



SIES

College of Arts,
Science &
Commerce (Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

(Affiliated to University of Mumbai)

Faculty: Science

Program: T.Y.B.Sc

**Subject: Fishery Biology
(Applied Component)**

Academic Year: 2020 – 2021

**Revised Syllabus in Fishery Biology
under Choice Based Credit System (CBCS)
Approved by the Board of Studies in Zoology
Effective from academic year 2020 – 2021**

T.Y.B.Sc. Fishery Biology (Applied Component) Syllabus (Autonomous)
Semester V and Semester VI
(Choice Based Credit System, with effect from academic year 2020-21)

Preamble

“Faith is a bird that feels the light and sings while the dawn is still dark.” – Rabindranath Tagore

Academic Autonomy entitles the institution with certain privileges, one of them being freedom to prescribe our own course and curriculum, and refine it to make it locally relevant. This academic freedom is a milestone for academic excellence. Thus, a revision of the syllabus is necessitated to give a competitive edge to the students to sustain themselves in this fast moving world.

The aim of introducing Applied Component in T.Y.B.Sc. program is to fuel the entrepreneurial potential of students. This may encourage those zoologists with a flair for business, to acquire an in depth knowledge of the subject for its applicability to earn a livelihood. Fishery Biology, an application of Zoology mainly concerns with the wealth of aquatic natural resources i.e., fish and other organisms living in water, that can yield economic benefits. It is concerned with management of fish stocks for commercial food production, one of the ways to eradicate malnutrition. It also involves the study of ecological aspects related to aquaculture and conservation of threatened aquatic species.

A collective effort of the professors of Zoology at SIES College, Sion (West) and other board members from outside the institution has helped in conceptualizing this syllabus. It was approved by the Board of Studies (Ad hoc) in the meeting held on 16th June 2018 at the institution’s department of Zoology.

This course in Fishery Biology is our approach to expose students to the research in fishery science and also to develop managerial skills among them.

*Dr. Satish Sarfare
Chairman,
Board of Studies in the subject of Zoology*

Members of the Board of Studies in the subject of Zoology

- ✓ *Professor (Dr.) Chhaya Panse – Principal and Head, Department of Zoology, MD College, Mumbai (Vice Chancellor's Nominee)*
 - ✓ *Professor (Dr.) Manoj Mahimkar – Principal Investigator, Cancer Research Institute, ACTREC, Kharghar, Navi Mumbai; (Subject expert from outside the Parent University to be nominated by the Academic Council)*
 - ✓ *Dr. Sasikumar Menon – Director, Institute for Advanced Training & Research in Interdisciplinary Sciences (IATRIS), (Therapeutic Drug Monitoring Lab), Sion, Mumbai; Faculty, Pharma Analytical Sciences, Ruia College, Mumbai (Subject Expert from outside college/Industry expert)*
 - ✓ *Mr. Kedar Gore – Director, The Corbett Foundation (Non-profit Organization), Mumbai, (Subject expert from outside college / Representative from Corporate sector / Allied area)*
 - ✓ *Ms. Uma Bandekar – Clinical Team Manager with ICON plc (Postgraduate Meritorious Alumnus)*
 - ✓ *Dr. Satish Sarfare – Head and Faculty, Department of Zoology, SIES College, Mumbai*
 - ✓ *Mr. Pushparaj Shetty – Faculty, Department of Zoology, SIES College, Mumbai*
 - ✓ *Dr. Rupali Vaity – Faculty, Department of Zoology, SIES College, Mumbai*
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**T.Y.B.Sc. Fishery Biology (Applied Component) Syllabus (Autonomous)
Choice Based Credit System (With effect from academic year 2020-21)**

Grid of Syllabus –Semester V

Course Code	Unit No.	Unit name	Credits	Lectures/Week
SIUSACFBIO51 (Oceanography, Aquaculture Practices, Marketing and Finance)	1	Oceanography	2	4
	2	Introduction to other Commercial Aquaculture Practices in Fresh Water		
	3	Quality Control and Packaging		
	4	Marketing and Finance		
SIUSACFBIO51		Practicals based on SIUSACFBIO51	2	4
Total			4	

