



Krishna University

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(Established under AP Act No. 29 of 2008)

Machilipatnam, Andhra Pradesh, India - 521004



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 III & IV)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
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	Economics, Marketing and Extension	3	3
			Economics, Marketing and Extension-Practical	2	1

M. Vijayalakshmi

B. A. S. S.

D. Rupasri

M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours) : Major
Semester End Examination
SEMESTER-III
COURSE 5: FISH HEALTH MANAGEMENT

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVES:

- To introduce fish pathology, disease diagnosis, and health management principles.
- To provide knowledge of major viral and bacterial diseases of finfish. □ To develop understanding of fungal and protozoan diseases in finfish.
- To familiarize students with parasitic diseases and fish therapeutics.
- To introduce nutritional, environmental, and genetic disorders in fish.

LEARNING OUTCOMES:

By the completion of the course student will be able to

- Explain fish diseases, pathological changes, and health management practices.
- Identify and manage important viral and bacterial fish diseases.
- Diagnose and recommend control measures for fungal and protozoan diseases.
- Evaluate parasitic diseases and their treatment and control methods.
- Assess and manage nutritional, environmental, and genetic fish disorders.

SYLLABUS:

UNIT-I: Pathology and parasitology

- 1.1. Principles of disease diagnosis and fish health management
- 1.2. Introduction to fish diseases –Definition and categories of diseases; Infectious Diseases – bacterial, Viral, fungal and Parasitic; Non- infectious Diseases - Environment, nutritional and genetic diseases
- 1.3. Disturbance in cell structure – Changes in cell metabolism, progressive and retrogressive tissue changes, types of degeneration, infiltration, necrosis, cell death and causes
- 1.4. Atrophy, Hypertrophy, Neoplasm, inflammation, healing and repair

UNIT-II: Viral and Bacterial Diseases of fin fish: Clinical symptoms, pathology, prevention and therapy of

- 2.1. Viral diseases in Brackish water fishes- Infectious hematopoietic necrosis in trout, Infectious pancreatic necrosis in salmonids
- 2.2. Viral diseases in fresh water fishes- Spring Viremia of carps, Swim-bladder inflammation in cyprinids
- 2.3. Bacterial diseases- (Aeromonas diseases) - Furunculosis, Epizootic Ulcerative Syndrome, Infectious abdominal dropsy, Tail and Fin Rot disease.

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2.4. Bacterial diseases- (Pseudomonas diseases) - Bacterial Gill Disease, Haemorrhagic Septicemia

2.5 Other bacterial Infections- Columnaris, Enteric Red mouth

UNIT- III: Fungal and Protozoan Diseases of fin fish: Clinical symptoms, pathology, prevention and therapy of

3.1. Fungal diseases – Saprolegniasis, Branchiomycosis, (Gill Rot) Ichthyophonus diseases

3.2. Protozoan diseases: Ichthyophthiriasis (White spot Disease), Costiasis, Whirling disease.

3.3. Common Chemicals and drugs used for treatment of Fungal and Protozoan diseases of fin fish

UNIT- IV: Parasitic diseases

4.1. Helminth diseases- Dactylogyus, Diplostomum spathaceum

4.2. Crustacean diseases- Argulosis (Fish Louse Infestation), Lernaeosis (Anchor Worm Infestation)

4.3. Antibiotics and Chemotherapeutics in fish health management

UNIT-V: Nutritional and Environmental Disorders: Clinical symptoms, pathology, prevention and therapy of

5.1. Nutritional Disorders – Protein (Essential amino acid) and Lipid (Essential fatty acid) deficiency disorders; Vitamin and mineral deficiency disorders; Fatty liver disease; 5.2. Environmental Disorders: Gas bubble disease, Asphyxiation.

5.3. Genetically induced diseases-- Inherited Muscular Dystrophy, Ichthyosis (Fish Scale Disease), Albinism and Cystic Kidney Disease (CKD)

REFERENCE BOOKS

1. Shaperclaus W. 1991 Fish Diseases- Vol.I& II. Oxonian PressPvt.ltd
2. Roberts RJ 1989. Fish pathology. Bailliere Tindall, New York
3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandry and medicine. Pergamon Press. Oxford
4. Jayaraman R 1996. Fisheries Economics. Tamil Nadu Veterinary and Animal Science University. Tuticorn
5. Subba Rao N 1986. Economics of Fisheries. Daya publishing house, Delhi 6. Shankar KM & Mohan CV. 2002. Fish and Shellfish Health Management. UNESCO Publ. Sindermann CJ. 1990
7. Walker P & Subasinghe RP. (Eds.). 2005 Principal Diseases of Marine Fish and Shellfish. Vols. I, II. 2nd Ed. Academic Press
8. DNA Based Molecular Diagnostic Techniques: Research Needs for Standardization and Validation of the Detection of Aquatic Animal Pathogens and Diseases. FAO Publ. Widmeyer, G, Meyer FP & Smith L. 19

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
SEMESTER-III

COURSE 5: FISH HEALTH MANAGEMENT

Practical

Credits: 1

2 hrs/week

SYLLABUS:

1. Enumeration of Bacteria by TPC Method
2. Enumeration of Total Coli forms
3. Observation of gross pathology and external lesions of fish with reference to the common diseases in aquaculture
4. Examination of pathological changes in gills and gut lumen, lymphoid organ, muscles and nerves of fish
5. Collection, processing and analysis of data for epidemiological investigations of viral diseases
6. Bacterial pathogens – isolation, culture and characterization
7. Identification of Viral diseases in fish
8. Identification of bacterial diseases in fish
9. Identification of fungal diseases in fish

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: III
Paper-5
Fish Health Management
Model Question Paper

Time: 3 Hours

Max. Marks: 70

SECTION – A

Answer any FIVE questions.

