# ANDHRA KESARI UNIVERSITY ::ONGOLE

## Syllabus for 4-Year UG Honours in B.Sc. (Aquaculture) as Major in consonance with Curriculum framework w.e.f. AY 2025-26

### COURSE STRUCTURE (for Semester I to II)

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| I | I | 1 | Basic Principles and Practices of Aquaculture | 3 | 3 |
| | | | Basic Principles and Practices of Aquaculture-Practical | 2 | 1 |
| | | 2 | Biology of Finfish & Shellfish | 3 | 3 |
| | | | Biology of Finfish & Shellfish - Practical | 2 | 1 |
| | II | 3 | Freshwater Aquaculture | 3 | 3 |
| | | | Freshwater Aquaculture - Practical | 2 | 1 |
| | | 4 | Brackish water Aquaculture and Mariculture | 3 | 3 |
| | | | Brackish water Aquaculture and Mariculture - Practical | 2 | 1 |
| II | III | 5 | Fish Health Management | 3 | 3 |
| | | | Fish Health Management - Practical | 2 | 1 |
| | | 6 | Shrimp Health Management | 3 | 3 |
| | | | Shrimp Health Management - Practical | 2 | 1 |
| | | 7 | Fish Nutrition & Feed Technology | 3 | 3 |
| | | | Fish Nutrition & Feed Technology - Practical | 2 | 1 |
| | IV | 8 | Fish Immunology | 3 | 3 |
| | | | Fish Immunology - Practical | 2 | 1 |
| | | 9 | Fish Processing Technology | 3 | 3 |
| | | | Fish Processing Technology -Practical | 2 | 1 |
| | | 10 | Extension, Economics and Marketing | 3 | 3 |
| | | | Extension, Economics and Marketing-Practical | 2 | 1 |
| III | V | 11 | Ornamental Fish Culture | 3 | 3 |
| | | | Ornamental Fish Culture -Practical | 2 | 1 |
| | | | | | |
| | | 12 A | Soil and Water Quality Management | 3 | 3 |
| | | | Soil and Water Quality Management-Practical | 2 | 1 |
| | | | **OR** | | |
| | | 12 B | Coastal Aquaculture | 3 | 3 |
| | | | Coastal Aquaculture - Practical | 2 | 1 |

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| | | **OR** | | | |
| | | **12 C** | Crustacean Culture | **3** | **3** |
| | | | Crustacean Culture - Practical | **2** | **1** |
| | | | | | |
| | | **13 A** | Aquaculture Microbiology | **3** | **3** |
| | | | Aquaculture Microbiology - Practical | **2** | **1** |
| | | **OR** | | | |
| | | **13 B** | Aquaculture Engineering | **3** | **3** |
| | | | Aquaculture Engineering - Practical | **2** | **1** |
| | | **OR** | | | |
| | | **13 C** | Molluscan and Seaweed culture | **3** | **3** |
| | | | Molluscan and Seaweed culture - Practical | **2** | **1** |
| | | | | | |
| | **VI** | **14 A** | Post-Harvest Technology & Transportation | **3** | **3** |
| | | | Post-Harvest Technology & Transportation - Practical | **2** | **1** |
| | | **OR** | | | |
| | | **14 B** | Hatchery Technology in Aquatic organisms | **3** | **3** |
| | | | Hatchery Technology in Aquatic organisms - Practical | **2** | **1** |
| | | **OR** | | | |
| | | **14 C** | Genetics in Aquaculture | **3** | **3** |
| | | | Genetics in Aquaculture - Practical | **2** | **1** |
| | | | | | |
| | | **15 A** | Techniques for Aqua Lab | **3** | **3** |
| | | | Techniques for Aqua Lab - Practical | **2** | **1** |
| | | **OR** | | | |
| | | **15 B** | Aquaculture Biotechnology | **3** | **3** |
| | | | Aquaculture Biotechnology - Practical | **2** | **1** |
| | | **OR** | | | |
| | | **15 C** | Quality Control in Processing Plants | **3** | **3** |
| | | | Quality Control in Processing Plants- Practical | **2** | **1** |

**Note:** In the III Year (during the V and VI Semesters), students are required to select a pair of electives from one of the Three specified domains. For example: if set 'A' is chosen, courses 12 to 15 to be chosen as 12 A, 13 A, 14 A and 15 A. To ensure in-depth understanding and skill development in the chosen domain, students must continue with the same domain electives in both the V and VI Semesters.