Grid of Syllabus –Semester VI

Course Code	Unit No.	Unit name	Credits	Lectures/Week
SIUSACFBIO61 (Marine fin fishery and Shell fishery, Nutritional requirements and Diseases in fish, Fish preservation, processing and Fish By-products)	1	Marine Fin Fish of India	2	4
	2	Marine Shell Fish of India		
	3	Nutritional Requirements and Diseases in Fishes		
	4	Fish Preservation, Processing and Fish By- products		
SIUSACFBIO61		Practicals based on SIUSACFBIO61	2	4
Total			4	

Programme: Bachelor of Science, B.Sc. – Zoology
Applied Component – Fishery Biology

“I cannot teach anybody anything, I can only make them think” - Socrates

The characteristic graduate attributes comprising of Programme Outcomes, Programme Specific Outcomes and Course Outcomes for a science graduate in the subject of Zoology are as follows:

Note the list of abbreviations:

PO: Programme Outcome, PSO: Programme Specific Outcome, CO: Course Outcome
Cognitive Levels:- R: Remember, U: Understand, Ap: Apply, An: Analyze, E: Evaluate, C: Create

Serial Number	Details of Programme Outcomes (POs)
PO1 (Skill Level)	Problem Solving Ability (<i>U, Ap</i>) <ul style="list-style-type: none"> • Apply the knowledge of various courses learned under a program to break down complex problems into simple components. • Adopt and assimilate problem-based learning models and apply one’s learning to solve real life problem situations.
PO2 (Skill Level)	Critical Thinking (<i>U, An, E</i>) <ul style="list-style-type: none"> • Develop critical thinking based on a rationale to identify assumptions, verifying the accuracy and validity of assumptions, and making informed decisions. • Inculcate the ability of logical reasoning to question the rationale behind concepts, ideas, and perspectives.
PO3 (Skill Level)	Effective Communication Skills (<i>Ap, C</i>) <ul style="list-style-type: none"> • Improve written and oral communication skills so as to express thoughts and ideas effectively. • Demonstrate the ability to listen carefully and imbibe soft skills to convey and receive instructions clearly. • Develop presentation skills to present complex information in a clear, lucid and concise manner.
PO4 (Skill Level)	Proficiency with Information and Communication Technology (<i>U, An, E</i>) <ul style="list-style-type: none"> • Demonstrate ability to access, evaluate and use a variety of relevant information resources inclusive of internet and electronic media for the purpose of collating and analysing data. • Understand the scope and limitations of tools or software’s used in Information and Communication Technology.
PO5 (Skill Level)	Leadership Skills and Team Work (<i>U, Ap, An, C</i>) <ul style="list-style-type: none"> • Demonstrate leadership skills formulating an inspiring vision, thereby building a team, motivating and inspiring team members to engage and achieve that vision. • Develop management skills to guide people in taking tasks to their logical conclusion. • Inculcate the ability to facilitate coordinated effort as a group or team in the interests of common cause and recognise the contribution of team members.
PO6 (Attitude Level)	Self-directed and Lifelong Learning (<i>U, Ap, An</i>) <ul style="list-style-type: none"> • Demonstrate the ability to work independently and take responsibility for ones actions. • Acquire the ability to explore and evolve by becoming self-sufficient and self-reliant. • Adapt lifelong learning approaches to broaden one’s horizons for personal growth

	and development.
PO7 (Attitude Level)	Ethical Values and Environmental Concerns (<i>U, Ap, E</i>) <ul style="list-style-type: none"> • Embrace moral or ethical values in conducting one's life and implement ethical practices in all aspects of life. • Create awareness and concern for environmental and sustainability issues. • Understand and realize the significance and relevance of co-habitation and co-evolution in attaining the needs of sustainable development.
PO8 (Attitude Level)	Gender Sensitization and Community Service (<i>U, Ap, An</i>) <ul style="list-style-type: none"> • Respect gender sensitivity, gender equity and gender justice. • Encourage mutual understanding and express empathetic social concern towards different value systems and different strata of society. • Engage in community service through Institutional Social Responsibility.

