

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA, VIJAYAWADA
(An autonomous college in the jurisdiction of Krishna University)

DEPARTMENT OF ZOOLOGY

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA, VIJAYAWADA.

(An autonomous college in the jurisdiction of Krishna University)

AQUACULTURE TECHNOLOGY

COURSE STRUCTURE BSC – AZC PROGRAMME UNDER CBCS

(w.e.f. 2020-2021)

AQUACULTURE	AQT T11A	2020-21	B.Sc., AZC
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SEMESTER- I

PAPER- I

BASIC PRINCIPLES OF AQUACULTURE (NEW SYLLABUS)

UNIT-I (11 HOURS) ONLINE

1.0. Introduction

- 1.1. Definition and History of Aquaculture **1 Hour**
- 1.2. Concept of Blue Revolution and Pradhan Mantri Matsya Sampada Yojana (PMMSY) **1 Hour**
- 1.3. Present status of Aquaculture at global level, India and Andhra Pradesh **2 Hours**
- 1.4. Aquaculture versus Agriculture; Present day needs with special reference to Andhra Pradesh **2 Hours**
- 1.5. Aquaculture resources: Ponds, tanks, lakes, reservoirs etc. **2 Hours**
- 1.6. Capture and Culture fisheries; Advantages of culture fishery over capture fishery **3 Hours**

UNIT-II (11 HOURS) ONLINE

2.0. Types of Fish Ponds

- 2.1. Lotic and lentic systems, streams and springs **2 Hours**
- 2.2. Classification of ponds based on water resources – spring, rain water, flood water, well water and water course ponds **3 Hours**
- 2.3. Functional classification of ponds – head pond, hatchery, nursery, rearing, production and stocking ponds; quarantine ponds, isolation ponds and wintering ponds **5 Hours**
- 2.4. Hatchery design **1 Hour**

UNIT- III (10 HOURS) ONLINE

3.0. Design and Construction of Aqua Farms

- 3.1. Important factors in the construction of an ideal fish pond – site selection, topography, nature of the soil, water resources **3 Hours**
- 3.2. Lay out and arrangement of ponds in a fish farm **4 Hours**
- 3.3. Construction of an ideal fish pond – space allocation, structure and components of barrage Pond **3 Hours**

UNIT-IV (14 HOURS)

4.0. Aquaculture Systems and Practices

- 4.1. Types of aquaculture **3 Hours**
- 4.1.1. Fresh water aquaculture
- 4.1.2. Brackish water aquaculture
- 4.1.3. Mariculture
- 4.2. Aquaculture Systems – Pond, Raceways, Cage, Pen, Rafts, Running water, Water Recirculating Systems, Biofloc Technology and 3-C System **5 Hours**
- 4.3. Pond culture practices- Traditional, Extensive, Modified Extensive, Semi-Intensive, Intensive &

- Super-intensive systems of fish and shrimp and their significance. **2 Hours**
- 4.4. Fin fish culture methods - Monoculture, Polyculture and Monosex culture and Integrated fish farming. **ONLINE 4 Hours**

UNIT-V (14 HOURS)

5.0. Management Factors of Culture Ponds

5.1. Pre-stocking Management

- 5.1.1. Dewatering, drying, ploughing/desilting **1 Hour**
- 5.1.2. Liming and fertilization; Need of fertilizer and manure application, NPK contents of different fertilizers and manures and precautions in their Application **2 Hours**

- 5.1.3. Predators, weeds and weed fish in culture ponds - Advantages and disadvantages of weed plants; Toxins used for weed control and control of predators. **4 Hours**

- 5.1.4. Algal blooms and their control **2 Hours**

- 5.2. **Stocking Management** – Stocking density and stocking **1 Hour**

5.3. Post-stocking Management

- 5.3.1. Feeding: Role of nutrients **1 Hour**
- 5.3.2. Water quality: Physico-chemical conditions of soil and water optimum for culture – temperature, depth, turbidity, light, water and shore currents, PH, DOD, CO₂, NH₃, NO₂ and nutrients **2 Hours**
- 5.3.3. Measures to increase oxygen and reduce ammonia & hydrogen sulphide in culture ponds; correction of PH **1 Hour**

PRESCRIBED BOOK(S):

1. Jhingran VG 1998. Fish and Fisheries of India. Hindusthan Publishing Corporation, New Delhi
2. Pillay TVR, 1996. Aquaculture Principles and Practices, Fishing News Books Ltd., London

REFERENCES:

1. Pillay TVR & M.A.Dill, 1979. Advances in Aquaculture. Fishing News Books Ltd., London
2. Stickney RR 1979. Principles of Warm Water Aquaculture. John Wiley & Sons Inc. 1981
3. Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing
4. Bose AN et.al, 1991. Costal Aquaculture Engineering. Oxford & IBH Publishing Company.

