Thermal Processing of Fishery Products	4	4	20	80	100
	4.4	SDC4FI18	Cured and Dried Fishery Products	4	4	20	80	100
	4.5	SDC4FI19(P)	Fishery microbiology	4	4	20	80	100
	4.6	SDC4FI20(P)	Biostatistics and Computer Applications	3	3	15	60	75
	4.7	SDC4FI21(PJ)	Project work/Field Visit/Study Tour	3	3	15	60	75
	4.8	SDC4FI22(PJ)	Traditional Methods of Fish Preservation/ Development of Value-Added Products	4	4	40	160	200
Semester V	5.1	GEC5EP12	Entrepreneurship in Food Industries	3	3	15	60	75
	5.2	SDC5FI23	Storage and Transportation of Fishery Products	3	3	15	60	75
	5.3	SDC5FI24(E01)	Instrumentation in Fish Processing Analysis	4	4	20	80	100
		SDC5FI24(E02)	Fisheries Economics and Extension	4	4	20	80	100
		SDC5FI24(E03)	Fisheries and Population Dynamics	4	4	20	80	100
	5.4	SDC5FI25	Quality Control, Inspection and Certification in Seafood	4	4	20	80	100
	5.5	SDC5FI26	Economics and Marketing in Seafood Trade	4	4	20	80	100
	5.6	SDC5FI27	Packing and Labelling of Fish and Fishery Products	4	4	20	80	100
	5.7	SDC5FI28(P)	Fish processing	4	4	20	80	100
	5.8	SDC5FI29(P)	Quality control in seafood processing	4	4	20	80	100
Semester VI	6.1	SDC6FI30(TP)	Term paper	2		50	--	50
	6.2	SDC6FI31	Project: A fish processing plant model preparation/ Microbiological quality of seafood exported from India	14		40	160	200
			Six months internship and a project (900 hrs)	14		40	160	200

*General education components (GEC) selected from list of common courses adopted by Board of Studies (BOS) in Aquaculture (board of studies for BVOC Fish Processing Technology programme), Group No. 4 of common courses as per the regulations of CBCSS UG 2019. Syllabus is already structured by BOS, therefore not attached in this draft.

X. Ability Enhancement Courses/Audit Courses (AEC /AC)

These are courses which are mandatory for a programme but not counted for the calculation of SGPA or CGPA. There shall be one Audit course each in the first four semesters. These courses are not meant for class room study. The students can attain

only pass (Grade P) for these courses. At the end of each semester there shall be examination conducted by the college from a pool of questions (Question Bank) set by the University. The students can also attain these credits through online courses like SWAYAM, MOOC etc (optional). The list of passed students must be sent to the University from the colleges at least before the fifth semester examination. The list of courses in each semester with credits is given below.

Course with Credit	Semester
Environment Studies – 4	1
Disaster Management - 4	2
*Human Rights /Intellectual Property Rights /Consumer Protection- 4	3
*Gender Studies/Gerontology- 4	4

XI. General education Components (GEC)

GEC5EP12 Entrepreneurship in Food Industries

3 credit**45 hours**

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and apply Types and trends in Entrepreneurial ventures in foods and nutrition	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F, P	15
C02	To understand and apply Steps involved to start an entrepreneurial venture	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F, P	15
C03	To understand and apply Funding sources in India for entrepreneurial venture	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F, P	15

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)Marketingmanagement 11thed.PearsonEducation(Singapore)Pte.Ltd.Delhi.
2. Agarwal,T.(2007)Strategichumanresource managementOxfordUniversityPress–NewDelhi.
3. Aswathappa, K. (2005). Human resource and personnel management – Text and Cases TataMcGraw – Hill Publishing Co. Ltd. NewDelhi.
4. Boyd, H.W., Walker, O.C. and Larreche, J. (1995) Marketing management – A strategicapproach with a global orientation 2nd ed. IrwinChicago.
5. Cartwright, R., Collins, M., Green, G. and Candy, A. (2001). The handbook for managingresources 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. New Delhi.
 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.) Suchandra Publications, Mumbai.

XII. Skill Development Components (SDC)

SDC1FI01 Fish Harvesting Technology

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To learn about Indian Marine Fishery Resources	PSO1	U	C, F	18 hours
C02	To learn about Indian Inland Fishery Resources	PSO1	U	C, F	16 hours
C03	To make an understanding on Different kinds of fishing crafts and gears and its operations	PSO1	U	C, F	10 hours
C04	To learn Fishing methods followed in India	PSO1	U	C, F	16 hours

Module I

Fisheries resources of India, potential and trends in fish production, 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

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

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

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.

SDC1FI02 Basic microbiology

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	Identify and characterize the microorganisms associated with daily life	PSO1	U	C, F	8 hours
C02	Recognize the significance of microorganisms in daily life	PSO1	U	C, F	8 hours
C03	Analyse the conditions for microbial multiplication	PSO1	U	C, F	7 hours
C04	Differentiate the microorganisms with their specific features	PSO1	U	C, F	6 hours
C05	Application of microorganisms in industrial (food) basis	PSO1	U	C, F	8 hours
C06	Identify the cause and sources of Food borne infections	PSO1	U	C, F	9 hours
C07	Summarize the symptoms associated with microbial food infection	PSO1	U	C, F	8 hours
C08	Apply the knowledge in reducing the risk associated with microbes in routine practice	PSO1	U	C, F	6 hours

Module I

Introduction to Microbiology - Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa & algae.

Module II

Microbial Growth – Growth curve, Effect of pH, Water activity, O₂ availability & temperature on the growth of microorganisms

Module III

Cultures and Media – Different types of media- Selective media and differential media; Preparation of media – PDA media, Nutrient agar, Mac Conkey agar, Culturing techniques – Pour plate, spread plate and streak plate.

Module IV

Beneficial microorganisms – SCP – Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP, Microorganisms of industrial importance, biomass, fermentation, enzymes & hormones, Antibiotics & Vaccines, Microorganisms & effluent treatment

Module V

Foodborne Diseases- Types – foodborne infections, foodborne intoxications and toxico infection. Common and recent examples – Botulism, Typhoid and Paratyphoid, Clostridium

perfringens, Listeriosis, Salmonellosis, Shigellosis etc., Sources and transmission of bacteria in foods: from human, animal, and environmental reservoirs, cross contamination.

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.

SDC1FI03 Technology of Food Preservation

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand Types of foods and its preservation	PSO1, PSO2, PSO4	U, Ap	C, F	12 hours
C02	To learn Food preservation methods by low temperature	PSO1, PSO2, PSO4	U, Ap	C, F	12 hours
C03	To learn Food preservation methods by high temperature	PSO1, PSO2, PSO4	U, Ap	C, F	12 hours
C04	To learn Methods of food preservation by controlling moisture	PSO1, PSO2, PSO4	U, Ap	C, F	12 hours
C05	To learn Methods of food preservation by applying irradiation	PSO1, PSO2, PSO4	U, Ap	C, F	12 hours

Module 1

Definition of food, classification of foods- based on origin, pH, nutritive value, functions of food, Health food, ethnic food, organic food, functional food, nutraceuticals, fabricated foods, convenience foods, GM food and space foods. Introduction to food preservation, Principles of Food Preservation, definition of shelf life, perishable foods, semi perishable foods, shelf-stable foods. Introduction to smoking

Module II

Food Preservation by Low temperature- Introduction to Freezing and chilling

cool storage and freezing, definition, principle of freezing, changes occurring during freezing, types of freezing i.e., slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food different thawing methods

Module III

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

Module IV

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

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 AgePublishers,2002
2. Meyer, Food Chemistry, NewAge,2004
3. Bawa. A.S, O.P Chauhanetal. Food Science. New India Publishing agency,2013
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi

SDC1FI04(P) Taxonomy, Fisheries and Fishing Technology

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	Identify and classify important fishes, molluscs and crustaceans.	PSO4	An, C	C, F	30 hours
C02	Identify fishing implements.	PSO4	U	P	30 hours

Experiments/ activities:

1. Identification of fishes up to species level- 20 nos. from different families
2. Identification of prawns of commercial importance
3. Identification of commercially important molluscs
4. Identification of traditional fishing gears
5. Different types of hooks
6. Identification of fishing accessories
7. Identification of synthetic and natural fibres
8. Artificial and live baits
9. Identification of modern gears
10. Fish detection devices - On board visit.

