ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

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

Prepared by Acharya Nagarjuna University, Guntur

COURSE STRUCTURE (for semesters I to II)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Foundations of Fisheries Science	3	3
			Foundations of Fisheries Science-Practical	2	1
		2	Principles of Aquaculture	3	3
			Principles of Aquaculture-Practical	2	1
	II	3	Fin Fish and Shell Fish Biology	3	3
			Fin Fish and Shell Fish Biology-Practical	2	1
		4	Aquatic Ecology and Environment	3	3
			Aquatic Ecology and Environment-Practical	2	1

SEMESTER - I

COURSE 1: FOUNDATIONS OF FISHERIES SCIENCE

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

Course Objectives:

1. To impart knowledge on the scope, historical development, and economic significance of the fisheries sector in India and globally.
2. To classify and describe the inland, brackish water, and marine fishery resources of India.
3. To introduce basic fishing methods, crafts, gears, and post-harvest techniques.
4. To comprehend the causes of fish spoilage and the scientific principles behind major preservation techniques.
5. To familiarize students with national policies, key institutions (ICAR, NFDB, FSI), and the role of emerging technologies in fisheries.

Learning Outcomes:

Upon completion, students will be able to:

1. Explain the importance and scope of the fisheries sector.
2. Identify and classify the major fishery resources of India.
3. Differentiate between various types of fishing crafts and gears.
4. Describe fundamental fish preservation techniques.
5. Recognize the role of national institutions and emerging technologies in fisheries development.

Theory:

Unit 1:

Introduction to Fisheries Science: Definitions and basic terminology; Historical perspective; Global and Indian scenario (production, productivity, rank); Contribution to GDP, nutritional security, employment, and exports.

Unit 2:

Fishery Resources of India & A.P State: Inland Fisheries: Rivers, reservoirs, floodplain lakes, estuaries, and cold-water fisheries. **Marine Fisheries:** Maritime states, Exclusive Economic Zone (EEZ), major fishing harbors, and potential fishing zones.

Unit 3:

Basic Fishing Technology: Fishing Crafts: Classification from traditional (catamarans, dug-out canoes) to mechanized vessels (trawlers, purse seiners). **Fishing Gears:** Classification; Active gears (trawls, seines) and Passive gears (gill nets, hook & line, traps).

Unit 4:

Principles of Post-Harvest Technology: Composition and nutritive value of fish; Causes of spoilage; Fundamental preservation methods: icing, freezing, drying, salting; Introduction to value addition.

Unit 5:

Fisheries Development: Overview of key national & A.P. State institutions (ICAR-CIFA, CIFRI, CMFRI,CIFE, CIFT; NFDB; FSI, NaCSa,, MPEDA, SIFT,); Important government schemes (PMMSY); Introduction to digital technologies and AI in fisheries.

Theory References:

1. **Jhingran, V. G. (1991).** *Fish and Fisheries of India*. Hindustan Publishing Corporation (India), New Delhi. *(Considered the bible of Indian fisheries; comprehensive resource for Units 1, 2 & 5)*
2. **Pillay, T. V. R. (1990).** *Aquaculture: Principles and Practices*. Fishing News Books, Blackwell Science, Oxford. *(Although focused on aquaculture, it has excellent foundational chapters on fisheries resources and principles).*
3. **George, V. C., Suseelan, C., & Gopakumar, K. (Eds.).** *Marine Fisheries of India*. ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi. *(Essential for marine resources and fishing technology).*
4. **Sugunan, V. V. (1995).** *Reservoir Fisheries of India*. FAO Fisheries Technical Paper No. 345. Food and Agriculture Organization of the United Nations, Rome. *(Authoritative text on inland reservoir fisheries).*
5. **Government of India (Latest Edition).** *Handbook of Fisheries Statistics*. Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying. *(For current data on production, exports, and scheme details).*

