

**ADUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS SIDDHARTHA DEGREE COLLEGE OF  
ARTS & SCIENCE, VUYYURU-521165, KRISHNA Dt., A.P. (AUTONOMOUS).**

NACC reaccredited at 'A' level

Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Taxonomy and functional Anatomy of fin fish and shell fish**

Semester: - II

Course Code	23AQMAL121	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-2024	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

**Course Out comes:**

<b>CO 1</b>	Acquire knowledge on the Classification of major groups of Finfish and Shellfish
<b>CO 2</b>	Students will be familiar with general characters of fin fish and shell fish
<b>CO 3</b>	Gain knowledge on the structure and functions of Digestive system
<b>CO 4</b>	Understand the difference between the brain of fish and prawn
<b>CO 5</b>	Acquire knowledge on the functional anatomy of fish and prawn

Unit	Learning Units	Lecture Hours
I	<b>General characters &amp; Classification of Cultivable fin fish and shell fish</b> General Characters of Crustacea Classification of Crustacean: Major groups up to orders and their important characters. General Characters of fishes Classification of Fishes: Major groups up to sub class and their important characters	
II	<b>Digestive and Respiratory systems of Fish and shell fish</b> Digestive system of fish – Digestion process & physiology Respiratory system of fish- Respiratory organs & Mechanism <b>Accessory respiratory organs in fishes</b> Digestive system of prawn- Digestion process & physiology Respiratory system in prawn - Respiratory organs & Mechanism	
III	<b>Circulatory systems of Fish and shell fish</b> Cardio vascular system: Structure of heart in fishes- ( <b>Shark, Labeo, Lates, Channa punctatus</b> ) Blood vascular system & course of circulation in prawn	
IV	<b>Nervous system of Fish and shell fish</b> Nervous system in fish: <b>Central nervous system &amp; Peripheral Nervous system</b> Central Nervous system, <b>peripheral nervous system, Sympathetic Nervous System in prawn</b>	
V	<b>Reproductive system of Fish and shell fish</b> Urino-genital system in fishes- Reproductive system, Excretory system in fishes Reproductive system in prawn- Male & female reproductive system	

**PRESCRIBED BOOK(S):**

1. Bone Q et al., 1995. Biology of fishes, Blackie academic & professional, LONDON
2. Saxena AB 1996. Life of Crustaceans. Anmol Publications Pvt.Ltd., New Delhi

**REFERENCES:**

1. Tandon K.K & Johal M.S 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing
2. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
3. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.
4. Barrington FJW 1971. Invertebrates: Structure and Function. ELBS
5. Parker F & Haswell 1992. The text book of Zoology, Vol I. Invertebrates

PRACTICAL- (At the end of II Semester)

**Title of the paper: Taxonomy and functional Anatomy of fin fish and shell fish**

**No of Hours: 30**  
**WEF: 2023-2024**

**Credits: 01**  
**Course Code: 23AQMAP121**

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1. Study of mouth parts in herbivorous and carnivorous fishes
2. Comparative study of digestive system of herbivorous and carnivorous fishes
3. Demonstration of brain of fish
4. Demonstration of cranial nerves of fish
5. Demonstration of Nervous system of prawn
6. Exposure of gills of prawn
7. Exposure of gills of fish

#### **REFERENCEBOOKS**

1. Bond E. Carl. 1979. *Biology of Fishes*, Saunders.
2. Halver J. E. 1972. *Fish Nutrition*. Academic Press.
3. Hoar W. S. and Randall D. J. 1970. *Fish Physiology*, Vol. I-IX, Academic Press, New York.
4. Lagler K. F., Bardach J. E., Miller R. R., Passino D. R. M. 1977. *Ichthyology*, 2<sup>nd</sup> Ed. John Wiley & Sons, New York.
5. Lovell J. 1989. *Nutrition and Feeding of Fish*. Van Nostrand Reinhold, New York.
6. Moyle P. B. and Joseph J. Cech Jr. 2004. *Fishes: An Introduction to Ichthyology*. 5<sup>th</sup> Ed. Prentice Hall.
7. Nikolsky G. V. 1963. *Ecology of Fishes*, Academic Press.
8. Norman J. R. and Greenwood P. H. 1975. *A History of Fishes*, Halsted Press.