Collection:

1. Different commercially important fishes/ crustaceans/ molluscs

Field visit:

1. Visit to fishing harbour

Institutional visit:

1. Visit to CIFT, NIFPNATT, CIFNET etc.

SDC1FI05(P) Basic microbiology

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	Basic rules and requirements of a microbiology laboratory	PSO4	An, C	C, F	20 hours
C02	Give emphasis towards the preparation of biological stains, reagents, media and their composition.	PSO4	An, C	C, F	30 hours
C03	To get thorough different methods for staining of microorganisms.	PSO4	An, C	C, F	10 hours

Module-1

Microbiology laboratory basic rules and requirements. Laboratory rules- basic rules of a microbiology lab, basic requirements of a microbiological lab- common glass ware; test tube, culture tube and screw capped tubes, Petri dish, pipette, Pasteur pipette, glass spreader, inoculation needle, Bunsen burner, water bath, autoclave, laminar air flow, incubator, hot air oven, Quebec colony counter, centrifuge, microscope. Disposal of laboratory waste and culture.

Module 2

Staining of microorganisms. Methods for detection of specific bacteria: wet mount preparation for motile bacteria, hanging drop mount method, Methods for staining of microorganism: Simple staining (Monochrome staining) Gram staining for differentiation of bacteria Negative staining of bacteria Endospore staining.

Module-3

Composition, preparation and sterilization of media. PDA media Nutrient agar media MacConkey agar media

Module-4

Demonstration of techniques for pure culture of microorganisms. Streak plate method, Pour plate method, Serial dilution agar plate method.

References

1. Dubey, R.C. and Maheshwari, D.K. Practical microbiology. S.Chand and Company Limited, Ramnagar. New Delhi 2002.

SDC2FI06 Fish Biochemistry and Spoilage

3 credits

45 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and analyse Biochemical constituents in fish, Crustaceans and Molluscs	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	9 hours
C02	To understand and analyse fatty acid composition and its significance in fishes	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	5 hours
C03	To understand and analyse Carbohydrate composition and its significance in fishes	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	12 hours
C04	To understand and analyse Causes and indices of seafood spoilage	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	9 hours
C05	To understand and analyse Post mortem changes occurring in chemical composition of fish muscle	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	10 hours

Module I

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

Module II

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

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

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.

References:

1. George, M.P. & Barbec, W.T., Seafood effects of Technology and Nutrition.
2. Joe, M. R. & Carrie, E.R, Food protein chemistry.
3. Lehninger, A.L., Principal of Biochemistry.
4. Michael Eskin N.A., Biochemistry of foods.
5. Owen, R.F., Food chemistry.
6. Pare J.R.J. & Belanger J.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. Stewart K.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.

SDC2FI07 Post-Harvest Handling of Fish

3 credits

45 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and apply Hygienic handling practises of fish on board	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	10 hours
C02	To understand and apply Methods and significance pre- treatment of fish on-board	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	12 hours
C03	To understand and apply Types of freezing techniques in seafood industry	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	11 hours
C04	To understand and apply Sanitary facilities in seafood industry	PSO1, PSO2, PSO3, PSO4	U, Ap, An	C, F, P	12 hours

Module I

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

Module II

Pre-treatment of fish-washing, gutting, filleting, beheading, peeling, deveining etc. Preservatives used in fishery industry: bio preservatives, chemical preservatives etc.

Module III

Post-harvest losses in fish and seafood (main type of post-harvest fish losses, physical loss quality loss, losses due to insect infestation, economic losses, quality losses in post-harvest handling etc.) Post-harvest handling of low-value fish products and threats to nutritional quality, losses due to traditional processing.

Module IV

Good manufacturing practices, Basics of Sanitation standard operating procedure, Sanitary and phytosanitary requirements for maintenance of quality during post-harvest handling of fish. Quality management of fish and fishery products

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

SDC2FI08 Food Safety in Seafood Industry

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and apply Microbial standards to be followed in seafood industry	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F	12 hours
C02	To understand and apply Food borne pathogens associated with seafood	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F	12 hours
C03	To understand and apply Isolation and identification of microorganisms associated with seafood	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F	12 hours
C04	To understand and apply Quality control measures in seafood industry	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F	12 hours
C05	To understand and apply Packaging materials and types for seafood products	PSO1, PSO2, PSO3, PSO4	U, Ap	C, F	12 hours

Module I

Microbiological standards in seafood industry. Sanitary measures adopted to reduce microbial load in fish. Food borne non- bacterial infections and intoxications: Aflatoxins, patulin, ochratoxin and other fungal toxins found in food.

Module II

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*

Module III

Hazard assessment in seafood (physical hazard: hooks, fishing nets, plastic, pieces of glass, wood, personal ornaments, biological hazard: pathogenic bacteria, viruses, and parasites, chemical hazard: pesticides, polychlorinated biphenyls (PCBs), heavy metals, veterinary medicines, dioxins, polycyclic aromatic hydrocarbons, marine biotoxins and biogenic amines) Risks and benefits of seafood consumption.

Module IV

Quality control of Laboratories. Good Laboratory Practices (GLP). General requirements for a food laboratory. (Lay out, Environmental requirements, Safety requirements etc) laboratory safety rules cross-contamination. Norms for using antimicrobial systems in food processing and preservation. Food Safety, Risk analysis. 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.

SDC2FI09(P) Fish biochemistry

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To learn to assess the biochemical composition of commercially available fish	PSO2, PSO3	U, An	C, F, P	30 hours
C02	To learn to assess the biochemical composition of fishery products	PSO2, PSO3	U, An	C, F, P	30 hours

Experiments

1. Estimation of moisture content by hot air-oven method
2. Estimation of crude fat content
3. Estimation of crude protein content by Micro-Kjeldahl method
4. Estimation of total ash content
5. Determination of soluble protein content by Lowry method
6. Determination of iodine number of a fat sample
7. Determination of saponification value of fats and oils
8. Estimation of glucose in a given sample

Field visit:

Visit to fish processing plant and laboratory

Institutional visit:

Visit to CIFT, NIFPNATT, CIFNET etc.

SDC3FI11 Fishery microbiology

3 credits

45 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	Identify the microorganisms associated with fish and fishery products	PSO2, PSO3	U, An	C, F, P	5 hours
C02	Summarize the sources of microorganisms in fish	PSO2, PSO3	U, An	C, F, P	4 hours
C03	Identify the product characteristics that entice the microbial growth	PSO2, PSO3	U, An	C, F, P	4 hours
C04	Identify the preventive measures to be adopted to reduce the microbial load in fish	PSO2, PSO3	U, An	C, F, P	5 hours
C05	Summarize the culture techniques for microorganisms associated with fishery products	PSO2, PSO3	U, An	C, F, P	5 hours
C06	Isolation and identification of microorganisms associated with fishery products	PSO2, PSO3	U, An	C, F, P	4 hours
C07	Rapid detection methods of microorganisms and its application in food industry	PSO2, PSO3	U, An	C, F, P	5 hours
C08	Understanding about different microbiological analysis methods	PSO2, PSO3	U, An	C, F, P	4 hours
C09	Summarize the microbiological sampling in seafood industry	PSO2, PSO3	U, An	C, F, P	4 hours

				P	
CO10	Summarize the microbiological standards in seafood industry	PSO ₂ , PSO ₃	U, An	C, F, P	5 hours

Module I

Introduction – Microbiology of Raw and Processed fish & shellfish, intrinsic and extrinsic parameters of fish that affect microbial growth.

Module II

Sources of microorganism to fish –Micro flora associated with the habitat, body surface and internal organs of fish and shell fish. Sanitary measures adopted to reduce microbial load in fish.

Module III

Cultivation of Microorganisms - qualitative and quantitative enumeration of Microorganisms, Total plate count, Coliforms-concept- indicator organism-MPN, estimation, isolation and identification of faecal coliforms, Salmonella, Vibrio, Streptococcus, Staphylococcus, Listeria spp. Rapid Methods of Detection of pathogens, General understanding about different microbiological methods. (FDA, CFIA, FSIS, AOAC).