SEMESTER - I

COURSE 1: FOUNDATIONS OF FISHERIES SCIENCE

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

1. **Identification of fishing gears and knot tying**: Identification of different types of fishing nets (e.g., gill net, cast net, trawl net model, seine net) and their components. Demonstration and practice of tying common fishing knots (e.g., bowline, clove hitch, sheet bend, fisherman's knot) and splices.
2. **Identification of major commercial finfish & shellfish:** Identification of 8-10 major marine commercial species (e.g., Oil Sardine, Mackerel, Bombay Duck, Pomfret, Seerfish) using specimens/charts. Identification of 8-10 major inland commercial species (e.g., Indian Major Carps, Hilsa, Murrels, Freshwater Shark) using specimens/charts. Identification of major commercial shellfish (e.g., Penaeid shrimps, *Macrobrachium*, Crabs, Lobsters) using specimens/charts.
3. **Sensory evaluation of fish freshness**: Assessment of freshness/quality of a fish sample using sensory parameters (appearance, eyes, gills, texture, odour) and grading.
4. **Icing and demonstration of drying/salting:** Practical demonstration of the correct method of layering fish with ice in an insulated box. Calculation of ice-to-fish ratio.
5. **Preparation of a value-added product:** Preparation of a simple value-added product (e.g., Fish cutlet, wafers, or pickle).
6. **Map work- marking resources & harbours**: Marking and labeling of major maritime states, important fishing harbors (e.g., Visakhapatnam, Kochi, Chennai), and river systems of India on a map. Marking the Exclusive Economic Zone (EEZ) of India and potential fishing zones (PFZ) on a map.
7. **Field visit to landing centre/market; report:** Visit to a Fish Landing Centre or Auction Market**,** Observation of fish varieties, auction process, handling, and infrastructure. Submission of a detailed field visit report.

References:

1. Nedelec, C. & Prado, J. (1990). *Definition and Classification of Fishing Gear Categories*. FAO Fisheries Technical Paper No. 222. FAO, Rome. *(Standard reference for fishing gear identification and classification).*
2. FAO Training Series (Various Years). *Fishing Gear and Technology*. Food and Agriculture Organization of the United Nations, Rome.
3. ICAR-Central Institute of Fisheries Technology (CIFT) (Latest Ed.). *Manual on Quality Assessment of Fish*. CIFT, Kochi. *(For practicals on freshness assessment and value addition).*
4. Talwar, P. K. & Jhingran, A. G. (1991). *Inland Fishes of India and Adjacent Countries (Vols. 1 & 2)*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. *(The definitive guide for species identification).*

SEMESTER - I

COURSE 2: PRINCIPLES OF AQUACULTURE

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

Course outcomes: By the completion of the course the graduate should be able to-

1. To define aquaculture and understand its global and national status and potential.
2. To classify different types of aquaculture systems based on various criteria.
3. To understand the fundamental principles of site selection, pond engineering, and farm construction.
4. To learn the basic concepts of water and soil quality management for aquaculture.
5. To understand the concepts of pond fertilization and liming

Learning objectives:

Upon completion, students will be able to:

1. Define aquaculture and classify its various systems.
2. List the criteria for selecting a suitable site for an aquaculture farm.
3. Draw a schematic layout of a typical aquaculture farm with essential components.
4. Identify key water and soil quality parameters and their significance in aquaculture.
5. Explain the purpose of fertilization and liming in pond management.

Unit 1:

Aquaculture: An Overview: Definition, history, and present status; Distinction between capture fisheries and aquaculture; Scope, opportunities, and constraints.

Unit 2:

Classification of Aquaculture Systems: Based on salinity (freshwater, brackish water, mariculture); intensity (extensive, semi-intensive, intensive); number of species (monoculture, polyculture); enclosure (pond, cage, pen, recirculating aquaculture systems-RAS).

Unit 3:

Planning and Construction of Aquafarm: Criteria for site selection: soil quality, water source & quality, topography, socio-economic factors. Pond engineering: design and construction of nursery, rearing, and stocking ponds; dykes, inlets, outlets, and monk sluice gates.

Unit 4:

Basics of Water Quality Management: Importance of water quality. Key physico-chemical parameters: temperature, transparency, dissolved oxygen (DO), pH, total alkalinity, total hardness. Their optimal ranges and simple management.

Unit 5:

Pond Soil Science and Fertilization: Properties of pond bottom soil; Importance of soil quality; Concept of fertilization: organic manures and inorganic fertilizers; Principle and purpose of liming.