Serial Number	Details of Programme Specific Outcomes (PSOs)
PSO1	Conceptual Understanding and Emerging Applications (<i>R, U, Ap, An</i>) <ul style="list-style-type: none"> • Inculcate conceptual and coherent understanding of zoology, and demonstrate a broad understanding of animal diversity, including fundamental and systematic knowledge of the scientific classification, taxonomy and evolutionary relationships of major groups of animals. • Understand the nature and basic concepts of cell biology, biochemistry, animal physiology, molecular biology, ecology among other topics, so as to recognize the relationships between structure and functions at different levels of biological organization for the major groups of animals. • Demonstrate interest in different areas of zoology so as to analyse the scope of emerging applications of biological sciences in medicine, genetics, wild life, etc. and apply appropriate methodologies with cutting edge tools/techniques in biological sciences to seek solutions to emerging problems faced by mankind. • Demonstrate the relevance of the procedural subject knowledge that creates different types of professionals related to the disciplinary/subject area of zoology, including professionals engaged in research and development, teaching and government/public service.
PSO2	Analytical reasoning and Scientific Inquiry (<i>U, An, E</i>) <ul style="list-style-type: none"> • Inculcate a sense of inquiry and capability for asking relevant or appropriate questions, articulating problems or concepts or questions. • Encourage the ability to analyse, interpret and draw conclusions from qualitative/quantitative data and critically evaluate ideas, experiences, theories and concepts by following scientific approach to knowledge development from an open minded and reasoned perspective. • Develop analytical skills involving paying attention to detail and imbibe the ability to construct logical arguments using correct technical language related to the relevant subject. • Analyse and interpret data/information collected or related to experiments or investigations, using appropriate methods involving Biostatistics, Bioinformatics among others and report accurately the findings of the experiment/investigations while relating the conclusions/ findings to relevant theories of zoology.
PSO3	Laboratory Skills and Fieldwork (<i>R, U, E, C</i>) <ul style="list-style-type: none"> • Understand and apply standard operating procedures as per Good Laboratory Practices so as to develop laboratory skills and qualities required for successful career in teaching, research, industry, etc. • Demonstrate awareness regarding animal ethics, human ethics, conservation of flora and fauna, so as to promote safe environment and ecosystem, in the pursuit of disciplinary knowledge.

	<ul style="list-style-type: none"> • Develop instrumentation handling skills and laboratory techniques relevant to academia and industry, integrate knowledge, skills with technical competency, so as to create solutions for issues and problems related to biological sciences. • Demonstrate leadership qualities, command trust and respect, thereby, motivating and inspiring team members to work effectively in diverse teams during excursions or study tours. Realise the relevance of participation in field studies in the context of teamwork as well as life on the outdoors.
PSO4	<p>Research Aptitude and Interdisciplinary Approach (<i>Ap, An, E, C</i>)</p> <ul style="list-style-type: none"> • Inculcate and adapt to research aptitude and culture, integrate research-based knowledge in an interdisciplinary framework, and realise the relevance of choosing research as an alternative career option. • Demonstrate the awareness regarding compliance with research ethics, awareness about conflicts of interests and Intellectual Property Rights, and avoiding unethical behaviour such as fabricating, falsifying or misrepresenting data or to committing plagiarism. • Inculcate the ability to recognise cause and effect relationships, formulate hypothesis, reporting the results of an experiment or investigation, and application of research tools for analysis and interpretation of data. • Inculcate an interdisciplinary approach, to understand and consolidate fundamental concepts through inquiry based curriculum, develop critical thinking and problem solving ability required to solve different types of biology related problems with well-defined solutions, and tackle open-ended problems that may cross disciplinary-area boundaries.