Module IV

Microbiological criteria for fish and Fishery products – Quality control and regulation for microbial quality of fish and shellfish, sampling for microbiological testing, microbiological standards for seafood products

Reference:

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 Bacterio
7. Schlegel General Microbiology
8. Maat A.G. and Wiley A Microbial Physiology
9. Pelezar Read and Chan Microbiology
10. Collins C.H. and Lyns P.M. Microbiological Methods
11. Lengeler Biology of Prokaryotes

SDC3FI12 Freezing Technology in Seafood Plants

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and analyse Techniques and principles of freezing in seafood industry	PSO2, PSO3	U, An	C, F, P	10 hours
C02	To understand and analyse kinds of freezing techniques used in seafood industry	PSO2, PSO3	U, An	C, F, P	10 hours
C03	To understand and analyse Treatments of products prior to freezing	PSO2, PSO3	U, An	C, F, P	10 hours
C04	To understand and analyse Physical and chemical changes of stored frozen products	PSO2, PSO3	U, An	C, F, P	10 hours
C05	To understand and analyse Preparation and grading of the seafood for freezing	PSO2, PSO3	U, An	C, F, P	10 hours

CO6	To understand and analyse Cold storage facilities of a seafood industry	PSO2, PSO3	U, An	C, F, P	10 hours
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Module I

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

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

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

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

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

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. et al., 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.

SDC3FI13 Fishery By-products and Value Addition

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand, analyse and apply Nutritional importance of fish meal and quality requirements	PSO2, PSO3	U, An, Ap	C, F, P	8 hours
C02	To understand, analyse and apply Nutritional importance of fish oil and methods to impart stability to fish oils on storage	PSO2, PSO3	U, An, Ap	C, F, P	8 hours
C03	To understand, analyse and apply Shrimp waste, crab shell and squilla utilization	PSO2, PSO3	U, An, Ap	C, F, P	9 hours
C04	To understand, analyse and apply Fish protein concentrate	PSO2, PSO3	U, An,	C, F, P	8 hours

			Ap		
CO5	To understand, analyse and apply Fish silage	PSO2, PSO3	U, An, Ap	C, F, P	8 hours
CO6	To understand, analyse and apply Miscellaneous by-products	PSO2, PSO3	U, An, Ap	C, F, P	9 hours
CO7	To understand, analyse and apply Production and trend of value-added products	PSO2, PSO3	U, An, Ap	C, F, P	10 hours

Module I

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

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

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

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

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

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.

Module VII

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.

SDC3FI15 Operation Management in Fish Processing Plants

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand, analyse and apply Fundamentals of processing plant design and lay-out	PSO2, PSO3, PSO4	U, An, Ap, C	C, F, P	10 hours
C02	To understand, analyse and apply Preventive maintenance of machinery and equipment of fish processing plants	PSO2, PSO3, PSO4	U, An, Ap, C	C, F, P	10 hours
C03	To understand, analyse and apply Legislation and standards of effluent discharge	PSO2, PSO3, PSO4	U, An, Ap, C	C, F, P	15 hours

C04	To understand, analyse and apply Measurement techniques and instruments used in seafood industry	PSO2, PSO3, PSO4	U, An, Ap, C	C, F, P	15 hours
C05	To understand, analyse and apply Mechanisms and modes of fishery extension and their impact on capture fisheries and fisher livelihoods	PSO2, PSO3, PSO4	U, An, Ap, C	C, F, P	10 hours

Module I

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, equipment and clothing.

Module II

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

Effluent treatment: Legislation and standards of effluent discharge, water pollution control measures in the food industry, waste water treatment process; dissolved air flotation, sedimentation, chemical treatment, biological treatment, aeration, carbon adsorption, granular media filtration and sludge handling.

Module IV

Measurement techniques; Sensors, active and passive sensors, characteristic of sensors for the measurement of temperature, relative humidity, aw 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 aw value, temperature, pH, freshness, gel strength, salinity, brine concentration. Thermometers: Different types of thermometers, characteristics and application.

Module V

Principles of fisheries extension. Mechanisms and modes of extension and their impact on capture fisheries and fisher livelihoods. National and international organization, institutions and agencies in fisheries extension. Seafood export promotion and organization 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.

SDC3FI16(P) By-products and value-added products development

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
CO1	Prepare important value-added products	PSO1, PSO2, PSO3	An, C	F, P	30 hours
CO2	Identify and/or prepare important fishery byproducts	PSO1, PSO2, PSO3	An, C	F, P	30 hours

Experiments

1. Preparation of fish meal,
2. Preparation of FPC,

3. Preparation of fish oils,
4. Preparation of chitin,
5. Preparation of chitosan,
6. Preparation of glucosamine hydrochloride,
7. Preparation of fish maws,
8. Preparation of isinglass,
9. Preparation of agar,
10. Preparation of alginic acid
11. Preparation of FISH glue
12. Preparation of pearl essence
13. Preparation of fish sauce
14. Preparation of fish wafers
15. Preparation of fish fingers
16. Preparation of cutlets
17. Preparation of pickles

SDC4FI17 Thermal Processing of Fishery Products

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and analyse Principles and concepts in thermal processing of fishery products	PSO2, PSO3	U, An	C, F, P	10 hours
C02	To understand and analyse Sterility and pasteurization techniques of fishery products	PSO2, PSO3	U, An	C, F, P	10 hours
C03	To understand and analyse Principles and method of canning process in seafood	PSO2, PSO3	U, An	C, F, P	10 hours
C04	To understand and analyse Application of hurdle technology in preserving seafood products	PSO2, PSO3	U, An	C, F, P	10 hours
C05	To understand and analyse Principles of irradiation process	PSO2, PSO3	U, An	C, F, P	10 hours

CO6	To understand and analyse Changes occurring in irradiated products	PSO ₂ , PSO ₃	U, An	C, F, P	10 hours
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Module I

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. F₀ value, cook value, D value, integrated F value and their inter-relationship. Heating equipment.

Module II

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

Module III

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

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

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 aw and adjuncts like Nisin to reduce severity of heat processing.

Module VI

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.

SDC4FI18 Cured and Dried Fishery Products

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand, analyse and apply water activity and sorption behaviours of foods	PSO2, PSO3	U, An, Ap	C, F, P	12 hours
C02	To understand, analyse and apply Principles of drying and dehydration	PSO2, PSO3	U, An, Ap	C, F, P	12 hours
C03	To understand, analyse and apply Curing of fish	PSO2, PSO3	U, An, Ap	C, F, P	12 hours
C04	To understand, analyse and apply Different types of curing	PSO2, PSO3	U, An, Ap	C, F,	12 hours

				P	
C05	To understand, analyse and apply Fermented products	PSO2, PSO3	U, An, Ap	C, F, P	12 hours

Module I

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. Recent trends in drying

Module II

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 salts, effect of impurities on salt penetration, temperature of salting.

Module III

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 IV

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.

SDC4FI19(P) Fishery microbiology

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
CO1	Identify the microorganisms associated with fish and fishery products	PSO1, PSO2, PSO3	An, C	F, P	10 hours
CO2	Summarize the sources of microorganisms in fish	PSO1, PSO2, PSO3	An, C	F, P	10 hours
CO3	Identify the product characteristics that entice the microbial growth	PSO1, PSO2, PSO3	An, C	F, P	10 hours

CO4	Identify the preventive measures to be adopted to reduce the microbial load in fish	PSO1, PSO2, PSO3	An, C	F, P	10 hours
CO5	Summarize the culture techniques for microorganisms associated with fishery products	PSO1, PSO2, PSO3	An, C	F, P	10 hours
CO6	Isolation and identification of microorganisms associated with fishery products	PSO1, PSO2, PSO3	An, C	F, P	10 hours

Experiments

1. Basic microbiological techniques
2. Sterilisation- dry heat, moist heat, filtration, flaming, UV-irradiation
3. Preparation and sterilisation of media
4. Bacterial Handling Techniques, aseptic transfer of microbes
5. Estimation of bacterial population in water and fish- TPC
6. MPN
7. Isolation and maintenance of pure culture
8. Study of morphological characters, colony morphology, microscopic examination of micro organisms
9. Staining of bacteria, gram stain, spore stain, capsule stain
10. Enrichment culture using selective media- Salmonella, vibrio.
11. Identification of E. coli, Staphylococcus, faecal streptococci
12. Growth of Fungi and yeast
13. Determination of mobility of bacteria