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## SEMESTER-I

## COURSE 1: BASIC PRINCIPLES AND PRACTICES OF AQUACULTURE

**Theory** **Credits: 3** **3 hrs/week**

### COURSE OBJECTIVES:

- To study the significance, history, present status of aquaculture in world, India and AP
- To gain knowledge on various types of aquaculture systems and practices
- To learn the design and construction principles of aqua farms and hatcheries.
- To understand the significance of water and soil quality parameters in aquaculture ponds.
- To study the methods of eradication of aquatic weeds, insects, unwanted fishes and algal blooms in culture ponds.
- To improve technical skills in water analysis, identification of pond biota and gain hands-on and field experience by visiting aqua farms.

### LEARNING OUTCOMES:

By the completion of the course, student will be able to –

- Understand the scope and status of aquaculture with related schemes and its significance.
- Differentiate various aquaculture systems and culture practices, and their significance.
- Explain design and construction principles of aqua farms and hatcheries.
- Analyse the physico-chemical and biological parameters of water and soil in aquaculture ponds and maintain their optimum levels for better production.
- Implement proper liming and fertilization techniques for maintaining pond health.
- Apply proper pond culture management practices for high yielding profitable culture.

### SYLLABUS:

**UNIT-I: Introduction**

1.1. Definition, Significance and History of Aquaculture.
1.2. Concept of Blue Revolution and Pradhan Mantri Matsya SampadaYojana (PMMSY)
1.3. Present status of Aquaculture at global, India and Andhra Pradesh level
1.4. Aquaculture versus Agriculture; Present day needs with special reference to A.P.

**UNIT-II: Aquaculture Systems and Practices**

2.1. Types of aquaculture: Freshwater aquaculture, Brackish water aquaculture and Mariculture
2.2. Culture Systems: Ponds, Raceways, Cages, Pens, Rafts, Water Recirculating Systems, Bio-floc technology and 3C system
2.3. Culture practices: Traditional, Extensive, Modified Extensive, Semi-Intensive, Intensive and Super Intensive systems of fish and shrimp.

2.4. Culture methods: Monoculture, Poly culture, Mono-sex culture and Integrated fish farming.

**UNIT-III**: **Design and Construction of Aqua Farms**

3.1. Functional classification of ponds – head pond, hatchery, nursery, rearing, production, stocking and quarantine ponds

3.2. Criteria for the selection of site for freshwater and brackish water pond farms

3.3. Design and construction of an ideal fish and shrimp farms.

3.4. Design and construction of fish and shrimp hatcheries.

**UNIT-IV: Pond Culture Management-I**

4.1. Water quality in freshwater fish ponds: Significance of physico-chemical (temperature, transparency, turbidity, light, pH, DO, $CO_2$, orthophspahates, $NH_3$, $NO_2$) and biological (plankton and benthos) characteristics and their management at optimal levels in ponds.

4.2. Water quality in shrimp culture ponds: Significance of physico-chemical and biological characteristics and their management at optimal levels in ponds.

4.3. Significance of soil characteristics and their optimal levels for culture

4.4. Liming and fertilization: Lime and Fertilizers (organic manures and chemical Fertilizers) - Types and need of their application in ponds

**UNIT-V: Pond Culture Management-II**

5.1. Common aquatic weeds- advantages and disadvantages and their control in culture ponds

5.2. Aquatic insects: Disadvantages of insects and their control

5.3. Unwanted fishes: Common weed and predatory fishes - Disadvantages and their control.

5.4. Algal blooms: Bloom forming algae and their control

**REFERENCE BOOKS:**


1. Jhingran VG 1998. *Fish and Fisheries of India*. Hindustan Publishing Corporation, New Delhi
2. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. 2nd Ed. Blackwell
3. Pillay TVR & Dill MA. 1979. *Advances in Aquaculture*. Fishing News Books Ltd., London
4. Stickney RR 1979. *Principles of Warm Water Aquaculture*. John Wiley & Sons Inc.1981
5. Boyd CE 1982. *Water Quality Management for Pond Fish Culture*. Elsivier Scientific Publ.
6. Bose AN et.al, 1991. *Costal Aquaculture Engineering*. Oxford & IBH Publishing Company.


