

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

NACC reaccredited at 'A' level

Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Introduction to Classical Biology**

Semester: - I

Course Code	<b>23CBLT01</b>	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 objectives**

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

**Learning Out comes:**

<b>CO 1</b>	Learn the principles of classification and preservation of biodiversity
<b>CO 2</b>	Understand the plant anatomical, physiological and reproductive processes
<b>CO 3</b>	Knowledge on animal classification, physiology, embryonic development and their economic importance
<b>CO 4</b>	Outline the cell components, cell processes like cell division, heredity and molecular processes.
<b>CO 5</b>	Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit	Learning Units	Lecture Hours
I	<p><b>Unit1: Introduction to systematic, taxonomy and ecology.</b>  Systematic –Definition and concept, Taxonomy– Definition and hierarchy.  Nomenclature–ICBN and ICZN, Binomial and trinomial nomenclature.  Ecology – Concept of ecosystem,(Structure and function-outlines)  Biodiversity and conservation.(Value of Biodiversity and types of conservation)  Pollution and climate change. (Causes, effects of air, water and soil pollution, ozone ion, acid rain, greenhouse gases, global warming.</p>	10
II	<p><b>Unit2: Essentials of Botany.</b>  The classification of plant kingdom. ( 2Whittaker Classification of Planate)  Plant physiological processes (Photosynthesis- light &amp;dark reactions, Respiration (- glycolysis ,link reaction, Krebs cycle&amp; oxidative phosphorylation, Transpiration- types ,stomatal complex, mechanism of stomatal movement based on K<sup>+</sup> ion movement ), phytohormones - Role of Auxins, Gibberellins, Cytokinins, Abscissic acid ,Ethylene).  Structure of flower–Micro and macro sporogenesis, pollination- (types&amp; agents), fertilization and structure of mono and dicot embryos.  Mushroom cultivation, oyster floriculture (of local flowers) and landscaping. (Principles )</p>	15
III	<p><b>Essentials of zoology</b>  Broad classification of Kingdom Animalia up to phyla.  Animal Physiology – Basics of Organ Systems and their functions, Hormones and Disorders.  Developmental Biology – Gametogenesis, Fertilization, Cleavage and Organogenesis ( Basic concepts)  Economic Zoology – Sericulture, Apiculture, Aquaculture (Concepts and Economic Importance.)</p>	10
IV	<p><b>Evolution, Cell Biology and Genetics</b>  Origin of life  Cell theory , Ultra structure of prokaryotic and eukaryotic cell, cell cycle( Outlines only)  Chromosomes and heredity – Structure of chromosomes, concept of gene.  Central Dogma of Molecular Biology (Outlines of transcription and translation, Role of genetic code)</p>	10
V	<p><b>Essentials of chemistry</b>  Definition and scope of chemistry, applications of chemistry in daily life ( Chemistry in food, Agriculture, Hygiene , Cosmetics, and Textiles &amp; Building construction).  Branches of chemistry ( Inorganic, Organic ,Physical , Analytical and Industrial chemistry)  Chemical bonds- ionic , covalent, non – covalent – vanderwaals , hydrophobic , hydrogen bonds.  Green chemistry</p>	15

## References

1. Sharma O.P., 1993. Plant taxonomy. 2<sup>nd</sup> Edition. McGraw Hill publishers.
2. Pandey B.P. 2001. The text book of botany Angiosperms. 4<sup>th</sup> edition. S.Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. Scand publishers, New Delhi, India.
4. Restage, S.C., 2019. Essentials of animal physiology. 4<sup>th</sup> Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chan publishers, New Delhi, India.
6. Satyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamental soft Biochemistry .S.Chand publishers, New Delhi, India.
8. Karen Timber lake, William Timber lake, 2019. Basic chemistry. 5<sup>th</sup> Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1<sup>st</sup> Edition. Oxford publishers.