5 × 4 = 20 Marks

1. Atrophy and hypertrophy
2. Inflammation and healing.
3. Spring Viremia of Carps
4. Enteric Red Mouth (ERM) disease.
5. Ichthyophonus disease.
6. Life cycle and pathogenic effects of Lernaea (Anchor Worm).
7. Chemotherapeutic agents.
8. Albinism and Cystic Kidney Disease in fishes.

SECTION – B

Answer ALL questions. Draw neat diagrams wherever necessary. 5 × 10 = 50 Marks

9. (a) Explain the principles of disease diagnosis and fish health management. Classify fish diseases with suitable examples.

(OR)

9. (b) Describe the disturbances in cell structure, including changes in cell metabolism, degeneration, infiltration, necrosis, and cell death.

10. (a) Discuss the viral diseases of finfish, namely Infectious Hematopoietic Necrosis (IHN) and Infectious Pancreatic Necrosis (IPN), with reference to symptoms, pathology, prevention, and therapy.

(OR)

10. (b) Explain the bacterial diseases Furunculosis, Infectious Abdominal Dropsy, Tail and Fin Rot, Bacterial Gill Disease, and Haemorrhagic Septicemia, with their clinical symptoms, pathology, prevention, and treatment.

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11. (a) Describe Saprolegniasis and Branchiomycosis (Gill Rot), including causative agents, pathology, prevention, and treatment.

(OR)

11. (b) Explain White Spot Disease (Ichthyophthiriasis) and Costiasis with reference to clinical signs, pathology, prevention, and therapy.

12. (a) Discuss the helminth diseases Dactylogyrus and Diplostomum spathaceum, including symptoms, pathology, prevention, and control.

(OR)

12. (b) Describe Argulosis (Fish Louse Infestation), including the causative organism, life cycle, pathology, prevention, and treatment.

13. (a) Explain the nutritional disorders in fishes caused by deficiencies of proteins, essential fatty acids, vitamins, and minerals. Add a note on Fatty Liver Disease.

(OR)

13. (b) Discuss the environmental disorders of fishes, namely Gas Bubble Disease and Asphyxiation, including their causes, symptoms, prevention, and therapy.

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: III
Paper-5
Fish Health Management
Practical Model Question Paper

External Examination Model Paper

Time: 2 Hrs

Max. Marks: 35

- | | |
|---|----------|
| 1. Major: Enumeration of Bacteria by TPC Method. | 15 Marks |
| 2. Minor: Identification One fungal disease in fish | 05 marks |
| 3. Identification One Viral disease in fish | 05 Marks |
| 4. Identification One Bacterial disease in fish | 05 Marks |
| 5. Record & Viva Voce (03+02) | 05 Marks |

Total

35 Marks

Internal Examination

CIA /Internal

15 Marks

Total

50 Marks

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-III
COURSE 6: SHRIMP HEALTH MANAGEMENT

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVES:

- To introduce major viral diseases of shrimp and shellfish along with their symptoms, treatment, and preventive measures.
- To study the occurrence, diagnosis, treatment, and prevention of fungal and bacterial diseases in shellfish.
- To understand protozoan and metazoan parasitic diseases of shellfish, their modes of infection, and control measures.
- To provide knowledge on diagnostic tools, vaccines, quarantine, and preventive health management practices in aquaculture.
- To impart knowledge on production of healthy, disease-free seeds through good management practices.

LEARNING OUTCOMES:

By the completion of the course student will able to –

- Identify common viral infections in shrimp and recommend suitable prophylaxis and therapy.
- Recognize major fungal and bacterial pathogens in shellfish and explain methods for their control.
- Diagnose protozoan and metazoan infestations in shellfish and suggest effective treatment and preventive practices.
- Apply diagnostic and preventive techniques, including immunological and molecular tools, for shellfish health management.
- Evaluate seed quality and apply probiotics, feed management, and zero-water exchange methods to maintain disease-free culture systems.

SYLLABUS:

UNIT- I: Viral Diseases of shell fish (Symptoms, Treatment and Prophylaxis)

1. 1. Major shrimp viral diseases – Baculo-virus penaeid, Monodon Baculo-virus, Baculoviral midgut necrosis
- 1.2. Infectious hypodermal and hematopoietic Necrosis Virus (IHHNV), Hepatopancreatic Parvo like virus

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

1. Observation of gross pathology and external lesions of prawn with reference to the common diseases in aquaculture
2. Examination of pathological changes in gut lumen, hepatopancreas, lymphoid organ, muscles and nerves of prawn and shrimp
3. Collection, processing and analysis of data for epidemiological investigations of viral diseases
4. Bacterial pathogens – isolation, culture and characterization
5. Immunological techniques: ELISA and Agglutination tests
6. Molecular Technique: PCR
7. Estimation of dose, calculation of concentration, methods of administration of various chemotherapeutics to shell fish
8. Identification of Viral diseases in shrimp
9. Identification of bacterial diseases in shrimp
10. Identification of fungal diseases in shrimp

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: III
Paper:- 6
Shrimp Health Management
Model Question Paper

Time: 3 Hours

Max. Marks: 70

SECTION – A

Answer any FIVE questions.

5 × 4 = 20 Marks

1. Baculoviral Midgut Necrosis (BMN).
2. Hepatopancreatic Parvo-like Virus (HPV).
3. Filamentous Bacterial Disease in shrimp
4. Loose Shell Syndrome.
5. Black Gill Disease.
6. Acineta as an ectocommensal protozoan.
7. Quarantine in shellfish.
8. Zero Water Exchange.

