



**KARNATAK UNIVERSITY, DHARWAD**

**B.Sc. Programme (General)**

**under CBCS**

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**SYLLABUS FOR THE SUBJECT**

**Industrial Fish and Fisheries (IF)**

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**Effective from 2020-21**

### B.Sc. (General) Programme structure under CBCS

Semester	*Core			Elective			Ability Enhancement Course						Total Credits
	DSC			**DSE			***SEC			AECC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	4+0+4	4+2=6							English-1	2+1+0	2+1=3	26
	DSC-2A	4+0+4	4+2=6							MIL-1	2+1+0	2+1=3	
	DSC-3A	4+0+4	4+2=6							ENVIRONMENTAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	4+0+4	4+2=6							English-2	2+1+0	2+1=3	26
	DSC-2B	4+0+4	4+2=6							MIL-2	2+1+0	2+1=3	
	DSC-3B	4+0+4	4+2=6							CONSTITUTION OF INDIA	2+0+0	2+0=2	
III	DSC-1C	4+0+4	4+2=6							English-3	2+1+0	2+1=3	24
	DSC-2C	4+0+4	4+2=6							MIL-3	2+1+0	2+1=3	
	DSC-3C	4+0+4	4+2=6										
IV	DSC-1D	4+0+4	4+2=6							English-4	2+1=0	2+1=3	24
	DSC-2D	4+0+4	4+2=6							MIL-4	2+1=0	2+1=3	
	DSC-3D	4+0+4	4+2=6										
V				DSE-1E	4+0+4	4+2=6	SEC-1E	2+0+0	2				22
				DSE-2E	4+0+4	4+2=6	SEC-2E	2+0+0	2				
				DSE-3E	4+0+4	4+2=6							
VI				DSE-1F	4+0+4	4+2=6	SEC-1F	2+0+0	2				22
				DSE-2F	4+0+4	4+2=6	SEC-2F	2+0+0	2				
				DSE-3F	4+0+4	4+2=6							
TOTAL			72			36			08			28	144

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week (no tutorial for practical subject).

\* If the core course is Mathematics, there shall be two papers of 75 marks each. Then L+T+P = (2x3)+(2x1)+0, but credit shall be 6 only.

\*\* Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

\*\*\* SEC 1 to 4 shall be from same DSC . Student shall choose any one DSC in 5<sup>th</sup> and 6<sup>th</sup> semester (SEC may be practical or theory for 2 credits)

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks(40 Sem. End exam +10 IA Exam).

2. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

3. Environmental Science/ Constitution of India / SEC shall have 30 hrs syllabus / semester for 50 marks in theory/ Practical (40 Sem. End exams +10 IA Exam).

Karnatak University, Dharwad  
B. Sc. (General) CBCS syllabus for Under Graduate Programme  
Subject :- *Industrial Fish and Fisheries*  
Effective from 2020-21

Sem ester	Theory/ Practical	Subject Code	Instruct hrs/wk	Syllabus hrs/ Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
I	Theory	DSC (IF-T:h A)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (IF-Pr: A)	04 hrs	52	03 hrs	10	40	50	02
II	Theory	DSC (IF-Th: B)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (IF Pr: B)	04 hrs	52	03 hrs	10	40	50	02
III	Theory	DSC (IF-Th: C)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (IF -Pr: C)	04 hrs	52	03 hrs	10	40	50	02
IV	Theory	DSC (IF -Th: D)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (IF-Pr: D)	04 hrs	52	03 hrs	10	40	50	02
V	*Theory P-I /P- II	DSE (IF-Th P-I E IF-Th: P-II E)	04 hrs / 04 hrs	60/60	03 hrs	20	80	100	04
	Practical	DSE (IF-Pr: E)	04 hrs	52	03 hrs	10	40	50	02
VI	*Theory P-I /P- II	DSE (IF-Th P-I F IF-Th: P-II F)	04 hrs / 04 hrs	60/60	03 hrs	20	80	100	04
	Practical	DSE (IF-Pr: F)	04 hrs	52	03 hrs	10	40	50	02
Total						180	720	900	36

\*Candidate shall choose either paper -I or P-II but not both in DSE theory.

**SKILL ENHANCEMENT COURSE (SEC) for *Industrial Fish and Fisheries* opted as DSC**

Sem ester	Theory	Subject Code	Instruction hour per week	Total Syllabus Hrs/ Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
V	Theory	(SEC-IF- 1E)	02 hrs	30	1.5 hrs	10	40	50	02
V	Theory	(SEC-IF- 2E)	02 hrs	30	1.5 hrs	10	40	50	02
VI	Theory	(SEC-IF- 1F)	02 hrs	30	1.5 hrs	10	40	50	02

VI	Theory	(SEC-IF- 2E)	02 hrs	30	1.5 hrs	10	40	50	02
Total			08 hrs	120		40	160	200	08

**B.Sc. Semester - I**  
**DSC - INDUSTRIAL FISH AND FISHERIES: IF-Th : A**

**Credits: I. Theory : 04** Theory class 4hrs /wk. Total theory: 60 Lectures  
80 marks for Sem end Examination(3 hrs) & 20 marks IA  
**II. Practical : 02** Practical: 4 hrs./wk. Total Practical: 52 hrs.  
40 marks for Sem end Examination(3 hrs) & 10 marks IA  
**Total Credits : 06** Total Theory marks 100 and Practical marks 50

**Syllabus :**

**BIOLOGY OF FIN FISH AND SHELL FISH: PART-I**

**Classification of super class Pisces;**

The differences between elasmobranches and teleosts. Study of external morphology of typical elasmobranches and teleosts. The structures used in taxonomic studies like skin, colouration, scales, mouth, jaws etc., External characters of fishes – shape, head, mouth, eyes, barbules, operculum, fins, spines, trunk, tail, scales, lateral line. External characters of Prawn, Lobsters, Bivalve, Gastropods and Cephalopods (two examples from each)

**15 hrs**

Commercially important orders, families, genera and species of elasmobranches and teleosts of Indian region and their identification. Identification of commercially important Fishes, Prawn, Lobsters, Bivalves, Gastropods and Cephalopods of India.