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## SEMESTER-I

## COURSE 1: BASIC PRINCIPLES AND PRACTICES OF AQUACULTURE

**Practical** **Credits: 1** **2 hrs/week**

1. Estimation of Dissolved Oxygen in pond water.
2. Estimation of total alkalinity, Bicarbonates and Carbonates in water samples.
3. Estimation of total hardness of water sample.
4. Estimation of Ammonia in water.
5. Study of beneficial and harmful algal species.
6. Collection, identification and isolation of zooplankton and phytoplankton.
7. Collection and study of aquatic weeds, aquatic insects, weed, predatory and larvivorous fishes.
8. Field visit to hatchery, nursery, rearing and stocking ponds of aqua farms.

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**SEMESTER-I**

## COURSE 2: BIOLOGY OF FINFISH & SHELLFISH

**Theory** **Credits: 3** **3 hrs/week**

### COURSE OBJECTIVES:

- To understand the classification, morphology and digestive system of fish and shrimp.
- To study the structure and functioning of respiratory, circulatory and endocrine systems of fish and shrimp.
- To explore the excretory, sensory, and reproductive systems in fish and shrimp.
- To understand feeding, methods of determination of age and growth in fish and shrimp.
- To study breeding biology, parental care and developmental stages in fish and shrimp.

### LEARNING OUTCOMES:

By the completion of the course student will be able to –

- Identify and describe general features and digestive system of fish and shrimp.
- Explain gill structure,mechanism of respiration and gaseous exchange and endocrine glands
- Compare circulatory physiology in fish (closed) and shrimp (open).
- Gain knowledge on endocrine glands and their significance in fish and shrimp.
- Describe excretory,sensory and reproductive systems in fish and shrimp.
- Provide suitable type of feeding for fish and shrimp in culture ponds.
- Apply different methods (scales, otoliths, skeletal parts) for age and growth determination.
- Outline breeding activity and larval development in fish and shrimp

### SYLLABUS:

**UNIT-I: General characters, Classification, External Morphology and Digestive System**

1.1. General characters of fishes and crustaceans
1.2. Classification of fish and crustaceans up to classes
1.3. External morphology of teleost fish and shrimp
1.4. Digestive system of fish and shrimp.

**UNIT-II: Respiratory, Circulatory and Endocrine systems**

2.1. Structure of gills, Mechanism of Respiration and gaseous exchange in fish and shrimp
2.2. Structure of heart in fishes
2.3. Physiology of Circulation in fish and Shrimp
2.4. Endocrine glands and their role in fish and shrimp.

**UNIT-III: Excretory, Sensory and Reproductive Systems**

3.1. Structure and function of kidneys in fishes.

3.2. Excretory organs in shrimp.
3.3. Sensory organs in fish and shrimp.
3.4. Reproductive structure in Fishes and Shrimp

**UNIT-IV: Feeding and Growth**

4.1. Natural food and feeding habits of commercially important fishes and shrimp.
4.2. Methods of determination of age and growth in fishes - scale method, otolith method, skeletal parts as age indicators
4.3. Factors affecting growth in fish and shrimp.
4.4. Molting and molting stages in shrimp.

**UNIT-V: Reproductive and Developmental Biology**

5.1. Breeding in fishes - breeding places and breeding habits
5.2. Parental care in fishes
5.3. Life cycle of carp and shrimp.
5.4. Larval forms of prawn and shrimp.