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NACC reaccredited at 'A' level

Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Biology of Fin fish and Shell fish**

Semester: - II

Course Code	23AQMAL122	Course Delivery Method	Class Room/Blended Mode - Both
Credits	4	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-2024	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

**Learning Outcomes:**

<b>CO 1</b>	Gain Knowledge of feeding habits, gut content analysis and growth factors in fishes
<b>CO 2</b>	Understand the commercial importance of crustaceans and Fish
<b>CO 3</b>	Understand and learn breeding in fishes ,breeding habits, method of induced breeding in fishes
<b>CO 4</b>	To create awareness on parental care of fishes and embryonic and larval development and environmental factors affecting development of major aquaculture organisms
<b>CO 5</b>	Acquire knowledge about Endocrine system in fishes

**Syllabus:**

Unit	Learning Units	Lecture Hours
I	<b>Specialized organs in fish</b> Sense organs of fishes and crustaceans. Specialized organs in fishes—electric organ, venom and toxins Buoyancy in fishes : swim bladder and mechanism of gas secretion Fish and Crustaceans of commercial importance	12
II	<b>Food, Feeding and Growth</b> Natural fish food, feeding habits, feeding intensity, stimuli for feeding, utilization of food, gut content analysis, forage ratio Principles of Age and growth determination; growth regulation, Growth rate measurement—scale method, otolith method, skeletal parts as age indicators Length-frequency method, age composition, age-length keys, absolute and specific growth, back calculation of length and growth, annual survival rate, Length-weight relationship	12
III	<b>Reproductive Biology</b> Breeding in fishes, breeding places, breeding habits & places, breeding in natural environment and in artificial ponds, courtship and reproductive cycles. Induced breeding in fishes Breeding in shrimp, oysters, mussels, clams, pearl oyster, pila, and cephalopods.	15
IV	<b>Development</b> Parental care in fishes, ovo-viviparity, oviparity, viviparity, nest building and brooding Embryonic and larval development of fishes Embryonic and larval development of shrimp, crabs and molluscs of commercial importance Environmental factors affecting reproduction and development of cultivable aquatic fin & shell fish	09
V	<b>Hormones &amp; Growth.</b> Endocrine system in fishes. Neuro-secretory cells, androgenic gland, ovary, chromatophores, Molting, molting stages, metamorphosis in crustacean shell fish	12

## REFERENCES

- Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11<sup>th</sup> Edition. Pearson publications, London, England.
- Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5<sup>th</sup> Edition. McGraw Education, New York, USA.
- Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.
- Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
- R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
- Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3<sup>rd</sup> Edition. Cambridge Publishers.
- U. Sathyanarayana, 2005. Biotechnology. 1<sup>st</sup> Edition. Books and Allied Publishers pvt. ltd., Kolkata.
- Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
- Arthur M. Lesk. Introduction to Bioinformatics. 5<sup>th</sup> Edition. Oxford publishers.
- AP Kulkarni, 2020. Basics of Biostatistics. 2<sup>nd</sup> Edition. CBS publishers.

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ACTIVITIES- I (At the end of I Semester)

**Title of the paper: Biology of Fin fish and shell fish**

**No of Hours: 30  
WEF: 2023-2024**

**Credits: 01  
Course Code: 23AQMAP122**

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- 1.Length-weightrelationshipof fishes
  - 2.Gutcontentanalysisin fishesandshrimp
  - 3.Mouthpartsandappendagesofcultivableprawns,shrimpsandothercrustaceans
  - 4.Studyof eggs of fishes,shrimps, prawns and othercrustaceans
  - 5.Studyof oystereggs
  - 6.Embryonicandlarvaldevelopmentoffish
  - 7.Study of gonadal maturity and fecundity in fishes and shellfish
  - 8.Observationofcrustaceanlarvae
  - 8.Studyofnest buildingandbrooding offishes

**PRESCRIBEDBOOK(S)**

BoneQ et al.,1995. Biologyoffishes,Blackie academic&professional, LONDON.

SaxenaAB1996.LifeofCrustaceans.AnmolPublicationsPvt.Ltd.,NewDelh

**REFERENCES:**

TandonKK&JohalMS1996.AgeandGrowthinIndianFreshWaterFishes.NarendraPublishing House, New Delhi.

Raymond T et al.,1990.CrustaceanSexualBiology,Columbia UniversityPress,NewYork

Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.1.18BarringtonFJW1971.Invertebrates: StructureandFunction.ELBS

1.19ParkerF&Haswell1992.The textbookofZoology, Voll.Invertebrates(eds.MarshAJ&Williams).E LBS & Mc Millan&Co.