SDC4FI20(P) Biostatistics and Computer Applications

3 credits

45 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	Apply statistical techniques in fish population analysis, fish growth and fishery data	PSO1, PSO2, PSO3	An, C	F, P	10 hours
C02	Use computer aided packages in handling of fisheries and aquaculture data.	PSO1, PSO2,	An, C	F, P	10 hours

		PSO3			
C03	Identify important computer hardware/storage devices/peripherals	PSO1, PSO2, PSO3	An, C	F, P	12 hours
C04	Extract information from fishery databases	PSO1, PSO2, PSO3	An, C	F, P	13 hours

Experiments

1. Study of computer components and external storage devices.
2. Formatting a document using word, use of mail merge
3. Use of internet to collect fisheries data - FAO, NACA, ICLARM etc.
4. Descriptive statistical analysis using excel; calculation of mean, median, mode, standard deviation, standard error using computer programmes/packages
5. t- test, Chi –square, F- test, one way ANOVA, Data analysis using computer analysis (excel, free softwares) Analysis of fisheries/ biological data using computer programmes/packages
6. Demonstration of FISHBASE

Projects

1. Length weight analysis of a given fish using computer
2. Analysis of biological data using statistical tools and its representation using appropriate computer too

SDC5FI23 Storage and Transportation of Fishery Products

3 credits

45 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand, analyse and apply Fish as raw material for processing	PSO2, PSO3, PSO4	U, An, Ap	C, F, P	8 hours
C02	To understand, analyse and apply Changes in Fish muscle during	PSO2, PSO3, PSO4	U, An, Ap	C, F,	7 hours

	freezing and in the cold storage				P	
C03	To understand, analyse and apply Layout and factors to be considered during storage	PSO2, PSO3, PSO4		U, An, Ap	C, F, P	10 hours
C04	To understand, analyse and apply Types of cold storage in seafood industry	PSO2, PSO3, PSO4		U, An, Ap	C, F, P	10 hours
C05	To understand, analyse and apply Various types of fish transport systems	PSO2, PSO3, PSO4		U, An, Ap	C, F, P	10 hours

Module I

Quality of fish and Fishery products – Factors affecting quality of fresh fish, Chilled, Frozen and stored fish. Changes in Quality of fish and fishery products during cold storage

Module II

Chill Storage - Methods used in chilling of fish, Factors affecting rate of chilling, Storage methods, Types of Ice, iced storage shelf life, physical, chemical, microbiological and sensory changes during chill storage, factors affecting spoilage in chill storage, cold shock, physical, chemical and sensory methods of analysis, advantages and disadvantages of chill storage of fish.

Module III

Frozen storage – Storage conditions, factors to be considered during storage of frozen products, frozen storage shelf life, factors affecting the product quality in frozen storage, physical, chemical, microbiological and sensory changes during frozen storage, physical, chemical and sensory methods of analysis, advantages and disadvantages of frozen storage of fishery products

Module IV

Layout and factors to be considered during storage – processing unit Chill room facilities, functions of chill room, design and construction of cold storage, location, accessibility, spacing, structural support, temperature control, machinery, ventilation, measures for controlling flies and animals, lighting etc.,

Module V

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, Cold chain.

Module VI

Cold chain in Seafood Industry – importance, cold chain management of fishery products, temperature monitoring systems, cold chain in supply chain management.

References:

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

SDC5FI24(E01) Instrumentation in Fish Processing Analysis

4 credits**60 hours**

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand Microscopy	PSO1, PSO4	U	C, F	12 hours
C02	To understand Probe meters for pH, temperature, chlorine check	PSO1, PSO4	U	C, F	12 hours
C03	To understand Chromatographic separation	PSO1,	U	C, F	12 hours

	methods.	PSO4			
C04	To understand Blotting techniques	PSO1, PSO4	U	C, F	12 hours
C05	To understand PCR	PSO1, PSO4	U	C, F	12 hours

Module I

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

Module II

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

Module III

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

Module IV

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

Module V

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.

SDC5FI24(E02) Fisheries Economics and Extension

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	Study basic economic principles	PSO1, PSO4	U	C, F	15 hours
C02	Understand the methods of business management	PSO1, PSO4	U	C, F	15 hours
C03	List the methods of Aquaculture extension and institutes/agencies concerned	PSO1, PSO4	U	C, F	15 hours

C04	Explain export procedures/policies	PSO1, PSO4	U	C, F	15 hours
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Module I

Introduction and Basics of Business. Economics- definition, meaning and scope of economics with reference to fisheries. Basic concepts of economics- goods, services, wants, utility. Demand and supply, value price, individual demand and market demand, elasticity of demand, law of diminishing marginal utility.

Module II

Business Management Nature and scope of business, meaning, definition, characteristics and functions of business. Requisites of a successful business, essential qualities of a good business man, Principles of management – characteristics, objective and levels of management. Functions of management – planning, organization, leading, staffing, direction, motivation, co-ordination and control. Types of management - marketing management, financial management, production management, administrative management, personal management and industrial relations. Different economic systems in operation- capitalism, communist economy and mixed economy. Classification of companies- sole, proprietorship, partnership, co-operative society, charter companies, public corporations and registered companies.

Module III

Marketing and Economic Analysis. Marketing – Introduction, basic marketing functions, consumer behavior and demand concepts, different types of market, identifying and selecting markets, regulation of markets, advertising and sales promotion, organizing market surveys and test marketing of a new product. Fish marketing – prices and price determination of fishes. Marketing institutions – Primary institutions- producer fishermen, fishermen cooperatives and fisheries corporations. Secondary institutions – merchant middlemen, agent middlemen and speculative middlemen. Methods of economic analysis of business organizations – pay-back period, average rate of return, discounting method, net present value method, benefit cost ratio method and internal rate of return.

Module IV

Fisheries Economics. Aquaculture economics. Production function - the laws of returns, returns to scale. Average, marginal and total revenues. Pricing-various factors influencing the price of a product. its assumptions in aquaculture analysis. Least cost combination of inputs, laws of variable proportions. Cost and earnings of aquaculture systems – carp culture, different shrimp farming systems and hatcheries. Cost and earnings of mechanized and non mechanized fishing units and freezing plants. Socio- economic conditions of fishermen in India and Kerala. Contributions of fisheries to the national economy.

Module V

Export of Fishery Products/ Export of fishery products from India- major countries, important products, role of CIFT and MPEDA in regulating quality and export of fishery products. Export documents and procedures. Prospects and constraints in export including tariff and

non- tariff barriers, marine insurance, export incentives, registered exporters. Legislation on export inspection in India. Quality standards in India and major importing countries like USA, Japan and EU.

Module VI

Fisheries Extension. Extension education – its meaning, importance and scope in fisheries. Various methods of extension – individual, group and mass methods, farm and home visits, seminars, discussions, exhibition and personal contacts.

References

1. Mithani,D.M. Principles of Economics.
2. Stonier,A.W and Hague,D.C. A Textbook of Economic Theory.
3. Anderson,L.G.The Economics of Fisheries Management.
4. Shang,Y.C. Aquaculture Economics.
5. Korakandy,R. Technological Change and the Development of Marine Fishing Industry in India..
6. Ibrahim,P. Fisheries Development in India

SDC5FI24(E03) Fisheries and Population Dynamics

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To develop basic knowledge about marine and inland fishery resources	PSO1, PSO4	U	C, F	30 hours
C02	To create awareness about relevant fisheries stock assessment methods	PSO1, PSO4	U	C, F	30 hours

Module 1

Riverine and Coldwater Fisheries. Inland fish production in India- Riverine fisheries – major river systems in India– riverine ecology- capture fisheries, fishing methods, major species captured, recent statistics of catches. Cold water fisheries- major species – rivers supporting cold water fisheries.