Course Outcomes for TYBSc

At the root of all (science) education (Core Learning Outcome):

“The imaginative and original mind need not be overawed by the imposing body of present knowledge or by the complex and costly paraphernalia which today surround much of scientific activity. The great shortage in science now is not opportunity, manpower, money, or laboratory space. What is really needed is more of that healthy scepticism which generates the key idea – the liberating concept.”

– P.H. Abelson

Purity of mind leads to clarity in thought and action for creation of an original archaic work.

As well, to consciously attempt the basic pursuit of understanding human existence.

Semester V – Theory

Course Code: SIUSACFBIO51

Course Name: Oceanography, Aquaculture Practices, Marketing and Finance

Students will accomplish the following outcomes:

Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
<p>CO1: Describe the physical, chemical and biological properties of oceanography. Life saving devices, sampling devices and fish finding devices, types of crafts and gears and their use on east and west coast of India, materials used for preparing the gears, traditional fishing methods and formation of co-operatives, types of commercial aquaculture practices, commercial aquaculture practices, various types of farming of major carps in India, Environmental Impact Assessment, Coastal Regulatory Zone.</p>	R, U	PO1 PSO1
<p>CO2: Explain about remote sensing and assess the areas where it can be used.</p>	U, An	PO2, PO6 PSO3

CO3: Evaluate/investigate the freshness and quality of seafood using organoleptic and microbial and chemical techniques, application of EIA, application of Coastal regulatory Zone	An, Ap, E	PO2, PO6, PO7 PSO3
CO4: Plan for fund raising to various institutes, government schemes and utilizing subsidies, preparing feasibility reports, Environment Monitoring Programme.	Ap	PO7 PSO3, PSO4

Semester V – Practical

Course Code: SIUSACFBIOP51

Course Name: Practical based on SIUSACFBIOP51

Students will accomplish the following outcomes:

Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
CO1: Identify and describe various oceanographic instruments, fishing vessels, fish finding devices, life saving devices, ornamental fishes, aquatic plants, aquarium accessories, various aquaculture models, types of packaging materials, aquaculture farm equipment. Identify and classify various plankton species (Phytoplankton/Zooplankton) on the basis of size, habitat collected from various sites	R, U	PO1 PSO1
CO2: Understand and apply different types of knots, bends and hitches.	U, Ap	PO2, PO6 PSO3
CO3: Identify various types of Prawns, types of bacteria by Gram's staining technique. Estimate the fecundity of fishes, freshness of fishes and prawns, feeding habits of fishes as per their dentition.	R, U	PO2, PO6 PSO3
CO4: Field visits to understand various aspects of Oceanography and Entrepreneurial skill developments.	U, Ap	PO2, PO3, PO5 PSO3

Semester VI – Theory

Course Code: SIUSACFBIOP61

Course Name: Marine fin fishery and Shell fishery, Nutritional requirements and Diseases in fish, Fish preservation, processing and Fish By- products

Students will accomplish the following outcomes:

Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
CO1: Describe types of marine fin fishery in India including pelagic and demersal fishery. Justify the commercial potential of major fin fishes.	R, U	PO2, PO7, PO8 PSO1
CO2: Acquire knowledge about the fishery of different crustaceans, molluscans in the marine waters of India. Justify the commercial potential of molluscan and crustacean	R, U	PO2, PO7, PO8 PSO1

fishery in India.		
CO3: Describe the nutritional requirements of fishes at various stages in development. Describe various physiological disorders/diseases in fishes and assess various types of bacterial, fungal, protozoan, crustacean, worm infections and their treatment.	R, U, An	PO2, PO8 PSO1, PSO2, PSO4
CO4: Acquire knowledge about the various types of fish preservation techniques like refrigeration, icing, salting, drying and their modifications that have taken place over the years, types of fish by-products and value added products.	R, U, An	PO2, PO8 PSO1, PSO2, PSO4

Semester VI – Practical

Course Code: SIUSACFBIOP61

Course Name: Practical based on SIUSACFBIOP61

Students will accomplish the following outcomes:

Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
CO1: Identify various commercially important fin fishes, crustaceans, molluscs. Know about the parasitic fish infections including bacterial, viral, protozoan, helminthic and worm, various types of seaweeds. Classification and distribution of sea weeds in India; economic importance of Mangrove species/ sea weeds, sea grasses, and their importance.	R, U, An	PO2, PO7, PO8 PSO1, PSO2, PSO3, PSO4
CO2: Compare types of phytoplankton/zooplankton obtained from various coastlines. Compare and analyse the amount of fat and protein from fishes and prawns.	U, An, Ap, E	PO2, PO7, PO8 PSO1, PSO2, PSO3, PSO4
CO3: Prepare Fish Burger, Prawn Pickle, Fish Protein Concentrates.	U, Ap	PO5, PO6, PO8 PSO1, PSO2, PSO3, PSO4
CO4: Synthesize formulated fish feed.	U, Ap	PO5, PO6, PO8 PSO1, PSO2, PSO3, PSO4

**T.Y.B.Sc. Fishery Biology (Applied Component) Syllabus (Autonomous)
Choice Based Credit System (With effect from academic year 2020-21)
Semester V – Theory**

Course code: SIUSACFBIO51

Course title: Oceanography, Aquaculture Practices, Marketing and Finance
(Any four units to be opted)

Learning Objectives

- *To introduce the basic concept of Oceanography and to learn about the various tools used in oceanographic studies.*
- *To know about the crafts and gears employed in fishery.*
- *To learn about the farming techniques involved in culturing commercially important fish/ crustaceans of fresh water, brackish water and marine water.*
- *To understand the importance of quality control and proper packaging in fishery to increase the shelf life of the products.*
- *To become familiar with the commerce aspect in fishery science.*

Unit 1: Oceanography

Lectures 15

1.1: Introduction to basic physical, chemical and biological oceanography

1.2: Navigational and sea safety equipments – Life saving devices, Global positioning system, radar, signalling devices

1.3: Oceanographic instruments – Nansen's reversing bottle, Niskin bottle, Peterson's grab, Eckmans grab, dredges, fish finding instruments/ methods, remote sensing

Unit 2: Introduction to other Commercial Aquaculture Practices in Fresh Water Lectures 15

2.1: Fresh water prawn –*Macrobrachium rosenbergii* - Breeding, life cycle, hatchery management and rearing, Composite culture

2.2: Ornamental fishes – Breeding and rearing of *Danio*, Angel, Discus, Neon Tetra, Red Sword Tail, Flower Horn, Siamese Fighter

2.3: Air Breathing Fishes – Breeding and rearing

Unit 3: Quality Control and Packaging

Lectures 15

3.1: Post mortem changes and mechanism of spoilage – Hyperaemia, Rigor Mortis, Autolysis, Rancidity

3.2: Brief methods for evaluating freshness and quality (Organoleptic, Microbial and Chemical) of fish and prawn

3.3: Various packaging materials used in freezing and canning industry – Polyolefin, wax duplex carton, master carton, can, lacquered can

Unit 4: Marketing and Finance

Lectures 15

4.1: Traditional marketing vis-a-vis role of fishery co-operatives with reference to operations at Satpati, Sasoon Dock and Karanja

4.2: Global marketing and Export-Import procedures

4.3: Fund raising – Financial institutions, schemes and subsidies, basic accounting, costing and feasibility report