SECTION – B

Answer ALL questions. Draw neat diagrams wherever necessary. 5 × 10 = 50 Marks

9. (a) Describe the important viral diseases of shrimp caused by Baculovirus penaei (BP) and Monodon Baculovirus (MBV), with reference to symptoms, treatment, and prophylaxis.
(OR)
9. (b) Explain Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV) and White Spot Syndrome Virus (WSSV) with their symptoms, pathology, prevention, and control.
10. (a) Discuss the bacterial diseases caused by Aeromonas, Pseudomonas, and Vibrio species in shellfish, including symptoms, treatment, and preventive measures.
(OR)
10. (b) Explain Luminous Bacterial Disease, Vibriosis, White Gut Disease (WGD), and Acute Hepatopancreatic Necrosis Disease (AHPND/EMS) with suitable illustrations.
11. (a) Describe the fungal diseases Larval Mycosis (Lagenidium) and Hepatopancreatic Microsporidiosis (HPM), including symptoms, diagnosis, and control measures.
(OR)
11. (b) Discuss the nutritional deficiency disorders of shrimp, namely Soft Shell Syndrome, Blue Disease (Pigment Deficiency Syndrome), Red Disease, and Cramp Tail Syndrome.

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12. (a) Explain the diagnostic tools used in shellfish disease diagnosis, including immune detection methods and DNA/RNA-based techniques.

(OR)

12. (b) Discuss the general preventive methods, prophylaxis, and application of vaccines in shellfish health management.

13. (a) Describe the production of disease-free seeds and explain the evaluation criteria for healthy seeds in aquaculture.

(OR)

13. (b) Discuss the role of good feed management, probiotics, and antibiotics in maintaining the health of cultured shellfish.

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester: III
Paper:- 6
Shrimp Health Management
Practical Examination Model Question Paper

External Examination
Model Paper

Time: 2 Hrs

Max. Marks: 35

- | | |
|--|-----------------|
| 1. Major: Collection, processing and analysis of data for epidemiological investigations of viral diseases . | 15 Marks |
| 2. Minor: Identification One fungal disease | 05 marks |
| 3. Identification One Viral disease | 05 Marks |
| 4. Identification One Bacterial disease | 05 Marks |
| 5. Record & Viva Voce (03+02) | 05 Marks |
| Total | 35 Marks |

Internal Examination

CIA /Internal

15 Marks

Total

50 Marks


M. Vijayalakshmi, B. A. S. I., D. Rupasri, M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-III
COURSE 7: FISH NUTRITION & FEED TECHNOLOGY -

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVES:

- To understand the nutritional requirements and dietary needs of fish and shellfish at different growth stages for optimal production.
- To provide knowledge of various live and artificial feeds used in aquaculture and their applications.
- To familiarize students with feeding devices, feeding schedules, and methods for efficient feed utilization.
- To impart knowledge on feed ingredient selection, feed manufacturing processes, and proper feed storage practices.
- To introduce the role of feed additives, growth promoters, enzymes, binders, and antinutritional factors in aquaculture nutrition.

LEARNING OUTCOMES:

- By the completion of the course student will able to –
- Evaluate nutrient requirements, feeding rates, and formulate balanced diets for cultivable fish and prawns.
- Distinguish different feed types and select suitable feeds for various aquaculture species and developmental stages.
- Design feeding strategies and assess feed efficiency using feed conversion indices.
- Formulate aquafeeds, understand feed processing techniques, and implement measures to prevent feed deterioration.
- Evaluate the use of feed additives and identify factors affecting feed quality and fish health.

SYLLABUS:

UNIT- I: Nutritional requirements of cultivable fish and shell fish

- 1.1. Requirements for energy, proteins, carbohydrates, lipids, fiber, micronutrients for different stages of cultivable fish and prawns
- 1.2. Essential amino acids and fatty acids, nutrient interactions.
- 1.3 . Dietary sources of energy, effect of ration on growth, determination of feeding rate.
- 1.4 . Importance of natural and supplementary feeds, balanced diet.

UNIT- II: Types of feeds

- 2.1. Live foods: Phytoplankton, zooplankton and their role in larval nutrition.
- 2.2. Artificial feeds: wet feeds, moist feeds, dry feeds, mashes, pelleted feeds - floating

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2.3. Water stability feeds, farm made aqua feeds, micro-coated feeds and microencapsulated feeds

3.1. Feeding devices and methods: Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding & tray feeding

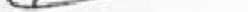
3.2. Feeding schedules: Frequency of feeding, feeding rates and ration size

3.3 evaluation: Feed conversion efficiency and Feed conversion ratio.

- 4.1. Feed ingredients: Selection, nutrient composition and nutrient availability.
- 4.2. Feed formulation – extrusion processing and steam pelleting, grinding, mixing and drying, pelletization, and packing
- 4.3. Microbial, insect and rodent damage of feed, chemical spoilage during storage period and proper storage methods

- 5.1. Binders and anti-oxidants
- 5.2. Feed attractants and feed stimulants
- 5.3. Enzymes and growth promoters
- 5.4. Anti-metabolites and aflatoxins

1. ADCP (Aquaculture Development & Co-ordination Program). 1980. Fish Feed Technology ADCP/REP/80/11 FAO
2. Cyrino EP, Bureau D & Kapoor BG. 2008. *Feeding and Digestive Functions in Fishes*. Science Publ.
3. De Silva SS & Anderson TA. 1995. *Fish Nutrition in Aquaculture*. Chapman & Hall Aquaculture Series.
4. Guillame J, Kaushik S, Bergot P & Metallier R. 2001. *Nutrition and Feeding of Fish and Crustaceans*. Springer Praxis Publ.
5. Halver JE & Tiews KT. 1979. *Finfish Nutrition and Fish feed Technology*. Vols. I, II Heenemann, Berlin.
6. Hertramp JW & Pascual FP. 2000. *Handbook on Ingredients for Aquaculture Feeds*. Kluwer.
7. Jobling M. 1994. *Fish Bioenergetics*. Chapman & Hall.
8. Lavens P & Sorgeloos P. 1996. *Manual on the Production and Use of Live Food for Aquaculture*. FAO Fisheries Tech. Paper 361, FAO.
9. Lovell R.T. 1998. *Nutrition and Feeding of Fishes*, Chapman & Hall, New York
10. *Nutritional Requirements of Warm Water Fishes* National Academy of Sciences, Washington.

