



ADIKAVI NANNAYA UNIVERSITY :: RAJAHMAHENDRAVARAM
B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

UG PROGRAM (4 years Honors)

CBCS - 2020-21

B. Sc
FISHERIES



Syllabus and Model Question Papers



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Note: BOS is to provide final soft copy in PDF and word formats and four copies of hard copies in bounded form to the office of Dean Academic affairs.



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1. Resolutions of the Board of Studies

Meeting held on:21-1-21 Time:10.30 am

At: Convention center, Adikavi Nannaya University :: Rajamahendravaram

Agenda:

Members present:

1.

Resolutions:



ADIKAVI NANNAYA UNIVERSITY :: RAJAHMAHENDRAVARAM
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UG Program (4 years Honors) Structure (CBCS)
 2020-21 A. Y., onwards
BACHLOR OF SCIENCE

(3rd and 4th year detailed design will be followed as per APSCE GUIDELINES)

Subjects/ Semesters		I		II		III		IV		V		VI			
		H/W	C	H/W	C	H/W	C	H/W	C	H/W	C	H/W	C		
Languages															
English		4	3	4	3	4	3								
Language (H/T/S)		4	3	4	3	4	3								
Life Skill Courses		2	2	2	2	2+2	2+2								
Skill Development Courses		2	2	2+2	2+2	2	2								
Core Papers															
M-1	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1				
M-2	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1				
M-3	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1				
M-1	SEC (C6,C7)											4+2	4+1		
M-2	SEC (C6,C7)											4+2	4+1		
M-3	SEC (C6,C7)											4+2	4+1		
Hrs/ W (Academic Credits)		30	25	32	27	32	27	36	30	36	30	0	12	4	4
Project Work															
Extension Activities (Non Academic Credits)															
NCC/NSS/Sports/Extra Curricular										2					
Yoga							1		1						
Extra Credits															
Hrs/W (Total Credits)		30	25	32	27	32	28	36	33	36	30	0	12	4	4

THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester

FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations).

M= Major; C= Core; SEC: Skill Enhancement Courses



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Marks & Credits distribution: UG-Sciences

Sl. No	Course type	No. of courses	Each course teaching Hrs/wk	Credit for each course	Total credits	Each course evaluation			Total marks
						Conti-Assess	Univ-exam	Total	
1	English	3	4	3	9	25	75	100	300
2	S.Lang	3	4	3	9	25	75	100	300
3	LS	4	2	2	8	0	50	50	200
4	SD	4	2	2	8	0	50	50	200
5	Core/SE -I	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -II	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -III	5+2	4+2	4+1	35	25	75+50	150	1050
6	Summer-Intern	2		4	8		100	200	200
7	Internship/ Apprentice/ on the job training	1		12	12		200	200	200
		38			159				4550
8	Extension Activities (Non Academic Credits)								
	NCC/NSS/Sports/ Extra Curricular			2	2				
	Yoga			2	1	2			
	Extra Credits								
	Total	40			142				



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DETAILS OF PAPER TITLES & CREDITS

I YEAR								
Sem	Course no	Course name	Course type (T/L/P)	Hrs/Week (Sciences 4+1)	Credits (Science 4+1)	Max.Marks Cont/Internal/Mid	Max. Marks Sem-end Exam	
I	1	Biology of Fin Fish	T	4	4	25	75	
		Biology of Fin Fish Practical-I	L	2	1	0	50	
II	2	Biology of Shell Fish	T	4	4	25	75	
		Biology of Shell Fish Practical-II	L	2	1	0	50	
II Year								
III	3	Capture Fisheries -I	T	4	4	25	75	
		Capture Fisheries -I Practical -III	L	2	1	0	50	
IV	4	Capture Fisheries -II	T	4	4	25	75	
		Capture Fisheries -II Practical -IV	L	2	1	0	50	
	5	Fin Fish Culture	T	4	4	25	75	
		Practical-V	L	2	1	0	50	
III Year								
V	6A	Fish Processing Technology	T	4	4	25	75	
		Fish Processing Technology Lab	L	2	1	0	50	
	7A	Fish Seed Production Technology	T	4	4	25	75	
		Fish Seed Production Technology Lab	L	2	1	0	50	
	OR							
	6B	Aquatic Pollution and Coastal Zone Management	T	4	4	25	75	
		Aquatic Pollution and Coastal Zone Management Lab	L	2	1	0	50	
	7B	Ornamental Fisheries	T	4	4	25	75	
		Ornamental Fisheries Lab	L	2	1	0	50	
	OR							
	6C	Fisheries Extension Education	T	4	4	25	75	
		Fisheries Extension Education Lab	L	2	1	0	50	
	7C	Microbiology of Fish and Fishery Products	T	4	4	25	75	
		Microbiology of Fish and Fishery products Lab	L	2	1	0	50	
Total								

Note; Course type code: T: Theory, L: Lab, P: Problem solving

Note 1: For Semester–V, for the domain subject **Fisheries**, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABC allotment is random, not on any priority basis).



Note 2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

Note 3: To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSICHE Guidelines.

- **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).
- **Credit For Course: 04**
- **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).
- **Credit For Course: 04**
- **Third internship/Project work (6th Semester Period):**
During the entire 6th Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work (the detailed guidelines are enclosed).

Credit For Course:12

a. Proposed combination subjects

Chemistry (M1), Zoology / Microbiology/Biotechnology/ Biochemistry (Choose any one as aM1)

b. Student eligibility for joining the course

Intermediated passed with combination of Bi.P.C and Diploma in Fisheries

c. Faculty eligibility for teaching the course

Fisheries – M.Sc., Ph.D. M.Sc- NET and SET Qualified, M.Sc, M.FSc., Ph.D. M.FSc - NETand SET, M.FSc,

Aquaculture – M.Sc., Ph.D. M.Sc- NET and SET Qualified, M.Sc, M.FSc., Ph.D. M.FSc -NET and SET, M.FSc,

Zoology - M.Sc., Ph.D. M.Sc- NET and SET Qualified, M.Sc,



d. List Proposed Skill enhancement courses with syllabus, if any

All Core papers are skill enhancement courses

e. Any newly proposed Skill development / Life skill courses with drafts syllabus and required resources

No

f. Required instruments / software / computers for the course (Lab/ Practical course – wiserequired i.e ., for a batch of 15 students)

Sem No	Lab/Practical Name	Name of Instruments /software/computers required with specifications	Brand Name	Qty Required
1	Biology of Fishes	Virtual Dissection software+15 CPUs	Biolab HP	1 15
2	Fishing Methods	Traditional Crafts and Boats	Local Made	2+2

g.List of suitable levels of positions eligible in the Govt/Pvt organization

S.No	Position	Company/Govt organization	Remarks	Additional skills required, if any
1	Fisheries Development officers	Govt- Fisheries Dept	Nil	Nil
2	Village fisheries officers	Govt- Fisheries Dept	Nil	Nil
3	Field assistants	Private Sector Fisheries Industries	Nil	Nil
4	Lab Technicians	Private Sector Fisheries Industries	Nil	Nil



h. List of Govt. organizations/ Pvt companies for employment opportunities or internships or projects

S.No	Company/ Govt organization	Position type	Level of Position		
1	Govt- Fisheries Dept	Fisheries Development officers	Group -II	Technical	
2	Govt- Fisheries Dept	Village fisheries officers	Group -IV	Technical	
3	Private Sector Fisheries Industries	Field assistants	Marketing	Marketing	
4	Private Sector Fisheries Industries	Lab Technicians	Technician	Technical	

I. Any specific instructions to the teacher/ paper setters/ papers setters/Exam -Chief Superintendent

Nil



3. Program objectives, outcomes, co-curricular and assessment methods

B. Sc	FISHERIES
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Aim and objectives of UG program in Subject:

- Promote, facilitate and influence the best possible standards of fisheries management across the British Isles.
- Provide the technical and general knowledge necessary for competent fisheries management.
- Be the organization of choice for evidence-based advice and guidance for sustainable fisheries management.
- Be the membership body of choice for fisheries managers, and to provide good value fisheries management services to members and customers of the Institute.

Learning outcomes of Subject

- To exchange and circulate information, ideas and practical experience on all matters relating to fisheries and their management.
- To admit students to the Institute and to increase the number of professionally qualified fisheries managers through the provision of training courses.
- To designate the categories of membership appropriate to the experience, qualifications and contribution of members to the profession and determine the letters that may be placed after the names of members indicating these designations.
- To establish and maintain an appropriate Branch and Specialist section structure to meet the local, specialist and overall needs of fisheries interests.
- To promote the interests of members.
- To co-operate with other institutions and associations in order to achieve common goals.

Recommended Skill enhancement courses:

Core subjects are all Skill enhancement courses

Recommended Co-curricular activities:

A. Measurable:

1. Assignments
2. Student seminar
3. Quiz Programmes
4. Individual Field Studies/ projects
5. Group discussion
6. Group/Team Projects

B. General:

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
2. Group Discussions on new trends Aquaculture related industries
3. Watching TV discussions and preparing summary points record of paper – cuttings relating to topics covered in syllabus
4. Any similar activities with imaginative thinking.



4. Details of course – wise Syllabus

B.Sc.	Semester - I	Credits: 4
Course: 1	Biology of Fishes	Hrs/Wk: 4

Objectives:

- To introduce the learner to general morphology and taxonomy of fin fishes.
- To study the Biological, Morphological and physiological characteristics of fin fishes
- To provide the knowledge on the taxonomic characteristics of the fin fishes

Learning Outcomes:

- By the end of the course the student will be equipped with the knowledge of taxonomy, morphology & physiology of fin fishes
- Knowledge on the basic taxonomic tools for the identification of fin fishes will be learnt by the student.

