

**FISHERIES  
SYLLABUS FOR B.Sc.**

**CHOICE BASED CREDIT SYSTEM (CBCS)**  
To be commenced from the Academic year 2025-26




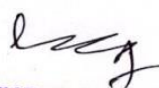
**KAKATIYA UNIVERSITY  
WARANGAL-506009  
TELANGANA STATE**





**KAKATIYA UNIVERSITY**  
CREDIT DISTRIBUTION FOR THE COURSE  
**Annexure-I (Credits)**  
**Proposed CBCS Structure from 2025-2026 for Undergraduate Course**

Courses		Papers	Total Credits	Credits for each paper/ Semester					
				B.Sc					
				I	II	III	IV	V	VI
<b>Core Courses (DSC)</b>	<b>Major-1</b>	6	30	5	5	5	5	5	5
	<b>Major-2</b>	6	30	5	5	5	5	5	5
	<b>Minor-1</b>	4	20	5	5	5	5	---	---
<b>MIL/AEC (First language)</b>	<b>English</b>	4	20	5	5	5	5	---	---
<b>Second Language (Telugu, Hindi, Urdu etc.,)</b>		4	20	5	5	5	5	---	---
<b>Multi Disciplinary Course</b>	<b>MDC-1</b>	1	4	---	---	---	---	4	---
<b>SEC 1,2</b>		2	4	---	---	---	---	2	2
<b>SEC 3,4</b>		2	4	---	---	---	---	2	2
<b>Value added course (VAC)</b>	<b>VAC 1,2</b>	2	6	---	---	---	---	3	3
<b>Internships</b>	<b>Internship/Project</b>	1	4	---	---	---	---	---	4
<b>Total Credits in each semester</b>		---	142	25	25	25	25	21	21
<b>Total Credits in UG</b>		---	142						

  
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CREDIT DISTRIBUTION FOR THE COURSE  
**CURRICULUM FOR FISHERIES FOR B.Sc. (UG) 2025-26**

Code	Semester	Course Title (Theory and Practical)	HPW	Number of Credits	Total Credits	Max. Marks		
						I.A	End Exam	Total
1 <sup>st</sup> Year	I Sem	Paper-1: Principles of Aquaculture (Theory)	4	4	5	20	80	100
		Principles of Aquaculture (Practical)	2	1		-	25	25
	II Sem	Paper-II: Taxonomy of Fishes (Theory)	4	4	5	20	80	100
		Taxonomy of Fishes (Practical)	2	1		-	25	25
2 <sup>nd</sup> Year	III Sem	Paper-III: Anatomy and Biology of Fishes (Theory)	4	4	5	20	80	100
		Anatomy and Biology of Fishes (Practical)	2	1		-	25	25
	IV Sem	Paper-IV: Fish Water Aquaculture (Theory)	4	4	5	20	80	100
		Fish Water Aquaculture (Practical)	2	1		-	25	25
3 <sup>rd</sup> Year	V Sem	Paper-V: Microbial and Parasitic Diseases of Fish (Theory)	4	4	5	20	80	100
		Microbial and Parasitic Diseases of Fish (Practical)	2	1		-	25	25
		MDC-1: Bioinformatics	4	4	4	20	80	100
		SEC-1: Fish Immunology	2	2	2	10	40	50
		SEC-2: Fish Canning Technology	2	2	2	10	40	50
		VAC-1: Fisheries Economics	3	3	3	15	60	75
	VI Sem	Paper-VI: Fish Nutrition and Feed Technology (Theory)	4	4	5	20	80	100
		Fish Nutrition and Feed Technology (Practical)	2	1		-	25	25
		SEC-3: Fishing Craft Technology	2	2	2	10	40	50
		SEC-4: Fishing Gear Technology	2	2	2	10	40	50
		VAC-2: Fishing Technology	3	3	3	15	60	75
		Internship / Project	4	4	4	20	80	100
		<b>TOTAL</b>	<b>58</b>	<b>52</b>	<b>52</b>	<b>230</b>	<b>1070</b>	<b>1300</b>

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Sl.No	Paper	Credits
1	Major - 1	30
2	Major -2	30
3	Minor - 1	20
4	AEC (Ability Enhancement Course) - English	20
5	Second Language	20
6	MDC (Multi-Disciplinary Course) - 1	4
7	SEC (Skill Enhancement Course) – 1,2,3,4	8
8	VAC (Value Added Course)-1,2	6
9	Project	4
	<b>TOTAL</b>	<b>142</b>

  
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Undergraduate Courses (Under CBCS 2025-26 onwards)  
**B. Sc. I YEAR - SEMESTER - I**

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**PAPER-I: PRINCIPLES OF AQUACULTURE (Theory)**

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**Unit I: Foundations of Aquaculture**