**15 hrs**

**Internal anatomy of fish;** Alimentary canal and associated structures. Respiratory system, Gill, Swim bladder, Accessory respiratory organs. Heart and circulatory system. Nervous system and lateral line system, Sense organs.

**10 hrs**

**Food and Feeding;** Feeding habitat in various groups of marine and freshwater fishes. Natural food of fishes. Anatomical difference of herbivore and carnivore fishes. Feeding habitat of Prawn, Crab, Lobsters, Bivalve and Cephalopods.

**10 hrs**

**Reproductive system in fishes:** Reproductive behaviour and parental care in fishes. Special behaviour, aggregation and shoaling. Migration of fishes; anadromous and catadromous.

**10 hrs**

**INDUSTRIAL FISH AND FISHERIES LAB: IF-Pr: A**

**Syllabus and distribution of marks in the practical Examination**

**I SEMESTER PRACTICAL**

**4 hrs/ week**

1. Study of external morphology and morphometry of a typical teleost fish.

(Types of scales, fins and mouth type) (03 Practicals )

2. Identification, classification, description and economic importance of fin fish and shell fish of South India. (06 Practicals)

3. Mounting of Scale, Amphullae of Lorenzini and mounting of brain of shark. (03 practicals)

## SCHEME OF PRACTICAL EXAMINATION

1. Mounting of Amphullae of Lorenzini/Scale/brain.	04 marks
2. Morphometry of the given fish.	10 marks
3. Identification 08X2	16 marks
4. Journal	05 marks
5. Viva	05 marks

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**Total 40 marks**

## B.Sc. Semester - II

**DSC -INDUSTRIAL FISH AND FISHERIES: IF-Th: B**

<b>Credits: I. Theory : 04</b>	<b>Theory class 4hrs /wk. Total theory: 60 Lectures 80 marks for Sem end Examination(3 hrs) &amp; 20 marks IA</b>
<b>II. Practical : 02</b>	<b>Practical: 4 hrs./wk. Total Practical: 52 hrs. 40 marks for Sem end Examination(3 hrs) &amp; 10 marks IA</b>
<b>Total Credits : 06</b>	<b>Total Theory marks 100 and Practical marks 50</b>

### Syllabus :

#### BIOLOGY OF FIN FISH AND SHELL FISH: PART-II

**Growth of Fish;** Absolute and relative growth. Isometric and allometric growth. Marking and tagging of fish for growth, length and weight relationship, ponderal index, relative factor, gonado somatic index.

**5 hrs**

**Reproduction;** Sex difference, sexual maturity, classification of maturity stages, estimation of fecundity, ova-diameter frequency, fecundity in relation to length, weight, age and food supply. Spawning habits, factor affecting spawning, spawning seasons and spawning frequency.

**Embryonic and early development;** Type of eggs, larvae. Metamorphosis of larvae, larval life and feeding habitats of fishes.

**10 hrs**

**Ornamental fishes:** Common species of ornamental fish suitable for aquarium. Water equality for breeding tanks, selection and conditioning of fish. Freshwater ornamental species- livebearers, egg layers. Maturation, secondary sexual characters, breeding habits. Parental care, development of eggs.

**Breeding of ornamental fish;** Egg scatters, egg depositors, mouth brooders, bubbles nest builders, livebearers etc., Hatching, larval rearing and their feeds and feeding. Use of pigment for colour enhancement.

**15 hrs**

**Marine ornamental fishes:** Marine ornamental fishes, their habitat, collection from nature. Methods of collection. Transportation of live fish, use of sedatives. Others ornamental organisms like Sea anemone, Lobster, Shrimps, Octopus, and Starfish etc., used in the aquarium.

**5 hrs**

**Freshwater ornamental Plants: Rooted plants;** Limnophila, Ditch moss, Potamogeton spp., Cabomba, Ceretophyllum, Indian fern, Cryptocornye spp., Amazon sward plant, Hair grass, Sagitteria, and Vallisneria.

**Floating Plants;** Duck weed, Pistia, Riccia and Salvinia. Multiplication or ornamental plants, nutrients and optimum environment conditions for their growth.

**5 hrs**

**Construction and maintenance of Aquarium:** Construction of home aquarium, material used, wooden and metal frame, frameless tanks, sealants and gums. Design and construction of public freshwater and marine aquaria. Aerators and filters, pebbles, ornamental objects and other equipment used in the aquaria. Cleaning the aquarium, maintenance of water quality, control of snails. Nutritional requirement for aquarium fishes. Preparation of dry feeds, feeding methods. Maintenance of aquarium,

**Live food** – brine shrimp, bloodworm, water flea, earthworm, infusoria, mosquito larvae, tubifex worm, other natural and artificial foods. Common disease of aquarium fishes, and their diagnostics and treatment.