UNIT I: General Characters and Classification of Cultivable Fin Fish

- 1.1 General characters and classification of fishes up to the level of classes.
- 1.2 Morphology of a teleost. Variation in the form and structure, skin, colouration, scales, mouth, jaws & teeth, fins.
- 1.3 Anatomy of a teleost fish. Alimentary canal and associated structures like gills, swim bladder, accessory respiratory organs, heart and circulation of blood.
- 1.4 Osmotic regulation and ion regulation – mechanism and general account.

UNIT II: Food & Feeding and Growth

- 2.1 General account and functional morphology of digestive system, natural fish food, feeding habits, feeding adaptations, digestion and absorption of food.
- 2.2 Age and growth of fish – absolute and relative growth, isometric and allometric growth.
- 2.3 Methods for determination of growth – length frequency analysis. Estimation of growth by direct methods – known age methods. Mark and recapture method, marking and tagging.

UNIT III: Reproductive Biology

- 3.1 Breeding in fishes, breeding places, breeding habits.
- 3.2. Induced breeding technique, bandh breeding,
- 3.3 Sexual maturity, testicular cycle, ovarian cycle, estimation of fecundity, ova diameter, frequency.
- 3.4 Fecundity in relation to length, weight, age and food supply.



UNIT IV: Development

- 4.1 Parental care in fishes, oviparity, viviparity,
- 4.2 Embryonic and larval development of fishes.
- 4.3 Environmental factors affecting reproduction and development of cultivable aquatic fin fish.

UNIT V: Locomotion

- 5.1 Fish Migration -
- 5.2 Locomotion
- 5.3 Classification of fishes based on degree of movement, zones inhabited, manner of reproduction.

REFERENCE BOOKS:

1. Jhingran, V.G. Fish and Fisheries of India. Hindustan Publishing Co., 1975.
2. Howar, W.S. & D.S. Randal Fish Physiology, Vols.: 1 to 4.
3. Moyle Peterb, Fishes: An Introduction to Ichthyology. Prentice Hall, 1974.
4. Meyer & Ashlock. Principles of systematic zoology.
5. Turnor – Text book of endocrinology.



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B.Sc.	Semester - I	Credits: 1
Course: 1(L)	Biology of Fishes Lab	Hrs/Wk: 2

List of the Practical Experiments:

1. Identification of commercially important fishes.
2. Identification of fish scales.
3. Study of mouth parts of herbivorous and carnivorous fishes.
4. Comparative study of digestive system of herbivorous and carnivorous fishes.
5. Gut content analysis.
6. Embryonic larval development of fishes.
7. Study of gonadal maturity and fertility.
8. Study of nest building and brooding of fishes.
9. Induced breeding technique.
10. Morphometric and meristic characters.
11. Study of Weberian Ossicles in cat fish.
12. Lateral line nerve of Trichiurus



B.Sc.	Semester - II	Credits: 4
Course: 2	Biology of Shell Fish	Hrs/Wk: 4

OBJECTIVES:

- To introduce the learner to general morphology and taxonomy of Shell fishes.
- To study the Biological, Morphological and physiological characteristics of shell fishes
- To provide the knowledge on the taxonomic characteristics of the Shell fishes

LEARNING OUTCOMES:

- By the end of the course the student will be equipped with the knowledge of taxonomy, morphology & physiology of Shell fishes.
- Knowledge on the basic taxonomic tools for the identification of shell fishes will be learnt by the student.

UNIT I: General Characters and Classification of Cultivable Shell Fish

- 1.1 General characters and classification of crustaceans and molluscs up to the level of class.
- 1.2 Commercial importance of crustaceans and molluscs.
- 1.3 Prawn external parts and appendages, exoskeleton and integument.
- 1.4 Respiration and circulatory systems of prawn. Structure of gills, mechanism of respiration.
- 1.5 Nervous and excretory system of crustacean molluscs.
- 1.6 Sense organs in crustaceans and molluscs.

UNIT II: Food, Feeding and Growth

- 2.1 Natural food, feeding habits, feeding intensity utilization of food, gut content analysis.
- 2.2 Digestive system of shrimp, crab and molluscs.
- 2.3 Integument and exoskeleton of crustaceans, their structure and functions.

UNIT III: Reproductive Biology

- 3.1 Induced maturation in shrimp –induced maturation technology physiological changes after induced maturation.
- 3.2 Breeding in Oysters, Mussel, Clams, Pearl Oyster, Pila, Fresh water Mussel and Cephalopods.
- 3.3 Reproductive organs in Shrimp.
- 3.4 Life cycle of Shrimp.

UNIT IV: Development

- 4.1 Embryonic and larval development of Shrimp, Crab and Molluscs.
- 4.2 Environmental factors affecting reproduction and development of cultivable shell fish.



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UNIT V: Hormones & Growth

- 5.1 Endocrine system of Prawn and Crab, Oyster.
- 5.2 Neurosecretory cells Androgenic gland, ovary, cuticle.
- 5.3 Moulting, Moulting stages, Metamorphosis in Crustaceans.

REFERENCE BOOKS:

1. Borradile & R.A. Potts. The Invertebrates. Asia Publishing House, 1962.
2. Kaestner, A. Invertebrate Zoology. Vol. I – III, John Wiley & Sons, 1967.
3. Barrington, F.J.W. Invertebrates : Structure and Functions. EIBS, 1971.
4. 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.



B.Sc.	Semester - II	Credits: 1
Course: 2(L)	Biology of Shell Fish Lab	Hrs/Wk: 2

List of the Practical Experiments:

1. Identification of commercially important shell fishes.
2. Study of different larval stages of shrimp.
3. Mouth parts and appendages of cultivable prawns, shrimp and other crustaceans.
4. Study of eggs of shrimps, prawns and other crustaceans.
5. Observations of Molluscan larva.
6. Study of visceral organs of fresh water mussels.
7. Dissections
 - A. Mounting of the shrimp/prawn appendages
 - B. Digestive system of shrimp/prawn
 - C. Nervous system of shrimp/prawn
 - D. Eye stalk ablation in shrimp/Prawn
 - E. Pituitary gland extract in fishes



B.Sc.	Semester - III	Credits: 4
Course: 3	Capture Fisheries - I	Hrs/Wk: 4

OBJECTIVES:

- To study the Fish Distribution, Riverine and Reservoir fisheries.
- To understand pelagic fishery resources and demersal resources

LEARNING OUT COME

- Student learns the knowledge on the inland fishery resources
- Student learns the knowledge on the pelagic and demersal fishery resources

UNIT I : Fish Catch Statistics

- 1.1 Fish production of the world both inland and marine, contribution of different countries, position of India in the Fish Catches.
- 1.2 The EEZ concept & its implementation in fisheries. The Indian EEZ, Fishery survey in India

UNIT II : Fish Distribution .

- 2.1 General account of the distribution,
- 2.2 Biology and fishery of important fishes and other aquatic animals of India,
- 2.3. Economically Important Fresh Water Fishes of Andhra Pradesh.

UNIT III: Riverine Fishery

- 3.1 Important characters of Streams.
- 3.2 Different riverine systems in India, and their fishery: The Ganga River System, the Brahmaputra river system,

UNIT IV: Riverine Fishery

- 4.1 The East Coast River System.
- 4.2 The West Coast River System, River Jhelum of the Indus River System, Fisheries of trout and Mahseer, Problems and management.

UNIT V: Reservoir Fishery (Lacustrine Fishery)

- 5.1 Definition of a Lake, Origin and classification of lakes.
- 5.2 Kolleru Lake and its fishery.
- 5.3 Different reservoirs of River systems in India with special reference to Nagarjuna Sagar,



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REFERENCE BOOKS :-

1. Jhingram, V.G. Fish and Fisheries of India. Second edition 1983, Hindustan Pub.Co.
2. Picker, W.E. Methods for assessment of Fish Production in Fresh Waters. Blackwell Scient. Publ. 1970
3. Bal, D.V. and Veerabhadra Rao, K. Marine Fisheries, Tata MC Grawhill Publications, New Delhi.
4. Srivastava, U.K. et.al. Freshwater aquaculture in India, Oxford and IBH Publ. Co. New Delhi 1980.
5. C.B.L. Srivastava – A text book of Fishery Science and Indian Fisheries. Kitab Mahal Agencies, Patna.



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B.Sc.	Semester - III	Credits: 1
Course: 3(L)	Capture Fisheries - I Lab	Hrs/Wk: 2

List of the Practical Experiments:

1. Identification of Freshwater fishes based on colour, Pigmentation, morphometric and meristic characters and other characters relevant to the group.
2. Identification of fry and fingerlings of Indian Major Crops.
3. Examination of Commercially Important Freshwater fishes and prawns, from the point of view of ecology and fishery.
4. Knowledge of common types of Freshwater craft and gear on models provided in the department.
5. **Field Work:** Visit to fish landing centers of rivers, lakes and reservoirs.



B.Sc.	Semester - IV	Credits: 4
Course: 4	Capture Fisheries II	Hrs/Wk: 4

OBJECTIVES:

- To develop basic knowledge about Estuarine and Marine Fishery resources and various crafts and gears used in fisheries
- To understand operation of various fishing gears
- To create awareness about fish finding devices.
- To develop basic knowledge on fishery management

LEARNING OUT COME:

- Student will learn the knowledge on Estuarine and Marine Fishery and various crafts and gears used in fisheries.
- Mechanism involved in the operation of the fishing gear will be learnt by the student.
- Tools for the identification of fishery resources and management of fisheries in different aspects will be learnt by the student

UNIT I: Estuarine Fishery

- 1.1 Definition of an estuary, Origin and Classification
- 1.2 Divergent estuaries in India, their location and species composition
- 1.3 Hooghly – Matlah Estuary, Mahanadi estuary, Godavari Estuary, Krishna Estuary

UNIT II: Marine Fishery

- 2.1 Marine Environment. Marine Fishery resources in India, Pelagic fishery resources.
- 2.2 Taxonomy, general description, distribution, food and feeding habits, reproduction, craft and gear, fish utilization of the following Sardines, Bombay Duck, Mackerel, Hilsa, Mulletts, Sharks and Rays, Pomfrets, Tuna, Seer Fish and Prawns,

UNIT III: Craft

- 3.1 Main types of the traditional crafts employed in Marine, fresh water fisheries of Andhra Pradesh.
- 3.2 Coracle, Dhoni, Sangadam, Canoes, Catamaran, Masula type boats, Fiber Glass boats
- 3.3 Techniques for the maintenance of the craft
- 3.4 Modern fishing crafts- trawlers, BLC. Mechanized Crafts

UNIT IV: Gear

- 4.1 Traditional gear
- 4.2 Dip & Lift Nets, cast nets, gill nets, Shore seines, Boat Seines, Hand Lines, Long Lines, Conical Set nets, Drag nets, Trawl nets and Basket traps.
- 4.3 Fish Finding Equipment (Echo sounder and sonar)
- 4.4 Modern gear- Techniques for the maintenance of the gear



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UNIT V: Fishery Management

- 5.1 Principles of conservation, and management.
- 5.2 Population dynamics – Overfishing, Maximum Sustainable yield (MSY), Maximum Economic Yield (MEY), Optimum Sustainable Yield (OSY).