Module 2

Reservoir and Estuarine Fisheries. Reservoir fisheries- Major reservoirs in India- reservoir ecology, capture fisheries, fishing methods, major species captured. Measures for increasing production from reservoirs in India and abroad. Estuarine fisheries- definition and classification of estuaries- capture fisheries, fishing methods, major species captured.

Module 3

Marine Fisheries- Pelagic Resources. Marine fishery resources in India- important fishing zones including wedge bank, maritime states. Major pelagic resource groups– sardines, mackerel, anchovies, ribbon fishes, tuna, seer fishes etc. Methods of fishing - Recent catch statistics of pelagic fisheries.

Module 4

Marine Fisheries- Demersal and Deep Sea Resources. Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources etc. Methods of fishing, recent catch statistics. Fishery of mud banks. Major deep sea resources - fishes, shrimps, lobsters – status of deep sea fishing in India. Chartered fishing in India- policies and problems. Marine fish production in India. - Estimated fishery resources – inshore – offshore - deep sea resource

Module 5

Population Dynamics. Stratified random sampling for estimation of fish landing. Concept of stock, recruitment, growth rate and mortality rate. Over fishing - maximum sustainable yield and maximum net economic yield. Conservation and regulation of fishing pressure - closed season, mesh size regulations, sanctuaries. Important fishing regulations.

References

1. Bal, D.V. and Rao, K.V. Marine Fisheries
2. Samuel, C.T. Marine Fisheries in India.
3. Kurien, C.V. and Sebastian, V.O. Prawns and Prawn Fisheries of India.
4. Talwar, P.K. and Kacker, R.K. Commercial Sea Fishes of India.
5. CMFRI Bulletin No.36 Tuna Fisheries of the Exclusive Economic Zone of India.
6. Jhingran, V.G. Fish and Fisheries of India.
7. Saigal, K.L. and Jhingran, V.G. Cold Water Fisheries of India.
8. CMFRI. Bulletin No.42 Shell Fish Resources and Farming.
9. CMFRI. Bulletin Cephalopod Resources of the EEZ of India.
10. Marine Fisheries Information Service (MFIS) CMFRI Publications, Monthly.
11. Devaraj, M. Fish Population Dynamics Course Manual.
12. Pauly, D. Some Simple Methods for the Assessment of Fish Stocks.

13. Sreekrishna, Y. and Shenoy L. (2001) Fishing Gear and Craft Technology, Indian Council of Agricultural Research, New Delhi.

SDC5FI25 Quality Control, Inspection and Certification in Seafood

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand, analyse and apply Significance of quality control in food processing	PSO2, PSO3	U, An, Ap	C, F, P	12 hours
C02	To understand, analyse and apply Quality assessment of fish and fishery products	PSO2, PSO3	U, An, Ap	C, F, P	12 hours

C03	To understand, analyse and apply HACCP and Good manufacturing practices in seafood industry	PSO2, PSO3	U, An, Ap	C, F, P	12 hours
C04	To understand, analyse and apply Quality evaluation techniques for seafood	PSO2, PSO3	U, An, Ap	C, F, P	12 hours
C05	To understand, analyse and apply Seafood certification systems	PSO2, PSO3	U, An, Ap	C, F, P	12 hours

Module I

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

Module II

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

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

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

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.

SDC5FI26 Economics and Marketing in Seafood Trade

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand and apply Definition, scope and role of fishery economics	PSO1, PSO2, PSO3	U, Ap	C, F	10 hours
C02	To understand and apply Economic theories and growth models of fish resource development and exploitation	PSO2, PSO3	U, An	C, F, P	10 hours

C03	To understand and apply Functions of fish marketing, Markets and market structure	PSO2, PSO3	U, An	C, F, P	10 hours
C04	To understand and apply Supply Chain Management Concepts and Evolution	PSO2, PSO3	U, An	C, F, P	10 hours
C05	To understand and apply Developing marketing strategies	PSO2, PSO3	U, An	C, F, P	10 hours
CO6	To understand and apply Price analysis determination of fish and fishery products	PSO2, PSO3	U, An	C, F, P	10 hours

Module I

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

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

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

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

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

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.

SDC5FI27 Packing and Labelling of Fish and Fishery Products

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To understand, apply and analyse technological aspects of packaging fishery products	PSO2, PSO3, PSO4	U, An, Ap	C, F, P	10 hours
C02	To understand, apply and analyse development of protective packaging for	PSO2, PSO3, PSO4	U, An,	C, F, P	10 hours

	fishery products		Ap		
C03	To understand, apply and analyse Methods of testing for packaging materials for their physical properties	PSO2, PSO3, PSO4	U, An, Ap	C, F, P	10 hours
C04	To understand, apply and analyse Types of packaging in seafood industry	PSO2, PSO3, PSO4	U, An, Ap	C, F, P	10 hours
C05	To understand, apply and analyse national and international, legislation on labelling	PSO2, PSO3, PSO4	U, An, Ap	C, F, P	10 hours
CO6	To understand, apply and analyse Nutritional labelling and education act	PSO2, PSO3, PSO4	U, An, Ap	C, F, P	10 hours

Module I

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

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

Module III

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

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

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

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.

SDC5FI28(P) Fish processing

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To study present day technologies	PSO1,	An, C	F, P	60 hours

	involved in fish processing	PSO2, PSO3			
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Experiments

1. Filleting of fish
2. Processing of Prawns, Lobster, Squid, Cuttle Fish, Crab etc. in different styles,
3. Packaging and Freezing,
4. Freezing curve
5. Determination of freezing point.
6. Studies on physical, chemical and sensory changes.
7. Evaluation of pasteurisation and sterilisation
8. Determination of TDT and F value
9. Examination of canned foods, can seams, testing sterility
10. Canning operations for different fish/shellfish products
11. Double seam profile, Heat Penetration Curve, F0 Value, Z value, Process time,
12. Canning of table fishes, Bivalves, Crustaceans in different containers,
13. Examination of canned fishery products.
14. Preparation of dried, cured and fermented fish products
15. Examination of salt, protein, moisture in dried / cured products
16. Examination of spoilage of dried / cured fish products.

Field visit:

Visit to fish processing plants

Institutional visit:

Visit to CIFT, NIFPNATT, etc.

SDC5FI29(P) Quality control in seafood processing

4 credits

60 hours

	Course Outcome	PSO	CL	KC	Class Sessions Allotted
C01	To study evaluation of freshness of	PSO1, PSO2,	An, C	F, P	30 hours

	fish	PSO3			
C02	To study evaluation spoilage in fish	PSO2, PSO3	U, An	C, F, P	30 hours

Experiments

1. Organoleptic analysis of fish and shell fish
2. Determination of total bacterial count in fishery products
3. Estimation of indicator bacteria and pathogens in fishery products
4. Isolation and identification of E. Coli, Staphylococcus, Vibrio, Salmonella, Listeria monocytogenes, Faecal streptococci, and Clostridium
5. Reactions in Triple Sugar Iron, Lysine Iron Agar, Indole. Methyl Red, Vogus-Proskauer and Citrate (IMVIC) test. Urease test, Agglutination using polyvalent sera, Analysis of indole, total nitrogen, trimethyl amine (TMA)
6. Analysis of filth and other extraneous materials from sea food
7. Analysis of ice, water and fish contact surfaces
8. Estimation of percentage chlorine in hypochlorate solution, Peroxide value of fish oil, acid value or free fatty acids of fish oil and refractive index of fish oil.
9. Paper chromatography
10. Thin layer chromatography
11. Colorimetry
12. Refractometry
13. Centrifugation

Field visit:

Visit to fishing harbour

Institutional visit:

Visit to CIFT, NIFINATT, etc.

SDC6FI30(TP) Term paper

2 credits

A research paper in fish processing technology which is eligible to publishing in UGC CARE listed journals.

Components in the manuscript

1. Introduction
2. Review of literature
3. Materials and methods
4. Results and discussion
5. Conclusion
6. References

SDC6FI31 Six months internship and Project (900 hrs)

28 CREDITS

900 hours

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.

Since Internship and Project is considered as a single course having a common course code and course name, external examination is also conducted as single. But the evaluation (internal as well as external) should be done separately for internship and project. In the mark sheet and Grade Card, the split up mark is to be shown. Distribution of marks will be in the following pattern: Internal Marks- 20 and External mark- 80 for both internship and project.