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Title of the Paper: **Fish Nutrition & Feed Technology**

**Semester: - IV**

Course Code	<b><i>AQTT01</i></b>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2020-21	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

**Learning Objectives:**

- 1 To know the nutritional requirements of fish and shell fish at different stages of their life.
- 2 To understand the different types of feeds, and feed additives used in the preparation of fish and shell fish feeds.
- 3 To improve the knowledge on feed manufacture and feed storage.
- 4 To gain knowledge on feeding and feed evaluation methods.
- 5 To gain knowledge on feed manufacture and storage
- 6 To know the nutritional pathology and remedial methods of cultivable fish and shrimp.
- 7 To improve the technical knowledge feed quality and nutritional value analysis.

Course outcomes:

<b>CO 1</b>	Understand Nutritional requirements of cultivable fishes and factors affecting energy partitioning and feeding.
<b>CO 2</b>	Know different types of feed and FCR and different types of feeders
<b>CO 3</b>	Gain Knowledge of Feed manufacture and storage methods of feeds
<b>CO 4</b>	Understand the value of Feed additives and Non-Nutrient ingredients
<b>CO 5</b>	To create awareness of different nutritional deficiency and importance of natural and supplementary feeds and balanced diet.



Syllabus  
Course Details

Unit	Learning Units	Lecture Hours
I	<p><b>Nutritional requirements of cultivable fish and shellfish</b> Classification of nutrients; Nutritional requirements (energy, proteins, carbohydrates, lipids, fiber, micronutrients) of different stages of cultivable fish and shellfish.</p> <p>Essential aminoacids and fatty acids, protein to energy ratio, nutrient interactions and protein sparing effect</p> <p>Dietary sources of energy, effect of ration on growth, determination of feeding rate, check tray, factors affecting energy partitioning and feeding</p> <p>Importance of natural and supplementary feeds, balanced diet.</p>	10
II	<p><b>Types of feeds and Feed additives</b> Live foods: Fish food organisms – Bacterio plankton, phytoplankton, zooplankton and their role in larval nutrition.</p> <p>Artificial feeds: Supplementary feed stuffs; Non-conventional feed ingredients; Forms of processed feeds - wet feeds, moist feeds, dry feeds, mashes, pelleted feeds - floating and sinking pellets; advantages of pelletization</p> <p>Water stability feeds, farm made aqua feeds, micro-coated feeds, micro-encapsulated feeds and micro-bound diets</p> <p>Feed additives: Binders, antioxidants, probiotics, enzymes, pigments, growth promoters, feed stimulants; use of preservatives.</p>	10
III	<p><b>Feed formulation, manufacture &amp; storage</b> Feed ingredients: selection, nutrient composition and nutrient availability.</p> <p>Feed formulation and manufacturing – extrusion processing and steam pelleting - grinding, mixing and drying, pelletization, and packing</p> <p>Microbial, insect and rodent damage of feed, chemical spoilage during storage period and feed storage methods.</p>	15
IV	<p><b>Feeding methods</b> Feeding devices and methods: Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding &amp; tray feeding</p> <p>Feeding schedules: Frequency of feeding, feeding rates and ration size</p> <p>Feed evaluation: feed conversion ratio, feed conversion efficiency and protein efficiency ratio.</p>	15
V	<p><b>Nutritional pathology of fish and shrimp</b> Protein (Essential amino acid) and Lipid (Essential fatty acid) deficiency disorders; Fatty liver disease in fishes</p> <p>Vitamin and mineral deficiency disorders</p> <p>Anti-nutrients and aflatoxins.</p>	10

**PRESCRIBED BOOK(S):**

1. Halver J.E 1989. Fish Nutrition. Academic press, San Diego.
2. NRC. Nutritional Requirements of Warm Water Fishes. National Academy of Sciences, Washington.

**REFERENCES:**

1. Lovell R.T. 1998. Nutrition and Feeding of Fishes, Chapman & Hall, New York
2. Sena De Silva, Trevor A Anderson 1995. Fish Nutrition in Aquaculture. Chapman & Hall, Aquaculture Series, London.

ZOOLOGY PRACTICAL SYLLABUS

PAPERS – IV

Paper Title: Fish Nutrition & Feed Technology

w.e.f. 2020 – 2021  
Paper Code: AQTP01

Credits: 2

Max.Marks:40

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**PRACTICALS: (Any 8 as per the local Industry needs and Requirement)**

1. Estimation of protein content in aquaculture feeds
2. Estimation of carbohydrate content in aquaculture feeds
3. Estimation of lipid content in aquaculture feeds
4. Estimation of ash in aquaculture feed
5. Study of water stability of pellet feeds
6. Feed formulation and preparation in the lab
7. Study of binders used in aquaculture feeds
8. Study of feed packing materials
9. Study of physical and chemical change during storage
10. Study on physical characteristics of floating and sinking feeds
11. Visit to a aqua-feed production unit
12. Visit to a farm for studying feeding practices

**PRESCRIBED BOOK(S):**

1. HalverJE 1989.Fish Nutrition. Academicpress, San diego

**REFERENCES:**

1. LovellR.T. 1998. Nutritionand Feedingof Fishes, Chapman& Hall, NewYork
2. SenaDeSilva,TrevorAAnderson1995.FishNutritioninAquaculture.Chapman andHall, AquacultureSeries,London.