Semester V – Practical SIUSACFBIOP51
Practical based on SIUSACFBIOP51

1. Introduction to Oceanographic Instruments – Nansen Reversing Bottle with Thermometer, Peterson's Grab, Dredge.
2. Layout of fishing vessels and Sectional view of 2 stroke and 4 stroke marine engines, life saving equipments, winch and deck side equipments.
3. Identification of penaeid and non-penaeid prawn.
4. Identification of Air Breathing Fishes – *Anabas testudineus*, *Clarias batrachus*, *Boleophthalmus spp.*
5. Identification of:
 - a) Ornamental fishes – Angel, Sword Tail, Neon tetra, Siamese fighter, Danio, Discus and Flower Horn
 - b) Aquatic plants – Ludwigia, Cobamba, Cork Screw Vallisneria, Aquarose, Amazon Sword plant
 - c) Aquarium accessories – Aerator, Bottom Filter, Column Filter, Surface Filter, Food dispensers
6. Identification and mounting of phytoplankton and zooplankton.
7. Microbial studies with respect to the habitat, gut and outer surface of the aquatic organisms
 - i) Dilution of sample
 - ii) Identification of bacteria from various samples by Gram staining technique
8. Study of index of freshness in fishes and prawns using Organoleptic tests.
9. Comparative study of feeding habits of different fishes with respect to its gut content and dentition.
10. Identification of packaging materials –
Waxed duplex carton, Master carton, Simple cans, Coated [Lacquered] cans, Polyolefin
11. Group Activities – Field Visits and Entrepreneurial Skill Development.

[Please refer the Annexures for the suggested topics for field visits (Annexure-I), and entrepreneurial skill development (Annexure- II) for SIUSACFBIOP51]

Semester VI – Theory

Course code: SIUSACFBIO61

Course title: Marine Fin Fishery, Shell Fishery, Nutritional requirements and Diseases in fish, Fish preservation, processing and Fish By-products

Learning Objectives

- To do a detailed study of the marine fin fish of India pertaining to coastal and deep sea fisheries.
- To study the crustacean wealth of India and to know its market demand.
- To study the nutritional aspects in fishery.
- To study the diseases in fish and the various preventive measures and treatments undertaken to improve health of the fish.
- To learn about the various preservation and processing techniques employed in fish industry.
- To appreciate a vast array of products of commercial importance obtained from fish that are surplus or trash fish and waste from the fishery industry.

Unit 1: Marine Fin Fish of India

Lectures 15

- 1.1: Coastal fisheries (up to 45 fathoms) – *Pampus sinensis*, *Pampus cinereus*, *Parastromateus niger*, *Polynemus tetradactylus*, *Psuedosciaena diacanthus*, *Trichiurus lepturus*, *Synagris japonicus*, *Scomber microlepidotus*, *Cybiium guttatum*, *Sardinella longiceps*
- 1.2: Deep sea fisheries (more than 45 fathoms) of Indian Exclusive Economic Zone – *Thunnus albacore*, *Sarda orientalis*
- 1.3: Commercial potential and major landing centres of the above fishes

Unit 2: Marine Shell Fish of India

Lectures 15

- 2.1: Crustacean fisheries – *Penaeus monodon*; *Metapenaeus affinis*, *Parapenaeopsis stylifera*, *Acetes indicus*, *Panulirus polyphagus*, *Scylla serrata*
- 2.2: Molluscan fisheries – *Pinctada vulgaris*, *Sepia pharaonis*, *Loligo duvauceli*
- 2.3: Commercial potential and major landing centres of the above shell fishes

Unit 3: Nutrition Requirements and Diseases in Fishes

Lectures 15

- 3.1: Nutritional requirements at various stages of development of fish and crustaceans
- 3.2: Culture of natural feed – *Daphnia*, *Chaetoceros* and *Artemia*
- 3.3: Formulated/ Pelleted feeds
- 3.4: Bacterial, Fungal, Protozoan infections and their treatment
- 3.5: Worm and crustacean infections and their treatment
- 3.6: Physiological disorders/ diseases and their treatment

Unit 4: Fish Preservation, Processing and Fish By-products

Lectures 15

- 4.1: Traditional methods of icing, drying, salting and their modifications
- 4.2: Introduction to refrigeration:
- 4.2.1 : Types and properties of refrigerants, types of freezers – Brine, air blast, tunnel, contact plate and cryo-quick
- 4.2.2 : Freezing procedures including hygienic washing, dressing, PUD (Peeled and Undeveined), DV (Deveined), packaging and freezing for fishes, prawns and their products
- 4.3: Principle and steps involved in can reform and canning of fish and prawns in various media
- 4.4: Fish by-products- Fish protein concentrate, Chitin, Chitosan, Glucosamine hydrochloride, Gelatin