REFERENCE BOOKS :

1. 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
2. Bal, D.V. and Veerabhadra Rao, K. Marine Fisheries, Tata MC Grawhill Publications, New Delhi
3. Srivastava, U.K. et.al. Freshwater aquaculture in India, Oxford and IBH Publ. Co. New Delhi 1980.
4. C.B.L. Srivastava – A text book of Fishery Science and Indian Fisheries. Kitab Mahal Agencies, Patna.

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



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B.Sc.	Semester - IV	Credits: 1
Course: 4(L)	Capture Fisheries II Lab	Hrs/Wk: 2

List of the Practical Experiments:

1. Identification of Marine and Estuarine water fishes based on colour, Pigmentation, morphometric and meristic characters and other characters relevant to the group.
2. Examination of Commercially Important Marine and Estuarine fishes and prawns, from the point of view of ecology and fishery.
3. Knowledge of common types of Marine and Estuarine craft and gear on models provided in the department.

Field Work:

Visit to Coastal region to observe marine fish landing centers, different types of traditional boats, mechanized boats and various types of traditional and modern nets used in the fish capture.

Demonstration of fish collection and operation of nets, observing different instruments used in Fisheries.

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



B.Sc.	Semester - IV	Credits: 4
Course: 5	Fin Fish Culture	Hrs/Wk: 4

OBJECTIVES:

- To provide basic idea about the basics of aquaculture and fin fish culture
- To provide basic technical knowledge about pond preparations, pond managements and carp culture practices in ponds
- To provide basic idea about the Design, construction and management of hatchery

LEARNING OUT COME:

- Student will learn the basics of aquaculture and fin fish culture
- Technical knowledge about pond preparations, pond managements and carp culture practices in ponds
- will be learnt.
- The Design, construction and management of hatchery will be learnt

UNIT I: Introduction

- 1.1 Basics of aquaculture – Scope and definition, history of aquaculture origin and growth, General principles underlying the practices of aquaculture.
- 1.2. Major cultivable Indian Carps, Chinese carps and Air Breathing fishes.
- 1.3. Different fresh water Aquaculture systems – Monoculture, Polyculture, Integrated culture, Cage culture, Pen culture, Monosex culture system.

UNIT II: Types of fish ponds

- 2.1. Classification of ponds based upon water resources – Spring, Rain water, Flood water, Well water and Water course ponds.
- 2.2. Classification of ponds based upon functions – Hatchery, Nursery, Rearing, Production, Stocking and Quarantine ponds.
- 2.3. Criteria for the selection of species for culture.

UNIT III: Pond Preparation

- 3.1. Important factors in construction of ideal fish pond – site selection, topography, nature of soil, water resources – quantity and quality of water, sources of pollution.
- 3.2. Design and construction of pond – layout of farm, size of farm, shape and depth of pond, dike design, pond bottom preparation, inlet, outlet, aerators and method of construction.



UNIT IV: Pond Management

- 4.1. Liming – properties of liming material, lime requirement and application to ponds, effect of liming on pond ecosystem.
- 4.2. Need of fertilizers and manures in culture ponds, role of nutrients, precautions in their application.
- 4.3. Physics – Chemical conditions of soil and water optimum culture – Temperature, depth, turbidity light water currents, pH, Dissolved oxygen, Co₂, Hardness, Nutrients.
- 4.4. Eradication of predator, and weed control – advantages and disadvantages of weed, types of weeds in culture pond, weed fish, toxins used for weed control and control of predators.

UNIT V: Hatchery Technology

- 5.1 Hatchery – Design and construction of hatchery;
- 5.2 water quality monitoring and management
- 5.3 Selection of brood stock and brood stock management
- 5.4 Different types of hatcheries.

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2. Pillay TVR, 1996. Aquaculture principles and practices, fishing news books Ltd., London.
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B.Sc.	Semester - IV	Credits: 1
Course: 5(L)	Fin Fish Culture Lab	Hrs/Wk: 2

List of the Practical Experiments:

I. Experiments

1. Estimation of dissolved oxygen.
2. Estimation of chlorides
3. Estimation of carbonates and bicarbonates

II. Breeding Techniques

Induced breeding techniques in carps – Dissection of pituitary gland preparation of hormone extract, dosage fixation, breeders selection. Study of Gonadal maturity and fecundity in carps.

Identification of life history stages of fish.

III. Hatchery

Study of water treatment and management in fish hatchery. Application of different chemicals and drugs used in hatchery.

IV. Field Trips

Field visit to fish hatchery.

Field visit to different fish ponds.



5. Model Question Paper (Sem-end, Exam)

MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: I

Course 1: Biology of Fishes

Time: 3Hrs.

Max. Marks: 75

SECTION – A

Answers any FIVE of the following.

5X5=25M

1. Types of fins.
2. Placoid scale.
3. Feeding habits.
4. Breeding habits.
5. Viviparous.
6. Manner of reproduction.
7. Hilsa ilisha
8. Marking.

SECTION – B

Answers ALL the following question. Draw diagrams wherever necessary.

5X10=50

9. (a) Write an essay on accessory respiratory organs in fishes.
(OR)
(b) Give an account on colouration in fishes
10. (a) Give an account of feeding adaptations in fishes.
(OR)
(b) Write about methods for determination of growth in fishes.
11. (a) Write an essay on induced breeding technique.
(OR)
(b) Explain Testicular cycle in male fishes.
12. (a) Describe parental care in fishes.
(OR)
(b) Give an account on factors affecting reproduction.
13. (a) Classification of fishes based on zones inhabited.
(OR)
(b) Write an essay on Migration.



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MODEL QUESTION COURSE
Semester End Examination - Practical
BIOLOGY OF FISHES LAB

Time: 3hrs

Max. Marks: 50M

I.	Identification of Spotters	5x05 = 25 Marks
II.	Dissection (Major)	1x10 = 10 M
III.	Dissection/ Analysis (Minor)	1x 05 = 05 M
IV.	Record+ Viva Voce	10 M



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: II

Course 2: Biology of Shell fish

Time: 3Hrs.

Max. Marks: 75

SECTION-A

Answer any FIVE of the following. Draw diagrams wherever necessary.

5x5=25 M

1. Sense organs in crustaceans.
2. Gastropoda
3. Feeding intensity.
4. Radula
5. Pearl Oyster
6. Megalopa
7. Neuro secretory cells
8. Androgenic glands

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5x10=50 M

- 9 (a) Describe respiratory system in Prawn.
(OR)
(b) Give a detailed account on Cephalic appendages of Prawn.
- 10 (a) Write an essay on integument in Crustaceans.
(OR)
(b) Explain digestive system of Crab.
- 11 (a) Give a detailed account on induced maturation in Shrimp.
(OR)
(b) Write an essay on breeding in Oysters.
- 12.(a) Write an essay on different larval stages of Shrimp.
(OR)
(b) Give an account on development of molluscs.
- 13.(a) Describe endocrine glands in Prawn.
(OR)
(b) Describe the moulting stages in Crustaceans.



MODEL QUESTION COURSE
Semester End Examination - Practical
BIOLOGY OF SHELL FISH LAB

Time: 3hrs

Max. Marks: 50M

I.	Identification of Spotters	5x5= 25 Marks
II.	Dissection/ Analysis (Major)	1x10= 10M
III.	Dissection/ Analysis (Minor)	1x5= 05 M
IV.	Record+ Viva Voce	10 M



SECTION-A

Answer any FIVE of the following. Draw diagrams wherever necessary.

5x5=25 M

1. EEZ
2. Reservoir fisheries
3. Coastal fishery
4. Pelagic resources
5. Kolleru
6. Sanctuaries
7. Lakesterine fisheries
8. Capture fisheries

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary.

5x10=50 M

9. a) Write an essay on world inland and marine fish production ?
OR
b) Write an essay on EEZ concept and its implementation in fisheries?
10. a) Write the notes on Biology and fishery of important fishes in India
OR
b) Write an essay on Economically Important Fresh Water Fishes of Andhra Pradesh?
11. a) Write about the important characters of Streams?
OR
b) Write an essay on Major river systems in India?
12. a) Write an essay on East Coast river systems in India?
OR
b) Write an essay on East Coast river systems in India?
13. a) Define Reservoir? Major reservoirs in India?
OR
b) Write an essay on Types of lakes and based on circulation?



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MODEL QUESTION COURSE
Semester End Examination - Practical
CAPTURE FISHERIES -I LAB

Time: 3hrs

Max. Marks: 50M

I. Identification of Spotters	5x5= 25 Marks
II. Experiment (Major)	1x10= 10M
III. Field Report	1x5= 05 M
IV. Record+ Viva Voce	10 M



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION
SEMESTER: IV
Course 4: CAPTURE FISHERIES -II

Time: 3Hrs.