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  M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-III
COURSE 7: FISH NUTRITION & FEED TECHNOLOGY

Practical

Credits: 1

2 hrs/week

SYLLABUS

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

M. Vijayalakshmi



B. A. I. L.



D. Rupasri

M. Anitha

M. Vijayalaxmi B. A. D. Rupasri
  M. Anitha

12. (a) Describe the selection of feed ingredients and explain the feed formulation process, including grinding, mixing, drying, extrusion, steam pelleting, pelletization, and packing.

(OR)

12. (b) Discuss the causes of feed spoilage during storage, including microbial, insect, rodent, and chemical damage, and explain proper feed storage methods.

13. (a) Discuss the role of feed attractants, feed stimulants, enzymes, and growth promoters in aquaculture nutrition.

(OR)

13. (b) Explain the importance of anti-oxidants and discuss the role of anti-metabolites in aquaculture feeds.

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M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: III
Paper-7
Fish Nutrition & Feed Technology
Practical Examination Model Question Paper

External examination Model Paper

Time: 2 Hrs

Max. Marks: 35

- | | |
|---|-----------------|
| 1. Major: Estimation of lipid content in aquaculture feeds. | 15 Marks |
| 2. Minor: Feed Packing material study | 05 marks |
| 3. Binders any one- Identification-characteristics | 05 Marks |
| 4. Floating/sinking feed characteristics | 05 Marks |
| 5. Record & Viva Voce (03+02) | 05 Marks |
| Total | 35 Marks |

Internal Examination

CIA /Internal

15 Marks

Total

50 Marks


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3 hrs/week

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- 2.2. Innate and Adaptive immune mechanisms in fish.
- 2.3. Properties of antigens
- 2.4. Immunoglobulins (Antibodies); structure and functions of IgM, IgD and teleost specific Ig Z
- 2.5 Major Histocompatibility Complex (**MHC**): Structure and function of MHC molecules in antigen presentation.

Unit- 3: Immune Response in Fish

- 3.1. Cell mediated immunity
- 3.2. Humoral immunity
- 3.3. Influence of environmental factors- impact of temperature, stress and pollutants
- 3.4. Immunological memory and tolerance

Unit- 4: Vaccines and Immunostimulants

- 4.1. Principles of fish vaccination.
- 4.2. Types of vaccines (inactivated, live-attenuated, subunit, and DNA vaccines).
- 4.3. Methods of vaccine administration (injection, immersion, oral).
- 4.4. Types of immunostimulants (e.g., β -glucans, nucleotides), Role of adjuvants in enhancing vaccine efficacy.

Unit- 5: Modern research techniques

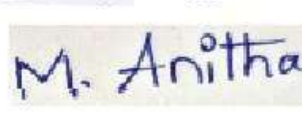
- 5.1. Techniques for measuring immune parameters (e.g., ELISA, flow cytometry, cytokine measurement)
- 5.2. Genetics and Immunogenetics: The genetic basis of disease resistance and how selective breeding can be used to improve fish health.
- 5.3. Hypersensitivity and auto immunity in fish
- 5.4. Acute and chronic inflammatory responses

Prescribed Books:

1. Anderson, D.P. (1992). *Fish Immunology*. T.F.H. Publications.
2. Abbas, A.K., Lichtman, A.H., & Pillai, S. (2022). *Cellular and Molecular Immunology*. Elsevier
3. Ellis, A.E. (1989). *Immunology of Teleosts*. Academic Press
4. Gudding, R., Lillehaug, A., & Evensen, (2014). *Fish Vaccination*. Wiley-Blackwell.
5. Magnadottir, B. (2010). *Immunological Control of Fish Diseases*. Springer.
6. Roitt, I., Brostoff, J., & Male, D. (2011). *Immunology*. 7th Edition. Mosby Elsevier.
7. Rombout, J.H.W.M., Kiron, V., & Kaattari, S. (2014). *Fish Immunology*. CRC Press.
8. Sakai, M. (2016). *Aquatic Animal Immunology*. Springer.
9. Savan, R., Sakai, M. & Secombes, C.J. (2020). *Advances in Fish Immunology*. Academic Press





KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-IV
COURSE 8: FISH IMMUNOLOGY

Practical Credits: 1 2 hrs/week

SYLLABUS

1. Microscopic observation of fish blood cells (leukocytes, erythrocytes, thrombocytes) – staining with Giemsa/Wright stain.
2. Differential leukocyte count in fish blood smears.
3. Identification of lymphoid organs (thymus, head kidney, spleen) through dissections and histological slides.
4. Preparation and observation of mucus smear from fish skin and gills (barrier defense).
5. Study of immune system development in larvae – observation of histological sections at different developmental stages (if available).
6. Estimation of lysozyme activity (as a measure of innate immunity)
7. Agglutination test with fish serum and RBCs (to demonstrate antibodies).
8. Demonstration of antigen-antibody reaction (precipitation test/gel diffusion method).
9. Demonstration of vaccine preparation and adjuvant mixing (using inactivated antigen suspensions, for training only).
10. Enzyme Linked Immunosorbent Assay (ELISA) demonstration for antibody detection.

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: IV
Paper-8
Fish Immunology
Model Question Paper

Time: 3 Hours

Max. Marks: 70

SECTION – A

Answer any FIVE questions.

5 × 4 = 20 Marks

1. Innate immunity and adaptive immunity.
2. Natural Killer (NK) cells in fish.
3. Antigens and their properties.
4. IgZ, the teleost-specific immunoglobulin.
5. Cell-mediated immunity and Humoral immunity.
6. Fish vaccines.
7. Immunostimulants with two examples.
8. Hypersensitivity in fish.

SECTION – B

Answer ALL questions. Draw neat diagrams wherever necessary.

5 × 10 = 50 Marks

9. (a) Explain the cells and organs of the fish immune system, including primary and secondary lymphoid organs, with suitable diagrams.

(OR)

9. (b) Describe the ontogeny of the immune system in fish from larval stages to adults.

10. (a) Discuss the physical and chemical barriers involved in innate immunity of fish. Explain the innate and adaptive immune mechanisms.