References:

1. **Pillay, T. V. R. & Kutty, M. N. (2005).** *Aquaculture: Principles and Practices (2nd Ed.)*. Wiley-Blackwell Publishing, Oxford, UK. *(The most widely recognized international textbook covering all fundamental principles).*
2. **Stickney, R. R. (Ed.). (2000).** *Encyclopedia of Aquaculture*. John Wiley & Sons, Inc., New York. *(Excellent for definitions and detailed explanations of concepts and systems).*
3. **ICAR (2016).** *Handbook of Fisheries and Aquaculture*. ICAR Publications, New Delhi. *(A concise Indian perspective covering all basics, including schemes and statistics).*
4. **Santhanam, R., Ramanathan, N., & Jegatheesan, G. (1989).** *A Textbook of Freshwater Aquaculture*. Narendra Publishing House, Delhi. *(A good Indian textbook with a focus on freshwater systems).*

SEMESTER - I

COURSE 2: PRINCIPLES OF AQUACULTURE

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

1. Measurement of critical water quality parameters: temperature, transparency (Secchi disc), pH, dissolved oxygen (using chemical test kits/portable meters).
2. Determination of total alkalinity and total hardness by titration.
3. Collection of soil samples and analysis of soil pH and texture.
4. Calculation of lime and fertilizer requirements for a given pond area.
5. Identification of different aquaculture systems from models, charts, and videos.
6. Technical drawing of an aquaculture farm layout.
7. Identification of common natural food organisms (phytoplankton and zooplankton) under a microscope.
8. Field visit to a functional aquaculture farm; report on observations.

References:

1. **APHA, AWWA, WEF. (2017).** *Standard Methods for the Examination of Water and Wastewater (23rd Ed.)*. American Public Health Association, Washington, D.C. *(The international gold standard for water quality analysis protocols).*
2. **Boyd, C. E. (1998).** *Water Quality for Pond Aquaculture*. Research and Development Series No. 43. International Center for Aquaculture and Aquatic Environments, Auburn University, Alabama, USA. *(A practical, applied guide to water quality management).*
3. **Boyd, C. E. & Tucker, C. S. (1992).** *Pond Aquaculture Water Quality Management*. Kluwer Academic Publishers, Boston. *(In-depth coverage of soil and water interactions).*
4. **ICAR-Central Institute of Freshwater Aquaculture (CIFA). (Latest Ed.).** *Manual on Soil and Water Analysis*. CIFA, Bhubaneswar. *(Provides regionally adapted, standard operating procedures for Indian conditions).*

SEMESTER - II

COURSE 3: FIN FISH AND SHELL FISH BIOLOGY

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

Course Objectives:

1. To learn the taxonomy and identification of major cultivable species.
2. To understand the morphology, feeding habits, and reproductive biology of key species.
3. To study the biology of exotic carps and cat fishes.
4. To know the biology of Finfish & Shell fish
5. To understand the age, growth & Reproduction of fin & shell fishes

Learning Outcomes:

1. Classify and identify cultivable fish and shellfish.
2. Perform morphometric and meristic studies.
3. Describe the biology of key species.
4. Describe the biology of important fin fish & shell fish
5. Determine age from scales and explain life cycles.

Unit 1:

Taxonomy and Morphology: Principles of classification; Binomial nomenclature; Morphometric and meristic characteristics; Use of identification keys.

Unit 2:

Biology of Indian Major Carps (IMC): *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* - study of distribution, habitat, food and feeding, reproductive biology (maturity, fecundity, spawning).

Unit 3:

Biology of Exotic Carps and Catfishes: Silver Carp, Grass Carp, Common Carp; *Pangasianodon hypophthalmus* (Pangasius), *Clarias batrachus* (Magur) - Biology and culture potential.

Unit 4: Biology of Other Finfish & Shell fish: Murrels (*Channa* spp.), Tilapia (*Oreochromis niloticus*), Freshwater Prawn (*Macrobrachium rosenbergii*) & Indian Pacific white shrimp (*Litopenaeus vannamei)*

Unit 5: Age, Growth and Reproduction: Methods of age determination (scales, otoliths); Concepts of growth measurement; Basic types of fish migration (Anadromous, Catadromous).