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SEMESTER-I

PRACTICAL - I

TITLE OF THE PAPER: BASIC PRINCIPLES OF AQUACULTURE

NEW SYLLABUS

NO OF HOURS: 30

CREDITS: 01

1. Estimation of Carbonates, Bicarbonates in water samples
2. Estimation of Chlorides in water samples
3. Estimation of Dissolved Oxygen
4. Estimation of Ammonia in water.
5. Estimation of Total Hardness of water sample.
6. Determination of soil Nitrogen and Phosphorus.
7. Study of beneficial and harmful algal species
8. Study of aeration devices
9. Collection, identification and isolation of zooplankton and phytoplankton
10. Collection and study of aquatic weeds, aquatic insects, weed fish and larvivorous fish
11. Study of fish species banned from culture (*Clarius gariepinus*, *Hypostomus plecostomus*)
12. Field visit to hatchery, nursery, rearing and stocking ponds of aqua farms.

PRESCRIBED BOOK(S):

1. Jhingran VG 1998. Fish and Fisheries of India, Hindustan Publishing Corporation, New Delhi
2. Pillay TVR, 1996. Aquaculture Principles and Practices, Fishing News Books Ltd., London

REFERENCES

1. Boyd CE. 1979. *Water Quality in Warm Water Fish Ponds*. Auburn University
2. Boyd, CE. 1982. *Water Quality Management for Pond Fish Culture*. Elsevier Sci. Publ. Co.
3. FAO. 2007. *Manual on Freshwater Prawn Farming*.
4. ICAR. 2006. *Hand Book of Fisheries and Aquaculture*. ICAR.
5. Lovell RT.1998. *Nutrition and Feeding of fishes*. Chapman & Hall.
6. Mevey JP. 1983. *Handbook of Mariculture*. CRC Press.
7. MPEDA: *Handbooks on culture of carp, shrimp, etc.*
8. Bose AN et.al., 1991. *Costal Aquaculture Engineering*. Oxford & IBH Publishing Company Pvt.Ltd.
9. Stickney RR 1979. *Principles of Warm Water Aquaculture*. John Wiley & Sons Inc. 1981
10. Pillay TVR & M.A.Dill, 1979. *Advances in Aquaculture*. Fishing News Books Ltd., London