**REFERENCE BOOKS:**


1. Lagler KF, Bardach, JE, Miller, RR, Passino DRM. 2005. *Ichthyology*, John Wiley & Sons.
2. Nikolsky GV. 1963. *Ecology of Fishes*, Academic Press.
3. Hoar WS and Randall DJ. 1970. *Fish Physiology*, Vol. I-IX, AP.
4. Bond E. Carl. 1979. *Biology of Fishes*, Saunders.
5. Norman JR and Greenwood PH 1975. *A History of Fishes*, Halsted Press.
6. Moyle PB and Joseph J. Cech. *Fishes: An Introduction to Ichthyology*, Prentice Hall.
7. Bone Q et al., 1995. *Biology of fishes*, Blackie academic & professional, LONDON.
8. Barnes RD. *Invertebrates Zoology*, III edition, W.B. Saunders Co., Philadelphia.
9. Saxena AB 1996. *Life of Crustaceans*. Anmol Publications Pvt.Ltd., New Delh
10. Barrington EJW. 1971. *Invertebrates: Structure and Function*. ELBS.
11. Tandon KK & Johal MS 1996. *Age and Growth in Indian Freshwater Fishes*. Narendra Publishing House, New Delhi.
12. Raymond T et al., 1990. *Crustacean Sexual Biology*, Columbia University Press, New York
13. Guiland J.A (ed) 1984. *Penaeid shrimps- Their Biology and Management*.
14. Barrington FJW 1971. *Invertebrates: Structure and Function*. ELBS
15. Parker TJ & Haswell WA1992. *The text book of Zoology*, Vol I. Invertebrates (eds. Marshal AJ & WD Williams). ELBS & Mc Millan & Co.


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**SEMESTER-I**

## COURSE 2: BIOLOGY OF FIN FISH & SHELLFISH

**Practical** **Credits: 1** **2 hrs/week**

1. External morphology of fish and shrimp.
2. Digestive system of herbivorous, carnivorous and predatory fishes, and in shrimp.
3. Gut content analysis in fish and shrimp
4. Mouth parts and appendages of cultivable prawn and shrimp.
5. Endocrine glands and its significance in fish and shrimp.
6. Study of eggs of fish, shrimp and prawn.
7. Study of maturity stages and fecundity in fish and shellfish
8. Life cycles of carp and shrimp.
9. Observation of crustacean larvae
10. Study of nest building and brooding of fishes

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**SEMESTER-II**

## COURSE 3: FRESHWATER AQUACULTURE

**Theory** **Credits: 3** **3 hrs/week**

### COURSE OBJECTIVES:

- To understand the status and prospects of freshwater aquaculture in world, India and AP.
- To know the criteria for the selection of species for culture and major cultivable species.
- To study the bundh and induced breeding techniques, and types of hatcheries.
- To learn the nursery, rearing and production pond management of Indian major carps.
- To know the culture of exotic and air-breathing fishes and their role in aquaculture
- To understand the biology, seed production, and culture practices of freshwater prawns.
- To acquire knowledge on freshwater ornamental fishes and sewage-fed fish culture.

### LEARNING OUTCOMES:

By the completion of the course student will be able to

- Explain the scope of freshwater aquaculture and water bodies suitable for culture.
- Select the species for culture and know the commercially important species of culture.
- Practice bundh and induced breeding of carps and hatchery management.
- Manage nursery, rearing and production ponds of Indian major carps
- Analyse the impact of exotic fishes, and culture of air-breathing fishes.
- Describe commercial prawn species, and their biology, seed production and culture.
- Fabricate and maintain aquaria and practice breeding and rearing of ornamental fishes.

### SYLLABUS:

**UNIT-I: Introduction to Freshwater Aquaculture**

1.1. Status, scope and prospects of freshwater aquaculture in the world, India and AP
1.2. Freshwater bodies suitable for culture in India – ponds, swamps, reservoirs and flood plain wetlands or beels.
1.3. Criteria for the selection of species for culture.
1.4. Major cultivable freshwater fish for aquaculture and their commercial importance.