Semester VI – Practical SIUSACFBIOP61
Practical based on SIUSACFBIOP61

1. Identification of commercially important marine fishes –
Pampus sinensis, Pampus cinereus, Parastromateus niger, Polynemus tetradactylus, Pseudosciaena diacanthus, Trichiurus lepturus, Synagris japonicus, Scomber microlepidotus, Cybium guttatum, Sardinella longiceps, Thunnus albacore, Sarda orientalis
2. Identification of Crustaceans and Molluscs –
Penaeus monodon, Metapenaeus affinis, Parapenaeopsis styliifera, Acetes indicus, Panulirus polyphagus, Scylla serrata, Pinctada vulgaris, Sepia pharaonis, Loligo duvauceli
3. Estimation of fish fecundity.
4. Comparative study of fat/lipid fishes by Folch's Method.
5. Comparative study of protein content of fishes by Lowry's Method.
6. Preparation of formulated feed for fish and prawn.
6. Identification of parasitic infections in aquatic organisms –
Fungal – Dermatomycosis; Bacterial – Fin/ Tail rot and Dropsy; Protozoan – Costiasis and White Spot disease; Worm – Leech; Crustacean – Argulosis
7. Preparation of fish protein concentrate and fish soup powder.
9. Preparation of fish burger and prawn pickle.
10. Identification of various farm equipments such as feeding cups, trays, paddle wheels, aerators, fountains, Sluice gate models, elbow pipe outlets.
11. Study of models of raft, pen, cage culture and materials used in rope culture.
12. Project (individual activity) and assignment (group activity).

[Please refer the Annexures for the suggested topics for Projects (Annexure-III) and Assignments (Annexure- IV) for SIUSACFBIOP61]

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- An Introduction to Fishes by Khanna S.S. – Central Book Depot, Allahabad (1993)
- Text Book of Fish Biology and Indian Fisheries by Dr. R. P. Parihar, Central Pub. House, Allahabad
- Financial management by Prasanna Chandra- Seventh Edition Financial management by Khan & Jain
- Financial management by I. M. Pandey Project Management by Prasanna Chandra Marketing Management by Philip Kotler
- For Additional and Latest Information on the topics, various websites can be visited.

Semester V – SIUSACFBIOP51
Annexure – I
Suggested Field Visits (Group activity)

Field visits are to be organised to facilitate students to have firsthand experience and exposure to technology/ production / functioning of an organisation / unit or witness a relevant activity. Each student must make at least 1 such visit to the units/ markets/ sea shores out of 2 to 3 such visits organized by the college.

- I) Visit to one of the units with one or multiple activities such as: Ornamental / Brackish water / Fresh water fish farm / hatchery
- II) Visit to witness one of the activities such as: Fish angling / trawling / purse seining / gill netting Fish finding operations, etc. (Echo Sounder/Sonar/Fish Magnifier).
- III) Visit any production units such as:
Food / Fish processing and preservation Ornamental articles
- IV) Hi-tech and multinational total export oriented units such as: IQF plant
Surimi plant Fishery plant Microbiological units
Hi-tech fish / prawn / chick hatcheries Fish consumer product industries
- V) Others : Self Sale Groups, Co-operative Societies
- VI) Government Offices such as: Fishery Department, MPEDA, Wild-life Authority CITES
JDEI (Jt. Director-Export & Import) Sales Tax, Income Tax Excise Department, Customs Authority of India Local Self Government (BMC) Clearing Agencies /Agents FDA
ISI, Ag Mark, etc.
- VII) Visit any ancillary unit such as: Ice plant, Can reforming Packaging Cold storage
- VIII) Visit to National Laboratories, National Research Labs and Training Institutes such as: NIO, CIFE, CMFRI, CIFT, FSI, IFP, CIFI, CIFNET, NBFGR, etc.