References

1. **Jayaram, K. C. (1999).** *The Freshwater Fishes of the Indian Region (2nd Ed.).* Narendra Publishing House, New Delhi. *(The most authoritative and updated taxonomic reference for Indian freshwater fishes).*

2. **Talwar, P. K. & Jhingran, A. G. (1991).** *Inland Fishes of India and Adjacent Countries (Vols. 1 & 2)*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. *(Extensive details on biology, distribution, and ecology of each species).*
3. **Pillay, T. V. R. (1990).** *Aquaculture: Principles and Practices*. Fishing News Books. *(Contains excellent chapters on the biology of cultivable species).*
4. **New, M. B., Valenti, W. C., Tidwell, J. H., D'Abramo, L. R., & Kutty, M. N. (2009).** *Freshwater Prawn Culture: The Farming of Macrobrachium rosenbergii*. Wiley-Blackwell, UK. *(The definitive textbook on the biology and culture of the giant freshwater prawn).*
5. **Lagler, K. F., Bardach, J. E., Miller, R. R., & Passino, D. R. M. (1977).** *Ichthyology (2nd Ed.)*. John Wiley & Sons, New York. *(A classic textbook on the biology of fishes).*

SEMESTER - II

COURSE 3: FIN FISH AND SHELL FISH BIOLOGY

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

1. Species identification using taxonomic keys:
2. Morphometric and meristic studies.:
3. Fish dissection and gut content analysis.
4. Gonadal staging and fecundity estimation.
5. Study of scales for age determination.
6. Drawing life cycle of *M. rosenbergii*./*L.vannamei*
7. Field visit to a hatchery; report.

References:

1. Talwar, P. K. & Jhingran, A. G. (1991). *Inland Fishes of India and Adjacent Countries (Vols. 1 & 2)*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. *(Primary practical guide for identification and morphometrics).*
2. ICAR-National Bureau of Fish Genetic Resources (NBFGR). (Various Years). *Field Identification Guides for Fishes*. NBFGR, Lucknow. *(Laminated, waterproof sheets excellent for field and lab use).*
3. Bagenal, T. B. & Braum, E. (1978). *Methods for Assessment of Fish Production in Fresh Waters (3rd Ed.)*. IBP Handbook No. 3, Blackwell Scientific Publications, Oxford. *(Standard methods for fecundity estimation, age-growth studies, and scale reading).*
4. ICAR-Central Institute of Freshwater Aquaculture (CIFA). (Latest Ed.). *Manual on Induced Breeding and Seed Production of Carps*. CIFA, Bhubaneswar. *(Contains detailed protocols for gonadal staging and broodstock management).*

SEMESTER - II

COURSE 4: AQUATIC ECOLOGY AND ENVIRONMENT

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

Course Objectives:

1. To understand the structure and function of different aquatic ecosystems.
2. To learn about aquatic biodiversity, its importance, and conservation.
3. To study the concepts of productivity, energy flow, and nutrient cycling in aquatic environments.
4. To understand the major threats to aquatic ecosystems and principles of environmental management.
5.

Learning Outcomes:

Upon completion, students will be able to:

1. Differentiate between various types of aquatic ecosystems.
2. Identify major groups of plankton and benthos.
3. Diagram aquatic food chains and food webs.
4. Explain the process of eutrophication and the cycling of major nutrients.
5. Suggest methods for the conservation and management of aquatic biodiversity.

Unit 1:

Aquatic Ecosystems: Types: Lentic (lakes, reservoirs, ponds) and Lotic (rivers, streams); Physical, chemical, and biological characteristics; Abiotic factors (light, temperature, currents).

Unit 2:

Aquatic Biodiversity: Major groups: Plankton (Phyto- and Zoo-), Nekton, Benthos; Biodiversity hotspots of India; Endangered and threatened aquatic species.

Unit 3:

Aquatic Productivity: Food chains and food webs; Energy flow and ecological efficiencies; Primary and secondary productivity; Factors affecting productivity.

Unit 4:

Nutrient Cycling: Biogeochemical cycles: Carbon, Nitrogen, and Phosphorus cycle in water bodies; Eutrophication: causes, process, and consequences.

Unit 5:

Conservation and Management: Major threats: pollution, habitat destruction, invasive species, climate change; Conservation strategies: In-situ (protected areas, sanctuaries) and Ex-situ (hatcheries, gene banks); Role of IUCN, CITES, and national biodiversity acts.