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AQUACULTURE	AQT T21	2020-21	B.Sc., AZC
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UNIT-I (11 HOURS)**1.0. Introduction ONLINE****1.1. Classification of Finfish and Shell fish**1.1.1. Classification of fishes up to the level of Class. **1 Hour**1.1.2. Classification of crustaceans up to the level of Class **1 Hour****1.2. Fin fish and Shell fish of Commercial Importance**1.2.1. Cultivable fin fish **2 Hours**1.2.2. Cultivable shell fish **1 Hour****1.3. Sense organs of fishes and crustaceans** **2 Hours****1.4. Specialized organs in fishes – electric organ, venom and toxins** **2 Hours****1.5. Buoyancy in fishes- swim bladder and mechanism of gas secretion** **2 Hours****UNIT-II (17 HOURS) ONLINE****2.0. Food, Feeding and Growth**2.1.1. Natural fish food **2 Hours**2.1.2. Feeding habits, feeding intensity, stimuli for feeding, utilization of food **2 Hours**2.1.3. Gut content analysis **1 Hour**2.1.4. Structural modifications in relation to feeding habits **1 Hour**2.1.5. Forage ratio and food selectivity index **1 Hour****2.1. Age and Growth**2.1.1. Principles of Age and growth determination **1 Hour**2.1.2. Growth regulation **1 Hour**2.1.3. Growth rate measurement – scale method, otolith method, skeletal parts as age indicators **1 Hour****2.2. Genetic, biotic & ecological factors in determining the longevity of fishes**2.2.1. Length frequency method, age composition, age-length keys, absolute and specific growth, back calculation of length and growth, annual survival rate, asymptomatic length, fitting of growth curve **5 Hours**2.2.2. Length-weight relationship **1 Hour**2.2.3. Condition factor/Ponderal index, relative condition factor **1 Hour****UNIT-III (9 HOURS) ONLINE****3.0. Reproductive Biology****3.1. Breeding in Fishes**3.1.1. Breeding habits & breeding grounds **1 Hour**3.1.2. Breeding in natural environment and in artificial ponds, courtship reproductive cycles **1 Hour**3.1.3. Induced breeding in fishes **1 Hour****3.2. Breeding in shrimp** **1 Hour****3.3. Breeding in pearl oyster** **1 Hour****UNIT – IV (12 HOURS)****4.0. Development**4.1. Ovo-viviparity, oviparity, viviparity in fishes **2 Hours**4.2. Parental care in fishes, nest building and brooding **2 Hours**4.3. Embryonic and larval development of fishes **2 Hours**4.4. Embryonic and larval development of shrimp **2 Hours**4.5. Embryonic and larval development of crabs **2 Hours**

4.6. Environmental factors affecting reproduction and development of cultivable

aquatic fin & shell fish **2****Hours****UNIT-V (11 HOURS)****5.0. Hormones & Growth**5.1. Endocrine system in fishes **3 Hours**

5.2. Neurosecretory cells, androgenic gland, ovary, Y-organ, chromatophores, pericardial glands and cuticle.

5

Hours

5.3. Molting, molting stages, metamorphosis in crustacean shell fish

3 Hours

PRESCRIBED BOOK(S):

1. Bone Q et al., 1995. Biology of fishes, Blackie academic & professional, LONDON
2. Saxena AB 1996. Life of Crustaceans. Anmol Publications Pvt. Ltd., New Delhi

REFERENCES:

1. Tandon K.K & Johal M.S 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing
2. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
3. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.
4. Barrington FJW 1971. Invertebrates: Structure and Function. ELBS
5. Parker F & Haswell 1992. The text book of Zoology, Vol I. Invertebrates

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AQUACULTURE	AQT P21	2020-21	B.Sc., AZC
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SEMESTER- II

PRACTICAL – II

BIOLOGY OF FIN FISH & SHELL FISH (NEW SYLLABUS)

NO OF HOURS: 45
WEF: 2019-20

CREDITS: 02
COURSE CODE: AQT P21A

1. Study of mouth parts in herbivorous omnivorous and carnivorous fishes
2. Comparative study of digestive system of herbivorous and carnivorous fishes

3. Length-weight relationship of fishes
4. Gut content analysis in fishes and shrimp
5. Mouth parts and appendages of cultivable prawns, shrimps and other crustaceans
6. Study of eggs of fishes, shrimps, prawns and other crustaceans
7. Study of gonadal maturity and fecundity in fishes and shellfish
8. Observation of crustacean larvae
9. Study of nest building and brooding of fishes
10. Biostatistics – Mean, Mode, Median, Standard Deviation, Correlation and t-test

REFERENCES

1. Bone Q et al., 1995. Biology of fishes, Blackie academic & professional, LONDON
2. Saxena AB 1996. Life of Crustaceans. Anmol Publications Pvt.Ltd., New Delhi
3. Tandon K.K & Johal M.S 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing
4. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
5. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology
6. **Thomas PC, Rath SC & Mohapatra KD.**2003.*Breeding and Seed Production of Finfish and Shellfish.* Daya Publ.
7. **Chakraborty C & Sadhu AK.** 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn.* Daya Publ. House