Semester V – SIUSACFBIOP51
Annexure – II
Suggested Topics for Entrepreneurial Skill Development (Group activity)

1. Curing and drying of Jew fish (Dhoma), Ribbon fish, Bombay duck
2. Preparation/ Collection of different fibres and their specifications
3. Preparation of aquarium fish feed
4. Setting and maintenance of fresh water aquarium
5. Setting and maintenance of marine aquarium
6. Breeding of various aquarium fishes
7. Collection of various types of Hooks used in fishing
8. Maintenance of *Daphnia* culture and Tubifex worms, Rotifer culture, *Artemia* culture
9. Study of shelf life of desired products such as prawn pickle, fish wafers, fish burger
10. Breeding of Prawns
11. Breeding of aquarium fishes
12. Rearing of aquarium fishes
13. Propagation of aquatic plants

Semester VI – SIUSACFBIOP61
Annexure – III
Suggested Topics for Individual Project

1. Feasibility report of the maintenance of aquarium fishes in high profile residences.
2. Feasibility report of fresh water /brackish water fish /prawn culture for extensive, semi-intensive and intensive systems.
3. Probability report of maintenance of a culture of *Chaetoceros* and *Artemia* by the fish farmers.
4. Project report for the establishment of small /medium /large scale ice factory, freezing and canning industry.
5. Feasibility report of various packaging materials in freezing /canning industry.
6. Feasibility report for establishing an aquarium shop.
7. Feasibility report for establishing a fish feed industry.
8. Monitoring various physico-chemical parameters of an aquarium /pond /lake /river /sea.

Semester VI – SIUSACFBIOP61
Annexure – IV
Suggested Topics for Group Assignments

1. Study of market survey for various preserved and processed fish /prawn.
2. Handling of fish on board, at landing centre, in secondary market and at consumer level.
3. Preparation of by-products from fishes /crustaceans /molluscs and their costing /production cost.
4. Survey of fish markets for fluctuation in the availability and price of fishes.
5. Survey of the local market for the availability of various by-products, value added products and their price.
6. Study of economics of brackish water pond culture.
7. Study of working of fisheries co-operative societies.
8. Study of cost of construction of fishing vessel and subsidies available for the same.
9. Study of cost of gear manufacturing with different materials and subsidies available for the same.
10. Study of cost and profit analysis of any one of the following methods - Trawler, Gill netter, Purse seiner, Hooks and lines, and Non-mechanised fishing units.
11. Survey of various packaging materials used in fish processing industries.
12. Survey of various feeds used in local aqua farms.
13. Study of economics of pond culture from nearby area.
14. Comparative cost analysis of fingerlings of major carps from your area.
15. Setting up of marine aquarium with various accessories and its costing.
16. Construction of aquaria of different sizes and shapes.
17. Study of various courses run by Institutes in your area in relation to fisheries.

**T.Y.B.Sc. Fishery Biology (Applied Component) Syllabus (Autonomous)
Choice Based Credit System (With effect from academic year 2020-21)**

Scheme of Examination

The performance of learners will be evaluated in two parts for the Theory component of the Course:

1. Internal Assessment with 40% marks
2. Semester End Examination (written) with 60% marks

The Practical component of the Course will be evaluated by conducting Semester End Practical Examination of 50 marks.

Internal Assessment Theory (40%)

It is the assessment of learners on the basis of continuous evaluation as envisaged in the Credit Based System by way of participation of learners in various academic and correlated activities in the given semester of the program.

Marks: 40

1. Class test (Centralized Examination): **20 Marks**
2. At the departmental level evaluation will be conducted on the basis of assignment/ case study report/ project submitted by the student: **20 Marks**

Semester End Assessment Theory (60%)

Marks: 60

Duration: 2 hours

Theory question paper pattern:

There shall be five questions of 12 marks each. On each unit there will be one question and the 5th question will be based on the entire syllabus.

OR

There shall be four questions of 15 marks each, each question based on one unit. All questions are compulsory with internal choice within the questions.

Questions may be subdivided and the allocation of marks depends on the weightage of the topic.

Semester End Assessment Practical

Marks: 100

Duration: 5 hours
