

**REVISED SYLLABUS OF AQUA CULTURE TECHNOLOGY
UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021**

PROGRAMME: THREE-YEAR B.Sc. (AQUACULTURE TECHNOLOGY)

AQUACULTURE



*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular
Activities & Model Q.P.)
For Five Courses of 1, 2, 3 & 4 Semesters)
(To be Implemented from 2020-21 Academic Year)*

Domain Subject: MARKET ORIENTED COURSE AQUA CULTURE TECHNOLOGY

*Activities, References & Model Q.P
For Five Courses of 1, 2, 3, 4 & 5 Semesters)*

“The domain subject “**AQUACULTURE TECHNOLOGY**”, embracing the fields of biology of commercial aquatic organisms like fish. Prawn, seaweed, pearl oysters, hatchery technology, culture practices, disease management, food and feeding habits, feed manufacturing, marketing, economics etc, is very much market oriented course as the state of Andhra Pradesh is having longest coastal belt providing greater employment opportunities to the community.

GENERAL CURRICULAR ACTIVITIES

Lecturer-based:

- 1) **Class-room activities:** Organization of Group discussions, question-answer sessions, scientific observations, use of audio-visual aids, guidance programmes, examination and evaluation work (scheduled and surprise tests), quizzes, preparation of question banks, student study material, material for PG entrance examinations etc.
- 2) **Library activities:** Reading books and magazines taking notes from prescribed and reference books and preparation of notes on lessons as per the syllabus; Reading journals and periodicals pertaining to different subjects of study; Making files of news-paper cuttings etc.
- 3) **Lab activities:** Organization of practicals use of virtual laboratory , maintenance of lab attendance registers/log registers, maintenance of glassware and chemicals
- 4) **Activities in the Seminars, workshops and conferences:** Organization of at least one seminar/workshop/conference per academic year either on academic/research aspects and inculcate research spirit among students
- 5) **Research activities:** Student study projects (General / RBPT model), Minor or Major research projects, Research guidance to research scholars, Publication of research articles/papers (at least one in 2 years) in UGC-recognized journals, Registration in Vidwan/Orcid/Scopus/Web of Science
- 6) **Smart Classroom Activities:** Organization of Departmental WhatsApp groups, Ed Modo groups/Google Class Rooms/Adobe Spark groups for quick delivery of the subject; Preparation of Moocs content & presentation tube lessons by trained lecturers; Using smart/digital/e- class rooms (mandarory) wherever present; Utilization of YouTube videos (subject to copy rights) etc.

Student-based:

- 1) **Class-room activities:** Power point presentations, seminars, assignments
- 2) **Library activities:** Visit to library during library hour and preparation of notes
- 3) **Lab activities:** Maintenance of observation note book and record, keeping lab clean and tidy
- 4) **Activities in the Seminars, workshops and conferences:** Participation/presentation in seminar/workshop/conference

CO-CURRICULAR ACTIVITIES

OBJECTIVES:

The co-curricular activities are aimed at strengthening the theoretical knowledge with an activity related to the content taught in the class room. The aesthetic development, character building, spiritual growth, physical growth, moral values, creativity of the student.

The different types of co-curricular activities relevant to Sericulture domain are listed below:

Academic – based

- Preparation of Charts/Clay or Thermocol Models
- Debates, Essay Writing Competitions
- Group Discussions
- Departmental (Sericulture) magazine
- Formation of Book clubs
- Animal album-making
- Viva-Voce

Lab/Research –based

- Documentaries
- Field Visit/Excursions/to sericulture research stations- sericulture units
- Training at research centres (sericulture etc.)
- Exposure to scientific instruments and hands-on experience
-

Value - based

- Organization of works shop with the aqua farmers like lab to pod activity annually with the students and stake holders

➤ **Observation of Days of National/International Importance**

World Cancer Day (February 4th)	International Biological Diversity Day (May 22nd)
Darwin Day (February 12th)	World Turtle Day (May 23rd)
National Science Day (Feb 28th)	World blood Donor Day (June 14th)
World Wildlife day (March 3rd)	World Zoonoses Day (July 6th)
National Vaccination Day (March 16th)	World Mosquito Day (August 20th)
World Health Day (April 7th)	World Turtle Day (May 23rd)
Earth Day (April 22nd)	World Mosquito Day (August 20th)
Malaria Day (April 25th)	World Animal day (October 4th)
World Hepatitis Day (May 19th)	World Fisheries Day (November 21)

Course Structure of **Aquaculture Technology** under CBCS 2020-21
Market oriented course