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Title of the Paper: **Fish Health Management and Fisheries Economics, Extension and Marketing**

**Semester: - IV**

Course Code	<i>AQTT42</i>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2020-21	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

**AIM**

- To know the fish health management strategies and different fisheries economic policies.

**OBJECTIVES**

- To understand the diseases of fin fish
- To understand the diseases of shell fish.
- To understand the fish health management strategies.
- To understand the different fisheries economic policies .
- To understand the various schemes for the welfare of fishermen community

**PREREQUISITE**

- Knowledge of fisheries management acquired in Intermediate.

**COURSE OUTCOMES**

**By the end of the course students will be able to**

<b>CO 1</b>	Describe the various fungal, viral and bacterial diseases of fin fish and their prevention and therapy.
<b>CO 2</b>	Explain the various viral, bacterial and protozoan diseases of shell fish and their prevention and therapy.
<b>CO 3</b>	Describe the fish health management strategies.
<b>CO 4</b>	Explain different fisheries economic policies.
<b>CO 5</b>	Describe the various schemes for the welfare of fishermen community.

Unit	Learning Units	Lecture Hours
I	<p><b>DISEASES OF FIN FISH</b></p> <p>.Fungal diseases– Saprolegniasis, branchiomycosis, ichthyophthiriasis diseases – Lagenidiumdiseases – Fusarium disease, prevention andtherapy</p> <p>Viral diseases – Emerging viral diseases in fish, haemorrhagic septicemia, springviremia of carps, infectious hematopoietic necrosis in trout,infectious pancreatic necrosis in salmonids, swim-bladder inflammation in cyprinids, channel cat fish viral disease, prevention andtherapy</p> <p>Bacterial diseases – Emerging bacterial diseases, <i>Aeromonas</i>,<i>Pseudomonas</i> and<i>Vibrio</i>infections, columnaris, furunculosis, epizootic ulcerative syndrome, infectious abdominal dropsy, bacterial gill disease, enteric red mouth, bacterial kidney disease, proliferative kidney disease, prevention and therapy</p>	10
II	<p><b>DISEASES OF SHELL FISH</b></p> <p>Major shrimp viral diseases – <i>Baculoviruspenaeii</i>, <i>MonodonBaculovirus</i>, Baculoviralmidgut necrosis, Infectious hypodermal and haematopoietic necrosis virus, Hepatopancreaticparvo like virus, Yellow head baculovirus, white spotbaculovirus.</p> <p>Bacterial diseases of shell fish – aeromonas, pseudomonas and vibrio infections,</p> <p>Luminous bacterial disease, filamentous bacterial disease. Prevention and therapy</p> <p>Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases,trypanosomiasis.Prevention and therapy</p>	10
III	<p><b>FISH HEALTH MANAGEMENT</b></p> <p>Diagnostic tools – immune detection- DNA/RNA techniques, General preventive methods and prophylaxis. Application and development of vaccines. Quarantine – Significance, methods and regulations for transplants. Good Feed management for healthy organisms, Zero water exchange, Probiotics in health management, Issues of biosecurity.</p>	15
IV	<p><b>FISHERIES ECONOMICS</b></p> <p>.Meaning and scope of economics with reference to fisheries</p> <p>Principles of aquaculture economics – Capital costs, variable costs, cost- benefit analysis</p> <p>.Aquaculture economics-</p> <p>Application of economics principles to aquaculture operations</p> <p>Various inputs and production function, laws of variable proportions</p> <p>Cost and earnings of aquaculture systems – carp culture, shrimp farming systems, hatcheries, Cost and earnings of fishing units and freezing plants</p> <p>Socio-economic conditions of fishermen in Andhra Pradesh</p> <p>Role of Matsyafed and NABARD in uplifting fishermen’s conditions, fishermen</p> <p>Cooperatives, Contribution of fisheries to the national economy</p>	15
V	<p><b>FISHERIESEXTENSION AND MARKETING</b></p> <p>.Fisheriesextension-scopeandobjectives,principlesandfeaturesoffisheries</p> <p>Extension education</p> <p>.Fisheries extension methods and rural development</p> <p>Fisheries Training and Education in India; Role of extension in community development</p> <p>.Fish marketing methods in India; Basic concepts in demand and price analysis2 .Methods of economic analysis of business organizations</p> <p>Preparation of project and project appraisal</p>	10