SEMESTER-III**PAPER- III****FRESH WATER & BRACKISHWATER AQUACULTURE (NEW SYLLABUS)**

NO OF HOURS: 60

CREDITS: 04

UNIT-1 13 HOURS**1.0. Freshwater Fin Fish Aquaculture**

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|--|----------------|
| 1.1. Status, scope and prospects of fresh water aquaculture in the world, India and AP | 2 Hours |
| 1.2. Criteria for the selection of species for culture | 1 Hour |
| 1.3. Natural seed resources and procurement of seed for stocking | 1 Hour |
| 1.4. Culture of cultivable major Indian carps – <i>Labeo</i> , <i>Catla</i> and <i>Cirrhinus</i> and Minor carps | 4 Hours |
| 1.5. Culture of Exotic fish species – <i>Tilapia</i> , <i>Pangassius</i> and <i>Clarius species</i> | 3 Hours |
| 1.6. Impact of exotic fish, compatibility of Indian and exotic carps and competition among them | 1 Hour |
| 1.7. Composite fish culture system of Indian and exotic and genetically modified carps (Amur common carp, Jayanthi Rohu) | 1 Hour |

UNIT-II 14 HOURS**2.0. Freshwater Shell Fish Aquaculture**

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|--|----------------|
| 2.1. Fresh water prawns of India - commercial value | 1 Hour |
| 2.2. Natural seed resources and procurement of seed for stocking | 1 Hour |
| 2.3. <i>Macrobrachium rosenbergii</i> – biology, seed production, pond preparation, stocking, management of nursery and grow-out ponds, feeding, morpho types and harvesting | 6 Hours |
| 2.4. <i>M. malcolmsonii</i> - biology, seed production, pond preparation, stocking, management of nursery and grow-out ponds, feeding, morpho types and harvesting | 6 Hours |

UNIT-III 15 HOURS**3.0. Brackish Water Fin Fish Aquaculture**

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|---|----------------|
| 3.1. Status, scope and prospects of brackish water aquaculture in the world, India and AP | 2 Hours |
| 3.2. Major cultivable species for brackish water aquaculture | 1 Hour |
| 3.3. Biology and culture of <i>Lates calcarifer</i> | 2 Hours |
| 3.4. Biology and culture of <i>Chanos chanos</i> | 2 Hours |
| 3.5. Biology and culture of <i>Mugil cephalus</i> | 2 Hours |
| 3.6. Biology and culture of <i>Etroplus suratensis</i> | 2 Hours |
| 3.7. Biology and culture of <i>Trachinotus</i> sps (Pampano) | 2 Hours |

UNIT-IV 11 HOURS**4.0. Brackish Water Shell Fish Aquaculture-I**

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|---|----------------|
| 4.1. Culture of <i>P.mondon</i> – Hatchery technology and culture practices including feed and disease management | 5 Hours |
| 4.2. Culture of <i>L. vannamei</i> – Hatchery technology and culture practices including feed and disease management. | 5 Hours |
| 4.3. Mixed culture of fish and prawns | 1 Hour |

UNIT-V 7 HOURS**5.0. Export – oriented Brackish Water Shell Fish Aquaculture-II**

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|--|----------------|
| 5.1. Biology and culture of <i>Scylla serrata</i> | 2 Hours |
| 5.2. Biology and culture of <i>Pinctada vulgaris</i> | 2 Hours |
| 5.3. Biology and culture of <i>Crassostrea</i> species | 3 Hours |

PRESCRIBED BOOK(S):

- Jhingran V.G. 1998. Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi

REFERENCES:

1. Santhanam R, N Sukumaran and P Natarajan 1987. A Manual of Aquaculture, Oxford-IBH, New Delhi
2. Srivatsava 1993. Fresh water Aquaculture in India, Oxford-IBH, New Delhi
3. Marcel H 1972. Text book of Fish Culture. Oxford Fishing News Book

AQUACULTURE	AQTP31A	2021-22	B.Sc., AZC
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SEMESTER-III

PRACTICAL- III

**TITLE OF THE PAPER: FRESH WATER & BRACKISHWATER AQUACULTURE
(NEW SYLLABUS)**

NO OF HOURS: 45

CREDITS: 01

WEF: 2020-2021

COURSE CODE:

PRACTICALS:

1. Identification of important cultivable fresh water fishes (carps, cat fishes and murrels)
2. Identification of important cultivable brackish water fishes
3. Identification of important cultivable fresh water prawns
4. Identification of important cultivable brackish water prawns
5. Identification of commercially viable crabs – *Scylla serrata*, *Portunus pelagicus*, *P.sanguinolentus*, *Neptunus pelagicus*, *N.Sanguinolentus*
6. Identification of oysters of nutritional significance – *Crossostrea madrasensis*, *C.gryphoides*, *C. cucullata*, *C.rivularis*, *Picnodonta*.
7. Morphotypes of *Macrobrachium rosenbergii*
8. Identification of crustacean larval sequences (shrimp and crab)
9. Identification of diseases of *L. vennamei* and *P. monodon*
10. Field visit to freshwater/brackish water/prawn/shrimp farm and study of culture aspects.