Max. Marks: 75

SECTION-A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5x5=25 M

1. Estuary
2. Sardines
3. Pelagic resources
4. Dhoni
5. Catamaran
6. Hand Lines
7. Trawl Net
8. Sanctuaries

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary.

5x10=50 M

9. a) Define Estuary? Explain about the Ecological significance of estuary?
OR
b) Write an essay on Major river systems in India?
10. a) Define Reservoir? Major reservoirs in India
OR
b) Write an essay on Types of lakes and based on circulation?
11. a) Write Different types of fishing crafts in India??
OR
b) Write Techniques for the maintenance of the craft?
12. a) Write Different types of traditional gears in India
OR
b) Write in detail about fish finding equipment?
13. a) Write the Principles and management of Fish conservation?
OR
b) Write a note on Population dynamics?



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MODEL QUESTION COURSE
Semester End Examination - Practical
CAPTURE FISHERIES -II LAB

Time: 3hrs

Max. Marks: 50M

I.	Identification of Spotters	5x5= 25 Marks
II.	Experiment (Major)	1x10= 10M
III.	Field Report	1x5= 05 M
IV.	Record+ Viva Voce	10 M



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: IV

Course 5: FIN FISH CULTURE

Time: 3Hrs.

Max. Marks: 75

SECTION A

Answer any FIVE of the following. Draw diagrams wherever necessary.

5x5=25 M

1. Polyculture
2. Cage culture
3. Nursery pond
4. Topography
5. Liming
6. Aquatic weeds
7. Bundh breeding
8. Chinese circular trough

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary.

5x10=50 M

9. (a) Give an account on two Indian major carps identification and breeding habits.
(or)
(b) Explain about any three fresh water aquaculture systems.
10. (a) Classify ponds based upon water resources availability.
(or)
(b) Based upon functional aspect what are the different types of fish ponds?
11. (a) Describe about important factors to be considered while constructing Fish pond.
(or)
(b) Write an essay on design and construction of a Fish pond.
12. (a) Describe physical factors present in water required for fish culture.
(or)
(b) Write briefly about aquatic weeds. Mention the methods employed to control Aquatic weeds.
13. (a) Define Hypophysation. Explain how this technique is employed in carps for breeding.
(or)
(b) Discuss about construction and management of any one type of fish hatchery in detail.



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MODEL QUESTION
COURSE
Semester End
Examination - Practical
FIN FISH CULTURE II
LAB

Time: 3hrs
50M

Max. Marks:

I.	Identification of life stages of Fish	2x5= 10Marks
II.	Dissection (Major)	1x15= 15M
III.	Experiment (Major)	1x10=10 M
IV.	Field Visit Report	1x5= 05 M
V.	Record+ Viva Voce	10 M



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 4
Course: 6A	Fish Processing Technology	Hrs/Wk: 4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Know the handling of fresh fish and principles of fish preservation and processing
2. Perform various preservation techniques of fish and shellfish
3. Demonstrate skills for the preparation of various fish by-products
4. Know the preparation and advantages of value added products of fish and shellfish
5. Understand the quality control standards followed in fish processing industry.

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Training and Unit tests etc.)

UNIT I: Principles of fish preservation and processing (10h)

1. Objectives of fish processing. Handling and Sanitation: Precautions taken in handling fish in the fishing vessel, landing center and processing plant.
2. Post mortem changes (rigor mortis and spoilage), Spoilage of marine and freshwater fish/shellfish. Containers for packaging and transportation of fish; Use of chemical preservatives, and Irradiation in extending shelf-life of finfish and shellfish.
3. Principles of fish preservation- Cleaning, lowering of temperature, raising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

UNIT II: Preservation techniques of fish/ shellfish processing (10h)

1. Principles of preservative methods – Curing (Drying, Salting, Smoking), Chilling, Freezing, Marinating and Canning.
2. Principles of freeze drying - Accelerated freeze drying and packing of freeze dried products.
3. Modern methods of preservation by irradiation and modified atmospheric storage.

UNIT III: Processing and preservation of fish by-products (10h)

1. Preparation and uses of fish meal, fish body oil, fish liver oil, fish protein concentrate, fish hydrolysates, fish meat, fish silage, fish maws, shark leather, fish manure and guano, fish glue, fish gelatin, fish factice, isinglass, fish fins, fish roe and fish cavier. Significance of biochemical and pharmaceutical products – Insulin, fish albumin, peptones, fish sutures, ambergiris, etc.
2. Production and uses of Chitin and Chitosan (shrimp wastes); Pearl essences and Beche-de-mer.
3. Utilization of sea weeds – agar-agar, alginic acid, alginate, mannitol, carrageenan, nori.

UNIT IV: Value added products (10h)

1. Status of value addition to fish and fish products in Indian seafood sector. Advantages of value addition.
2. Different types of value added products from fish and shellfishes: Preparation and uses of Marinated and fermented products, Fish paste products, and Diversified (battered and breaded) products - Fish and prawn pickles, fish sauce, surimi, **fish sausage, fish ham, fish cake, kamaboko, fish macaroni, fish biscuits, fish burger**, fish mince, fish finger, fish cutlet, fish wafer, fish chowder, fish soup, fish stacks, fillets, fish curry, fish papad, mussel products, etc.
3. Packing and Labeling of fish and fishery products. Cold Storages and Export of Fishery Products.



UNIT V: Quality Assurance and Quality Control (10h)

1. Quality Assurance – Concepts of Hazard Analysis Critical Control Point (HACCP) in sea food safety; Good Manufacturing Practice (GMPs), Standard Operating Procedure (SOPs). Determining the quality assurance of sea food.
2. Sanitation and Quality control – Basic concepts and quality control of fish processing. Good Hygienic practices (GHPs). Sanitary Standard Operating Procedures (SSOP).
3. National and International standards – ISO 9000: 2000 Series of Quality Assurance System, Codex Alimentarius.

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1. Gopakumar K. (2002). Text Book of Fish Processing Technology. ICAR.
2. Govindhan, TK. (1985). Fish processing Technology. Oxford & IBH Publ. Co., New Delhi.
3. Hall, GM. (1992). Fish Processing Technology. Blackie. Springer science and business.
4. Balachandran KK. (2001). Post-harvest Technology of Fish and Fish Products. Daya Publ.
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6. Sen, DP. (2005). Advantages in Fish Processing Technology. Allied Publ. Pvt.Ltd. Mumbai.
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8. Ninawe, AS. and RatnaKumar, K. (2008). Fish Processing Technology and Product Development. Narendra Publishing House, Delhi
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11. Surendran, PK., Nirmala,T, Narayanan, NV. and Lalitha, KV. (2003). Laboratory Manual on Microbiological Examination of Sea food, CIFT, Cochin.
12. Velayutham, P. and Indira Jasmine, G. (1996). Manual on Fishery By-Products, Tamilnadu Veterinary and Animal Sciences University, Chennai.
13. Ruit. (1995). Fish and Fishery Products. CAB International Publication
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15. Balachandran, KK. (2004). Fish Canning Principles and Practices. Central Institute of Fisheries Technology, ICAR, Cochin.
16. Gopakumar, K.(1993). Fish Packaging Technology–Materials & Methods. Concept Publishing Co., New Delhi.
17. JeyaShakila, R., Sukumar, D. and Velayutham, P. (2007). Packaging of Fish and Fishery Products. TANUVASU, Tamil Nadu.
18. Quality Assurance in seafood Processing. (2005). Published by CIFT, Cochin.
19. Bonell, AO. (1994). Quality Assurance in Seafood Processing: A practical Guide. Chapman and Hall, New York.
20. Huss, HH.et al. (1992). Quality Assurance in the Fish Industry. Elsevier Science Publishers, B.V., Amsterdam, Netherlands.
21. Bond, et al. (1971) Fish Inspection and Quality Control. Fishing News Books, England.
22. Jaya Shakila, R. and Sukumar, D. (2006). Text Book of Quality and Safety of Sea foods. Tamilnadu Veterinary and Animal Sciences University, Chennai.
23. *Web resources suggested by the teacher concerned and the college librarian including reading material.*



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 1
Course: 6A	Fish Processing Technology Lab	Hrs/Wk: 2

Practical Syllabus: Course 6A:Fish Processing Technology

Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Execute various techniques of fish preservation.
2. Assess the quality of processed fish and fish by-products.
3. Familiarize with fish packaging materials and containers.
4. Prepare common fish/shell fish by-products and value added products.
5. Assess the sanitation and quality control standards in fish processing plants.

Practical Syllabus:

1. Techniques of fish preservation: Preparation of dried fish, salted fish and smoked fish by different methods.
2. Organoleptic analysis of fish. Quality assessment of salted, dried and smoked fish
3. Types of cans, canning equipment and layout of cannery. Canning of fish/shrimp.
4. Acquaintance with various packaging materials and containers for fish products.
5. Assessment of quality of packaging materials used for packaging of fish and fish products.
6. Preparation of 10 fish/shellfish by-products
7. Preparation of 10 value added products of fish and shellfish: prawn and fish pickles, fermented fish sauce, fish paste products, diversified fish products.
8. Collection of fishery by-products
9. Quality assessment of individual by-products and value added products.
10. Assessment of sanitation in fish processing plants
11. HACCP and GMP with SSOP.

Co-Curricular Activities:

a) Mandatory: (Training of students by teacher on field related skills: 15 hours)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing and preservation of fish/shellfish and their by-products and value added products; and the quality management and certification in fish processing.
2. **For Student:** Individual visit to a fish processing plant or related field or to a laboratory in research organization/private sector and study the sanitation measures followed while handling, storage and transport of fresh fish for further processing, various methods of processing and preservation of fish/shellfish and their products, packaging and labeling, cold storage and export. Also study the sanitary procedures, HACCP and GMPs implemented for quality assurance and quality control of seafood in fish processing plants. Submission of a hand written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including the preparation of novel value added products and processing of fish products)
3. Seminars, Group discussions, Quiz, Debates, etc. (on related topics).