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.

XIII. Model Question Papers

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

GEC5EP12 Entrepreneurship in Food Industries

Time: 2 Hours

Maximum: 60 marks

Section A.

Each question carries 2 marks

(Ceiling - 20 marks)

1. What is called feasibility analysis?
2. Describe the components of business plan
3. How an entrepreneur identifies opportunities?
4. How the ethical behaviour helps in business?
5. Mention the elements of project formulation
6. Define budget
7. What are the types of franchising?
8. Brief on fund raising in entrepreneurship
9. Comment on underpricing and overpricing a product
10. What are the internal and external factors in pricing a product?
11. Point out the motivational factors in women entrepreneurship
12. Explain Factory Act, 1948?

Section B.

Each question carries 5 marks

(Ceiling - 30 marks)

13. Compare cost benefit analysis and social cost benefit analysis
14. Discuss on fund raising for an entrepreneurship
15. Discuss on business regulations in India
16. Discuss on Intellectual Property Rights in entrepreneurship
17. Government support for small scale industries development in India
18. Comment on ISO and FSSAI
19. Comment on profit generation in entrepreneurship

Section C.

(1x10=10 marks)

Answer any *one* questions

20. What are the Tools of analysis of costing? Explain cost control and budgeting in detail?
21. Discuss on significance of product pricing and factors involved in pricing a product

FIRST SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC1FI01 Fish Harvesting Technology

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 20 marks)

Each question carries 2 marks

1. What are aerial traps?
2. What is a trammel net?
3. What is a falling gear?
4. What are lift nets?
5. What are dredges?
6. Define trawls
7. What are five basic mechanism of fish capturing?
8. Describe the pelagic fishery of India
9. Describe the demersal fishery of India
10. Describe the inland fishery of India
11. Describe the cold water fishery of India
12. Write short note on mud banks
13. Write short note on mud banks
14. Write short note on trawl ban
15. Write short note on EEZ

Section B.

Each question carries 5 marks

(Ceiling - 30 marks)

16. What is dolnet?
17. What are traps?
18. Explain the types of trawls
19. Explain the types of seines
20. Explain the types of purse seines
21. Explain the types of gillnets
22. Explain the types of longlines
23. Describe the pelagic fishery of India

Section C.

(2x10=10 marks)

Answer any two questions

24. Describe longlining and its operation
25. Classify fishing gears of India
26. Describe purse seine and its operation
27. Describe gillnetting and its operation

FIRST SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC1FI02 Basic microbiology

Time: 2.5 Hours

Maximum: 80 marks
(Ceiling - 25 marks)

Section A.

Each question carries 2 marks

1. Give example of food borne intoxicants
2. Define moist heat sterilization
3. What is SCP?
4. Define Vaccine
5. What is synthetic culture media? Give example
6. Define Pasteurization
7. What is meant by MIC of anti-bacterial agent?
8. Describe briefly about coliform organisms
9. Define generation time of bacteria
10. Name four microorganisms which are beneficial for human
11. Define Toxic infection
12. Differentiate Yeast and Mold
13. Explain Listeriosis
14. Define stationary phase of growth curve
15. What is CFU?

Section B.

(Ceiling - 35 marks)

Each question carries 5 marks

16. Explain the factors affecting microbial growth
17. Write down economic importance of Protozoa
18. Explain role of bacteria in biochemical cycle
19. What is bacterial culture media? Classify?
20. Explain sources of microbes in food
21. Note on infection, intoxication and toxic infection with examples
22. What is the role of microbes in Agriculture?
23. What is Bioterrorism

Section C.

Answer any *two* questions

(2x10=20 marks)

24. Explain in detail the microorganisms and their significance in human life with examples
25. What are vaccines? Classify. Write notes on various vaccines administered as per national immunization programme
26. Give the structure of endospore and discuss about germination and sporulation of endospore
27. Explain in detail the following with suitable examples:
 - a) Foodborne infection
 - b) Foodborne intoxication
 - c) Foodborne toxic infection

FIRST SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC1FI03 Technology of Food Preservation

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What is struvite formation
2. What is radio frequency thawing system?
3. What is drip loss?
4. Lacquering in seafood canning?
5. Mould formation salted fish
6. What is vacuum thawing system
7. What is moisture migration?
8. Consequence of inadequate thawing
9. How is fish naturally drying carried out?
10. What is freeze drying?
11. Principles of freezing?
12. What is super cooling
13. What is over thawing?
14. what is crystallization?
15. What is commercial sterilization?

Section B.

(Ceiling - 35 marks)

Each question carries 5 marks

16. Define drying .explain its main purpose seafood preservation
17. Explain freezing
18. List some of the old methods of food preservation followed at home giving examples and their viability in present times.
19. Role of preservatives in Preservation of food?
20. Brief the Methods of Irradiation?
21. Describe the perishable foods with examples and its applications?
22. Explain the thermal processing methods of preservation with example?
23. Discriminate the direct indirect effect of irradiation?

Section C.

(2x10=20 marks)

Answer any *two* questions

24. Write detailed notes on the scope and benefit of industrial food preservation?
25. Explain the thermal processing methods of preservation with example?
26. Describe the methods of freezing of fish,explain the criteria of selection of a method for particular food
27. Explain the following
 - (i) Principal of freeze drying techniques.
 - (ii) High pressure processing of foods have several advantages.

SECOND SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC2FI06 Fish Biochemistry and Spoilage

Time: 2 Hours

Maximum: 60 marks
(Ceiling – 20 marks)

Section A.

Each question carries 2 marks

1. Define Spoilage indicator of fish
2. Define Psychrophilic microorganisms
3. What are Phases of fish spoilage
4. Give two roles of lipids in fish nutrition.
5. What are lipoproteins?
6. Define gluconeogenesis.
7. What is meant by glycogenolysis?
8. What is glycolysis?
9. Define glycogenesis?
10. Mention two differences between glycolysis and gluconeogenesis.
11. What is β -oxidation of fatty acids and where does it occur?
12. Name the sugar and bases present in DNA.

Section B.

(Ceiling - 30 marks)

Each question carries 5 marks

13. Proximate composition of fish
14. Major constituents in fish muscle
15. Minor constituents in fish muscle
16. Protein composition of fish muscle
17. Sarcoplasmic proteins in fish muscle
18. Myofibrillar proteins in fish muscle
19. Stroma proteins in fish muscle

Section C.

(1x10=10 marks)

Answer any *two* questions

20. Explain Phases of fish spoilage
21. Explain Intrinsic and extrinsic factors affecting spoilage

SECOND SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC2FI07 Post-Harvest Handling of Fish

Time: 2.00 Hours

Maximum: 60 marks

Section A.

Each question carries 2 marks

(Ceiling - 20 marks)

1. Examples of cross-contamination
2. Expand MAP
3. Expand RSW & CSW
4. Comment on the waste management systems in a seafood plant
5. Describe the sanitation procedures in a seafood processing plant
6. Describe the marketing strategy of seafood products
7. What is glazing?
8. Physical changes during fish handling
9. what are CCPs?
10. Different methods are employed for storing fish
11. Describe the standards for glazing water
12. What is the storage life of fishery products?

Section B.

Each question carries 5 marks

(Ceiling - 30 marks)

13. HACCP and seven principles?
14. Explain the biochemical aspects of fresh fish and spoilage in fish?
15. What is spoilage? What are its causes?
16. What are the physio chemical causes and manifestations of spoilage in fish?
17. Describe the changes occur in fish due to spoilage
18. Describe the texture change occur in fish due to spoilage What is the requirements for GMP
19. Different methods are employed for storing fish

Section C.

Answer any one questions

(1x10=10 marks)

20. What are the sanitary and phyto -sanitary requirements for maintenance of quality during post harvest handling of fish
21. Describe the different types of fresh fish cutting and style

SECOND SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC2FI08 Food Safety in Seafood Industry

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What is meant by food safety?
2. Significance of seafood safety and quality control
3. What are the 3 most common ways accidents or incidents occur in the laboratory?
4. What type of solution(s) should be used to disinfect a bench top before and after lab?
5. What are contaminants?
6. Where do contaminants come from?
7. What are food borne diseases?
8. What are the risks of eating seafood contaminated with mercury and PCBs?
9. What about mercury in canned tuna? What is viral infection?
10. What is HACCP?
11. List out any important 4 Safety Features of a good laboratory
12. What is Ameobiasis?
13. What iso?
14. Quality control of a food laboratory?
15. What is SSOP?
16. Risk benefits of seafood consumption?