(OR)

10. (b) Describe the structure and functions of immunoglobulins (IgM, IgD, and IgZ) and explain the role of the Major Histocompatibility Complex (MHC) in antigen presentation.

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11. (a) Explain the influence of environmental factors, such as temperature, stress, and pollutants, on the immune response of fish.

(OR)

11. (b) Discuss immunological memory and immune tolerance in fish with suitable examples.

12. (a) Explain the principles of fish vaccination and describe the different methods of vaccine administration, including injection, immersion, and oral vaccination.

(OR)

12. (b) Discuss the role of adjuvants in vaccines and explain the importance of immunostimulants in fish health management.

13. (a) Describe the techniques used for measuring immune parameters in fish, including ELISA, flow cytometry, and cytokine measurement.

(OR)

13. (b) Discuss the genetic basis of disease resistance in fish and explain the role of selective breeding in improving fish health. Add a note on acute and chronic inflammatory responses.

M. Vijayalakshmi



B. A. S. S.



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M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: IV
Paper-8
Fish Immunology
Practical Examination Model Question Paper

External examination Model Paper

Time: 2 Hrs

Max. Marks: 35

- | | |
|---|-----------------|
| 1. Major: Enzyme Linked Immunosorbent Assay (ELISA) demonstration for antibody detection. | 15 Marks |
| 2. Minor: Estimation of lysozyme activity | 10 Marks |
| 3. Lymphoid organ identification-chart/image -characteristics | 05 Marks |
| 4. Record & Viva Voce (03+02) | 05 Marks |
| Total | 35 Marks |

Internal Examination

CIA /Internal

15 Marks


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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-IV
COURSE 9: FISH PROCESSING TECHNOLOGY

THEORY

Credits: 3

3hrs/week

COURSE OBJECTIVES:

- To understand the biochemical composition of fish, post-mortem changes, and fundamental principles of fish preservation methods.
- To study microbial spoilage in fish and the role of microorganisms in fish preservation and food safety.
- To impart knowledge on handling, storage, transport, and traditional and modern methods of fish preservation.
- To familiarize students with quality assurance systems, food safety standards, and certification procedures in seafood processing.
- To provide knowledge on packaging, cold storage, transportation, and export procedures of fishery products.

LEARNING OUTCOMES:

- Students will be able to explain fish biochemical constituents, spoilage mechanisms, and preservation principles used in fisheries processing.
- Students will be able to identify spoilage microorganisms, factors affecting spoilage, and preventive measures for maintaining fish quality.
- Students will be able to apply suitable fish handling and preservation techniques for extending shelf life and maintaining quality.
- Students will be able to implement quality management practices and understand national and international seafood safety regulation
- Students will be able to evaluate packaging systems, cold chain management, and export requirements for fishery products from India.

SYLLABUS:

UNIT -1: Process Biochemistry

- 1.1. Major and minor constituents of fish, their distribution and function-moisture, proteins, lipids, carbohydrates, vitamins and minerals.
- 1.2. Post-mortem biochemical changes in fish: Rigor mortis, Autolysis, Autooxidation

M. Vijayakumar *B. A. S. S.* *D. Rupasri*
[Signature] *[Signature]* *M. Anitha*

1.3. Principles of fish preservation- Cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays

2.1. Biochemical and microbial spoilage of fish

2.3. Role of bacteria and moulds in fish preservation-pathogenic organisms encountered products, faecal indicator organisms. **UNIT – III: Handling and Fish Preservation**

3.1. Handling, storage and transport of fresh fish

3.3 Modern techniques employed in fish preservation: Chilling, Canning, Accelerated Freeze Drying (AFD), Irradiation.

4.1. Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs)

4.3. National and International Standards - ISO 9000 Series, 2000 Series of Quality Assurance System

V: Packing, Cold Storage and Export of Fishery Products:

5.2. Different types of cold storages, Insulated and refrigerated vehicles.

5.4. Prospects and constraints in export including tariff and non- tariff barriers, marine insurance, export incentives, registered exporters

1. M. Martin, Fisheries – Processing Chapman & Hall, Madras

4. Ed. G. M. Hall – Fish Processing Technology Chopra & Hall. Madras

5. Gopakumar, K. Fish Processing Technology, ICAR, New Delhi

6. Gopakumar, K. Fish Packaging Technology

7. K.K. Balachandran Fish Canning – Principles & Practices.

8. K.K. Balachandran, Postharvest Technology in Fish and Fishery Products.

9. T.K. Govindan, Fish Processing Technology Oxford & IBH Publication Co.

M. Vijayalaxmi

B. A. l.

D. Rupasri

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M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-IV
COURSE 9: FISH PROCESSING TECHNOLOGY

Practical

Credits: 1

2 hrs/week

SYLLABUS

1. Determination of moisture content in fish and fishery products
2. Processing fish
3. Filleting of fish
4. Drying of fish
5. Organoleptic analysis of fish
7. Preparation of fishery by products
8. Preparation of shark fin rays, fish maws, chitin, fish wafer
9. Fish pickling
10. Value added fishery products, fish curry, cutlets fish finger.

Field visit:

1. Visit to sea food pre-processing plants
2. Visit to fish processing plants

M. Vijayalakshmi



B. A. S. S. S.



D. Rupasri

M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: IV
Paper-9
Fish Processing Technology
Model Question Paper

Time: 3 Hours

Max. Marks: 70

SECTION – A

Answer any FIVE questions.

5 × 4 = 20 Marks

1. Rigor mortis in fish.
2. Fish preservatives used in fish preservation.
3. Faecal indicator organisms and their significance.
4. Sun drying and smoking of fish.
5. Good Manufacturing Practices-GMPs
6. Codex Alimentarius Commission in seafood safety
7. Labelling requirements for fishery products.
8. Four major fishery products exported from India.

SECTION – B

Answer ALL questions. Draw neat diagrams wherever necessary.