**PRESCRIBED BOOK(S):**

1. Shaperclaus W. 1991 Fish Diseases- Vol.I& II. Oxonian PressPvt.ltd
2. Roberts RJ 1989. Fish pathology. BailliereTindall, NewYork
3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandry and medicine. Pergamon Press.Oxford
4. Jayaraman R 1996. Fisheries Economics. Tamilnadu Veterinary and Animal Science University.Tuticorn
5. SubbaRao N 1986. Economics of Fisheries. Daya publishing house,Delhi
- 6.

**REFERENCES:**

1. Shankar KM & Mohan CV. 2002. Fish and Shellfish Health Management. UNESCO Publ. Sindermann CJ.1990
2. Walker P &Subasinghe RP. (Eds.). 2005 Principal Diseases of Marine Fish and Shellfish. Vols. I, II. 2nd Ed. AcademicPress
3. DNA Based Molecular Diagnostic Techniques: Research Needs for Standardization and Validation of the Detection of Aquatic Animal Pathogens and Diseases. FAO Publ. Wedmeyer G, Meyer FP & Smith L.1999.
4. Bullock G et.al., 1972 Bacterial diseases of fishes. TFH publications, NewJersey
5. Post G 1987. Text book of Fish Health. TFH publications, NewJersey
6. Johnson SK 1995. Handbook of shrimp diseases. Texas A & M University,Texas
7. Dewwett KK and Varma JD 1993. Elementary economic theory. S.chand, NewDelhi
8. Korakandy R 1996. Economics of Fisheries Mangement. Daya Publishing House,Delhi
9. Tripathi SD 1992. Aquaculture Economics. Asian Fisheries Society,Mangalore.

Code: AQTP42  
(2hrs/week)

Title of the paper:- Fish Health Management and Fisheries Economics, Extension and Marketing

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**LEARNING OUTCOMES:**

**By the end of the course students will be able to**

- Identify the pathological changes in the visceral organs of fish, prawn and shrimp.
- Analyse the data for epidemiological investigations of viral diseases.
- Isolate, culture and characterize the bacterial pathogens.
- Identify the external parasites, prepare and evaluate antibiograms
- Develop skill in molecular and immunological techniques.
- Estimate the dose of antibiotics and probiotics used in aquaculture practices and methods of administering various chemotherapeutics.
- Maintain a neat record of experiments and exhibit the hidden creative talent.

1. Enumeration of Bacteria by TPC Method
2. Enumeration of total Coli forms
3. Observation of gross pathology and external lesions of fish and prawn with reference to the common diseases in aquaculture
4. Examination of pathological changes in gills and gut lumen, lymphoid organ, muscles and nerves offish
5. Examination of pathological changes in gut lumen,hepato pancreas, lymphoid organ, muscles and nerves of prawn and shrimp
6. Collection, processing and analysis of data for epidemiological investigations of viral diseases
7. Bacterial pathogens – isolation, culture and characterization
8. Identification of parasites in fishes: Protozoan, Helminths, Crustaceans
9. Antibiograms – preparation and evaluation
10. Molecular and immunological techniques; Biochemical tests; PCR; ELISA; Agglutination test; Challenge tests; Purification of virus for development of vaccines (Demonstration at institutes/labs)
11. Estimation of dose, calculation of concentration, methods of administration of various chemotherapeutics to fish and shellfish
12. Estimation of antibiotics used in aquaculture practices
13. Estimation of probiotics used in aquaculture
14. Field visit to farm for health monitoring and disease diagnosis
15. Cost benefit analysis calculations

**PRESCRIBED BOOK(S):**

1. Shaperclaus W. 1991 Fish Diseases- Vol.I& II. Oxonian PressPvt.ltd
2. Roberts RJ 1989. Fish pathology. BailliereTindall, NewYork
3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandray and medicine. Pergamon Press.Oxford
4. Jayaraman R 1996. Fisheries Economics. Tamilnadu Veterinary and Animal Science University.Tuticorn
5. SubbaRao N 1986. Economics of Fisheries. Daya publishing house,Delhi

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Title of the Paper: **Aquarium management and Ornamental Fish Culture**

**Semester: - V**

Course Code	<b>AQTSET01</b>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	25
No. of Lecture Hours/ Week	3	Semester End Exam Marks	75
Total Number of Lecture Hours	45	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

**I. Learning Outcomes:**

After successful completion of this course student will be able to

<b>CO 1</b>	Understand the design and construction of aquarium
<b>CO 2</b>	Identify the ornamental fresh water fishes
<b>CO 3</b>	Identify the marine ornamental fish resources
<b>CO 4</b>	Know the mass production of ornamental fishes
<b>CO 5</b>	Identify the Major marine ornamental fish resources of India. Method of collection of live fish.