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

17. Mission of GLP
18. What happens if a workplace Does not comply with federal good laboratory practice standards?
19. What are the laboratory safety rules
20. What are the elements of SSOP
21. What are the proper hand washing procedures in seafood plant
22. How to prevent cross contamination in a seafood plant
23. Principles of food hygiene

Section C.

Answer any two questions

(2x10=20 marks)

24. Layout and general requirements of food laboratory
25. Biological hazards in seafood?
26. Lists key points on SSOP and Sketch the chlorination chart
27. Explain precautionary practices are exercised to prevent cross contamination

THIRD SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC3FI11 Fishery microbiology

Time: 2 Hours

Maximum: 60 marks

Section A.

Each question carries 2 marks

(Ceiling - 20 marks)

1. Define enrichment media. Give examples
2. What are advantages of sterilization using moist heat?
3. Comment on microbial water quality in fish processing
4. Brief on Microbiological standards for seafood products
5. What is IMViC stands for?
6. Define CFU
7. Comment on Faecal coliform
8. Comment on Seafood safety
9. What is decline phase of bacterial growth curve
10. Comment on microbial water quality
11. Give an example for any one rapid detection of microorganisms
12. Comment on pre enrichment of microorganisms

Section B.

Each question carries 5 marks

(Ceiling - 30 marks)

13. Note on microbiological media sterilization
14. Extrinsic factors affecting bacterial growth in fishery products
15. Comment on *Vibrio cholerae* and *Vibrio parahaemolyticus*
16. Indices of sanitary quality of fish
17. Comment on GLP
18. Quality management in seafood processing
19. Sterilization procedures

Section C.

Answer any *one* questions

(1x10=10 marks)

20. Define Quality and Explain Quality indicators of fish and fishery products
21. Discuss on colony morphology of
 - a. *Salmonella* in XLDA
 - b. *E. coli* in Tergitol 7 agar
 - c. *Staphylococcus* in BP agar
 - d. *Vibrio cholerae* in TCBS agar

THIRD SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC3FI12 Freezing Technology in Seafood Plants

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What is IQF?
2. What is freezer burn?
3. What are "green" shrimp?
4. What are the safest ways to thaw frozen foods?
5. Does the color of frozen food change after thawing?
6. Once meat is thawed, is it safe to refreeze without cooking?
7. What is shelf life?
8. Freezing curve for fish
9. Describe atomic structure of water
10. Crystallization of water
11. Super cooling
12. Eutectic point
13. What are the physical changes during freezing?
14. Briefly explain the technique of freezing
15. What are different freezing methods?

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Freezing curve for fish
17. Describe atomic structure of water
18. Crystallization of water
19. What are the physical changes during freezing?
20. Briefly explain the technique of freezing
21. What are different freezing methods?
22. What are the recent advances in fish thawing?
23. Crystallization of water

Section C.

Answer any two questions

(2x10=20 marks)

24. What is IQF? Explain
25. What is freezer burn? Explain
26. What are the safest ways to thaw frozen foods?.
27. What are the physical and chemical changes during freezing?

THIRD SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology
SDC3FI13 Fishery By-products and Value Addition

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What is the nutritional importance of fish oil?
2. What are the storage conditions of fish oil?
3. Enzyme hydrolysis of fish
4. What are fish hydrolysates?
5. What is glucosamine hydrochloride?
6. What is shrimp extract?
7. What is fish maws?
8. What is carragenan?
9. Write a note on Ambergris
10. Comment on advantages of value addition
11. How are fish pickled prepared?
12. What is isinglass ?what are its uses
13. How are fish oil prepared
14. Which are the major by-products obtained during the processing of shrimp?
15. Masmin

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. List out the important byproducts of fish?
17. What is fish protein concentrate? How does FPC differ from fish meal? Explain different types of albumin?
18. Explain processing of fish silage?
19. Uses of chitin and chitosan?
20. Value added products from surimi
21. Advantages of Value addition
22. Quality assessment of surimi
23. List out the important byproducts of fish?

Section C.

Answer any two questions

(2x10=20 marks)

24. Write an essay on fishery byproducts
25. Explain the production and uses fish silage
26. Explain briefly the significance of Food Technology. How has it affected the life of modern housewives, specially working women?
27. Give a brief account of development of food preservation to its present status

THIRD SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC3FI15 Operation Management in Fish Processing Plants

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What is brine concentration?
2. Comment in personnel hygiene
3. Fisheries extension and its importance?
4. Layout of a freezing plant
5. Botulism
6. Types of thermometers
7. Legislation and standard of effluent discharge
8. Chlorination in fish processing plant
9. Layout of a cold storage
10. SSOP?
11. Layout of a canning plant
12. What is sludge?
13. What is air curtains?
14. Importance of fisheries extension?
15. What is sensors?

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. What is the requirements for GMP
17. What is meant by biological treatment?
18. Simple communication model fisheries extension?
19. What is the chemical treatment methods of waste water?
20. Role of extension for national development ?
21. Main objectives of MATSYAFED
22. Essential for a ideal layout?
23. List out the agencies under the department of fisheries

Section C.

Answer any two questions

(2x10=20 marks)

24. Explain Mechanisms and modes of extension and their impact on capture fisheries and fisher livelihoods.
25. Legislation and standards for effluent discharge
26. Fish processing industrial pollution and control measures
27. Different types of thermometers, characteristics and application.

FOURTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology
SDC4FI17 Thermal Processing of Fishery Products

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. HACCP
2. GMP
3. UHT
4. MAP
5. What is cooking?
6. What are symptoms of botulism?
7. What are the characters of *C. botulinum*?
8. What is pasteurization?
9. What is blanching?
10. What is TPC?
11. What is UHT?
12. What is D Value?
13. What is canning?
14. What is sterilization?
15. What is retort pouching?

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. What are the purposes of blanching?
17. What is MAP?
18. What is commercial sterility?
19. Which are the heat resistant organisms in fishery products?
20. What is GMP?
21. Canned foods
22. Conditions affecting the growth of micro-organisms
23. TPC

Section C.

Answer any two questions

(2x10=20 marks)

24. Mechanism of food preservation by hurdle technology
25. Explain the thermal processing of fishes
26. Explain the potential hurdles in fish preservation
27. Explain the process of canning of fish

FOURTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC4FI18 Cured and Dried Fishery Products

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. Storage characteristics of dried and cured fish
2. Microbial spoilage effects of water activity
3. Enzymatic reactions of cured fish
4. Lipid oxidation control of micro-organisms in dried fish
5. Control of micro-organisms in cured fish
6. Principles of drying and dehydration of fish
7. Different types of dryers
8. Freeze drying preparation and nutritive value of freeze dried products
9. What are the precautions to be taken in fish drying?
10. What is shelf life?
11. What are the types of freezing?
12. Define fermented food
13. How do shelf life of food increase by fermentation ?
14. What are the differences between sun drying and dehydration?
15. What are the factors affecting rate of drying?

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Preparation and nutritive value of freeze dried products
17. What are the precautions to be taken in fish drying?
18. Cured fish
19. Types of salt curing
20. The use of salt in fish and factors affecting salt uptake by fish
21. Describe Smoke curing of fish
22. Method of smoking of fish?
23. Explain Fermented products and different methods of fermentation

Section C.

Answer any two questions

(2x10=20 marks)

24. Explain drying and curing methods of food preservation
25. Explain briefly the significance of Food Technology. How has it affected the life of modern housewives, especially working women?
26. Give a brief account of development of food preservation to its present status
27. Describe the methods of drying of fish, explain the criteria of selection of a method for particular food

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC5FI23 Storage and Transportation of Fishery Products

Time: 2 Hours

Maximum: 60 marks

Section A.