References:

1. **Wetzel, R. G. (2001).** *Limnology: Lake and River Ecosystems (3rd Ed.)*. Academic Press, San Diego. *(The most comprehensive and authoritative global textbook on aquatic ecology).*
2. **Datta Munshi, J. S. & Srivastava, M. P. (1988).** *Natural History of Fishes and Systematics of Freshwater Fishes of India*. Narendra Publishing House, Delhi. *(Provides an excellent Indian context on fish ecology and habitat).*
3. **Odum, E. P. & Barrett, G. W. (2004).** *Fundamentals of Ecology (5th Ed.)*. Brooks/Cole, Cengage Learning, USA. *(For core ecological concepts like energy flow, nutrient cycling, and ecosystem dynamics).*
4. **Mason, C. F. (1991).** *Biology of Freshwater Pollution (2nd Ed.)*. Longman Scientific & Technical, Essex, UK. *(Excellent resource for understanding aquatic pollution and its impacts).*
5. **IUCN (Latest Ed.).** *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature. *(Online resource for information on endangered aquatic species).*

SEMESTER - II

COURSE 4: AQUATIC ECOLOGY AND ENVIRONMENT

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

1. **Water Sampling:** Techniques for surface and column water sampling from pond/lake.
2. **Physico-Chemical Analysis:**
    - *In-situ:* Temperature, Transparency (Secchi Depth), pH (Pen-type meter).
    - *Ex-situ:* Dissolved Oxygen (Winkler's Method/DO Meter), Total Alkalinity, Total Hardness.
3. **Biological Community Analysis:**
    - **Plankton:** Qualitative and quantitative analysis using plankton net and sedgewick rafter cell.
    - **Benthos:** Qualitative collection using Ekman Dredge/Petersen Grab and identification.
4. **Biological Indices:**
    - Calculation of Shannon-Wiener Diversity Index (H') for plankton/benthos.
5. **Primary Productivity Estimation:** Light and Dark Bottle Method (Demonstration).
6. **Case Study:** Analysis of water quality data to diagnose a pollution scenario (e.g., eutrophication).
7. **Field Visit:** Visit to a local water body for comprehensive ecological observation and report.

References:

1. APHA, AWWA, WEF. (2017). *Standard Methods for the Examination of Water and Wastewater (23rd Ed.)*. American Public Health Association, Washington, D.C. *(Mandatory for standardized protocols in water quality analysis).*
2. Welch, P. S. (1948). *Limnological Methods*. McGraw-Hill Book Co., Philadelphia. *(A classic text detailing methods for plankton collection, benthic sampling, and productivity measurements).*
3. Trivedy, R. K. & Goel, P. K. (1984). *Chemical and Biological Methods for Water Pollution Studies*. Environmental Publications, Karad, India. *(A practical Indian guidebook with simple protocols for ecological studies and pollution assessment).*
4. Needham, J. G. & Needham, P. R. (1962). *A Guide to the Study of Freshwater Biology (5th Ed.)*. Holden-Day, Inc., San Francisco. *(An excellent illustrated guide for the identification of freshwater plankton and benthos).*
5. ICAR-Central Inland Fisheries Research Institute (CIFRI). (Various Bulletins). *Ecological Studies of Indian Rivers and Reservoirs*. CIFRI, Barrackpore. *(For case studies and region-specific ecological data).*

MODEL QUESTION PAPER FOR THEORY
PAPER – III
PRINCIPLES OF AQUACULTURE

Time: 3 hrs **Max. Marks:75**

THEORY MODEL PAPER

I. Answer any FIVE of the following:
5x5=25
Draw labelled diagrams wherever necessary

1.
2.
3.
4.
5.
6.
7.
8.

II. Answer any FIVE of the following:
5x10=50
Draw labelled diagrams wherever necessary

9.a)

OR

b)

10.a)

OR

b)

11.a)

OR

b)

12.a)

OR

b)

13.a)

OR

b)

MODEL QUESTION PAPER FOR PRACTICAL

PAPER – II
PRINCIPLES OF AQUACULTURE

Time: 2 hrs **Max. Marks:50**

PRACTICAL MODEL PAPER

1. Estimate carbonates/Bicarbonates/chlorides/DO/Ammonia /Soil pH &Texture in a given sample and write procedure and principle **10 marks**
2. Identify the following spotters **20 marks**
   a) Phytoplankton
   b) Aquaculture system-fresh water/RAS
   c) Zooplankton
   d) Monk sluice gate

3. Record **05 marks**
4. Internal assessment **15 marks**