Syllabus  
Course Details

Unit	Learning Units	Lecture Hours
I	<p><b>Aquarium design and Construction</b>  <b>Introduction</b> to aquarium. World aquarium trade and present status.            Design and construction of home and public aquaria (freshwater and marine), oceanarium.            Aquarium accessories - Aerators, filters (different types) and lighting.            Water quality requirements.</p>	13
II	<p><b>Aquarium Management</b>            Setting up of aquarium – under gravel filter, pebbles, plants, drift wood, ornamental objects and selection of fishes, Quarantine measures.            Aquarium maintenance and water quality management for fresh water and marine aquariums.            Handling, care, packing and transportation of fishes - Use of anaesthetics.            Temperature acclimation</p>	14
III	<p><b>Freshwater Ornamental Fishes</b>            Species of ornamental fishes - their taxonomy and biology- Live bearers, Gold fish and Koi, Gourami, Barbs and Tetras, angel fish, cichlids.            Maturation, secondary sexual characters, breeding habits, spawning, parental care, fertilization and development of eggs.            Hatching, larval rearing and their health.</p>	15
IV	<p><b>Commercial Production</b>            Commercial production of goldfish, live bearers, gouramies, barbs and tetras, angel fish.            Natural ponds for the mass production of ornamental fishes.            Multiplication of aquarium plants – different methods.</p>	11
V	<p><b>Marine Ornamental Fishes</b>            Marine ornamental fishes – varieties and their habitat.            Major marine ornamental fish resources of India. Method of collection of live fish.            Breeding of marine ornamental fishes (clown fishes and Damsel fishes).</p>	07



## II. References

1. Alappat, H.J. & A. Biju Kumar 1996. Aquarium Fishes (A Colourful Profile). B.R. Publ., Delhi, 106 pp.
2. Atz, W. 1971. Aquarium Fishes. Pelham Books Ltd., London, 110 pp.
3. Axelrod, H.R. & W. Vorderwinkler 1962. Encyclopedia of Tropical Fishes with Special Emphasis on Techniques of Breeding. TFH. Publ., Inc., NJ, 763 pp.
4. Biju Kumar, A. & H.J. Alappat 1996. A Complete Guide to Aquarium Keeping. Books for All, Delhi, 80 pp.
5. Dholakia, A.D. 2009. *Ornamental fish Culture & Aquarium Management*. Daya Publishing House, Delhi, 313pp.
6. Faulkner, D. & J.W. Atz 1971. Aquarium Fishes, Their Beauty, History and Care. Pelham Books, London, 110 pp.
7. Favre, H. 1977. Dictionary of the Freshwater Aquarium. Wardlock Ltd., London, 160 pp.
8. Frey, H. 1961. Illustrated Dictionary of Tropical Fish. TFH. Publ. Inc., NJ, 768 pp.
9. Gohm, D. 1984. Tropical Fish. Hamlyn Publ. Group Ltd., London, 143 pp.
10. Gopakumar G. 2011. *Marine Ornamental fish Culture: Package of Practices*. CMFRI Cochin. 100pp.
11. ICAR 2011. Handbook of Fisheries and Aquaculture. ICAR, New Delhi, 1116 pp.
12. Innes, W.T. 1953. Exotic Aquarium Fishes. Innes Publ. Co., Philadelphia, 533 pp.
13. Kurup, M.B. 2008. Ornamental Fish Farming, Breeding and Trade. Dept. Fish., Govt. Kerala, 280 pp.
14. Meenakshi, J., N.K. Yadava & R.K. Gupta. 2010. *Freshwater Ornamental Fishes*. Mangalam Publications, Delhi, 397pp.
15. Mills, D. 1981. The Tropical Aquarium. Salamander Books Ltd., London, pp.
16. Mills, D. 1984. A Fish Keepers Guide to the Tropical Aquarium. Salamander Books, Ltd., London, 115 pp.
17. Mills, D. 1987. The Practical Encyclopedia of the Marine Aquarium. Salamander Books Limited, London.
18. Petrovicky, I. 1988. Aquarium Fish of the World. Hamlyn Publ. Group Ltd., London, 499 pp.