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4. Preparation of videos on fish/shellfish processing and various methods of preserving fish/fish products, preparation of value added products, packaging, labeling, etc,
5. Collection of material/figures/photos related to fish processing, preservation and value added products, writing and organizing them in a systematic way in a file.
6. Visits to fish processing plant/industry, firms, research institutes, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Suggested Question Paper Pattern:

Max. Marks: 75

Time: 3 hours



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 4
Course: 7A	Fish Seed Production Technology	Hrs/Wk: 4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Know the natural fish and shellfish seed resources and their collection.
2. Understand the carp breeding techniques and hatchery management for seed production.
3. Acquire knowledge on the breeding techniques and seed production of other fishes.
4. Familiarize with the hatchery management of commercially important shrimps.
5. Acquaint with seed production technology of other cultivable crustaceans and molluscs.

Syllabus: (Total Hours:90 including Teaching, Lab, Field Training and Unit tests, etc.)

UNIT I: Natural Seed resources (10h)

1. Natural breeding and Seed resources of carp in major rivers of India. Selection of riverine spawn collection sites, gears used and methods of collection. Seed resources of other freshwater fishes of India.
2. Marine finfish and shellfish - Natural habitats for seed collection and collection methods.
3. Natural shrimp seed resources, site selection and collection methods. Seed resources and collection of freshwater prawn.

UNIT II: Carp Breeding and Hatchery Management (10h)

1. Bundh breeding: Wet and dry bundhs; bundh breeding techniques; Collection and hatching of eggs; Factors influencing bundh breeding; Advantages and disadvantages of bundh breeding.
2. Induced breeding of Indian major carp by hypophysation: Fish pituitary gland – structure, collection and preservation, preparation of pituitary extract for injection, dosage calculation and methods of injection. Broodstock maintenance and selection of breeders for injection. Synthetic hormones used for induced breeding of carps.
3. Types of hatcheries and spawn production – traditional, chinese, jar and modern controlled hatcheries.

UNIT III: Breeding and Seed production of other Fishes (10h)

1. Breeding techniques and Seed production of exotic carps – Common carp and Chinese carps. Stripping and fertilization.
2. Breeding techniques and Seed production of *Channa, Pangasius, Clarias batrachus, Tilapia*.
3. Marine fish seed production: Seabass, milkfish, mullets, cobia and pompanos.

UNIT IV: Shrimp Hatchery Management (10h)

1. General design of shrimp hatcheries. Various components, equipment and infrastructure facilities required in hatchery.
2. Operation and management of hatchery sections: Maturation section– Selection and maintenance of broodstock, induced maturation by eyestalk ablation, selection of potential spawners, spawning and hatching, quantitative and qualitative evaluation of nauplii; Larval section – shrimp life cycle, biology of shrimp larvae, larval rearing operations; Algal section and *Artemia* section; and Post larval section.
3. Health management in hatcheries. Sea water filtration and treatment processes.



UNIT V: Seed Production of other shellfish (10h)

1. Seed production and nursery rearing of *Macrobrachium rosenbergii* / *M. malcolmsonii*.
2. Seed production of crabs and lobsters.
3. Seed production of pearl oysters, edible oysters and freshwater mussel.

REFERENCES:

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10. *Web resources suggested by the teacher concerned and the college librarian including reading material.*



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 1
Course: 7A	Fish Seed Production Technology Lab	Hrs/Wk: 2

Practical Syllabus: Course 7A: Fish Seed Production Technology

Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Know the natural seed resources of different fishes and shellfishes.
2. Produce carp seed by hypophysation technique.
3. Operate different fish hatcheries for seed production.
4. Identify broodstock, eggs and larval stages of fishes and shellfishes.
5. Acquaint with the hatchery technology for seed production of shrimps and other crustaceans and molluscs.

Practical Syllabus:

1. Collection of information on natural seed resources of different freshwater and marine finfish and shellfishes.
2. Selection/Identification of breeders of different fishes.
3. Dissection and collection of fish pituitary gland, preservation, extract preparation, doses determination, selection of breeders and injection to the brood fishes.
4. Use of synthetic compounds for induced breeding of fishes.
5. Study of design and operation of hapa, chinese and jar hatcheries of fishes.
6. Identification of eggs, spawn, fry and fingerlings of different fishes.
7. Study of seed production technology of cultivable fishes and shellfishes.
8. Identification of broodstock and maturity stages of important crustaceans and molluscs
9. Demonstration of eyestalk ablation in *Penaeusmonodon*.
10. Identification of larval stages of common cultivable crustaceans and molluscs.
11. Water quality monitoring in fish hatcheries and nurseries.
12. Construction and working of biofilter.
13. *Artemianauplii* production for feeding shrimp larvae.
14. Identification of different live feeds used in the marine shellfish hatchery.
15. Preparation of larval feeds and feeding.
16. Preparation of *Spirulinabased* feed for broodstock and larvae.
17. Different chemicals and drugs used in shrimp/prawn hatchery.
18. Different marine shellfish hatchery models and layout preparations.

Co-Curricular Activities:

a) Mandatory: (Training of students by teacher on field related skills: 15 hours)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing and preservation of fish/shellfish and their by-products and value added products; and the quality management and certification in fish processing.
2. **For Student:** Individual visit to a fish processing plant or related field or to a laboratory in research organization/private sector and study the sanitation measures followed while handling, storage and transport of fresh fish for further processing, various methods of processing and preservation of fish/shellfish and their products, packaging and labeling, cold storage and export. Also study the sanitary procedures, HACCP and GMPs implemented for quality assurance and quality control of seafood in fish processing plants. Submission of a hand written Fieldwork Report not exceeding 10 pages in the given format.



3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including the preparation of novel value added products and processing of fish products)
3. Seminars, Group discussions, Quiz, Debates, etc. (on related topics).
4. Preparation of videos on fish/shellfish processing and various methods of preserving fish/fish products, preparation of value added products, packaging, labeling, etc,
5. Collection of material/figures/photos related to fish processing, preservation and value added products, writing and organizing them in a systematic way in a file.
6. Visits to fish processing plant/industry, firms, research institutes, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Suggested Question Paper Pattern:

Max. Marks: 75



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 4
Course: 6B	Aquatic Pollution and Coastal Zone Management	Hrs/Wk: 4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the sources and classification of water pollution.
2. Acquaint with the types of aquatic pollution.
3. Familiarize with the aquatic microbes and their pollution and EIA.
4. Know the resources of coastal ecosystems, remote sensing and GIS for coastal management.
5. Comprehend the methods of coastal management, CRZ Act, ICZM and international treaties and conventions.

Syllabus: (Total Hours:90 including Teaching, Lab, Field Training and Unit tests, etc.)

UNIT I: Classification and Source of aquatic pollution (10h)

1. Definition of pollution; Classification of pollution – Physical, chemical and biological classification of water pollution- description. Point and non-point source of pollution.
2. Sewage and domestic wastes: Composition, pollution effects, sewage treatment and reuse
3. Agricultural wastes: Organic detritus, nutrients; Adverse effects of oxygen demanding wastes: Importance of dissolved oxygen, Oxygen demand; BOD; COD;Oxygen budget; Biological effects of organic matter. Excessive plant nutrients: Eutrophication; Red tides and fish kills.

UNIT II: Types of water pollution (10h)

1. Pesticide pollution: Types and categories; Organochlorine compounds; Organo-phosphorous compounds; Polychlorinated biphenyls (PCBs); Biomagnification - Bioaccumulation and impact on aquatic fauna and human health.
2. Heavy metal pollution: Interaction of heavy metals with water and aquatic organisms, their ill effects. Oil Pollution: Crude oil and its fractions; Source of oil pollution; Treatment of oil spills at sea; Beach cleaning; Toxicity of petroleum hydrocarbons; Ecological impact of oil pollution - case studies.
3. Thermal pollution and its effects. Radioactive pollution: Radioactive wastes and special effects of radioactive pollution. Physical and chemical nature of possible effluents from major industries.

UNIT III: Microbiological pollution and EIA (10h)

1. Microbial pollution: Types of aquatic microbes; autotrophs and heterotrophs; saprotrophs and necrotrophs; Sewage fungus complex; Transmission of human pathogenic organisms; Zoonosis; Development of antibiotic resistance and its impact; Biofilms and Biocorrosion.
2. Monitoring and Control of pollution: Biological indicators of pollution in natural waters; Solid waste management; Bioremediation; Phytoremediation; Advanced waste treatment measures; Pollution control boards.
3. Environmental Impact Assessment (EIA) for fisheries and aquaculture projects. Anthropogenic activities and their impact on coastal zones - aquaculture, waste disposal, property and infrastructure development, ports and shipping, tourism (beach and coral reef), industries (petroleum industry, heavy metal industry, forest industry), mining and marine excavations, water supply projects.



UNIT IV: Coastal Zone Management (CZM)

(10h)

1. Coastal Ecosystems: Estuaries; Wet lands and Lagoons; Living and non-living resources. Goals and purposes of CZM.
2. Remote sensing: Principles of remote sensing; Remote sensing for coastal management.
3. Geographical Information System (GIS): Definition; Concepts; Applications of GIS in aquatic resource identification.

UNIT V: CZM methods, CRZ and ICZM

(10h)

1. Management methods and information: public awareness and environment policy, general coastal zone programs, shore lands management, coastal water basin protection, coastal water quality protection, harvestable resources, and ecosystem restoration.
2. Coastal Regulation Zone (CRZ) Act.
3. Integrated Coastal Zone Management (ICZM). International treaties and conventions.

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4. Clark, R.B. (1994). Marine Pollution. Clarendon Press, Oxford.
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9. Clark, JR. (1992). Integrated Management of Coastal Zones. FAO Fisheries Tech. Paper No. 327, Rome.
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11. *Web resources suggested by the teacher concerned and the college librarian including reading material.*



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 1
Course: 6B	Aquatic Pollution and Coastal Zone Management Lab	Hrs/Wk: 2

Practical Syllabus: Course 6B: Aquatic Pollution and Coastal Zone Management

Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Acquire skills in analyzing water, sediment and microbes in polluted water bodies.
2. Assess the quality and quantity of bacteria in polluted waters.
3. List out and identify the bacteria, flora and fauna as indicator species of aquatic pollution.
4. Acquaint with different types of pesticides and their pollution.
5. Demonstrate the procedure of preparing EIA, Coastal projects and Coastal zone mapping.