Each question carries 2 marks

(Ceiling - 20 marks)

1. Determining the quality of raw fish for processing
2. What is called storage stability
3. Define shelf life of a product
4. What is FIFO?
5. Comment on structural supports of a cold storage
6. Describe the rate of chilling
7. Discuss on modes of transportation of fishery products
8. Comment on sensory changes of fish stored for a long time
9. Brief on temperature monitoring systems in seafood
10. Describe enzymatic spoilage in fish
11. What is called microbial quality of fish
12. Freezing of fish

Section B.

Each question carries 5 marks

(Ceiling - 30 marks)

13. Discuss the factors to be considered in cold storage selection
14. Onboard chilling techniques of fish
15. Describe storage containers of fish
16. What are the risk factors in transporting frozen fish?
17. Comment on the quality of ice for fish storage
18. Comment on spacing and structural supports of a cold storage
19. Role of QC in maintaining quality of seafood

Section C.

Answer any *one* questions

(1x10=10 marks)

20. Discuss on the significance of maintaining cold chain in seafood processing
21. Factors to be considered during transportation of frozen fishery products

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC5FI24(E01) Instrumentation in Fish Processing Analysis

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. Southern blotting
2. Northern blotting
3. ELISA
4. Working principle of light microscopes
5. Fluorescent microscope
6. Phase contrast microscope
7. Electronic microscope
8. Explain different types of Electronic microscope
9. TEM
10. SEM
11. What is pH meter?
12. Explain working of pH meter
13. Explain different types of oxygen probes
14. Explain different types of temperature probes
15. Flame Photometry

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. What is pH meter?
17. Explain working of pH meter
18. Explain different types of oxygen probes
19. Explain different types of temperature probes
20. Flame Photometry
21. Spectrophotometry
22. High performance liquid chromatography
23. Electrone microscopy

Section C.

Answer any two questions

(2x10=20 marks)

24. Explain microscopy
25. Different types of chromatography
26. Electrophoresis
27. HPLC

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC5FI24(E02) Fisheries Economics and Extension

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. Pricing
2. Market segmentation
3. Perfect competition
4. Marketing management
5. Finance management
6. Marginal revenue
7. Law of diminishing marginal utility
8. Law of supply
9. Elasticity of demand
10. Factors of production
11. Goods and services
12. Explain different types of cold storage
13. What do you mean good manufacturing practices.
14. Explain 'Biotoxins.'
15. Distinguish between refrigerated seawater and chilled sea water

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Explain the major quality standards in India and in European Unions
17. Law of diminishing marginal utility
18. Law of diminishing marginal utility
19. Marginal revenue
20. Law of supply
21. Law of returns
22. Elasticity of demand
23. Factors of production

Section C.

Answer any two questions

(2x10=20 marks)

24. Pricing strategies in used for marketing.
25. Describe the principle and functions of management.
26. What are the marketing functions?
27. What is Production function? How does it help an aqua culturist?

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC5FI24(E03) Fisheries and Population Dynamics

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. Sardinella longiceps
2. Cephalopod fishery
3. MEY
4. Individual Transferable Quota
5. Indian Fisheries Act
6. EEZ
7. Coldwater fishery
8. Letter of Permission
9. Institutes under ICAR concerned with fisheries
10. Bombay duck fishery
11. Reservoir fishery
12. Monsoon trawl ban
13. Mesh size regulation
14. Overfishing
15. Deep sea fisheries

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Cold water fisheries
17. Major pelagic fishery of India.
18. Major causes of marine fishery depletion.
19. Bombay duck and Cephalopod fishery in India.
20. Policy and problems of deep sea fisheries in India.
21. MSY and MEY concepts – discuss.
22. Sardine and Mackerel fisheries of India.
23. How the concepts of MSY and MEY are helpful in managing fisheries?

Section C.

Answer any two questions

(2x10=20 marks)

24. Deep sea fisheries and deep sea fishing policy of Govt. of India.
25. Describe the estuarine fisheries in India.
26. Inland fisheries in India.
27. Concept of stock, recruitment, growth rate and mortality rate in fisheries.

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)
Fish Processing Technology
SDC5FI25 Quality Control, Inspection and Certification in Seafood

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What is struvite formation
2. What is radio frequency thawing system?
3. What is drip loss?
4. Lacquering in seafood canning?
5. Mould formation salted fish
6. What is vacuum thawing system
7. What is moisture migration?
8. Consequence of inadequate thawing
9. How is fish naturally drying carried out?
10. What is freeze drying?
11. Principles of freezing?
12. What is super cooling
13. What is over thawing?
14. what is crystallization?
15. What is commercial sterilization?

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Define drying. explain its main purpose seafood preservation
17. Explain freezing
18. List some of the old methods of food preservation followed at home giving examples and their viability in present times.
19. Role of preservatives in Preservation of food?
20. Brief the Methods of Irradiation?
21. Describe the perishable foods with examples and its applications?
22. Explain the thermal processing methods of preservation with example?
23. Discriminate the direct indirect effect of irradiation?

Section C.

Answer any two questions

(2x10=20 marks)

24. Write detailed notes on the scope and benefit of industrial food preservation?
25. Explain the thermal processing methods of preservation with example?
26. Describe the methods of freezing of fish, explain the criteria of selection of a method for particular food
 - a. Explain the following
 - b. Principal of freeze drying techniques.
 - c. High pressure processing of foods have several advantages.

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC5FI26

Economics and Marketing in Seafood Trade

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. What are the functions of fish marketing/market?
2. How Marshall defined economics?
3. Differentiate positive and normative economics
4. Define the term “production”
5. Scope of economics
6. Qualities of a good packaging material
7. Define production function
8. Define resource utility
9. Define marketing intelligence
10. Demand curve
11. Define production and consumption
12. Note on monopoly in market
13. Marketing strategy of fisheries products
14. What are the factors influencing the price determination of fishery products?
15. Point out the challenges in fish supply chain

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Explain elasticity of demand and its types
17. Explain the price determinants of fisheries market
18. Comment on significance of value addition in fish marketing
19. Fish supply and demand characteristics
20. Explain price elasticity and the determinants of price elasticity in fish marketing
21. Note on perfect and imperfect competition
22. Cost and earnings of seafood processing plants
23. Role of NCDC in fishermen welfare

Section C.

Answer any two questions

(2x10=20 marks)

24. What is the nature and scope of managerial economics?
25. Role of Matsyafed in uplifting socioeconomic status of marine fishermen
26. Explain the i) Market structure ii) Elements of market and iii) Marketing channels of fishery products
27. Discuss on packaging and labeling of fishery products

FIFTH SEMESTER BVOC DEGREE EXAMINATION

(2021 admission onwards)

Fish Processing Technology

SDC5FI27 Packing and Labelling of Fish and Fishery Products

Time: 2.5 Hours

Maximum: 80 marks

Section A.

(Ceiling - 25 marks)

Each question carries 2 marks

1. Methods of icing onboard
2. Describe the specifications in colour of labeling
3. What are the major nutrients?
4. What are minor nutrients?
5. What are essential nutrients?
6. Define anti nutritional factor
7. Requirements of food packaging?
8. Packaging requirements of fresh fish
9. Selection of packaging material for MAP
10. What are the objectives of labeling?
11. What are the necessary components of a label?
12. Advantages of packaging of frozen fish?
13. describe physical properties of packaging material?
14. What is duplex carton?
15. Packaging of IQF products

Section B.

Each question carries 5 marks

(Ceiling - 35 marks)

16. Describe the texture change occur in fish due to spoilage What is the requirements for GMP What are the anti nutritional factors in seafood.
17. Nutritional la belling and education act
18. food labeling in CODEX ALIMENTARIOUS
19. What is gas packaging?Packaging of thermally processed fishery products
20. Packaging for other seafood products
21. What is e-sign? What does the e-sign mean on a label?
22. Different types of packaging materials
23. Explain pasteurization and sterilization? What are the difference between them?

Section C.

Answer any two questions

(2x10=20 marks)

24. Describe the different types of fresh fish cutting and style Packaging requirements for Canned fish Products and also explain retort pouch packaging
25. General requirements for packaging and labeling of pre -packed foods
26. What is included in a typical label design?what is the specification in color and size in labeling
27. Colors on food labels-are there any rules?