5 × 10 = 50 Marks

9. (a) Explain the major and minor constituents of fish, including moisture, proteins, lipids, carbohydrates, vitamins, and minerals, and discuss their functions.

(OR)

9. (b) Describe the principles of fish preservation, including cleaning, temperature control, salting, chemical preservatives, and irradiation.

10. (a) Discuss the biochemical and microbial spoilage of fish and explain the factors affecting fish spoilage with suitable examples.

(OR)

10. (b) Explain the role of bacteria and moulds in fish preservation. Add a note on pathogenic microorganisms encountered in fish products.

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[Signature] *[Signature]* *M. Anitha*

11. (a) Describe the handling, storage, and transport of fresh fish to maintain quality and freshness.

(OR)

11. (b) Explain the modern methods of fish preservation, including chilling, canning, accelerated freeze drying (AFD), and irradiation.

12. (a) Discuss Good Laboratory Practices (GLPs), Standard Operating Procedures (SOPs), and their importance in seafood quality management.

(OR)

12. (b) Explain the Hazard Analysis and Critical Control Points (HACCP) system and discuss the ISO 9000/2000 Quality Assurance System in seafood processing.

13. (a) Describe the types of packing materials, their quality evaluation, and explain the different types of cold storage systems used for fish and fishery products.

(OR)

13. (b) Discuss the export of fishery products from India, including export procedures, export documents, tariff and non-tariff barriers, marine insurance, export incentives, and registered exporters.

M. Vijayalakshmi

B. A. S. S.

D. Rupasri





M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: IV
Paper-9
Fish Processing Technology
Practical Examinations Model Question Paper

External examination Model Paper

Time: 2 Hrs

Max. Marks: 35

- | | |
|--|-----------------|
| 1. Major: Determination of moisture content in fish and fishery products | 15 Marks |
| 2. Minor: Any one fish by product | 05 Marks |
| 3. Any one – Fish value added product | 05 Marks |
| 4. Drying/filleting | 05 Marks |
| 5. Record & Viva Voce (03+02) | 05 Marks |
| Total | 35 Marks |

Internal Examination

CIA /Internal

15 Marks


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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
SEMESTER-IV

COURSE 10: ECONOMICS, MARKETING AND EXTENSION

THEORY

Credits: 3

3hrs/week

COURSE OBJECTIVES:

- To introduce economic principles and their application in fisheries.
- To learn the economics of fish farming and fishing communities.
- To familiarize students with fish marketing systems, price determination, and marketing institutions in fisheries.
- To study fisheries extension, funding, and entrepreneurship.
- To impart knowledge on technology transfer mechanisms and the role of fisheries development agencies and communication tools.

LEARNING OUTCOMES:

By the completion of the course student will able to –

- Analyse demand, supply, production functions, costs, budgeting, and profitability in aquaculture systems
- Evaluate farm economics, calculate unit costs, and assess the role of institutions in fisheries development
- Assess marketing channels, pricing mechanisms, and the functions of primary and secondary marketing institutions.
- Identify extension approaches, funding opportunities, and entrepreneurial prospects in the fisheries sector.
- Explain technology dissemination and institutional roles in fisheries.

SYLLABUS:

UNIT – I: Principles of Aquaculture Economics

- 1.1. Basic concepts of economics, demand and supply, elasticity of demand, and interrelationships of aquaculture systems.
- 1.2. Theory of production, production functions in fisheries, input–output relationships
- 1.3. Production costs, fixed and variable costs, cost–benefit analysis
- 1.4. Partial budgeting, cash flow analysis

UNIT – II: Fisheries Economics

- 2.1. Economics of carp production farm (Unit costs).
- 2.2. Economics of a shrimp farm and freshwater prawn farm
- 2.3. Socio-economic conditions of fishermen in Andhra Pradesh and the role of Matsyafed, NABARD, and fishermen cooperatives in fisheries development.

UNIT – III: Fisheries Marketing and Investment Economics


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- 3.1. Basic concepts and functions of fish marketing, fish marketing methods in India, market survey, and test marketing.
- 3.2. Fish marketing – Prices and price determination of fishes
- 3.3. Marketing institutions- Primary -producer fishermen, fishermen cooperatives, and fisheries corporations
- 3.4. Marketing institutions - Secondary - merchant/agent/speculative middlemen

UNIT – IV: Fisheries Extension and Development

- 4.1. Fisheries training and Education in India: Training Institutes, Universities, Research organizations.
- 4.2. Institutional funding to fisheries and aquaculture sector
- 4.3. Fisheries extension methods and rural development
- 4.4. Entrepreneurship Development in Fisheries- Small-scale fisheries enterprises, Financial support and schemes

UNIT – V: Transfer of Technology and Fisheries Development Agencies

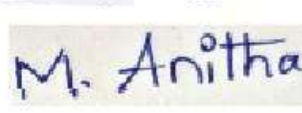
- 5.1. ICAR programs – Research- Central Institute of Freshwater Aquaculture; Training - KVK, Extension- Front Line Demonstrations (FLDs) and On-Farm Testing (OFT)
- 5.2. DAATT centres and their role in tot programs
- 5.3. Video conferencing, education of farmers through print and electronic media

REFERENCE BOOKS

1. Allen, et al.(Eds). 1984. *Bio-Economics of Aquaculture*. Elsevier Publ.
2. Chaston I. 1984. *Business Management in Fisheries and Aquaculture*, Fishing News Books.
3. **Dey, M.M. & Garcia, Y.T. (2004).** *Fish Marketing Systems and Development*. Oxford & IBH Publishing.
4. **Gupta, O.P. (2010).** *Fisheries Economics and Management*. ABD Publishers.
5. Hephher B and Pruginin Y. 1989. *Commercial Fish Farming*. Wiley-Interscience.
6. Ian C. 1984. *Marketing in Fisheries and Aquaculture*. Fishing News Books.
7. Kumar D. 1996. *Aquaculture Extension Services Review: India*. FAO Fisheries Circular No. 906, Rome.
8. Meade JW. 1989. *Aquaculture Management* Van Nostrand, New York.
9. Pillay TVR. 1990. *Aquaculture Principles and Practices*. Fishing News Books Ltd. London
10. Ray GL. 2006. *Extension, Communication and Management*. 6th Ed. Kalyani Publ. Delhi.
11. Shang YC. 1990. *Aquaculture Economic Analysis - An Introduction*. World Aquaculture Society, USA.
12. Sathiadhas, R. (2009). *Fisheries Economics and Marketing in India*. Central Marine Fisheries Research Institute (CMFRI).
13. Srinath, K. & Sathiadhas, R. (2003). *Economics of Fishing Operations*. CMFRI, Kochi.