Practical Syllabus:

1. Physical characteristics of polluted waters; Colour, Odour, Turbidity.
2. Water analysis: Determination of pH, salinity, alkalinity, hardness, BOD, COD, hydrogen sulphide, phosphates, ammonia, nitrates, heavy metals and oil and grease.
3. Sediment analysis: Determination of pH, conductivity, organic carbon, nitrogen and phosphorus.
4. Study of pathogenic and coliform bacteria.
5. Bacteriological quality of water: Colliform tests, IMViC test, standard plate count.
6. Methods of enumerating bacterial biomass in waters and waste waters.
7. Pollution flora and fauna: indicator species- algae, protozoa and insect larvae.
8. Pesticide pollution: Acquaintance with different types of pesticides; Warning pictograms and symbols. Methods of pesticide residue analysis in waters and fish tissues; Bioassay and toxicity study.
9. Study on coastal living resources; and Coastal zone mapping.
10. Project preparation of EIA.
11. Preparation of projects based on the provided Guidelines and Standards for Coastal Projects aquaculture, agriculture, estuarine flood protection, sewage treatment systems, solid waste disposal, urban runoff, Power plants, disasters, etc.

Co-Curricular Activities:

a) Mandatory: (*Training of students by teacher on field related skills: 15 hours*)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing and preservation of fish/shellfish and their by-products and value added products; and the quality management and certification in fish processing.
2. **For Student:** Individual visit to a fish processing plant or related field or to a laboratory in research organization/private sector and study the sanitation measures followed while handling, storage and transport of fresh fish for further processing, various methods of processing and preservation of fish/shellfish and their products, packaging and labeling, cold storage and export. Also study the sanitary procedures, HACCP and GMPs implemented for quality assurance and quality control of seafood in fish processing plants. Submission of a hand written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
5. Unit tests (IE).



b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including the preparation of novel value added products and processing of fish products)
3. Seminars, Group discussions, Quiz, Debates, etc. (on related topics).
4. Preparation of videos on fish/shellfish processing and various methods of preserving fish/fish products, preparation of value added products, packaging, labeling, etc,
5. Collection of material/figures/photos related to fish processing, preservation and value added products, writing and organizing them in a systematic way in a file.
6. Visits to fish processing plant/industry, firms, research institutes, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Suggested Question Paper Pattern:

Max. Marks: 75



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 4
Course: 7B	Ornamental Fisheries	Hrs/Wk: 4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Know the global and Indian status of ornamental fisheries
2. Identify various commercially important freshwater and marine ornamental fishes
3. Demonstrate skills for breeding and larval rearing of ornamental fishes
4. Construct, set up and maintain the freshwater and marine aquaria for fish keeping
5. Understand the ornamental fish trade regulations and wildlife act, and establishment of breeding and culture units for commercial production of ornamental fishes.

Syllabus: (Total Hours:90 including Teaching, Lab, Field Training and Unit tests, etc.)

UNIT I: Status of Ornamental fisheries (10h)

1. World trade of ornamental fish and export potential. Present status and scope of ornamental fish farming and trade in India. Indian ornamental fish diversity and its status.
2. Types of aquaria - Home and public aquaria (freshwater and marine), oceanarium.

UNIT II: Freshwater Ornamental Fishes (10h)

1. Freshwater ornamental fishes – their taxonomy and biology - varieties of Gold fish, Koi, Barbs, Danios (cyprinids); Gourami, Betta (anabantids); Tetras (characins), Live bearers (Guppy, molly, sword tail, platy); Angel fish and other Cichlids, Catfishes, Loaches.
2. Brood stock management; breeding and larval rearing. Larval feeds and feeding. Application of genetics and biotechnology for quality strain production.
3. Freshwater plants – their taxonomy and morphology, and propagation methods.

UNIT III: Marine Ornamental Fishes (10h)

1. Marine ornamental fishes–varieties and their habitats. Other ornamental organisms – anemones, worms, lobsters, shrimps, octopus, starfish. Reef aquarium and live rocks.
2. Major marine ornamental fish resources of India. Method of collection of live fish. Use of anesthetics.
3. Breeding of marine ornamental fishes (clown and damsel fishes) and larval rearing.

UNIT IV: Aquarium fish keeping (10h)

1. Fabrication, setting up and maintenance of freshwater and marine aquarium - Lighting and aeration - Aquarium plants - Aquarium accessories and decoratives.
2. Water quality management for freshwater and marine aquariums. Water filtration system – biological, mechanical and chemical. Types of filters.
3. Aquarium fish feeds – Live feeds, Dry and wet feeds. Pigmented feeds for colour enhancement.
4. Common diseases of aquarium fish – diagnosis and treatment. Control of snail and algal growth. Medicines and chemicals used in aquaria.

UNIT V: Ornamental fish trade (10h)

1. Fish conditioning, packing, transport and quarantine methods.
2. Trade regulations and Wildlife act in relation to ornamental fishes.
3. Prerequisites for the establishment of ornamental fish breeding and culture unit for entrepreneurship development. Socio-economic upliftment of women through ornamental fish farming.



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3. Dick Mills (1998). Aquarium Fishes, Dorling Kindersly Ltd., London.
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15. *Web resources suggested by the teacher concerned and the college librarian including reading material.*



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 1
Course: 7B	Ornamental Fisheries Lab	Hrs/Wk: 2

Practical Syllabus: Course 7B: Ornamental Fisheries

Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Identify the common ornamental fishes and aquarium plants.
2. Fabricate a glass aquarium and set up with equipment and accessories
3. Maintain the fishes in aquarium with proper water quality, feeding and disease management.
4. Exhibit skills for breeding egg-layers and live-bearers and fry rearing.
5. Condition the fish for packing and transport.

Practical Syllabus:

1. Identification of common freshwater and marine aquarium fishes
2. Construction of a glass aquarium
3. Setting up and maintenance of aquarium (maintained by students can be evaluated after one month)
4. Water quality management in freshwater and marine aquariums
5. Identification of Aquarium plants and live food organisms, and decoratives
6. Aerators and Types of Filters
7. Breeding of egg layers (Gold fish), live bearers (Guppy) and bubble nest builder (Gourami)
8. Ornamental fish diseases and their diagnosis and treatment. Calculation of medicine/chemical treatment doses.
9. Conditioning and packing of ornamental fishes.

Co-Curricular Activities:

a) Mandatory: (*Training of students by teacher on field related skills: 15 hours*)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing and preservation of fish/shellfish and their by-products and value added products; and the quality management and certification in fish processing.
2. **For Student:** Individual visit to a fish processing plant or related field or to a laboratory in research organization/private sector and study the sanitation measures followed while handling, storage and transport of fresh fish for further processing, various methods of processing and preservation of fish/shellfish and their products, packaging and labeling, cold storage and export. Also study the sanitary procedures, HACCP and GMPs implemented for quality assurance and quality control of seafood in fish processing plants. Submission of a hand written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including the preparation of novel value added products and processing of fish products)
3. Seminars, Group discussions, Quiz, Debates, etc. (on related topics).



4. Preparation of videos on fish/shellfish processing and various methods of preserving fish/fish products, preparation of value added products, packaging, labeling, etc,
5. Collection of material/figures/photos related to fish processing, preservation and value added products, writing and organizing them in a systematic way in a file.
6. Visits to fish processing plant/industry, firms, research institutes, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Suggested Question Paper Pattern:

Max. Marks: 75



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 4
Course: 6C	Fisheries Extension Education	Hrs/Wk: 4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Know the concept of fisheries extension education and Fisheries training institutes and research organizations in India.
2. Acquaint with the methods of educating the fishermen and farmers on fisheries extension
3. Demonstrate the transfer of technology programs in fisheries
4. Understand the rural sociology and educational psychology
5. Execute the planning and evaluation of extension programs.

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Training and Unit tests etc.)

UNIT I: Introduction (10h)

1. Extension Education: Concepts, objectives and principles - formal and informal education.
2. History and role of fisheries extension in fisheries development.
3. Fisheries training and Education in India: Training Institutes, Universities, Research organizations.

UNIT II: Fisheries extension methods (10h)

1. Individual, group and mass contact methods and their effectiveness, factors influencing their selection and use.
2. Audio visual aids – definitions, advantages and disadvantages.
3. Classification and choice of audio visual aids. Criteria for selection and evaluation of audio visual aids.

UNIT III: Transfer of Technology (10h)

1. Characteristics of technology and Process of transfer of technology. Important TOT Programs in fisheries. ICAR programs – salient features of ORP, NDS, LLP, IRDP, ITDA, KVK, FFDA, FCS, FTI, TRYSEM.
2. DAATT centers and their role in TOT programs, video conferencing, educating farmers through print and electronic media.
3. Adoption and diffusion of innovations and process, barriers in diffusion of fisheries innovations. Role of BFDA, FFDA, MPEDA, CAA, NGOs and SHGs in Fisheries. Fisheries co-management.

UNIT IV: Rural Sociology and Educational Psychology (10h)

1. Basic concepts in rural sociology and psychology and their relevance in fisheries extension.
2. Social change, social control, social problems and conflicts in fisheries. Gender issues in fisheries. Theories of learning, learning experience and learning situation.
3. Village institutions and Voluntary organizations - their role in fisheries and aquaculture development.

UNIT V: Extension Program Planning and Evaluation (10h)

1. Steps in Extension Program Planning and Evaluation and its importance; Participatory planning process.
2. Programs for weaker section of the community.
3. Fishery development plans and various schemes, Fish Farmer's Development Agencies and their achievements.