**UNIT-II**: **Carp Culture**

2.1. Bundh breeding of Indian major carp
2.2. Induced breeding of Indian major car.
2.3. Types of hatcheries – traditional, chinese and jar hatcheries.
2.4. Preparation and Management of Indian major carp culture ponds.

**UNIT-III**: **Culture of Exotic and Air-breathing fishes**

3.1. Exotic fishes introduced into India and their impact on indigenous fishes

3.2. Culture of *Tilapia* and *Pangasius*.

3.3. Recent developments in the culture of murrels, magur and koi.

3.4. Advantages and constraints in the culture of air-breathing fishes.

**UNIT-IV**: **Culture of freshwater prawns**

4.1. Fresh water prawns of India - commercial value

4.2. *Macrobrachium rosenbergii* and *M. malcolmsonii* – biology and seed production.

4.3. Preparation and management of freshwater prawn culture ponds.

4.4. Morphotypes and harvesting techniques of prawns.

**UNIT-V**: **Ornamental and sewage-fed fish culture**

5.1. Common freshwater ornamental fishes.

5.2. Fabrication, setting up and maintenance of an aquarium.

5.3. Breeding and rearing of freshwater ornamental fishes.

5.4. Sewage-fed fish culture

**REFERENCE BOOKS:**


1. Jhingran VG 1998. *Fish and Fisheries of India*. Hindustan Publishing Corporation, New Delhi
2. MPEDA: *Handbooks on culture of carp, shrimp, etc.*
3. Pillay TVR. 1990. *Aquaculture- Principles and Practices.* Fishing News Books Ltd., London.
4. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. 2nd Ed. Blackwell
5. ICAR. 2006. *Hand Book of Fisheries and Aquaculture*. ICAR.
6. FAO. 2007. *Manual on Freshwater Prawn Farming.*
7. Stickney RR. 1979. *Principles of Warmwater Fish Culture.* John Wiley & Sons.Santharam R, N Sukumaran & P Natarajan 1987. *A manual of aquaculture*, Oxford-IBH, New Delhi
8. Srivatsava 1993. *Fresh water aquaculture in India*, Oxford-IBH, New Delhi
9. Rath RK. 2000. *Freshwater Aquaculture*. Scientific Publ.
10. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn.* Daya Publ. House.
11. Huet J. 1986. *A text Book of Fish Culture*. Fishing News Books Ltd.
12. Marcel H 1972. *Text book of fish culture*. Oxford fishing news books.


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**SEMESTER-II**

## COURSE 3: FRESHWATER AQUACULTURE

**Practical** **Credits: 1** **2 hrs/week**

1. Identification of important cultivable carps.
2. Identification of exotic fishes.
3. Identification of important cultivable air-breathing fishes
4. Identification of important cultivable freshwater prawns.
5. Identification of different life history stages of fish.
6. Identification of different life history stages of freshwater prawn.
7. Identification of Phytoplankton and Zooplankton (any 5 each).
8. Pituitary gland – structure, collection, preparation of pituitary extract, dosage and injection for induced breeding of carp.
9. Morphotypes of prawn
10. Identification of important freshwater ornamental fishes
11. Fabrication, setting up and maintenance of an aquarium.
12. Field visit to fish hatchery.
13. Field visit to fish farm /culture ponds.

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**SEMESTER-II**

## COURSE 4: BRACKISH WATER AQUACULTURE AND MARICULTURE

**Theory** **Credits: 3** **3 hrs/week**

### COURSE OBJECTIVES:

- To understand the status and prospects of brackish water aquaculture and mariculture in India and AP.
- To know the brackish water resources (water bodies and species) for culture in India
- To study the breeding, hatchery techniques, seed management, and culture of shrimps
- To learn breeding and culture techniques of brackish water fishes.
- To acquire knowledge on the culture of mud crabs and marine ornamental fishes
- To study the culture methods of edible and pearl oysters and seaweeds.