KRISHNA UNIVERSITY
B.Sc. Aquaculture(Honours): Major
SEMESTER-IV
COURSE 10: - ECONOMICS, MARKETING AND EXTENSION

Practical Credits: 1 2 hrs/week

SYLLABUS:

1. Demand, supply, and elasticity calculations for fish products.
2. Cost-benefit analysis of an aquaculture farm.
3. Preparation of cash-flow and partial budgeting statements.
4. Estimation of unit cost of carp production.
5. Economic analysis of shrimp/freshwater prawn farming.
6. Socio-economic survey of fishermen communities.
7. Fish market survey and marketing channel analysis.
8. Fish price data collection and price trend analysis.
9. Preparation of fisheries extension materials and business plans.
10. Visit report on KVK/ICAR/DAATTC and technology transfer activities.

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KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: IV
Paper-10 Economics, Marketing and Extension
Model Question Paper

Time: 3 Hours

Max. Marks: 70

SECTION – A

Answer any FIVE questions.

5 × 4 = 20 Marks

1. Demand and Supply.
2. Fixed costs and variable costs.
3. Economics of freshwater prawn farming.
4. Functions of fish marketing
5. Role of middlemen in fish marketing.
6. Institutional funding for the fisheries sector.
7. Front Line Demonstrations (FLDs).
8. Role of video conferencing and electronic media in fisheries extension.

SECTION – B

Answer ALL questions. Draw neat diagrams wherever necessary.

5 × 10 = 50 Marks

9. (a) Explain the basic concepts of economics, including demand, supply, elasticity of demand, and the interrelationship of aquaculture systems.

(OR)

9. (b) Discuss the theory of production, production functions in fisheries, input–output relationships, cost–benefit analysis, and partial budgeting.

10. (a) Explain the economics of carp farming with reference to unit costs, production costs, and profitability.

(OR)

10. (b) Discuss the socio-economic conditions of fishermen in Andhra Pradesh and explain the role of Matsyafed, NABARD, and fishermen cooperatives in fisheries development.

11. (a) Describe the fish marketing system in India, including marketing methods, market survey, test marketing, and price determination.

(OR)

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[Signature] *[Signature]* *M. Anitha*

11. (b) Discuss the role of primary marketing institutions, including producer fishermen, fishermen cooperatives, and fisheries corporations, in fish marketing.

12. (a) Explain the fisheries training and education system in India, highlighting the role of training institutes, universities, and research organizations.

(OR)

12. (b) Discuss fisheries extension methods, rural development, and entrepreneurship development in fisheries, including financial support and government schemes.

13. (a) Explain the ICAR programmes in fisheries with special reference to the Central Institute of Freshwater Aquaculture (CIFA), Krishi Vigyan Kendras (KVKs), On-Farm Testing (OFT), and Front Line Demonstrations (FLDs).

(OR)

13. (b) Describe the role of DAATTC centres in technology transfer and explain the use of print and electronic media in fisheries extension programmes.

M. Vijayalakshmi



B. A. S. S.



D. Rupasri

M. Anitha

KRISHNA UNIVERSITY
B.Sc. Aquaculture (Honours): Major
Semester End Examination
Semester: IV
Paper-10: Economics, Marketing and Extension
Practical Examinations Model Question Paper

External examination Model Paper

Time: 2 Hrs

Max. Marks: 35

- | | |
|---|-----------------|
| 1. Major: Preparation of cash-flow and partial budgeting statements | 15 Marks |
| 2. Minor: Fish price trend analysis | 05 Marks |
| 3. Any one – Extension material | 05 Marks |
| 4. Fish Market survey | 05 Marks |
| 5. Record & Viva Voce (03+02) | 05 Marks |
| Total | 35 Marks |

Internal Examination

CIA /Internal

15 Marks


The bottom of the page features five handwritten signatures. From left to right, they are: 'M. Vijayalakshmi' in blue ink, a signature in blue ink that appears to be 'B. A. ...', 'D. Rupasri' in blue ink, a signature in blue ink that appears to be 'M. Anitha', and 'M. Anitha' in blue ink on a yellow sticky note.



Krishna University

కృష్ణ విశ్వవిద్యాలయం

(Established under AP Act No. 29 of 2008)

Machilipatnam, Andhra Pradesh, India - 521004



**Syllabus for B.Sc. Aquaculture as MINOR in
consonance with Curriculum framework w.e.f. AY 2025-26**

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	1	Basic Principles and Practices of Aquaculture	3	3
			Basic Principles and Practices of Aquaculture-Practical	2	1
	IV	2	Biology of Finfish and Shellfish	3	3
			Biology of Finfish and Shellfish-Practical	2	1
III	V	3	Freshwater Aquaculture	3	3
			Freshwater Aquaculture-Practical	2	1
		4	Brackishwater Aquaculture and Mariculture	3	3
			Brackishwater Aquaculture and Mariculture-Practical	2	1
	VI	5	Fish Nutrition and Feed Technology	3	3
			Fish Nutrition and Feed Technology-Practical	2	1
		6	Fish Processing Technology	3	3
			Fish Processing Technology-Practical	2	1

M. Vijayalaxmi

B. A. S. S.

D. Rupasri

M. Anitha

B.Sc. Aquaculture- Minor
SEMESTER-III

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 Sampada Yojana (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

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[Signature] [Signature] M. Anitha

- 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, CO₂, orthophosphates, NH₃, NO₂) 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*. Elsevier Scientific Publ.
6. Bose AN et.al, 1991. *Costal Aquaculture Engineering*. Oxford & IBH Publishing Company.