**20 hrs**

### ***INDUSTRIAL FISH AND FISHERIES LAB: IF -Pr: B***

#### **Syllabus and distribution of marks in the practical Examination**

##### **II SEMESTER PRACTICALS**

**4 hrs/ week**

1. Anatomy of typical elasmobranches and teleost (Dissection of Cranial nervous system and Arterial system) (03 Practicals).
2. Classification, Identification and Description of (06 Practicals)
  - a) Ornamental marine fishes
  - b) Ornamental freshwater fishes
  - c) Ornamental organism used in the aquarium
  - d) Ornamental plants
3. Construction and Maintenance of home aquarium. (03 Practicals)

##### **SCHEME FOR PRACTICAL EXAMINATION**

- |                                                                                |          |
|--------------------------------------------------------------------------------|----------|
| 1. Dissection and display cranial/ arterial system in given fish-----          | 10 marks |
| 2. Identification and describe of aquarium fish / plants / other materials 8X2 | 16 marks |
| 3. Construction of aquarium                                                    | 04 marks |
| 4. Journal                                                                     | 05 marks |
| 5. Viva                                                                        | 05 marks |

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**Total: 40 marks**

## B.Sc. Semester - III

### DSC -INDUSTRIAL FISH AND FISHERIES: IF-Th: C

<b>Credits: I. Theory</b>	<b>: 04</b>	<b>Theory class 4hrs /wk. Total theory: 60 Lectures</b>
		<b>80 marks for Sem end Examination(3 hrs) &amp; 20 marks IA</b>
<b>II. Practical</b>	<b>: 02</b>	<b>Practical: 4 hrs./wk. Total Practical: 52 hrs.</b>
		<b>40 marks for Sem end Examination(3 hrs) &amp; 10 marks IA</b>
<b>Total Credits</b>	<b>: 06</b>	<b>Total Theory marks 100 and Practical marks 50</b>

### Syllabus :

#### Capture Fisheries

**CAPTURE FISHERIES;** Importance of capture fisheries of the World. Present yield and estimate of potential fisheries. International fisheries commissions. The Inland capture fisheries resource of world and India. Riverine fisheries. Fisheries of major and minor carps, catfishes and other groups. Problems and managements.

**10 hrs**

Coldwater fisheries resources; Fisheries of trout, Mahaseer and other coldwater fish species. Development and management.

**10 hrs**

Lacustrine fisheries sources, potentials and problems of development and management.

**5 hrs**

Estuarine fisheries resource; fishes of clupeoids, prawns, molluscs, mullets and other important groups. Fisheries of brackishwater lakes and backwaters.

**10 hrs**

**Capture fishers fisheries of marine;** Marine fisheries resources of India. Pelagic fisheries; Fisheries of Oil sardines, Lesser sardines, Anchovies, Clupeoids, Mackerels, Ribbon fisheries, Tunas, Seer fish, Carangids and Cephalopods.

**10 hrs**

**Mid water and demersal fisheries;** Fisheries of elasmobranches, Bombay duck, Catfishes, Silver bellies, Sciaenids, Pomfrets, Threadfins, Perches, Flatfish, Prawns, Lobsters, Crabs, Mussels, Oysters and Clams and their economic importance. Fishing regulatory and Laws.

**15 hrs**

### INDUSTRIAL FISH AND FISHERIES LAB: IF-Pr: C

#### Syllabus and distribution of marks in the practical Examination

##### III SEMESTER PRACTICAL

**4 hrs/ week**

1. Freshwater fish gears and crafts. (03 Practicals)
2. Marine water gears and crafts. (03 Practicals)
3. Length and weight relationship in fishes.(03 Practicals)
4. Population structure and Length frequency data in fishes. (02 Practicals)
5. Compulsory Field Visit to marine fish landing centre, beach etc., (Carries 10 marks for Field Report)

##### SCHEME OF PRACTICAL EXAMINATION

- |                                                                       |          |
|-----------------------------------------------------------------------|----------|
| 1. Length and weight relationship in fishes                           | 10 marks |
| 2. Population structure and frequency data                            | 05 marks |
| 3. Identification of gears and crafts 5X2                             | 10 marks |
| 4. Field visit Report and Viva (7+3)<br>(Compulsory study tour visit) | 10 marks |
| 5. Journals                                                           | 05 marks |

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**Total 40 marks**



## B.Sc. Semester - IV

DSC- INDUSTRIAL FISH AND FISHERIES: IF-Th: D

<b>Credits: I. Theory</b>	<b>: 04</b>	<b>Theory class 4hrs /wk. Total theory: 60 Lectures</b>
		<b>80 marks for Sem end Examination(3 hrs) &amp; 20 marks IA</b>
<b>II. Practical</b>	<b>: 02</b>	<b>Practical: 4 hrs./wk. Total Practical: 52 hrs.</b>
		<b>40 marks for Sem end Examination(3 hrs) &amp; 10 marks IA</b>
<b>Total Credits</b>	<b>: 06</b>	<b>Total Theory marks 100 and Practical marks 50</b>

### Syllabus

#### FISHERIES TECHNOLOGY:

Principles and importance of fish preservation – Sun drying, Salt curing, Pickling, Smoking, Chilling, Frying and Canning. Processing and preservation of fish products and byproducts. Paste products, Minced meat, Fish Protein Concentrate, Fish meal, Shark liver oil, Fish body oil, Liquid fish (fish ensilage), Shark fins and fin rays, Fish skin leather, Ambergris, Fish cake, Fish salads, Fish wafers, Fish soup powder, Fish hydrolysate, Fish Sauce, Fish glue, Isinglass, Chitin and Chitosan, Pearl essence, bêche-de-mer.