PRACTICAL - V

w.e.f. 2021-2022.

2hrs/week)

Credits: 02

Code: AQTSEP01  
MAX.MARKS:50

**Title of the paper :- Aquarium management and Ornamental Fish Culture**

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**III. Lab work - Skills Outcomes:**

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

- Classify different types of craft and gear used for fishing
- Asses the quality of yarn used in fishing gear
- Understand importance of natural fibers

**Practical (Laboratory) Syllabus: (30 hrs)**

(Max.50 Marks)

1. Fresh water Ornamental fishes (Exotic-Goldfish, Angel, Tiger barb, Sword tail, Fighter fish, Oscar. Indigenous- Dwarf Gourami, Indian glass fish, Zebra Danio, Y loach, Peacock eel, Rosy barb) – characters with diagrams – record work
2. Aquarium accessories (Aerators/filters/decors/feeding equipment/heaters/pumps/lights)
3. Aquarium plants (6 species)
4. Aquarium setting (Freshwater)
5. Aquarium fabrication and maintenance
6. Breeding trials on selected aquarium fishes.

**IV. Lab References:**

1. Atz, W. 1971. Aquarium Fishes. Pelham Books Ltd., London, 110 pp.
2. <https://www.agrifarming.in/ornamental-fish-farming-beginners>
3. <http://ecoursesonline.iasri.res.in/course/view.php?id=297>
4. [https://agritech.tnau.ac.in/fishery/fish\\_cul\\_ornamental.html](https://agritech.tnau.ac.in/fishery/fish_cul_ornamental.html)
5. <https://nfdb.gov.in/PDF/E%20Publications/4%20Mission%20Ornamental%20Fisheries%202017.pdf>

**V. Co-Curricular Activities**

**a) Mandatory:** (Student training by teacher in field skills: Total 15 hrs., Lab:10 + field 05)

1. For Teacher: Training of students by the teacher in the classroom or in the laboratory for a total of not less than 10 hours various concepts aquarium – types –models- aquarium maintenance- ornamental fish culture-commercial production- importance - marketing
2. For Student: Individual laboratory work and visit to local aquarium for observation of aquarium fishes- aquarium accessories- ornamental fishes- marketing and maintenance
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work

Name of the aquarium /shop visited, date of visit, persons contacted, details of aquarium maintenance - details observed in marketing - breeding of ornamental fish - important points to be correlated with the theory/ practical curriculum in relation to ornamental fisheries

5. Unit tests (IE).

**b) Suggested Co-Curricular Activities**

1. Preparation of aquarium
2. Ornamental fish breeding
3. Listing out accessories of aquarium
4. Seminar, Invited lecture, Assignment, Group discussion. Quiz, Collection of Material,
5. Video preparation etc



**ADUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYURU-521165, KRISHNA Dt., A.P. (AUTONOMOUS).**

NAAC recredited at 'A' level  
Autonomous –ISO 9001-2015 Certified

Title of the Paper: Post harvest Technology of Fish and Fisheries .

Course Code	<b>AQTSET02</b>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	3	Semester End Exam Marks	70
Total Number of Lecture Hours	45	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2023-2024	Year of Revision	Percentage of Revision: 0%

Objective of the course To prepare students to become future aqua culturists.

<b>CO 1</b>	Identify the types of preservation methods employed in aquaculture
<b>CO 2</b>	Choose the suitable processing methods in aquaculture
<b>CO 3</b>	They can earn while they learn
<b>CO 4</b>	Maintain the standard quality control protocols laid down in aqua industry
<b>CO 5</b>	Identify the best Seafood quality assurance system

Syllabus  
Course Details

Unit	Learning Units	Lecture Hours
I	<p><b>Handling and Principles of fish Preservation</b>            Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and fresh water fish.            Principles of preservation – cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.</p>	15
II	<p><b>Methods of fish Preservation</b>            Traditional methods - sun drying, salt curing, pickling and smoking.            .Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, irradiation and Accelerated Freeze drying (AFD).</p>	08
III	<p><b>Processing and preservation of fish and fish by-products</b>            Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.            Fish by-products – fish glue, Using glass, chitosan, pearl essence, shark fins, fish Leather and fish maws.</p>	17
IV	<p><b>Sanitation and Quality control</b>            Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.            Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.</p>	08
V	<p><b>Quality Assurance, Management and Certification</b>            Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.            National and International standards – ISO 9000: 2000 Series of Quality Assurance System, <i>Codex Alimentarius</i>.</p>	12

Code: AQTSE02

Post harvest Technology of Fish and Fisheries

MAX.MARKS: 50.