REFERENCES:

1. Chauhan, N.B, Patel, B.S and Patel R.C(2007) Fundamentals of Extension Education, Department of Extension Education, B.A.College of Agriculture, AAU, Anand.
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5. Chitambar, J.B.(1990). Introductory Rural Sociology. Wiley Eastern Ltd., NewDelhi.
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7. Dahama OP and Bhatnagar, OP (2019). Education and Communication for Development, Oxford and IBH Co, New Delhi.
8. *Web resources suggested by the teacher concerned and the college librarian including reading material.*



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 1
Course: 6C	Fisheries Extension Education Lab	Hrs/Wk: 2

Practical Syllabus: Course 6C: Fisheries Extension Education

Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Execute various audio-visual aids.
2. Conduct meetings and surveys on social and gender issues.
3. Organize audiovisual programs on fisheries extension
4. Know the role of formal and non-government organizations in fisheries extension
5. Assess the developmental needs of the fishermen community.

Practical Syllabus:

1. Preparation and use of audio-visual aids in fisheries extension.
2. Preparation and use of non-projected visual aids in fisheries extension.
3. Preparation and use of projected aids in fisheries extension.
4. Preparation and presentation of radio script and television talk.
5. Study of social issues/problems through participatory and rapid rural appraisal techniques, stake holder's analysis and needs assessment.
6. Assessment of the developmental needs of community.
7. Role of formal and non-governmental organizations through Stake holder analysis.
8. Case studies on social/ gender issues and social conflicts in fisheries.
9. Case studies on extension programs and success stories.
10. Practical exercises on conducting/demonstrating different fish farmers meetings.

Co-Curricular Activities:

a) Mandatory: (Training of students by teacher on field related skills: 15 hours)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing and preservation of fish/shellfish and their by-products and value added products; and the quality management and certification in fish processing.
2. **For Student:** Individual visit to a fish processing plant or related field or to a laboratory in research organization/private sector and study the sanitation measures followed while handling, storage and transport of fresh fish for further processing, various methods of processing and preservation of fish/shellfish and their products, packaging and labeling, cold storage and export. Also study the sanitary procedures, HACCP and GMPs implemented for quality assurance and quality control of seafood in fish processing plants. Submission of a hand written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including the preparation of novel value added products and processing of fish products)
3. Seminars, Group discussions, Quiz, Debates, etc. (on related topics).



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4. Preparation of videos on fish/shellfish processing and various methods of preserving fish/fish products, preparation of value added products, packaging, labeling, etc,
5. Collection of material/figures/photos related to fish processing, preservation and value added products, writing and organizing them in a systematic way in a file.
6. Visits to fish processing plant/industry, firms, research institutes, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Suggested Question Paper Pattern:

Max. Marks: 75



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 4
Course: 7C	Microbiology of Fish and Fishery products	Hrs/Wk: 4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Know the history and significance of microorganisms in fish foods
2. Understand the microorganisms in fish foods, the factors affecting the microbial growth and their role in food spoilage.
3. Acquire knowledge on microbes involved in foodborne infections and intoxications
4. Ascertain the various types of fish spoilage and its control
5. Maintain the seafood safety and quality in fish processing industries.

Syllabus: (Total Hours:90 including Teaching, Lab, Field Training and Unit tests, etc.)

UNIT I:Introduction to microbiology (10h)

1. History of microorganisms in foods .Role and significance of microorganisms in foods.
2. Microbial principles of fish preservation and processing - application of low temperature, high temperature, drying, irradiation and chemicals.
3. Conventional and rapid techniques for the detection of microorganisms in food.

UNIT II: Fish microbiology (10h)

1. Microorganisms in fresh and processed fish–rawfish, chilled fish, frozenfish, cured fish, cannedfish, fermented, irradiated, value added and other miscellaneous fish products. Isolation and identification of common bacteria.
2. Intrinsic and extrinsic parameters that affect microbial growth in fish.
3. Psychrophiles, halophiles and thermophiles, their role in spoilage and food poisoning.

UNIT III: Foodborne pathogens (10h)

1. Study ofbacteria involved in foodborne infections and intoxications– *Vibrio parahaemolyticus*, *V. cholerae*, *Listeria monocytogenes*, *Clostridium*; *Salmonella*, *Shigella*, *Staphylococcus*, *E. coli*.
2. Occurrence, growth, survival, pathogenicity, prevention and risk assessment of common bacteria present in fish.
3. Biological hazards associated with fish and fishery products: Marine toxins - Shellfish toxins, scombroid toxins, ciguatera toxins and puffer fish toxins; mycotoxins, parasites and viruses.

UNIT IV: Fish spoilage (10h)

1. Types of spoilage of fish and fishery products. Indicators/Indices of fish spoilage.
2. Microbial spoilage of fish / shellfish. Control measures to reduce microbial load in fish and fishery products.
3. Assessment of fish spoilage and Limiting spoilage

UNIT V:Seafood safety and quality management (10h)

1. Quality Indicators of fish products. Bacteria of sanitary significance.
2. SSOP, GHP and GMP. Process water quality in fish processing industries. Disinfectants, detergents and cleaning schedule.
3. Concepts of Quality Management; Quality standards for fish and fishery products – BIS, FSSAI, Codex Alimentarius, ISO 9000 series and HACCP. Microbiological standards and criteria.



REFERENCES:

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15. Balachandran, KK. (2001). Post-harvest technology of fish and fish products. Daya Publ.
16. Anthony, TT. (1988). Handbook of Natural toxins, Marine toxins and Venom. Vol.III. Marcel Dekker.
17. *Web resources suggested by the teacher concerned and the college librarian including reading material.*



B.Sc.	Semester - V (Skill Enhancement Course - Elective)	Credits: 1
Course: 7C	Microbiology of Fish and Fishery products Lab	Hrs/Wk: 2

Practical Syllabus: Course 7C:Microbiology of Fish and Fishery products

Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Collect and process the fish/shellfish samples for microbial studies.
2. Establish the laboratory for the isolation and culture of microorganisms.
3. Identify and enumerate the microbes in water, ice, fish and fishery products.
4. Characterize the bacteria by biochemical tests and detect them by molecular, conventional and rapid methods.
5. Assess the indices of freshness and quality of fresh and processed fish/shellfish.

Practical Syllabus:

1. Sampling and processing of fish/shellfish samples for microbiological investigation.
2. Sterilization techniques, Media preparation, Isolation and maintenance of bacteria, and Gram staining of bacteria.
3. Conventional and rapid methods for detection of microorganisms.
4. Enumeration of microorganisms associated with fish/shellfish and fishery products – Total plate count (TPC).
5. Enumeration of microorganisms in water and ice.
6. Isolation and identification of foodborne pathogens in fish/shellfish and fishery products.
7. Enumeration of specific spoilage microbes from fish and fishery products.
8. Biochemical tests for characterization of bacteria.
9. Molecular methods for the detection of pathogenic microorganisms.
10. Determination of MIC and MBC of chemical preservatives.
11. Assessment of freshness of fish and shrimp by using organoleptic characters.
12. Assessment of sanitation in fish processing plants.
13. Determination of available chlorine.

Co-Curricular Activities:

a) Mandatory: (*Training of students by teacher on field related skills: 15 hours*)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing and preservation of fish/shellfish and their by-products and value added products; and the quality management and certification in fish processing.
2. **For Student:** Individual visit to a fish processing plant or related field or to a laboratory in research organization/private sector and study the sanitation measures followed while handling, storage and transport of fresh fish for further processing, various methods of processing and preservation of fish/shellfish and their products, packaging and labeling, cold storage and export. Also study the sanitary procedures, HACCP and GMPs implemented for quality assurance and quality control of seafood in fish processing plants. Submission of a hand written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
5. Unit tests (IE).



b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including the preparation of novel value added products and processing of fish products)
3. Seminars, Group discussions, Quiz, Debates, etc. (on related topics).
4. Preparation of videos on fish/shellfish processing and various methods of preserving fish/fish products, preparation of value added products, packaging, labeling, etc,
5. Collection of material/figures/photos related to fish processing, preservation and value added products, writing and organizing them in a systematic way in a file.
6. Visits to fish processing plant/industry, firms, research institutes, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Suggested Question Paper Pattern:

Max. Marks: 75



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: V (Skill Enhancement Course - Elective)

Course 6A: Fish Processing Technology

Time: 3Hrs.

Max. Marks: 75

SECTION -A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5 x 5 =25M

1. Quality of ice in fish handling and processing
2. Use of chemical preservatives
3. Canning
4. Shark leather
5. Chitosan
6. Fish sauce
7. Prawn pickles
8. Codex Alimentarius

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5 x 10 =50M

9. a) Explain the Aims of fish processing?

OR

b) Give a detail account on Principles of fish preservation?

10.a) Write in detail about the Traditional methods of fish preservation?

OR

b) Write in detail about advanced methods of shell fish preservation?

11. a) Explain the Significance of Insulin, fish albumin and peptones

OR

b) Write the Utilization of sea weeds?

12. a) Write the Status of value addition to fish and fish products in Indian seafood sector?

OR

b) Describe the Packing and Labeling of fish and fishery products?

13. a) Explain the Concepts of Hazard Analysis Critical Control Point (HACCP) in sea food safety?

OR

b) Describe the Basic concepts and quality control of fish processing?



ADIKAVI NANNAYA UNIVERSITY :: RAJAHMAHENDRAVARAM
B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

Suggested Question Paper Model for Practical Examination
Semester – V/ Fisheries Course – 6A (Skill Enhancement Course)
Fish Processing Technology

Max. Time : 3 Hours

Max. Marks : 50

- | | |
|--|------------|
| 1. Organoleptic analysis of fish/ Fish preservation method 'A' | 8 M |
| 2. Fish by-products 'B' | 10 M |
| 3. Value added products 'C' | 10 M |
| 4. Demonstration of HACCP / Sanitation and Quality control 'D' | 12 M |
| 5. Record + Viva-voce | 6+4 = 10 M |



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: V (Skill Enhancement Course - Elective)

Course 7A: Fish Seed Production Technology

Time: 3Hrs.