25 hrs

Sea weeds – Edible, Industrial and Pharmaceutical products and their uses.

05 hrs

Handling, preservation and transportation of fresh fish, freezing preservation of fish, modern techniques employed in fish preservations

05 hrs

Sanitation in processing and quality control of fresh and processed fish and fisheries products.

05 hrs

**Fish catching methods;** Indigenous fishing gears of India. Recent development in fishing gears in India. Indigenous fishing crafts of India. Mechanization of Indian fishing crafts, fishing vessels. Electronics in fishing industry. Sea fishing methods.

10 hrs

**Pearl producing molluscans;** Freshwater and marine pearl producing molluscans. Pearl formation. Pearl production states in India.

05 hrs

**Fisherman Co-operative Societies;** Roll of co-operative in fishery economy. Organization of fisherman Co-operative society. Roll of Co-operative Societies in fish production and marketing. Fisheries extension.

05 hrs

#### INDUSTRIAL FISH AND FISHERIES LAB: IF-Pr: D

#### Syllabus and distribution of marks in the practical Examination

##### IV SEMESTER PRACTICALS

4Hrs/week

1. Study of By-products and their economic importance.  
(Fish wafers, Soup powder, Fish Ensilage, Isinglass, fish pickle, Shark fin and fin rays, fish body oil, Chitin and Chitosan, Fish sauce, Fish cake, FPC) etc., (07 Practicals)
2. Preparation of Chitosan from prawn shells
3. Extraction of fish body oil and liver oil (02 Practicals)
4. Fish Food formulation and pellet preparation
5. Compulsory visit to cold storages, Fisheries Institutes and processing plants and fish landing centre and submission of study tour reports.

#### SCHEME OF PRACTICAL EXAMINATION

1. Identification, economic importance and edible importance of fish by-products 8X2	16 marks
2. Preparation of Chitosan/Fish liver oil/Body oil extraction and uses	05 marks
3. Fish feed preparation	04 marks
4. Field report and Viva (7+3)	10 marks
5. Journal	05 marks

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Total **40 marks**

**B.Sc. Semester - V**  
**DSE- INDUSTRIAL FISH AND FISHERIES: Paper-I (IF-Th:P-I E)**

**(Candidate shall choose either Paper-I or paper-II)**

<b>Credits: I. Theory : 04</b>	<b>Theory class 4hrs /wk. Total theory: 60 Lectures</b>
	<b>80 marks for Sem end Examination(3 hrs) &amp; 20 marks IA</b>
<b>II. Practical : 02</b>	<b>Practical: 4 hrs./wk. Total Practical: 52 hrs.</b>
	<b>40 marks for Sem end Examination(3 hrs) &amp; 10 marks IA</b>
<b>Total Credits : 06</b>	<b>Total Theory marks 100 and Practical marks 50</b>

**Syllabus :**

**Principles and practice of Aquaculture:** Definition and history of Aquaculture; Scope and importance of aquaculture. Principles of site selection, Kinds of fish farm, Productivity of water, Soil and soil characteristics and other parameters. Different systems of aquaculture, monoculture, polyculture, integrated fish farming, pond culture, cage culture, pen culture, raft culture, extensive, semi intensive and intensive fish culture, raceway culture, sewage fed fish culture. Factors for success of fish culture enterprises. Aquaculture diversification-Aquaponics, Biofloc culture, periphyton culture.

**20 hrs**

**COSTAL AQUACULTURE;** Marine fisheries resource of India, Brakishwater fisheries resource of India. Important species of Pennaeid prawns and life history of typical Prawn, hatchery production of seed, nursery rearing, transportation of Prawn seed, hatchery management. Breeding and culture of brakishwater fish - Milk fish, Mulletts, Pearl spot, Sea bass etc. Mariculture of edible oysters, mussels, Clams, Sea urchin, Sea cucumber and culture of sea weeds. Fisheries Institutes of India.

**20 hrs**

Present status of Aquaculture, Preparation of culture pond, Pre stocking management, Control of aquatic weeds, aquatic insects, weed fishes, predators, algal blooms and their control, liming and fertilization, manuring of nursery and rearing ponds. Criteria of selection of species for culture, seed procurement and stocking. Post stocking management, phased manuring, supplementary feeds and feeding.

**10 hrs**

Breeding and culture of freshwater Prawns and their polyculture with finfish. Air breathing fish culture. Coldwater fishes and their culture.

**5 hrs**

**Fish Histology:** Histological studies of most important internal organs of fish - gills, liver, Intestine, Kidney, Muscle.

**5 hrs**

**B.Sc. Semester - V**

**DSE- INDUSTRIAL FISH AND FISHERIES: Paper-II (IF-Th:P-II E)**  
**(Candidate shall choose either Paper-I or paper-II)**

**Credits: I. Theory : 04** Theory class 4hrs /wk. Total theory: 60 Lectures  
80 marks for Sem end Examination(3 hrs) & 20 marks IA  
**II. Practical : 02** Practical: 4 hrs./wk. Total Practical: 52 hrs.  
40 marks for Sem end Examination(3 hrs) & 10 marks IA  
**Total Credits : 06** Total Theory marks 100 and Practical marks 50

**Syllabus :**

**Aquaculture:** Definition and history of Aquaculture; Scope and importance of aquaculture. Principles of site selection, Kinds of fish farm, Productivity of water, Soil and soil characteristics and other parameters. Different systems of aquaculture, monoculture, polyculture, integrated fish farming, pond culture, cage culture, pen culture, raft culture, extensive, semi intensive and intensive fish culture, raceway culture, sewage fed fish culture. Factors for success of fish culture enterprises. Aquaculture diversification-Aquaponics, Biofloc culture, periphyton culture.