Demonstration of dissection / dissected / virtual dissection:

3. *Channa* - Reproductive system
4. Shrimp – Reproductive system (Identification of male & female)

PRESCRIBED BOOK(S):

1. Jhingran VG 1998. Fish and Fisheries of India, Hindustan Publishing Corporation, New Delhi

REFERENCES:

1. Santhanam R, N Sukumaran and P Natarajan 1987. A Manual of Aquaculture, Oxford- IBH, New Delhi
2. Srivatsava 1993. Fresh water Aquaculture in India, Oxford-IBH, New Delhi
3. Marcel H 1972. Text book of Fish Culture. Oxford fishing news books

SEMESTER-III**PAPER- IV****FISH NUTRITION & FEED TECHNOLOGY (NEW SYLLABUS)**

NO OF HOURS: 60

CREDITS: 04

UNIT-I (14 HOURS)**1.0. Nutritional Requirements of Cultivable Fish**

- 1.1. Requirements for energy, proteins, carbohydrates, lipids, fibre, micronutrients for different stages of cultivable fish and prawns **4 Hours**
- 1.2. Essential amino acids and fatty acids, protein to energy ratio, nutrient interactions and protein sparing effect **4 Hours**
- 1.3. Dietary sources of energy, effect of ration on growth, determination of feeding rate, check tray **4 Hours**
- 1.4. Factors affecting energy partitioning and feeding **2 Hours**

UNIT-II (12 HOURS)**2.0. Forms of Feeds & Feeding Methods**

- 2.1. Feed conversion efficiency, feed conversion ratio and protein efficiency ratio **4 Hour**
- 2.2. Forms of feeds: Wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets, advantages of palletisation **3 Hours**
- 2.3. Feeding devices and methods: Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding and tray feeding **4 Hours**
- 2.4. Frequency of feeding **1 Hour**

UNIT-III (13 HOURS)**3.0. Feed Manufacture & Storage**

- 3.1. Feed ingredients and their selection, nutrient composition and nutrient availability of feed Ingredients **2 Hours**
- 3.2. Feed formulation – extrusion processing and steam pelleting, grinding, mixing and drying, palletisation, and packing **4 Hours**
- 3.3. Water stability of feeds, farm made aqua feeds, micro-coated feeds, micro-encapsulated feeds and micro-bound diets **3 Hours**
- 3.4. Microbial, insect and rodent damage of feed, chemical spoilage during storage period and proper storage methods **4 Hours**

UNIT-IV (12 HOURS)**4.0. Feed Additives & Non-Nutrient Ingredients**

- 4.1. Importance of binders, anti-oxidants and probiotics **2 Hours**
- 4.2. Feed attractants and feed stimulants **2 Hours**
- 4.3. Enzymes, hormones, growth promoters and pigments **3 Hours**
- 4.4. Anti-metabolites, aflatoxins and fibre **2 Hours**
- 4.5. Functional feeds in shrimp farming **3 Hours**

UNIT-V (9 HOURS)**5.0. Nutritional Deficiency in Cultivable Fish and Shellfish**

- 5.1. Protein deficiency, vitamin and mineral deficiency symptoms **3 Hours**
- 5.2. Nutritional pathology and anti-nutrients **3 Hours**
- 5.3. Importance of natural and supplementary feeds, balanced diet **3 Hours**

PRESCRIBED BOOK(S):

- Halver J.E 1989. Fish Nutrition. Academic press, San Diego.
- NRC. Nutritional Requirements of Warm Water Fishes. National Academy of Sciences, Washington.