- 1.1 Definition, scope and history of aquaculture
- 1.2 Present global and national scenario of aquaculture
- 1.3 Comparison between aquaculture and agriculture
- 1.4 Principles and practices of organic aquaculture

**Unit II: Aquaculture Systems and Water Bodies**


- 2.1 Systems of aquaculture: pond, pen, cage, running water, and zero water exchange
- 2.2 Classification: extensive, semi-intensive, intensive, and super-intensive systems
- 2.3 Aquaculture in different water bodies: freshwater, brackish water, inland saline, and marine
- 2.4 Components and layout of aquaculture farms


**Unit III: Pond Management and Productivity**


- 3.1 Pre-stocking and post-stocking pond management practices
- 3.2 Carrying capacity of ponds and influencing factors
- 3.3 Water and soil quality parameters affecting fish production
- 3.4 Physical, chemical, and biological factors influencing pond productivity


**Unit IV: Species Selection and Culture Techniques**

- 4.1 Criteria for selection of candidate species for aquaculture
- 4.2 Major candidate species: freshwater, brackish-water, and marine
- 4.3 Culture systems: monoculture, polyculture, and integrated culture
- 4.4 Growth studies and waste accumulation in aquaculture systems ( $\text{NH}_3$ ,  $\text{CO}_2$ , organic matter)

  
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B. Sc. I YEAR - SEMESTER - I

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**PAPER-I: PRINCIPLES OF AQUACULTURE (Practical)**

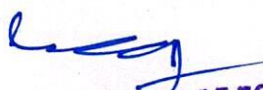
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1. **Analysis of Global and National Aquaculture Production Statistics** (Studying FAO and NFDB databases; interpretation of trends and growth patterns)
2. **Survey of Aquaculture Resources** (Mapping physical resources and water bodies suitable for aquaculture in India and globally)
3. **Design and Layout of Aquaculture Farms** (Identifying core components like ponds, tanks, filters, and water exchange systems)
4. **Estimation of Pond Carrying Capacity** (Calculation using biomass and productivity parameters under varying culture conditions)
5. **Practices in Pre-stocking Pond Management** (Cleaning, liming, fertilization, and water preparation techniques)
6. **Practices in Post-stocking Pond Management** (Feed management, aeration systems, health monitoring, and harvesting techniques)
7. **Growth Studies in Aquaculture Systems** (Use of growth models; periodic sampling; feed conversion ratio (FCR) analysis)
8. **Measurement of Waste Accumulation** (Estimating levels of ammonia (NH<sub>3</sub>), carbon dioxide (CO<sub>2</sub>), and organic matter in cultured ponds)
9. **Manure Sampling and Analysis** (Evaluation of nutrient composition and its impact on water quality)
10. **Water and Soil Quality Testing** (Physical (temperature, turbidity), chemical (pH, DO, hardness), and biological (plankton) indicators for productivity)

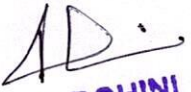
**Recommended Books**

- Ayyappan, S. *Handbook of Fisheries and Aquaculture*. New Delhi: ICAR Publications, 2011.
- Rath, R.K. *Freshwater Aquaculture*. New Delhi: Scientific Publishers, 2011.
- Porkodi, M., & Felix, S. *Principles of Aquaculture: Theory Manual*. New Delhi: Daya Publishing House, 2024.

  
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**B. Sc. I YEAR - SEMESTER - II**

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**PAPER-II: TAXONOMY OF FISHES (Theory)**

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**Unit I: Principles and Foundations of Taxonomy**

- 1.1 Principles and scope of taxonomy in aquatic organisms
- 1.2 Nomenclature: rules, codes, and classification types
- 1.3 Taxonomic hierarchy and interrelationships among finfish and shellfish
- 1.4 Criteria for generic and specific identification in fishes and shellfishes

**Unit II: Morphological and Analytical Tools**

- 2.1 Morphological, morphometric, and meristic characters of taxonomic significance
- 2.2 Major taxa of inland and marine finfishes up to family level
- 2.3 Commercially important freshwater and marine finfishes of India and their diagnostic features
- 2.4 Modern taxonomic tools: karyo taxonomy, DNA barcoding, protein analysis, and DNA polymorphism

**Unit III: Taxonomy of Shellfish – Crustacea**

- 3.1 External morphology and meristic characteristics of crustaceans
- 3.2 Classification of crustaceans up to species level
- 3.3 Commercially important crustacean species of India
- 3.4 Taxonomic keys and identification techniques for crustaceans


**Unit IV: Taxonomy of Shellfish – Mollusca**

- 4.1 External morphology and meristic characteristics of molluscs
- 4.2 Classification of molluscs up to species level
- 4.3 Commercially important molluscan species of India
- 4.4 Comparative taxonomy of finfish, crustaceans, and molluscs