**20 hrs**

**Mariculture:** Marine fisheries resource of India, Brakishwater fisheries resource of India. Important species of Pennaeid prawns and life history of typical Prawn, hatchery production of seed, nursery rearing, transportation of Prawn seed, hatchery management. Breeding and culture of brakishwater fish - Milk fish, Mullets, Pearl spot, Sea bass etc. Mariculture of edible oysters, mussels, Clams, Sea urchin, Sea cucumber and culture of sea weeds. Fisheries Institutes of India.

**20 hrs**

**Fish pathology:** Significance of fish disease in relation to aquaculture practices. Principles of disease diagnosis and fish health management. Disease caused by crustaceans, parasites (Ergasilosis, Lerniae, Argulus, Isopodeparasite). Protozoan diseases, Fungal diseases, Viral diseases and Bacterial diseases of fishes, symptoms and their control methods.

**12 hrs**

Breeding and culture of freshwater Prawns and their polyculture with finfish. Air breathing fish culture. Coldwater fishes and their culture. Formulation of artificial diet of fishes. Storage of feeds, feeding techniques, natural feed and its importance in aquaculture. Aqua farm management, concepts and principles of aqua farm management. Major cultivable freshwater fishes of India.

**08 hrs**

**INDUSTRIAL FISH AND FISHERIES LAB: IF-Pr: E**

**(Common for both Paper I and II)**

**Syllabus and distribution of marks in the practical Examination**

**4Hrs/week**

1. Water analysis. (03 Practicals)  
(Dissolved oxygen, carbon dioxide, alkalinity, salinity, pH, hardness)
2. Soil parameters. (02 Practicals)  
(Collection and preservation, analysis of particle size, water holding capacity, pH).
3. Aquatic insects, aquatic weeds, predatory & weed fishes. (Identification and describe) (02 Practicals)
4. Economics of fish (05 examples) (02 Practicals)
5. Histological and Histochemical technique.
6. Stain preparation and staining technique
7. Compulsory Field visit to fish seed hatchery and fisheries Institutes.

**SCHEME FOR PRACTICAL EXAMINATION**

1. Water analysis –	10 marks
2. Soil parameter analysis.	05 marks
3. Identifications 5x2	10 marks
4. Journal	05 marks
5. Field Report and Viva (7+3)	10 marks

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**Total      40 marks**

## B.Sc. Semester - VI

**DSE- INDUSTRIAL FISH AND FISHERIES: Paper-I (IF-Th: P-I F)**  
**(Candidate shall choose either Paper-I or II)**

<b>Credits: I. Theory    : 04</b>	<b>Theory class 4hrs /wk. Total theory: 60 Lectures</b>
	<b>80 marks for Sem. end Examination (3 hrs) &amp; 20 marks IA</b>
<b>II. Practical        : 02</b>	<b>Practical: 4 hrs. / wk.    Total Practical: 52 hrs.</b>
	<b>40 marks for Sem. end Examination (3 hrs) &amp; 10 marks IA</b>
<b>Total Credits     : 06</b>	<b>Total Theory marks 100 and Practical marks 50</b>

### Syllabus :

**Seed Production:** Roll of gonadotrophin in fish breeding, Brood stock management, breeding of carps and other cultivable fishes, induced breeding. Ovulation agent used (fish pituitary glands, human chorionic gonadotrophin), pheromones and other new generation drugs. Hatchery technology, bund breeding, riverine seed collection, seed transportation, Different stages of fish seed (spawn, fry, fingerlings).

**10 hrs**

**Environmental Biology:** Definition, scope and importance of ecology. Ecological habitats, abiotic and biotic factors. Primary productivity of water mass and fish production, trophic levels of fish in the food chain, predatory prey relationship, ecology of freshwater ponds, ecology of river, ecology of estuaries, brackishwater and sea. Nutrition Cycles: Carbon cycle, Nitrogen cycle and oxygen cycle and Phosphorous. Water and soil pollution, source and effects and control. Pesticide impact on aquatic organisms, thermal pollution, radioactivity, assessment and monitoring of water pollution. Biogeo cycle: Carbon cycle, oxygen cycle, nitrogen cycle, sulphur cycle, Phosphorous cycle

**20 hrs**

### BIOCHEMISTRY

Carbohydrates: Classification, properties of important monosaccharide, disaccharides, polysaccharides. Lipid classification, properties and functions. Protein classification, properties and functions. Enzymes, classification and applications. Vitamins dietary sources and functions. Special reference to fish moisture, fish protein, fats, ash, contents, fish enzymes and non protein nitrogen compounds like- Tri-methylamine oxide, urea, free alpha amino acids and volatile bases. Bioenergetics (Kreb's cycle, glycolysis, electron transport system)

**20 hrs**

**Fish Genetics:** Introductions to cytogenetics and its application in fisheries. Sex determination and Inheritance. Different methods of breeding-Inbreeding, out breeding, cross breeding, selective breeding, random breeding. Hybridization and transgenic fish. Cryopreservation of gametes, Gynogenesis, androgenesis, polyploidy, production of monosex and sterile fish. Sex reversal techniques. Principal of biochemical and molecular genetics and its applications in fisheries