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**ACTIVITIES- I (At the end of I Semester)**

**Title of the paper: Introduction to Classical Biology**

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

**Credits: 01  
Course Code: 23CBLT01**

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**ACTIVITIES:**

1. Make a display chart of life cycle of non flowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photo synthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a near by mushroom cultivation unit and know the economic soft mushroom cultivation.
10. Draw the Ultra structure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo/Sericulture / Apiculture/ Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

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NACC reaccredited at 'A' level

Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Introduction to Applied Biology**

Semester: - I

Course Code	<b>23ABLT01</b>	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 objectives**

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

### **Learning Outcomes:**

<b>CO 1</b>	Learn the history, ultra structure, diversity and importance of microorganisms.
<b>CO 2</b>	Understand the structure and functions of macromolecules
<b>CO 3</b>	Knowledge on biotechnology principles and its applications in food and medicine
<b>CO 4</b>	Outline the techniques, tools and their uses in diagnosis and therapy
<b>CO 5</b>	Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit	Learning Units	Lecture Hours
I	<p><b>Essentials of Microbiology and Immunology</b>            History and Major Milestones of Microbiology, Contributions of Louis Pasteur, Robert Koch, Edward Jenner and Joseph Lister.            Structure and characteristics of Bacteria, Fungi, Archaea and Viruses.            Applications of microorganisms in Food, Agriculture, Environment and Industry.            Immune system – Types of immunity ( Innate and Acquired), Cells and organs of immune system.</p>	12
II	<p><b>Essentials of Biochemistry</b>            Bio molecules I – Carbohydrates, Lipids (General Structure, classification and Biological importance).            Bio molecules II – Amino acids ( General Structure, classification- Essential and Non- Essential and Biological importance), Proteins( General Structure, classification and Biological importance)            Bio molecules III – Nucleic acids - DNA and RNA (Structure, Types and Biological importance)            Basics of Metabolism – Anabolism and catabolism (Definition and examples)</p>	12
III	<p><b>Essentials of Biotechnology</b>            History, scope and significance of Bio technology- Applications of Biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.            Environmental Biotechnology – Bio remediation and Bio fuels, Bio fertilizers and Bio pesticides. (Definitions and common examples)            Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors- P<sup>BR322</sup>, λ phage. Methods of Gene transfer- Physical- Electroporation, chemical- PEG, and Biological- Transduction.            Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal ( Fish ) and disease models.(Mouse)</p>	15
IV	<p><b>Analytical Tools and techniques in biology – Applications</b>            Applications in forensics – PCR and DNA fingerprinting (Concept and application)            Immunological techniques – Immunoblotting and ELISA. (Concept and application)            Monoclonal antibodies – Applications in diagnosis and therapy.            Eugenics and Gene therapy (Definition and examples)</p>	09
V	<p><b>Biostatistics and Bioinformatics</b>            Data collection and sampling. Measures of central tendency – Mean, Median, Mode.            Measures of dispersion – range, standard deviation and variance. Probability and tests of significance- t- test            Introduction , Genomics, Proteomics, types of Biological data, Biological databases- NCBI,EBI, Gen Bank; Protein 3D structures, Sequence alignment.            Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench</p>	12

## REFERENCES

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

ACTIVITIES- I (At the end of I Semester)

**Title of the paper: Introduction to Applied Biology**

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

**Credits: 01**  
**Course Code: 23ABLP01**

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**ACTIVITIES**

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[**NOTE:** In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty]



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NAAC reaccredited at 'A' level  
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Title of the Paper: **Fresh water & Brackish water Aquaculture**  
**Semester: - III**

Course Code	<b>AQTT31A</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 – 2022-23	Percentage of Revision: 30%

Objective of the course: The students understand Fresh water & Brackish water Aquaculture.

Course outcomes:

CO1: Learn the Status, Scope and Prospects of fresh water aquaculture in the world, India and AP.

CO2: Learn about Major Cultivable Indian Carps and Exotic fish Species introduced in India

CO3: Know about recent developments in the culture of clarius, anabas and murrels and special systems of aquaculture.

CO4: Gain knowledge of commercially valuable Fresh water prawns of India and their culturing methods.

CO5: Learn about culturing of brackish water Prawn Species P.mondon and L.vannamei and hatchery technology's involved

Learning Objectives:

- To know the present status of freshwater and brackish water aquaculture and their role in world economy and food production.
- To gain knowledge on carp, prawn, shrimp and crab culture and composite fish culture systems.
- To improve the technical knowledge on fish and shrimp hatchery technology and culture practices.
- To improve the knowledge and technical skills for the identification of cultivable fin fish and shell fish.