Max. Marks: 75

SECTION - A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5 x 5 =25M

1. Seed Collection Gears
2. Write short notes on Fish Breeding sites
3. Synthetic hormones
4. Traditional Hatchery
5. Common carp
6. Pompanos
7. Eyestalk ablation
8. *Macrobrachium malcolmsonii*

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5 x 10 =50M

9. a) Write a notes on Natural breeding and Seed resources of carp in major rivers of India?
OR
b) Give a detail account on Seed resources and collection of freshwater prawn?
10. a) Write in detail about Bundh breeding?
OR
b) What is induced breeding? Write the structure and collection of Fish pituitary gland?
11. a) . Explain the Breeding techniques and Seed production of *Channa*?
OR
b) Write the seed production in Seabass?
12. a) Describe the General design of shrimp hatcheries?
OR
b) Describe the Sea water filtration and treatment processes?
13. a) Write an essay on Seed production of crabs?
OR
b) Write in detail about Seed production of pearl oysters?



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B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

Suggested Question Paper Model for Practical Examination
Semester – V/ Fisheries Course – 7A (Skill Enhancement Course)
Fish Seed Production Technology

Max. Time : 3 Hours

Max. Marks : 50

-
1. Demonstration of eyestalk ablation in *Penaeus monodon* 'A' 8 M
 2. Demonstration of fish hatcheries/ shrimp hatchery 'B' 8 M
 3. Demonstration of hypophysation technique in Indian major carps 'C' 12 M
 4. Identification, salient features and importance of the following. 4 x 3 = 12 M
 - a) Larval stage of crustaceans
 - b) Larval stage of mollusks
 - c) Live algal feed
 - d) Larval feed / Live feed - rotifer / *Artemia* nauplii
 5. Record + Viva-voce 6+4 = 10 M



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: V (Skill Enhancement Course - Elective)
Course 6B: Aquatic Pollution and Coastal Zone Management

Time: 3Hrs.

Max. Marks: 75

SECTION - A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5 x 5 =25M

1. Pollution Definition
2. Point source of pollution
3. Polychlorinated biphenyls (PCBs)
4. Oil Pollution
5. Bioremediation
6. Zoonosis
7. Estuaries
8. Harvestable resources

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5 x 10 =50M

9. a) Write definition of pollution ? Give a detail account on classification pollution?
OR
b) What is sewage? Explain the sewage pollution and its treatment?
- 10.a) Write an essay on pesticide pollution?
OR
b) What is Radioactive pollution? Explain the special effects of radioactive pollution?
11. a) . Explain the microbial pollution in culture ponds?
OR
b) What is an anthropogenic activity? Explain their impact on coastal zones and aquaculture?
12. a) Write the principle of Remote sensing ? Explain applications of remote sensing for coastal management?
OR
b) Write Definition and Concepts GSI? Explain applications of GIS in aquatic resource identification.
13. a) Write an essay on general coastal zone programs?
OR
b) Write in detail about Coastal Regulation Zone (CRZ) Act?



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B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

Suggested Question Paper Model for Practical Examination
Semester – V/ Fisheries Course – 6B (Skill Enhancement Course)
Aquatic Pollution and Coastal Zone Management

Max. Time : 3 Hours

Max. Marks : 50

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- | | |
|--|--------------|
| 1. Determination of a polluted water parameter 'A' | 8 M |
| 2. Estimation of a sediment parameter 'B' | 8 M |
| 3. Demonstration of EIA / coastal project / coastal zone mapping 'C' | 12 M |
| 4. Identification, salient features and importance of the following. | 4 x 3 = 12 M |
| a) Pollution indicator species | |
| b) Warning pictogram and symbol of a pesticide | |
| c) Coastal finfish/ shellfish | |
| d) Coastal mangrove/ algae/ other invertebrate/ vertebrate | |
| 5. Record + Viva-voce | 6+4 = 10 M |



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: V (Skill Enhancement Course - Elective)

Course 7B: Ornamental Fisheries

Time: 3Hrs.

Max. Marks: 75

SECTION- A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5 x 5 =25M

1. Method of collection of live fish
2. Types of aquaria
3. Gold fish
4. Starfish
5. Aquarium plants
6. Control of snail
7. Damsel fishes larval rearing
8. Fish conditioning

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5 x 10 =50M

9. a) Explain the Global status of ornamental fish trade and export potential?
OR
b) Give a detail account on Indian ornamental fish diversity and its status?
10. a) write the taxonomy of Freshwater ornamental fishes?
OR
b) Explain in detail about Marine ornamental fishes?
11. a) Write an essay on Aquarium fish feed?
OR
b) Explain the biological, mechanical and chemical water filtration systems?
12. a) Explain in detail about Breeding of Live bearers and Egg layers
OR
b) Describe the Application of genetics and biotechnology for quality strain production?
13. a) Write the notes on Mass production of aquarium plants?
OR
b) Describe the Retail marketing and export of ornamental fish?



ADIKAVI NANNAYA UNIVERSITY :: RAJAHMAHENDRAVARAM
B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

Suggested Question Paper Model for Practical Examination
Semester – V/ Fisheries Course – 7B (Skill Enhancement Course)

Ornamental Fisheries

Max. Time : 3 Hours

Max. Marks : 50

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- | | |
|---|--------------|
| 1. Identification of two freshwater aquarium fishes ‘A’ | 8 M |
| 2. Identification of two marine aquarium fishes ‘B’ | 8 M |
| 3. Demonstration of breeding technique of egg layers/live bearers ‘C’ | 12 M |
| 4. Write about the following. | 4 x 3 = 12 M |
| a) Aerators | |
| b) Biofilters | |
| c) Aquatic plant | |
| d) Live feed / Fish disease and its treatment | |
| 5. Record + Viva-voce | 6+4 = 10 M |



ADIKAVI NANNAYA UNIVERSITY :: RAJAHMAHENDRAVARAM
B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: V (Skill Enhancement Course - Elective)

Course 6C: Fisheries Extension Education

Time: 3Hrs.

Max. Marks: 75

SECTION - A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5 x 5 =25M

1. Extension Education objectives
2. CIFE
3. Advantages of Audio visual aids
4. TRYSEM
5. KVK
6. CAA
7. Rural sociology
8. Fish Farmer's Development Agencies

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5 x 10 =50M

9. a) Write History and role of fisheries extension in fisheries development?
OR
b) Give a detail account on Fisheries training and Education in India ?
- 10.a) Write the Individual, group and mass contact methods and their effectiveness?
OR
b) Explain in detail about Classification and choice of audio visual aids?
11. a) Explain the salient features of ORP, NDS, LLP, IRD?
OR
b) Explain the Adoption and diffusion of innovations and process in fisheries sector?
12. a) Explain Basic concepts in rural sociology and their relevance in fisheries extension
OR
b) Describe the role of Village institutions and Voluntary organizations in fisheries and aquaculture development ?
13. a) Write steps in Extension Program Planning and Evaluation and its importance?
OR
b) Describe the Programs for weaker section of the community?



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B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

Suggested Question Paper Model for Practical Examination
Semester – V/ Fisheries Course – 7C (Skill Enhancement Course)
Fisheries Extension Education

Max. Time : 3 Hours

Max. Marks : 50

1. Audio-visual aids ‘**A**’ 8 M
2. Projected / Non-projected aids ‘**B**’ 10 M
3. Social/ gender issues in fisheries ‘**C**’ 10 M
4. Demonstration of role of formal and non-governmental organizations ‘**D**’ 12 M
5. Record + Viva-voce 6 + 4 = 10 M



MODEL QUESTION COURSE

B. Sc DEGREE EXAMINATION

SEMESTER: V (Skill Enhancement Course - Elective)
Course 7C: Microbiology of Fish and Fishery Products

Time: 3Hrs.

Max. Marks: 75

SECTION - A

Answer any FIVE of the following. Draw diagrams wherever necessary. 5 x 5 =25M

1. Rapid techniques for Enumeration of microorganisms
2. Psychrophiles,
3. Halophiles
4. Prevention and risk assessment of common bacteria present in fish.
5. Indicators/Indices of fish spoilage.
6. TQM,
7. BIS
8. ISO 9000 series

SECTION-B

Answer ALL the following. Draw diagrams wherever necessary. 5 x 10 =50M

9. a) History of microorganisms in foods. Write the Role and significance of microorganisms in foods?
OR
b) Give a detail account on Microbial principles of fish preservation and processing?
10. a) Write in detail about Isolation and identification of common bacteria?
OR
b) What are the Factors affecting the growth and survival of microorganisms in fish?
11. a) . Write note on bacteria involved in food borne infections and intoxications?
OR
b) Write the Biological hazards associated with fish and fishery products?
12. a) Write the Types of spoilage of fish and fish products?
OR
b) Assessment of quality of fish and fishery products?
13. a) Explain the Process of water quality in fish processing industries.?
OR
b) Explain the Microbiological standards and criteria?



ADIKAVI NANNAYA UNIVERSITY :: RAJAHMAHENDRAVARAM
B.Sc Fisheries Syllabus (w.e.f: 2020-21 A.Y)

Suggested Question Paper Model for Practical Examination
Semester – V/ Fisheries Course – 7C (Skill Enhancement Course)
Microbiology of Fish and Fishery products

Max. Time : 3 Hours

Max. Marks : 50

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- | | |
|---|--------------|
| 1. Sterilization techniques/ Staining techniques ‘A’ | 8 M |
| 2. Preparation of microbiological media / Organoleptic evaluation of fish ‘B’ | 10 M |
| 3. Isolation/ culture/ characterization of bacteria from fishes and water ‘C’ | 10 M |
| 4. Demonstration of HACCP / Sanitation and Quality control ‘D’ | 12 M |
| 5. Record + Viva-voce | 6 + 4 = 10 M |