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M. Anitha

B.Sc. Aquaculture- Minor
SEMESTER-III
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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  M. Anitha

KRISHNA UNIVERSITY
B. Sc, AQUACULTURE: Minor
SEMESTER- III
MODEL QUESTION PAPER COURSE: 1
BASIC PRINCIPLES AND PRACTICES OF AQUACULTURE

Time: 3 Hrs

Max. Marks: 70

SECTION-A

Answer any FIVE questions

5×4 = 20M

1. Pradhan Mantri Matsya Sampada Yojana (PMMSY)
2. 3C system - culture
3. Characteristics of Ideal Pond
4. Importance of liming in Pond preparation
5. Control of aquatic weeds
6. Polyculture
7. Predatory fish control
8. Characteristics of plankton in the pond

SECTION-B

Answer ALL questions Draw diagrams wherever necessary

5x10M = 50M

- 9 (a). Describe the concept of Blue revolution, with a note on its importance.
(OR)
(b). Write an essay on the current status of Aquaculture in India
- 10 (a) Describe i) Cage Culture ii) Bio floc Technology
(OR)
(b) Write notes on i) Extensive Culture ii) Super Intensive Culture
- 11 (a) Explain the Criteria for the selection of site for freshwater pond farm.
(OR)
(b) Write an essay on the design of a shrimp hatchery
- 12 (a) Write an essay physico- chemical parameter of water for a fresh water culture pond.
(OR)
(b) Write an essay on Significance of soil characteristics and their optimal levels for aquaculture
- 13 (a) Write an essay disadvantage of aquatic insects and a note on their control.
(OR)
(b) Explain formation of algal blooms. Add a note on their control.

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[Signature] *[Signature]* *M. Anitha*

KRISHNA UNIVERSITY
B.Sc, AQUACULTURE: Minor
SEMESTER- III
PRACTICAL MODEL QUESTION PAPER COURSE: 1 BASIC PRINCIPLES AND
PRACTICES OF AQUACULTURE
Laboratory course

**External
Model Paper**

Time: 2 Hrs

Max. Marks:35

- | | |
|---|----------|
| 1. Major: Estimation of Dissolved Oxygen in pond water. | 15 Marks |
| 2. Algae/ Zooplankton/ Phytoplankton:
identification notes | 05 Marks |
| 3. Aquatic weed/ Aquatic insect Identification notes | 05 Marks |
| 4. Filed visit Book | 05 Marks |
| 5. Record & Viva Voce (03+02) | 05 Marks |

Total

35 Marks

CIA

Internal

15 Marks

Total

50 Marks

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M. Anitha

B.Sc. Aquaculture- Minor
SEMESTER-IV
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.

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- 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

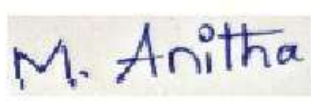
- 4.1. Natural food and feeding habits of commercially important fishes and shrimp.
- 4.2. Methods of determination of age and growth in fishes - scale method, otolith method, skeletal parts as age indicators
- 4.3. Factors affecting growth in fish and shrimp.
- 4.4. Molting and molting stages in shrimp.

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.
- 5.5.

REFERENCE BOOKS:

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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.
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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.

M. Vijayalaxmi B.A. D. Rupasri
  
M. Anitha

B.Sc. Aquaculture- Minor
SEMESTER-IV
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
-

M. Vijayakumar

B. A. S. S.

D. Rupasri





M. Anitha

KRISHNA UNIVERSITY
B. Sc. AQUACULTURE: Minor
SEMESTER- IV
MODEL QUESTION PAPER COURSE: 2
BIOLOGY OF FINFISH & SHELLFISH

Time: 3 Hrs

Max. Marks: 70

SECTION-A

Answer any FIVE questions

5×4 = 20M

1. Scales of Fishes
2. Gaseous exchange in Shrimp
3. Gaseous exchange in Shrimp
4. Internal ear of Fish
5. Compound eye of Shrimp
6. Moulting stages in shrimp
7. Breeding habits of Fish
8. Factors affecting the growth of shrimp

Answer ALL questions Draw diagrams wherever necessary

5x10M = 50M

- 9 (a). Describe the concept of Blue revolution, with a note on its importance.
(OR)
(b). Write an essay on the current status of Aquaculture in India
- 10 (a) Describe Structure of Heart in fish
(OR)
(b) Write an essay on the neurosecretory system of shrimp
- 11 (a) Explain the Excretory system in fish.
(OR)
(b) Write an essay on the reproductive structures of shrimp
- 12 (a) Write an essay age determination of fish by scale method.
(OR)
(b) Write an essay on feeding habits of commercially important fish
- 13 (a) Write an essay on Parental care in fishes.
(OR)
(b) Explain the life cycle of shrimp.

M. Vijayalaxmi *B. A. S. S.* *D. Rupasri*
[Signature] *[Signature]* *M. Anitha*

KRISHNA UNIVERSITY
B.Sc ., Honours AQUACULTURE: Minor
SEMESTER- IV
PRACTICAL MODEL QUESTION PAPER
COURSE: 2 BIOLOGY OF FINFISH & SHELLFISH
Laboratory course

External Examination
Model Paper

Time: 2 Hrs

Max. Marks: 35

1. Major: Gut Content analysis of Fish	15 Marks
2. Minor: Mouth parts of Shrimp	05 marks
3. Fish Egg / Shrimp Egg Identification	05 Marks
4. Crustacean Larve/ Maturity stages of Fish	05 Marks
5. Record & Viva Voce (03+02)	05 Marks
Total	35 Marks

Internal Examination

CIA /Internal

15 Marks

Total

50 Marks

M. Vijayalaxmi B. A. D. Rupasri
M. Anitha