  
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**PAPER-II: TAXONOMY OF FISHES (Practical)**

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1. Collection and taxonomic identification of inland and marine finfish species from local water bodies using diagnostic morphological features
2. Comparative analysis of meristic and morphometric characters in commercially important fish groups for species-level classification
3. Protein profiling of selected finfish species using electrophoresis techniques to assess taxonomic relationships
4. Chromosome preparation and karyo-taxonomy studies in representative fish specimens
5. DNA extraction and barcoding of commercially important fish species for molecular identification
6. Assessment of genetic variation in fish populations through DNA polymorphism techniques
7. Visit to fish landing centers to document species diversity, catch composition, and identification of commercially significant fishes
8. Collection, preservation, and classification of shellfish including prawns, shrimps, crabs, and lobsters from estuarine and coastal habitats
9. External morphological and meristic studies on molluscan groups such as bivalves, gastropods, and cephalopods
10. Field-based identification of shellfish species with preparation of field keys and specimen records for crustaceans and molluscs


**Recommended Books**

1. Talwar, P.K., & Jhingran, A.G. *Inland Fishes of India and Adjacent Countries*. New Delhi: Oxford & IBH Publishing Co., 1991.
2. Nelson, J.S. *Fishes of the World*. 4th ed. Hoboken: John Wiley & Sons, 2006.
3. Gopalakrishnan, A., et al. *Species Identification Manual: Finfish and Shellfish*. Kochi: ICAR-Central Marine Fisheries Research Institute, 2017.

  
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**B. Sc. II YEAR - SEMESTER - III**

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**PAPER-III: ANATOMY AND BIOLOGY OF FISHES (Theory)**

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**Unit I: External and Internal Anatomy**

- 1.1 External anatomy of major fish groups
- 1.2 Oral region and associated structures
- 1.3 Digestive system and associated digestive glands
- 1.4 Food and feeding habits of commercially important fishes

**Unit II: Physiological Systems**

- 2.1 Circulatory and respiratory systems
- 2.2 Nervous and urino-genital systems
- 2.3 Endocrine and skeletal systems
- 2.4 Sensory organs and their adaptations

**Unit III: Reproductive and Developmental Biology**

- 3.1 Reproductive biology: maturity stages, gonado-somatic index, ponderal index, fecundity, sex ratio
- 3.2 Spawning behavior and reproductive cycles
- 3.3 Eggs, larval stages, and developmental biology
- 3.4 Age and growth determination: direct and indirect methods

**Unit IV: Ecological and Analytical Techniques**

- 4.1 Gut content analysis: qualitative and quantitative methods
- 4.2 Fish migration: types and ecological significance
- 4.3 Tagging and marking techniques in fish biology
- 4.4 Applications of anatomical and biological studies in fisheries science

  
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**B. Sc. II YEAR - SEMESTER - III**

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**PAPER-III: ANATOMY AND BIOLOGY OF FISHES (Practical)**

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1. Dissection and identification of internal organs in finfish: digestive, respiratory, circulatory, nervous, urino-genital, skeletal, and endocrine systems
2. Examination of feeding apparatus and oral structures across different fish species
3. Analysis of gut contents using qualitative and quantitative methods to assess feeding habits
4. Estimation of age in fish using scale and otolith ring analysis (direct and indirect methods)
5. Observation and classification of gonadal development stages for maturity assessment
6. Estimation of fecundity through ovary sampling and egg counting techniques
7. Study of larval development and early life stages under laboratory or field conditions
8. Comparative study of skeletal types in cartilaginous and bony fishes
9. Investigation of respiratory adaptations via gill structure and ventilation mechanisms
10. Practice of fish tagging and marking techniques for migration and growth studies

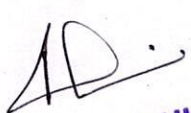
**Recommended Books**

- Lagler, K.F., Bardach, J.E., Miller, R.R., & Passino, D.R.M. *Ichthyology*. 2nd ed. Toronto: John Wiley & Sons, Inc., 1977.
- Bone, Q., & Moore, R.H. *Biology of Fishes*. London: Blackie Academic & Professional, 1995.
- Kumar, S., & Tembhre, M. *Anatomy and Physiology of Fishes*. New Delhi: Vikas Publishing House Pvt. Ltd., 1996.
- Munshi, J.S.D. *Fish Morphology*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 1995.