(2hrs/week)

Credits: 02

(30 hrs)

### PRACTICAL SYLLABUS

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#### Learning Outcomes:

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

- Identify the quality of aqua processed products.
- Determine the quality of fishery by products by observation.
- Analyze the protocols of aqua processing methods.

#### Practical Syllabus:

1. Evaluation of fish/fishery products for organoleptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish
3. Examination of salt,protein,moisture in dried/cured products
4. Examination of spoilage of dried/cured fish products marinades, pickles, sauce.
5. Preparation of isinglass, collagen and chitosan from shrimp and crab shell.
6. Developing flow charts and exercises in identification of hazards–preparation of Hazard analysis work sheet
7. Corrective action procedures in processing of fish-flowchart-work sheet preparation.

#### References:

- Balachandran KK. 2001. *Post-harvest Technology of Fish and Fish Products*. Daya Publ.  
2. Bond, et al. 1971. *Fish Inspection and Quality Control*. Fishing News Books, England.

#### Websites of Interest:

- [https://www.youtube.com/watch?v=xyf\\_g7fku-4](https://www.youtube.com/watch?v=xyf_g7fku-4)  
[https://www.youtube.com/watch?v=bvtqb\\_ccmy4](https://www.youtube.com/watch?v=bvtqb_ccmy4)

#### Co-Curricular Activities

- a) Mandatory:** (*Lab/field training of students by teacher (lab 10 + field 05)*): 1. For Teacher: Training of students by the teacher in laboratory/field for not less than 15 hours on various steps of post-harvest techniques of fishes, on the advanced techniques in post-harvest technology – Training of students on other employability skills in the Post-harvest sector of Aquaculture Industry- like Processing, Packing, marketing of processed aqua products. 2. For Student: Students shall (individually) visit - Any fish/shrimp Processing Plant/Packing industry and make observations on post harvesting techniques and submit a brief handwritten Fieldwork/Project work Report with pictures and data /survey in 10 pages.  
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements*
5. (IE): Unit tests, b) Suggested Co-Curricular Activities
1. Observation of fish/shrimp processing plants – visit web sites of processing companies and record the details of that Unit
  2. Interaction with local fishermen to know the method of preservation and details with the available traditional technology
  3. Collection of web resources on the Quality assurance, quality control measures in Aqua Industries- cross checking the standards during the visit to any processing units.
  4. Assignments, Seminar, Group discussion. Quiz, Collection of Material, Invited lecture, Video preparation etc.,

**VALUE ADDED  
COURSE OFFERED BY**

**THE DEPARTMENT OF ZOOLOGY**

**DURING -2023-2024**

SYLLABUS:- ORGANIC FARMING

Value added course

Max.Marks: 50.

Total hours: 30.

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**Objective of the course:** To provide skill based education to make them entrepreneurs.

**Course outcomes:**

- ❖ Students imbibe skills along with knowledge of organic farming.
- ❖ They learn about different varieties of crop production and their rearing Plants
- ❖ They learn about different varieties of Ornamental crops & Medicinal plants and their crop production.
- ❖ They become aware of the difference between chemical fertilizers, organic and bio manures

**UNIT: I: - Concept of Organic farming.**

- 1.1: Introduction- Farming, Organic farming, concept and development of organic farming.
- 1.2: Principals of organic farming, types of organic farming.
- 1.3: Benefits of organic farming.
- 1.4: Need for organic farming.
- 1.5: Requirements for organic farming.

**UNIT: II: - Organic crop production practices-I**

- 2.1: Organic crop production methods- vegetables- Solanum melongena, Avelmoschus esculentus, capsicum (chilies) Lycopersicum, Amaranthus, Cucurbitaceae.
- 2.2: Organic crop production methods –Fruits- Banana, Papaya.
- 2.3: Livestock component in organic farming.

**UNIT: III: - Organic crop production practices-II**

- 3.1: Organic crop production methods- Spices- peper,ginger
- 3.2: Organic crop production methods- Medicinal and aromatics.
- 3.3: Organic crop production methods- Ornamental crops

**UNIT: IV: - Organic plant protection and nutrient management.**

- 4.1: Soil tillage, land preparation and mulching.
- 4.2: Green manuring, composting-principles, composting methods, vermi composting.
- 4.3: Organic manures, organic preparations.
- 4.4: Bio-fertilizers-types.
- 4.5: Weed management.

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