**10 hrs**

**B.Sc. Semester - VI**  
**DSE- INDUSTRIAL FISH AND FISHERIES: Paper-II (IF-Th:P-II F)**  
**(Candidate shall choose either Paper-I or paper-II)**

<b>Credits: I. Theory : 04</b>	<b>Theory class 4hrs /wk. Total theory: 60 Lectures</b>
	<b>80 marks for Sem end Examination(3 hrs) &amp; 20 marks IA</b>
<b>II. Practical : 02</b>	<b>Practical: 4 hrs./wk. Total Practical: 52 hrs.</b>
	<b>40 marks for Sem end Examination(3 hrs) &amp; 10 marks IA</b>
<b>Total Credits : 06</b>	<b>Total Theory marks 100 and Practical marks 50</b>

**Syllabus :**

**Seed Production:** Roll of gonadotrophin in fish breeding, Brood stock management, breeding of carps and other cultivable fishes, induced breeding. Ovulation agent used (fish pituitary glands, human chorionic gonadotrophin), pheromones and other new generation drugs. Hatchery technology, bund breeding, riverine seed collection, seed transportation, Different stages of fish seed (spawn, fry, fingerlings). Application of genetics in fish farming.

**10 hrs**

**Environmental Biology:** Definition, scope and importance of ecology. Ecological habitats, abiotic and biotic factors. Primary productivity of water mass and fish production, trophic levels of fish in the food chain, predatory prey relationship, ecology of freshwater ponds, ecology of river, ecology of estuaries, brackishwater and sea. Nutrition Cycles: Carbon cycle, Nitrogen cycle and oxygen cycle and Phosphorous. Water and soil pollution, source and effects and control. Pesticide impact on aquatic organisms, thermal pollution, radioactivity, assessment and monitoring of water pollution. Biogeo cycle: Carbon cycle, oxygen cycle, nitrogen cycle, sulphur cycle, Phosphorous cycle

**20 hrs**

**FISH MICROBIOLOGY**

Diversity of microbial community – General characteristics of bacteria, fungi, viruses, algae and protozoans. Structure of prokaryotic cell, Structure and function of bacterial cell wall, plasma membrane, capsule, flagella and endospore. Structure of fungi and yeast cell. Structure of virus. Classification of viruses. Autotrophic and heterotrophic microorganisms in aquatic environment. Health significant bacteria in culture ponds. Culture characteristics and epidemiology of *E. coli*, pathogenic *Vibrio*, *Salmonella*, *Aeromonashydrophila*, and *Pseudomonas*. Pathogenic microorganisms in fishes, role of microorganisms in fisheries, Pathogenic organism encountered in fish products, fecal indicator organisms.

Perishability of seafood – Microbial spoilage of fish and shellfish. Spoilage microflora. Intrinsic and extrinsic factors affecting spoilage. Microflora associated with body parts. Food borne pathogens. Sources of contamination. Microbiology scope and its importance in fisheries.

**15 hrs**

**Fish Biotechnology** Biotechnology scope and its importance in fisheries, molecular techniques in stock characterization, Principles and applications of HPLC, Principles and application of PCR, Principles and applications of SDS page, Electrophoresis. General properties of organic and inorganic compounds. Role of herbal therapy in fish health management. Application of molecular engineering and nucleic acid manipulation in fisheries.

Recombinant DNA technology, Aquaculture biotechnology- Biotechnological tools for aquaculture, gene manipulation in fish, transgenic fish production, transgenic synthetic hormone for fish breeding.

Application of tissue culture in seaweed and pearl production. Marine toxins. Industrial chemicals and pharmaceuticals from marine sources. Use of probiotics and antibiotics in aquaculture operations.

**INDUSTRIAL FISH AND FISHERIES LAB: IF-Pr-F****(Common for both Paper I and II)****Syllabus and distribution of marks in the practical Examination****VI SEMESTER PRACTICAL 4Hrs/week**

1. Plankton study: Collection methods and preservation.
2. Primary productivity (light and dark bottle). (02 Practicals )
3. Induced breeding technique.
4. Preparation of percent Molarity, molality, normality of a solution.
5. Assay enzyme activity of analyses.
6. Quantitative analysis of protein by spectrometry method.
7. Estimation of glucose and glycogen in fish tissue and blood.
8. Composite fish culture.
9. Study of different stages of fish seed. (spawn, fry, fingerlings)
10. Study of Pond as Ecosystem
11. Compulsory field visit to fisheries institute, beaches and landing centre, fish processing centre.

**SCHEME PRACTICAL**

- |                                                                |          |
|----------------------------------------------------------------|----------|
| 1. Estimation of glucose/glycogen/protein in fish tissue/blood | 10 marks |
| 2. Primary productivity                                        | 10 marks |
| 3. Induced breeding                                            | 05 marks |
| 4. Field Report and Viva                                       | 10 marks |
| 5. Journal                                                     | 05 marks |

Total	40 marks
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**GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL THE SEMESTERS**

1. Question number 1-12 carries 2marks to answer any 10 questions : 20 marks
2. Question number 13-21 carries 5marks to answer any 6 questions : 30 marks
3. Question number 22-26 carries 10marks to answer any 3 questions : 30 marks  
(10 marks question may be either 10 or 6+4 or 7+3 or 4+3+3)

**Total: 80 marks****REFERENCE BOOKS**

Bal, D.V. and Veerabhadra Rao, K. Marine Fisheries, Tata MC Grawhill Publications, New Delhi.