REFERENCES:

- Lovell R.T. 1998. Nutrition and Feeding of Fishes, Chapman & Hall, New York

2. Sena De Silva, Trevor A Anderson 1995. Fish Nutrition in Aquaculture. Chapman & Hall, Aquaculture Series, London.
3. New, M.B. 1987. Feed and Feeding of Fish and Shrimp. A Manual on the Preparation and Preservation of Compound Feeds for Shrimp and Fish in Aquaculture. F.A.O. Rome.

AQUACULTURE	AQTP01	2021-22	B.Sc., AZC
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SEMESTER-III

PRACTICAL- IV

FISH NUTRITION & FEED TECHNOLOGY (NEW SYLLABUS)

NO OF HOURS: 45

CREDITS: 01

PRACTICALS:

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. Types of binders used in aquaculture feeds.
8. Different 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 an aqua-feed production unit
12. Visit to a farm for studying feeding practices.

PRESCRIBED BOOK(S):

1. Halver JE 1989. Fish Nutrition. Academic press, San diego

REFERENCES:

1. Lovell R.T. 1998. Nutrition and Feeding of Fishes, Chapman & Hall, New York
2. Sena De Silva, Trevor A Anderson 1995. Fish Nutrition in Aquaculture. Chapman and Hall, Aquaculture Series, London.

AQUACULTURE	AQTT42	2021-22	B.Sc., AZC
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SEMESTER- IV**PAPER- V****FISH HEALTH MANAGEMENT, FISHERIES ECONOMICS, EXTENSION AND MARKETING (NEW SYLLABUS)**

NO OF HOURS: 60

CREDITS: 04

UNIT - I (12 HOURS)**1.0. DISEASES OF FIN FISH**

- 1.1. Fungal diseases– Saprolegniasis, branchiomycosis, ichthyophiriasis diseases – Lagenidium diseases – Fusarium disease, prevention and therapy **2 Hours**
- 1.2. Viral diseases – Emerging viral diseases in fish, haemorrhagic septicemia, spring viremia of carps, infectious hematopoietic necrosis in trout, infectious pancreatic necrosis in salmonids, swim-bladder inflammation in cyprinids, channel cat fish viral disease, prevention and therapy **5 Hours**
- 1.3. Bacterial diseases – Emerging bacterial diseases, *Aeromonas*, *Pseudomonas* and *Vibrio* infections, columnaris, furunculosis, epizootic ulcerative syndrome, infectious abdominal dropsy, bacterial gill disease, enteric red mouth, bacterial kidney disease, proliferative kidney disease, prevention and therapy **5 Hours**

UNIT – II (10 HOURS)**2.0. DISEASES OF SHELL FISH**

- 2.1. Major shrimp viral diseases – *Baculovirus penaeii*, *Monodon Baculovirus*, Baculoviral midgut necrosis, Infectious hypodermal and haematopoietic necrosis virus, Hepatopancreatic parvo like virus, Yellow head baculovirus, white spot baculovirus. **4 Hours**
- 2.2. Bacterial diseases of shell fish – aeromonas, pseudomonas and vibrio infections, luminous bacterial disease, filamentous bacterial disease. Prevention and therapy **4 Hours**
- 2.3. Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis. Prevention and therapy **2 Hours**

UNIT - III (10 HOURS)**3.0. FISH HEALTH MANAGEMENT**

- 3.1 Diagnostic tools – immune detection- DNA/RNA techniques, General preventive methods and prophylaxis. Application and development of vaccines. **4 Hours**
- 3.2 Quarantine – Significance, methods and regulations for transplants. **2 Hours**
- 3.3 Good Feed management for healthy organisms, Zero water exchange, Probiotics in health management, Issues of biosecurity. **4 Hours**

UNIT - IV (16 HOURS)**4.0. FISHERIES ECONOMICS**

- 4.1. Meaning and scope of economics with reference to fisheries **1 Hour**
- 4.2. Principles of aquaculture economics – Capital costs, variable costs, cost- benefit analysis **2 Hours**
- 4.3. Aquaculture economics-
4.3.1. Application of economics principles to aquaculture operations **2 Hours**
4.3.2. Various inputs and production function, laws of variable proportions **2 Hours**
- 4.4. Cost and earnings of aquaculture systems – carp culture, shrimp farming systems, hatcheries, Cost and earnings of fishing units and freezing plants **4 Hours**
- 4.5. Socio-economic conditions of fishermen in Andhra Pradesh **2 Hours**
- 4.6. Role of Matsyafed and NABARD in uplifting fishermen's conditions, fishermen Cooperatives, Contribution of fisheries to the national economy **3 Hours**