### LEARNING OUTCOMES:

By the completion of the course student will be able to

- Understand the scope and prospects of brackish water aquaculture and mariculture.
- Know various resources supporting brackish water aquaculture.
- Acquire knowledge on shrimp breeding, seed management and culture practices to improve productivity and sustainability in shrimp farming.
- Gain practical understanding of rearing and culture potentials of brackish water fishes.
- Culture the mud crabs and maintain marine aquaria.
- Understand the culture of edible oysters and techniques of pearl production and artificial pearl production prospects in India.
- Explain the commercially important seaweed species and their culture methods.

### SYLLABUS:

**UNIT-I: Introduction**

1.1. Status, scope and prospects of brackish water aquaculture and mariculture in India and AP
1.2. Brackish water as a medium for aquaculture, ecological factors – Abiotic and biotic factors.
1.3. Brackish water resources for culture in India –Bheries, lagoons (Chilka lake, Pulicat Lake, Vembanad Lake), paddy/pokkali fields and coastal ponds.
1.4 Major cultivable species for brackish water aquaculture and their commercial importance.

**UNIT-II: Culture of shrimps**

2.1. Breeding and hatchery management of a typical penaeid shrimp (*Penaeus monodon / Litopenaeus vannamei*).
2.2. Transportation of shrimp seed and nursery management
2.3. Pond preparation and management of *P. mondon* or *L. vannamei* culture ponds.

2.4. Biofloc technology (BFT) in shrimp culture – Benefits and management practices.

**UNIT-III: Culture of brackish water fishes**

3.1. Breeding and culture of Milk fish, *Chanos chanos*

3.2. Breeding and culture of Asian sea bass, *Lates calcarifer*

3.3. Breeding and culture of Grey mullet, *Mugil cephalus*

**UNIT-IV: Culture of crabs and ornamental fishes**

4.1. Culture of mud crab, *Scylla serrata* – Biology and culture techniques.

4.2. Common marine ornamental fishes.

4.3. Setting up and maintenance of marine aquarium.

4.4. Breeding and rearing of marine ornamental fishes.

**UNIT-V: Culture of oysters and seaweeds**

5.1. Cultivable species of edible oysters and pearl oysters

5.2. Culture techniques for farming edible oysters.

5.3. Method of artificial pearl production.

5.4. Major commercial seaweed species; Methods of seaweed culture.

**REFERENCE BOOKS:**


1. Jhingran VG. 1991. *Fish and Fisheries of India*. Hindustan Publ. Corporation, India.
2. ICAR. 2006. *Hand Book of Fisheries and Aquaculture*. ICAR.
3. MPEDA: *Handbooks on culture of carp, shrimp, etc.*
4. Pillay TVR. 1990. *Aquaculture-Principles and Practices.*Fishing News Books Ltd., London.
5. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. 2nd Ed. Blackwell
6. Nandeesha MC & AG Jhingran. *Brackishwater Aquaculture in India*. ICAR-CIBA Publ.
7. Felix, S. *Coastal Aquaculture in India*. Dr. J. Jayalalithaa Fisheries University (TNJFU)
8. Kurian CV & Sabastian VO. 1976. *Prawns and Prawn Fisheries of India.* Hindustan Publ.Co.
9. Shankar KM & Mohan CV 2002. *Fish and Shell Fish Health Management* UNESCO. Publ. Sundermann CJ.
10. Guland JA (ed) 1984. *Penaeid Shrimps – Their Biology and Management.*
11. Raymond T et al.,1990. *Crustacean Sexual Biology*,Columbia UniversityPress,New York.


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**SEMESTER-II**

**COURSE 4: BRACKISH WATER AQUACULTURE AND MARICULTURE**

**Practical** **Credits: 1** **2 hrs/week**

1. Identification of cultivable brackish water fish and shrimp (any 3 each)
2. Identification of crabs, and edible & pearl oysters of commercial importance (any 2 each)
3. Identification of different live feed organisms for shrimp larvae (any 4)
4. Identification of larval stages of shrimp.
5. Demonstration of eye stalk ablation in *Penaeus monodon.*
6. Identification and mounting of appendages of shrimp.
7. Field visit to shrimp hatchery.
8. Field visit to shrimp culture ponds / farm.

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