Barrington, F.J.W. Invertebrates : Structure and Functions. EIBS, 1971.

Borradile & R.A. Potts. The Invertebrates. Asia Publishing House, 1962.

Bose AN et.al., 1991. Costal Aquaculture Engineering. Oxford & IBH Publishing Company Pvt. Ltd. 6. Pillay TVR, 1996. Aquaculture Principles and Practices, Fishing News Books Ltd., London

Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing Company.

C.B.L. Srivastava – A text book of Fishery Science and Indian Fisheries. Kitab Mahal Agencies, Patna.

DNA Based Molecular Diagnostic Techniques: Research Needs for Standardization and Validation of the Detection of Aquatic Animal Pathogens and Diseases. FAO Publ. Wedmeyer G, Meyer FP & Smith L. 1999.

Ellis Harward. 18 Felix S, Riji John K, Prince Jeyaseelan MJ & Sundararaj V. 2001 Bacterial Fish Pathogens (Diseases in Farm and Wild)

Fish Disease Diagnosis and Health Management. Fisheries College and Research Institute, T.N. Veterinary and Animal Sciences University. Thoothukkudi. Inglis V, Roberts RJ & Bromage NR. 1993.

Guland J.A. (ed) 1984. Penaeid Shrimps – Their Biology and Management.

Howar, W.S. & D.S. Randal Fish Physiology, Vols.: 1 to 4.

Jhingram, V.G. Fish and Fisheries of India. Second edition 1983, Hindustan Pub.Co. Picker, W.E. Methods for assessment of Fish Production in Fresh Waters. Blackwell Scient. Publ. 1970

Jhingran VG 1998. Fish and Fisheries of India. Hindusthan Publishing Corporation, New Delhi.

Jhingran, V.G. Fish and Fisheries of India. Hindustan Publishing Co., 1975.

Kaestner, A. Invertebrate Zoology. Vol. I – III, John Wiley & Sons, 1967.

Kurian, C.V. & V.O. Sabastian. Prawns and Prawn Fisheries of India. Hindustan Pub. Co., 1976. 5. Parker, J. & W.A. Haswell. The Textbook of Zoology. Vol. I. Invertebrates (eds. A.J. Marshall & W.D. Williams), ELBS & McMillan & Co., 1992

Maintenance of field work note book to be evaluated at the time of examination.

Meyer & Ashlock. Principles of systematic zoology.

Moyle Peterb, Fishes: An Introduction to Ichthyology. Prentice Hall, 1974.

Picker, W.E. Methods for assessment of Fish Production in Fresh Waters. Blackwell Scient. Publ. 1970

Pillay TVR & Dill, WMA, 1979. Advances in Aquaculture. Fishing news books ltd., England.

Pillay TVR & Kutty MN 2005. Aquaculture – Principles and practices, Blackwell.

Pillay TVR, 1996. Aquaculture principles and practices, fishing news books ltd., London.

Pillay, TVR. Aquaculture principles and practices, Fishery News (Books) Ltd., London 1990.

Prawn and prawn fisheries by Kurain and Sebestain.

Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York.

Roberts RJ 1989. Fish pathology. Bailliere Tindall, New York 3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandry and medicine. Pergamon Press. Oxford

Shankar KM & Mohan CV 2002. Fish and Shell Fish Health Management UNESCO. Publ. Sundermann CJ 1990.

Johnson SK 1995. Hand book of shrimp diseases Texas A & M university, Texas.

Shaperclaus W. 1991 Fish Diseases- Vol.I & II. Oxonian Press Pvt.ltd

Srivastava, U.K. et.al. Freshwater aquaculture in India, Oxford and IBH Publ. Co. New Delhi 1980.

Turnor – Text book of endocrinology.

Walker P & Subasinghe RP. (Eds.). 2005 Principal Diseases of Marine Fish and Shellfish. Vols. I, II. 2nd Ed. Academic Press

James PSBR 1991. Manual of pearl culture techniques. Cmfri bulletin no.39. Cochin

Das ML and Patnaik PN 1994. Brackish water prawn culture. Palani Paramount Publications, Palani

Fast AW and Lester LJ (Ed.)

Adivi Reddy sv 1997. An introduction to extension education. Oxford & IBH Co.Pvt. Ltd. New Delhi

Jayaraman R 1996. Fisheries Economics. Tamilnadu Veterinary and Animal Science University. Tuticorn

Subba Rao N 1986. Economics of Fisheries. Daya publishing house, Delhi

Dewwett KK and Varma JD 1993. Elementary economic theory. S.chand, New Delhi

Korakandy R 1996. Economics of Fisheries Mangement. Daya Publishing House, Delhi

Tripathi SD 1992. Aquaculture Economics. Asian Fisheries Society, Mangalore.  
Balachandran KK 2001. Post-harvest technology of fish and fish products. Daya publishing ouse, Delhi  
Moorjani MN 1998. Fish processing in India, ICAR, New Delhi  
Fernandes R. Microbiology Handbook: Fish and Seafood. Leatherhead Food Research Association; 2nd New edition edition  
Harry W. Seeley, Paul J. Vandemark, and John J. Lee- Microbes in Action: A Laboratory Manual of Microbiology. W. H. Freeman ☒  
Pawar and Diganawala- General Microbiology – Vol. I and Vol. II ☒  
Frobisher et al- Fundamentals of Microbiology

## **SKILL ENHANCEMENT COURSES (SEC) in *Industrial Fish and Fisheries***

### **B.Sc. Semester - V**

#### **SEC - *INDUSTRIAL FISH AND FISHERIES* (SEC-IF- 1E)**

**Total Syllabus: 30 hrs / Sem.:**

**2 hrs / Week**

**Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)**

**Duration of Exam: 1.5 hrs**

#### **Syllabus and reference books**

Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

Pearl oyster culture: Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls- Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters. Pearl Oyster surgery (Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery), Postoperative culture, harvesting of pearl, clearing of pearl.