UNIT – V (12 HOURS)**5.0. FISHERIES EXTENSION AND MARKETING**

- 5.1. Fisheries extension-scope and objectives, principles and features of fisheries extension education **2 Hours**
- 5.2. Fisheries extension methods and rural development **2 Hours**
- 5.3. Fisheries Training and Education in India; Role of extension in

community development	2 Hours
5.4. Fish marketing methods in India; Basic concepts in demand and price analysis	2 Hours
5.5. Methods of economic analysis of business organizations	2 Hours
5.6. Preparation of project and project appraisal	2 Hours

PRESCRIBED BOOK(S):

1. Shaperclaus W. 1991 Fish Diseases- Vol.I & II. Oxonian Press Pvt.ltd
2. Roberts RJ 1989. Fish pathology. Bailliere Tindall, New York
3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandray and medicine. Pergamon Press. Oxford
4. Jayaraman R 1996. Fisheries Economics. Tamilnadu Veterinary and Animal Science University. Tuticorn
5. Subba Rao N 1986. Economics of Fisheries. Daya publishing house, Delhi

REFERENCES:

1. Shankar KM & Mohan CV. 2002. Fish and Shellfish Health Management. UNESCO Publ. Sindermann CJ. 1990
2. Walker P & Subasinghe RP. (Eds.). 2005 Principal Diseases of Marine Fish and Shellfish. Vols. I, II. 2nd Ed. Academic Press
3. DNA Based Molecular Diagnostic Techniques: Research Needs for Standardization and Validation of the Detection of Aquatic Animal Pathogens and Diseases. FAO Publ. Wedmeyer G, Meyer FP & Smith L. 1999.
4. Bullock G et.al., 1972 Bacterial diseases of fishes. TFH publications, New Jersey
5. Post G 1987. Text book of Fish Health. TFH publications, New Jersey
6. Johnson SK 1995. Handbook of shrimp diseases. Texas A & M University, Texas
7. Dewwett KK and Varma JD 1993. Elementary economic theory. S.chand, NewDelhi
8. Korakandy R 1996. Economics of Fisheries Mangement. Daya Publishing House, Delhi
9. Tripathi SD 1992. Aquaculture Economics. Asian Fisheries Society, Mangalore.

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SEMESTER- IV

PRACTICAL- V

**TITLE OF THE PAPER: FISH HEALTH MANAGEMENT AND FISHERIES ECONOMICS
(NEW SYLLABUS) AQTP42**

NO OF HOURS: 30

CREDITS: 01

1. Enumeration of Bacteria by TPC Method
2. Enumeration of total Coliforms
3. Observation of gross pathology and external lesions of fish and prawn 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. Examination of pathological changes in gut lumen, hepatopancreas, lymphoid organ, muscles and nerves of prawn and shrimp
6. Collection, processing and analysis of data for epidemiological investigations of viral diseases
7. Bacterial pathogens – isolation, culture and characterization
8. Identification of parasites in fishes: Protozoan, Helminths, Crustaceans
9. Antibigrams – preparation and evaluation
10. Molecular and immunological techniques; Biochemical tests; PCR; ELISA; Agglutination test; Challenge tests; Purification of virus for development of vaccines (Demonstration at institutes/labs)
11. Estimation of dose, calculation of concentration, methods of administration of various chemotherapeutics to fish and shell fish
12. Estimation of antibiotics used in aquaculture practices
13. Estimation of probiotics used in aquaculture
14. Field visit to farm for health monitoring and disease diagnosis
15. Cost benefit analysis calculations

PRESCRIBED BOOK(S):

1. Shaperclaus W. 1991 Fish Diseases- Vol.I & II. Oxonian Press Pvt.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. Tamilnadu Veterinary and Animal Science University. Tuticorn
5. Subba Rao N 1986. Economics of Fisheries. Daya publishing house, Delhi