Syllabus  
Course Details

Unit	Learning Units	Lecture Hours
I	<p><b>Freshwater Fin Fish Aquaculture</b>            Status, scope and prospects of fresh water aquaculture in the world, India and AP            Criteria for the selection of species for culture            Natural seed resources and procurement of seed for stocking            Culture of cultivable major Indian carps–<i>Labeo</i>, <i>Catla</i> and <i>Cirrhinus</i> And Minor carps            Culture of Exotic fish species – <i>Tilapia</i>, <i>Pangassius</i> and <i>Clarius</i> species            Impact of exotic fish, compatibility of Indian and exotic carps and Competition among them            Composite fish culture system of Indian and exotic and genetically modified carps (Amur common carp, Jayanthi Rohu)</p>	13
II	<p><b>Freshwater Shell Fish Aquaculture</b>            Fresh water prawns of India -commercial value            Natural seed resources and procurement of seed for stocking  <i>Macrobrachium rosenbergii</i>– biology, seed production, pond preparation, stocking,            Management of nursery and grow-out ponds, feeding ,morpho types and harvesting  <i>M. malcolmsonii</i> - biology, seed production, pond preparation, stocking,            Management of nursery and grow-out ponds, feeding, morpho types and harvesting</p>	14
III	<p><b>Brackish Water Fin Fish Aquaculture</b>            Status, scope and prospects of brackish water aquaculture in the world, India and AP            Major cultivable species for brackish water aquaculture            Biology and culture of <i>Latescalcarifer</i>            Biology and culture of <i>Chanoschanos</i>            Biology and culture of <i>Mugilcephalus</i>            Biology and culture of <i>Etroplussuratensis</i>            Biology and culture of <i>Trachinotussps</i> (Pampano)</p>	15
IV	<p><b>Brackish Water Shell Fish Aquaculture-I</b>            Culture of <i>P.mondon</i>–Hatchery technology and culture practices including feed and            Disease management            Culture of <i>L.vannamei</i>– Hatchery technology and culture practices including feed and Disease management.            Mixed culture of fish and prawns</p>	11
V	<p><b>Export – oriented Brackish Water Shell Fish Aquaculture-II</b>            Biology and culture of <i>Scylla serrata</i>            Biology and culture of <i>Pinctada vulgaris</i>            Biology and culture of <i>Crassostrea</i> species</p>	07

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A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165,  
KRISHNA Dt.,A.P. (AUTONOMOUS)  
AQUACULTURE  
PRACTICAL - III

Code: AQTP31A  
(2hrs/week)

w.e.f. 2022-2023.  
MAX.MARKS: 50.

**PRACTICAL SYLLABUS**

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**PRACTICALS:**

1. Identification of important cultivable fresh water fishes (carps, cat fishes and Murrells)
2. Identification of important cultivable brackish water fishes
3. Identification of important cultivable fresh water prawns
4. Identification of important cultivable brackish water prawns
5. Identification of commercially viable crabs – *Scyllaserrata*,  
*Portunuspelagicus*, *P.sanguinolentus*, *Neptunuspelagicus*, *N.Sanguinolentus*
6. Identification of oysters of nutritional significance – *Crossostrea madrasensis*,  
*C.gryphoides*, *C. cucullata*, *C.rivularis*, *Picnodanta*.
7. Morph types of *Macro brachium rosenbergii*
8. Identification of crustacean larval sequences (shrimp and crab)
9. Identification of diseases of *L. vennamei* and *P. monodon*
10. Field visit to fresh water/brackish water/prawn/shrimp farm and study of culture aspects.

**Demonstration of dissection / dissected / virtual dissection:**

1. *Channa*- Reproductive system
2. Shrimp – Reproductive system (Identification of male & female)

**PRESCRIBED BOOK(S):**

1. JhingranVG1998.FishandFisheriesofIndia, Hindustan Publishing Corporation, New Delhi

**REFERENCES:**

1. SanthanamR,NSukumaranandPNatarajan1987.AManualofAquaculture, Oxford- IBH, New Delhi
2. Srivatsava1993. Fresh water Aquaculture in India, Oxford- IBH, New Delhi
3. Marcel H 1972.Text book of Fish Culture. Oxford fishing news books

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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 : 2021-2022	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 atotal 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

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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	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%

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**

**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.,