Present status, prospects and problems of pearl industry in India.

#### **References:**

- Thomas PC, Rath SC & Mohapatra KD. 2003. Breeding and Seed Production of Finfish and Shellfish. Daya Publ.
- Southgate P. and Lucas J. 2008. The Pearl Oyster 1st Edition. Elsevier Science

### **B.Sc. Semester - V**

#### **SEC - *INDUSTRIAL FISH AND FISHERIES* (SEC-IF- 2E)**

**Total Syllabus: 30 hrs / Sem.:**

**2 hrs / Week**



**Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)**

**Duration of Exam: 1.5 hrs**

### **Syllabus and reference books**

Open sea farming: Scope and species cultured. Selection of site for sea farming. Different designs of open sea farming structures – construction of cages – bioengineering problems and solutions. Molluscs, Echinoderms and Seaweed Culture: Molluscan culture- edible oysters, mussels and clams culture techniques. Echinoderms culture- important species, culture techniques. Culture of seaweeds- cultivable species, culture techniques and harvesting, important seaweed products.

Environmental Impacts: Environmental impact of brackish water and coastal aquaculture - Salinity intrusion, effluent discharge, eutrophication, chemical residues including antibiotics and hormones, destruction of natural habitat including paddy field and mangroves. Social issues and conflicts with other users on resources.

Candidate species of phytoplankton and zoo-plankton as live food organisms of freshwater and marine species. Tropic potentials- proximate composition of live feed. Biology and culture requirements of important live food organisms. Green algae, blue-green algae, spirulina, diatoms, infusoria, rotifers, cladocerans, tubifex, brine shrimp, chironomids. Culture of earthworms, bait fish and forage fish.

### **References:**

- . Pillay T.V.R. and Kutty M.N. Aquaculture: Principles and Management. Willey India Pvt. Ltd
- . Bardach J.E. Aquaculture. Willey
- . Badapanda K.C. Aquaculture. Wiley
- . Thomas P.C. Breeding and seed production of fin fish and shellfish. Daya publishing house.

## **B.Sc. Semester - VI**

**SEC- INDUSTRIAL FISH AND FISHERIES (SEC-IF- 1F)**

**Total Syllabus: 30 hrs / Sem.:**

**2 hrs / Week**

**Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)**

**Duration of Exam: 1.5 hrs**

### **Syllabus and reference books**

Quality Assurance and Export of Fishery Products: Quality control – basic concepts, quality and quality control. Sanitation procedures in seafood processing plants. Waste management in fish processing industries. Risk factors in seafood bio toxins, seafood pathogens, endogenous parasites. Methods of evaluating fish freshness and quality – organoleptic, physical, chemical, microbiological and instrumental methods. Quality control programmes - pre-shipment inspection, IPQC, MIPQC, HACCP and ISO Series in seafood industry. Quality standards in India

and major importing countries like USA, Japan and EU. Export of fishery products from India – major countries, important products, export documents and procedures. Traceability, Quality certifications, Eco-labelling.

References:

Biswas K.P. Fish Processing and Preservation. Daya Pub. House.

Govindan T.K. Fish Processing Technology. Oxford & IBH Pub. Co.

Badapanda K.C. Fish processing and preservation technology. Narendra Publishing House

## **B.Sc. Semester - VI**

**SEC- INDUSTRIAL FISH AND FISHERIES (SEC-IF- 2F)**

**Total Syllabus: 30 hrs / Sem.:**

**2 hrs / Week**

**Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)**

**Duration of Exam: 1.5 hrs**

### **Syllabus and reference books**

Introduction: History and Present status of crab culture in India. Biology of Crabs: Economically important species of crabs. Morphology and anatomy of crabs. Sexual dimorphism, Reproductive biology & Life cycle of crabs. Habit & Habitat, Food & Feeding habits of crabs.

Crabs culture: Cultivable species of crabs in India. Techniques of Crabs culture- seed production of mud crabs, crab hatchery, feeding of the larvae. Crabs fattening

Prospect, problems and development of crab culture in India.

References:

ICAR. 2006. Hand Book of Fisheries and Aquaculture. ICAR.

Landau M. 1992. Introduction to Aquaculture. John Wiley & Sons.

Mcvey JP. 1983. Handbook of Mariculture. CRC Press.

Pillay TVR & Kutty MN. 2005. Aquaculture- Principles and Practices. Blackwell.

Thomas PC, Rath SC & Mohapatra KD. 2003. Breeding and Seed Production of Finfish and Shellfish. Daya Publ.

### **Examination Pattern**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL SEC**

1. Question number 1-6 carries 2marks to answer any 5 questions : 10 marks
2. Question number 7-14 carries 4 marks to answer any 5 questions : 20 marks
3. Question number 15-17 carries 5 marks to answer any 2 questions : 10marks

Total: 40 marks