  
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**B. Sc. III YEAR - SEMESTER - IV**

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**PAPER-IV: FRESH WATER AQUACULTURE (Theory)**

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**Unit I: Overview and Resources**

- 1.1 Major freshwater species cultured globally and in India
- 1.2 Production trends and prospects in different regions
- 1.3 Freshwater aquaculture resources: ponds, tanks, lakes, reservoirs
- 1.4 Nursery, rearing, and grow-out pond preparation and management

**Unit II: Pond Management and Seed Handling**


- 2.1 Control of aquatic weeds, algal blooms, predatory and weed fishes
- 2.2 Liming, fertilization/manuring, biofertilizers, and supplementary feeding
- 2.3 Water quality management in freshwater aquaculture systems
- 2.4 Selection, transportation, and acclimatization of fish seed

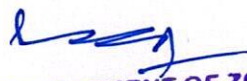
**Unit III: Species and Culture Systems**

- 3.1 Traits and culture methods of Indian major carps, exotic carps, air-breathing fishes, cold water fishes
- 3.2 Culture of freshwater prawns and mussels; wintering, quarantine, and isolation ponds
- 3.3 Sewage-fed fish culture; principles of organic cycling and detritus food chain
- 3.4 Composite fish culture systems: competition and compatibility


**Unit IV: Integrated and Alternative Aquaculture**

- 4.1 Exotic fish species introduced to India; culture of medium/minor carps, catfish, murels
- 4.2 Species suitable for integrated aquaculture systems
- 4.3 Integration with agriculture, horticulture, and livestock
- 4.4 Cultivation of aquatic macrophytes (e.g., makhana); paddy-cum-fish/shrimp culture

  
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**PAPER-IV: FRESH WATER AQUACULTURE (Practical)**


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1. Preparation and management of nursery, rearing, and grow-out ponds
2. Study of liming, manuring, and fertilization effects on pond hydrobiology and fish growth
3. Collection, identification, and control of aquatic weeds, insects, predatory and weed fishes
4. Identification of eggs and larval forms of freshwater fishes
5. Observation and control of algal blooms in aquaculture ponds
6. Estimation of plankton and benthic biomass in freshwater systems
7. Evaluation of natural vs. supplementary feed contribution to fish growth
8. Economic analysis of various freshwater culture practices
9. Estimation of livestock requirement per unit in integrated aquaculture systems
10. Design of paddy plots for paddy-cum-fish culture and layout of livestock sheds on pond embankments


**Recommended Books**

- Jhingran, V.G. *Fish and Fisheries of India*. New Delhi: Hindustan Publishing Corporation, 1998.
- Huet, Marcel. *Textbook of Fish Culture*. Oxford: Fishing News Books, 1972.
- Santhanam, R., Sukumaran, N., & Natarajan, P. *A Manual of Aquaculture*. New Delhi: Oxford & IBH Publishing Co., 1987.
- Srivastava, C.B.L. *Freshwater Aquaculture in India*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 1993

  
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B. Sc. III YEAR - SEMESTER - V

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**PAPER-V: MICROBIAL AND PARASITIC DISEASES OF FISH (Theory)**

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**Unit I: Overview of Aquatic Diseases**

- 1.1 General characteristics and life cycles of parasitic, bacterial, fungal, and viral pathogens
- 1.2 Diagnosis, prevention, and treatment of microbial and parasitic diseases in finfish and shellfish
- 1.3 OIE-listed aquatic animal diseases and their significance
- 1.4 Disease surveillance, reporting, quarantine, and health certification in aquaculture

**Unit II: Health Management Strategies**

- 2.1 Vaccines, immunostimulants, bioremediation, and probiotics in aquatic health
- 2.2 Crop rotation, good and best management practices (GMP/BMP)
- 2.3 Development and application of SPF (Specific Pathogen Free) and SPR (Specific Pathogen Resistant) stocks
- 2.4 Biosecurity principles and sanitary/phytosanitary agreements

**Unit III: Environmental and Zoonotic Considerations**

- 3.1 Disease control through environmental management
- 3.2 Role of biofilm, biofloc, and periphyton in aquatic health
- 3.3 Zoonotic diseases associated with fish and shellfish
- 3.4 Stress-related disease susceptibility and mitigation strategies


**Unit IV: Diagnostic Techniques**

- 4.1 Principles of disease diagnosis: conventional, molecular, and antibody-based methods
- 4.2 Rapid diagnostic techniques and field-level applications
- 4.3 Histopathological and biochemical approaches to disease identification
- 4.4 Challenge tests and virus purification protocols

  
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**B. Sc. III YEAR - SEMESTER - V**

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**PAPER-V: MICROBIAL AND PARASITIC DISEASES OF FISH (Practical)**


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1. General procedures for disease diagnosis in finfish and shellfish
2. Sampling techniques for diseased specimens and preparation for lab analysis
3. Taxonomy, lifecycle, and identification of common fish and shellfish parasites
4. Media preparation and culture techniques for pathogenic bacteria
5. Bacterial classification using staining and biochemical tests
6. Microbiological and haematological diagnostic methods
7. Histopathological examination of infected tissues
8. Immunological and molecular techniques for pathogen detection
9. Agglutination tests and challenge experiments for disease confirmation
10. Stress-related studies and therapeutic interventions in diseased aquatic animals


**Recommended Books**

- Roberts, R.J., ed. *Fish Pathology*. New York: Bailliere Tindall, 1989.
- Bell, T.A., and Lightner, D.V. *A Handbook of Normal Penaeid Shrimp Histology*. Baton Rouge: World Aquaculture Society, 1988.
- Ferguson, H. *Systematic Pathology of Fish*. Ames: Iowa State University Press, 1989.
- Lightner, D.V. *A Handbook of Shrimp Pathology and Diagnostic Procedures for Diseases of Cultured Penaeid Shrimp*. Baton Rouge: World Aquaculture Society, 1996.
- Hibiya, T. *An Atlas of Fish Histology: Normal and Pathological Features*. Tokyo: Kodansha Ltd., 1982.

  
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**PAPER-VI: BIOINFORMATICS (MDS-1)**

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**UNIT – I: Introduction To Computational Biology And Bioinformatics**

- 1.1 Definitions and Scope of Computational Biology and Bioinformatics
- 1.2 Applications in Life Sciences and Poultry Science
- 1.3 Basic Concepts in Molecular Biology: DNA, RNA, Proteins
- 1.4 Introduction to Central Dogma and Gene Expression

**UNIT – II: Biological Databases And Data Retrieval**

- 2.1 Types of Biological Databases – Primary, Secondary, Composite
- 2.2 NCBI, EMBL, DDBJ, UniProt – Structure and Use
- 2.3 Sequence Data Retrieval – Using GenBank and FASTA formats
- 2.4 BLAST: Basic Local Alignment Search Tool – Concept and Applications

**UNIT – III: Sequence Alignment And Phylogenetics**

- 3.1 Pairwise Sequence Alignment – Global and Local
- 3.2 Multiple Sequence Alignment – Introduction and Tools (e.g., CLUSTALW)
- 3.3 Scoring Matrices – PAM and BLOSUM
- 3.4 Basics of Phylogenetic Tree Construction and Applications


**UNIT – IV: Applications In Poultry And Biotechnology**

- 4.1 Use of Bioinformatics in Poultry Genetics and Breeding
- 4.2 Protein Structure Prediction – Primary to Tertiary
- 4.3 Molecular Docking and Vaccine Design – Introduction
- 4.4 Future Perspectives: AI and Machine Learning in Poultry Bioinformatics


**References**

- 1. Lesk, Arthur M. *Introduction to Bioinformatics*. 5th ed., Oxford University Press, 2019.
- 2. Mount, David W. *Bioinformatics: Sequence and Genome Analysis*. 2nd ed., Cold Spring Harbor Laboratory Press, 2004.
- 3. Baxevanis, Andreas D., and B. F. Francis Ouellette. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*. 3rd ed., Wiley-Interscience, 2005.
- 4. Rastogi, S. C., N. Mendiratta, and P. Rastogi. *Bioinformatics: Methods and Applications – Genomics, Proteomics and Drug Discovery*. 4th ed., PHI Learning Pvt. Ltd., 2015.

  
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**PAPER-VII: FISH IMMUNOLOGY (SEC-1)**

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**Unit I: Basics of Immunology**

- 1.1 Introduction and brief history of immunology
- 1.2 Types of immunity: innate and adaptive
- 1.3 Cell-mediated and humoral immunity
- 1.4 Cells and organs of the fish immune system

**Unit II: Antigens and Antibodies**

- 2.1 Antigens: structure, types, epitopes, and haptens
- 2.2 Antibody structure, classes, and functions
- 2.3 Antigenic determinants on immunoglobulins
- 2.4 MHC complex: types, structure, and role

**Unit III: Immune Responses and Disease Mechanisms**

- 3.1 Antigen-antibody interactions and recognition by B and T cells
- 3.2 Precipitin and agglutination reactions
- 3.3 Microorganisms in fish health and disease
- 3.4 Defense mechanisms in finfish and shellfish

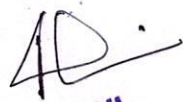
**Unit IV: Applications in Aquatic Health**

- 4.1 Vaccines: types and administration methods
- 4.2 Immunostimulants: types and mechanisms
- 4.3 Diagnostic methods: ELISA, immunodiffusion, immunofluorescence
- 4.4 Role of stress, pathogenicity, and zoonotic concerns

  
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**PAPER-VIII: FISH CANNING TECHNOLOGY (SEC-2)**

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**Unit I: Introduction and Fundamentals**

- 1.1 Historical development and significance of fish canning
- 1.2 Advantages of canning over other preservation methods
- 1.3 Raw and sub-materials: characteristics and suitability for canning
- 1.4 Classification of foods based on pH, sterility, and thermal treatment

**Unit II: Canning Process and Techniques**

- 2.1 Process flow: HTST and aseptic canning methods
- 2.2 General steps: raw material preparation, packing, pre-cooking, exhausting
- 2.3 Seaming, retorting, cooling, labeling, and storage procedures
- 2.4 Principles of thermal processing and heat transfer mechanisms

**Unit III: Process Calculations and Product Handling**

- 3.1 Heat resistance of microorganisms and heat penetration studies
- 3.2 Cold spot significance and pack types: convection vs. conduction
- 3.3 Process calculations: Fo value, D-value, Z-value, TDT, F-value, lethal rate
- 3.4 Commercial sterilization and the 12-D concept

**Unit IV: Product Quality and Packaging**

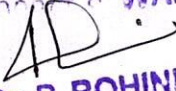
- 4.1 Canning of finfish, shellfish, and cephalopods
- 4.2 Spoilage types, causes, and preventive measures
- 4.3 Quality standards, plant layout, hygiene, sanitation, and waste disposal
- 4.4 Packaging materials: tinplate, TFS, aluminum cans, and retortable pouches

**Recommended Books**

- Balachandran, K.K. *Fish Canning Principles and Practices*. Cochin: Central Institute of Fisheries Technology, ICAR, 2004.
- Footitt, R.J., & Lewis, A.S. *The Canning of Fish and Meat*. London: Blackie Academic & Professional, 1995.
- Warne, D. *Manual on Fish Canning*. FAO Fisheries Technical Paper No. 285. Rome: FAO, 1988.
- Wheaton, F.W., & Lawson, T.B. *Processing Aquatic Food Products*. New York: Wiley-Interscience, 1985.

  
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**PAPER-IX: FISHERIES ECONOMICS (VAC-1)**

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**Unit I: Introduction to Fisheries Economics**

- 1.1. Basic concepts: micro vs. macroeconomics, positive vs. normative economics
- 1.2. Environmental economics, resource use, and scarcity
- 1.3. Farm-firm relationships and production in fisheries
- 1.4. Role of fisheries in national economic development

**Unit II: Microeconomics and Production Analysis**

- 2.1. Demand, supply, market equilibrium and consumption
- 2.2. Elasticity: price, income, cross elasticity and applications in fisheries
- 2.3. Farm production functions in capture and culture fisheries
- 2.4. Cost, returns, breakeven analysis, marginal cost and returns

**Unit III: Macroeconomics and Global Impact**

- 3.1. National income: meaning, measurement, and fisheries contribution
- 3.2. Balance of payments, economic growth, and sustainability
- 3.3. Globalization: key features and driving forces
- 3.4. WTO and GATT: introduction and relevance to fisheries

**Unit IV: Trade Policies, Patents & IPR**

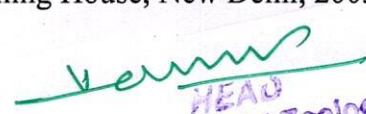
- 4.1. SPS Agreement, seafood export regulations, NTBs and anti-dumping
- 4.2. Fisheries subsidies and trade-environment linkages
- 4.3. Intellectual Property Rights: patents, TRIPS and bio-piracy
- 4.4. Indian Patent Act 2005 and GMOs in fisheries

**Reference Books:**

- Jayaraman, R. *Fisheries Economics*. Tamilnadu Veterinary and Animal Science University, Tuticorin, 1996.
- Rao, N. Subba. *Economics of Fisheries*. Daya Publishing House, Delhi, 1986.
- Dewett, K.K., & Varma, J.D. *Elementary Economic Theory*. S. Chand, New Delhi, 1993.
- Korakandy, R. *Economics of Fisheries Management*. Daya Publishing House, Delhi, 1996.
- Singh, R.K.P. *Economics of Aquaculture*. Daya Publishing House, New Delhi, 2003.

  
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**PAPER-X: FISH NUTRITION AND FEED TECHNOLOGY (Theory)**

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**Unit I: Fundamentals of Fish Nutrition**

1. Basic concepts of fish nutrition and nutritional physiology
2. Nutritional requirements of cultivable finfish and shellfish
3. Growth in fish: factors influencing growth and growth indices
4. Nutritional energetics – definition and forms of energy partitioning

**Unit II: Feed Ingredients and Additives**

1. Principal nutrients: proteins, lipids, carbohydrates, vitamins, minerals
2. Non-conventional feed ingredients and anti-nutritional factors
3. Feed additives: types and roles (binders, antioxidants, enzymes, pigments, growth promoters)
4. Digestive enzymes and factors affecting digestibility

**Unit III: Feed Formulation and Processing**

1. Methods of feed formulation (pearson's square, software-based methods)
2. Types and forms of feeds: wet, moist, dry, mash, pellet, floating and sinking feeds
3. Feed manufacturing processes: grinding, mixing, pelleting, extrusion
4. Feed storage: use of preservatives and antioxidants


**Unit IV: Feed Evaluation and Feeding Management**

1. Feed evaluation: FCR, FER, PER, NPU, biological value
2. Feeding methods and devices in aquaculture
3. Nutritional deficiency diseases in fish and shellfish
4. Digestibility determination and impact on feed efficiency

  
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**PAPER-X: FISH NUTRITION AND FEED TECHNOLOGY (Practical)**

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1. Proximate analysis of feed ingredients: moisture, crude protein, fat, ash
2. Proximate composition analysis of formulated feeds
3. Preparation of artificial feeds using locally available feed ingredients
4. Formulation of practical diets using Pearson's square method
5. Preparation of pelleted feeds and moisture feeds
6. Determination of sinking rate and water stability of feeds
7. Assessment of feed digestibility using inert markers
8. Evaluation of feed quality under different storage conditions
9. Identification of anti-nutritional factors in non-conventional ingredients
10. Demonstration of feed additives and their roles in feed formulations


**Reference Books:**

- Suzuki, T. (1981). *Fish and krill protein: Processing technology*. Applied Science Publishers Ltd.
- Nettleton, J. A. (1985). *Seafood nutrition*. Van Nostrand Reinhold.
- Vashishta, M. (1998). *Food nutrition and processing*. Anmol Publications Pvt. Ltd.
- Swaminathan, M. (1985). *Handbook of food and nutrition*. The Bangalore Printing and Publishing Co. Ltd.

  
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**PAPER-XI: FISHING CRAFT TECHNOLOGY (SEC-3)**

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**Unit I: Introduction to Fishing Crafts**

1. History and development of fishing crafts in India and globally
2. Traditional fishing crafts of India and their regional variations
3. Classification of fishing crafts based on fabrication, function, and depth of operation
4. Mechanization of fishing crafts: history, evolution, and current trends

**Unit II: Geometry and Hydrostatics of Fishing Vessels**

1. Basic geometric concepts and terminology of fishing vessels
2. Form coefficients and properties of irregular shapes
3. Calculation of longitudinal and transverse sectional areas using Trapezoidal and Simpson's rules
4. State of equilibrium, volume of displacement, CG, CB, VCB, LCB

**Unit III: Vessel Stability and Tonnage Systems**



1. Stability of fishing vessels: longitudinal and transverse stability
2. Equilibrium states of ships: stable, unstable, and neutral
3. Weight classifications: light weight, dead weight, and displacement
4. Tonnage measurement: Gross Registered Tonnage (GRT) and Net Registered Tonnage (NRT)



**Unit IV: Boat Construction and Materials**

1. Boat building materials: wood, steel, FRP, ferrocement, and aluminum – properties, pros & cons
2. Seasoning and preservation of wood; fouling and boring organisms
3. Constructional details: offset tables, mould lofting, backbone assembly
4. Introduction to deck fittings, and outboard and inboard engines

**Reference Books:**

- Fyson, J. (Ed.). (1985). *Design of small fishing vessels*. Fishing News Books Ltd.
- Hind, J. A. (1982). *Stability and trim of fishing vessels*. Fishing News Books Ltd.
- Subramaniam, H. (1995). *Ship stability* (Vols. 1–3). Vijaya Publications Ltd.
- Food and Agriculture Organization. (n.d.). *Fishing boats of the world* (Vols. 1–3). Fishing News Books Ltd.

  
  
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**PAPER-XII: FISHING GEAR TECHNOLOGY (SEC-4)**

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**Unit I: Introduction to Fishing Gears and Classification**

1. Evolution and development of fishing gears and fishing technology
2. Mechanization of fishing operations
3. Classification of fishing gears: Principal, Subsidiary, and Auxiliary gears
4. International classification systems: FAO classification and ISSCFG

**Unit II: Fishing Gear Materials and Their Properties**

1. Natural vs. synthetic fishing gear materials and their classifications
2. Types of synthetic materials: nylon (PA 6, PA 66), polyethylene, polypropylene, etc.
3. Yarn and fibre types: monofilament, multifilament, staple, split fibres, folded yarns
4. Identification of synthetic materials: visual inspection, solubility, burning, water, and melting point tests

**Unit III: Construction and Characteristics of Netting Materials**

1. Methods of netting: knotted and knotless webbing, mesh shapes (diamond, square, hexagonal)
2. Netting twines and rope constructions: twisted, braided, cable nettings
3. Yarn numbering systems: Direct (Tex, Denier) and Indirect (British Count, Metric Count), and their conversions
4. Physical, chemical, and biological properties of netting materials (e.g., strength, abrasion resistance, elasticity, shrinkage, weather resistance)

**Unit IV: Gear Design, Rigging and Application**


1. Floats and sinkers: materials, types, properties, buoyancy calculation, and negative buoyancy
2. Factors in gear design and selection: biological, environmental, vessel characteristics, mesh regulation
3. Gear types and applications: choice of netting materials for trawl, gillnet, and purse seine
4. Trawl gear classification: 2-seam, 4-seam, and wing trawls; design and rigging of wing trawl; arrangement of bridles, sweeps, tickler chains, bobbins, rock hoppers, and otter boards.

**Reference books:**

- Fridman, A. L. (1992). *Calculations for fishing gear designs*. Fishing News Books Ltd.
- Gabriel, O., Lange, K., Dahm, E., & Wendt, T. (2005). *Von Brandt's fish catching methods of the world* (4th ed.). Blackwell Publishing.
- Klust, G. (1982). *Netting materials for fishing gear*. Fishing News Books Ltd.
- Food and Agriculture Organization. (1978). *Catalogue of fishing gear designs*. Fishing News Books Ltd.

  
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**PAPER-XIII: FISHING TECHNOLOGY (VAC-2)**

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**Unit I: Commercial Fishing Gears and Rigging Systems**

1. Structure and classification of various commercial fishing gears
2. Rigging of fishing gears: bridles, sweep lines, floats, otter boards, and ground gear arrangements
3. Otter doors: types and behavior in water (angle of attack, heel, and tilt)
4. Fishing accessories: thimbles, shackles, C-links, G-links, rings, Kelly's eye, stoppers, bottle screw

**Unit II: Fishing Methods and Gear Operations**

1. Trawling methods: beam trawling, otter trawling, side trawling, twin trawling, outrigger trawling, bull trawling, and midwater trawling
2. Purse seine construction: single-boat and two-boat purse seines, and methods of operation
3. Gillnets: construction and types – simple gillnet, trammel net, stick-held gillnet, frame gillnet, and vertical line gillnet
4. Gillnet operation: set gillnetting, drift gillnetting, bottom, midwater, and pelagic gillnetting

**Unit III: Line Fishing and Other Gear Operations**

1. Line fishing gears: types of hooks, their structure, sizes, and applications
2. Construction and types of longlines: tuna longline, vertical longline, pole & line, and trolling line
3. Methods of longline operation: set and drift longlining; bottom, midwater, pelagic longlining; jigging
4. Operation of beach seine, boat seine, and different types of traps


**Unit IV: Selectivity, Deck Equipment, and Fishing Electronics**

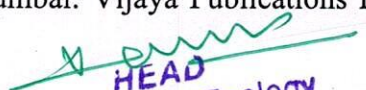

1. Selectivity in fishing gears and use of bycatch reduction devices (BRDs)
2. Deck layout of fishing vessels; types and functions of deck equipment – winches, net haulers, line haulers, triple drum, power blocks, fish pumps
3. Fishing equipment: GPS, fish finders, sonar, net sonde, and gear monitoring systems
4. Modern technological aids in fishing and their application in efficient gear operation

**Reference Books:**

- Fyson, John, ed. *Design of Small Fishing Vessels*. London: Fishing News Books Ltd., 1985.
- Hind, J. Antony. *Stability and Trim of Fishing Vessels*. London: Fishing News Books Ltd., 1982.
- Subramaniam, H. *Ship Stability*. Volumes 1, 2 & 3. Mumbai: Vijaya Publications Ltd., 1995.

  
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**Annexure – I (Credits)**  
**Proposed CBCS Structure from 2025-26 for Under Graduate Courses**

Courses		Papers	Total Credits	Credits for each paper / Semester						Credits for each paper / Semester						Credits for each paper / Semester					
				BA						B.Com.						B.Sc.					
				I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Core Courses DSC	Major-1	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Major -2	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
MIL/AEC (First Language)	English	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Second Language (Telugu, Hindi, Urdu, etc.)		4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Multi- Disciplinary Course	MDC 1	1	4	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4	-
Sec 1, 2		2	4					2	2					2	2					2	2
Sec 3, 4		2	4					2	2					2	2					2	2
Value added course (VAC)	VAC 1, 2	2	6	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3
Internships	Internship / Project	1	4	-	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4
Total Credits in each semester			142	25	25	25	25	21	21	25	25	25	25	21	21	25	25	25	25	21	21
Total Credits in UG				142						142						142					
Credits under Non-CGPA (Community engagement and service)		NSS /NCC /sports / Extra curricular	6	Upto 6 (2 in each year)						Upto 6 (2 in each year)						Upto 6 (2 in each year)					
		IKS	4	Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)					