Year	Semester	paper	COURSE TITLE	Marks		credits	
				CIA	SEE		
I	I	I	BASIC PRINCIPLES OF AQUACULTURE	25	75	03	
			Practical - I		50	02	
	II	II	BIOLOGY OF FIN FISH & SHELL FISH	25	75	03	
			Practical - II		50	02	
II	III	III	FISH NUTRITION & FEED TECHNOLOGY	25	75	03	
			Practical - III		50	02	
	IV	IV	FRESHWATER & BRACKISHWATER AQUACULTURE	25	75	03	
			Practical - IV		50	02	
		V	V	FISHERIES - HEALTH MANAGEMENT, EXTENSION & MARKETING	25	75	03
				Practical - V		50	02
III	VI	VI	SEC -1	25	75	03	
			Practical- VI		50	02	
	V	VII	SEC-2	25	75	03	
			Practical -VII		50	02	
	VI		APPRENTICE SHIP				

* Recommended Combination: Zoology, Chemistry & Aquaculture Technology

AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER - I – PAPER-1

BASIC PRINCIPLES OF AQUACULTURE

Course Outcomes: By the completion of the course the graduate should able to –

CO1: Describe the concept of blue revolution and different aqua culture systems

CO2: Explain the pond ecosystem

CO3: Describe the different types of fish ponds

CO4: Explain the steps of pond preparation

CO5: Describe the pond management practices

Learning objectives

1. To understand the concept of blue revolution and different aqua culture systems .
2. To understand the pond ecosystem .
3. To understand the different types of fish ponds.
4. To understand steps of pond preparation.
5. To understand the pond management practices

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)

AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER - I – PAPER-1
BASIC PRINCIPLES OF AQUACULTURE

UNIT-I: INTRODUCTION

- 1-1 Concept of Blue Revolution - History and definition of Aquaculture
- 1.2 Scope of Aquaculture at global Level, India and Andhra Pradesh
- 1.3 Different Aquaculture systems – Pond, Cage, Pen, Running water, Extensive, Intensive and & Semi-Intensive Systems and their significance.
- 1.4 Monoculture, Polyculture and Monosex culture systems

UNIT-II: POND ECOSYSTEM

- 2.1 General Concepts of Ecology, Carrying Capacity and Food Chains
- 2.2 Lotic and lentic systems, streams and springs
- 2.3 Nutrient Cycles in Culture Ponds – Phosphorus, Carbon and Nitrogen
Importance of Plankton and Benthos in culture ponds, nutrient dynamics and algal blooms
- 2.4 Concepts of Productivity, estimation and improvement of productivity

UNIT-III: TYPES OF FISH PONDS

- 3.1 Classification of ponds based on water resources – spring, rain water, flood water, well water and water course ponds
- 3.2 Functional classification of ponds – head pond, hatchery, nursery ponds
- 3.3 Functional classification of ponds -rearing, production, stocking and quarantine ponds
- 3.4 Fish Hatchery design

UNIT- IV: POND PREPARATION

- 4.1 Important factors in the construction of an ideal fish pond – site selection, topography
- 4.2 Important factors in the construction of an ideal fish pond- nature of the soil, water resources
- 4.3 Lay out and arrangements of ponds in a fish farm
- 4.4 Construction of an ideal fish pond – space allocation, structure and components of barrage pond

UNIT-V: POND MANAGEMENT FACTORS

- 5.1 Need of fertilizer and manure application in culture ponds
- 5.2 Role of nutrients; NPK contents of different fertilizers and manures used in aquaculture; and precautions in their application

5.3 Physico-chemical conditions of soil and water optimum for culture –temperature, depth, turbidity, light, water and shore currents, PH, DOD, CO₂ and nutrients; measures to increase oxygen and reduce ammonia & hydrogen sulphide in culture ponds; correction of PH

5.4 Eradication of predators and weed control – advantages and disadvantages of weed, weed plants in culture ponds, aquatic weeds, weed fish, toxins used for weed control and control of predators

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER - I – PAPER-1
BASIC PRINCIPLES OF AQUACULTURE
MODEL QUESTION PAPER

Time : 3 hrs

Max. Marks : 75

SECTION –I

Answer any FIVE of the following

5x5 = 25 Marks

(Draw labelled diagrams wherever necessary)

1. SQ from Unit 1
2. SQ from Unit 1
3. SQ from Unit 2
4. SQ from Unit 3
5. SQ from Unit 3
6. SQ from Unit 4
7. SQ from Unit 5
8. SQ from Unit 5

SECTION –II

Answer ALL the questions each question carries 10 marks

5x10=50 Marks

(Draw diagrams wherever necessary)

9. (a) Question form Unit 1 (or)
(b) Question form Unit 1
10. (a) Question form Unit 2 (or)
(b) Question form Unit 2
11. (a) Question form Unit 3 (or)
(b) Question form Unit 3
12. (a) Question form Unit 4 (or)
(b) Question form Unit 4
13. (a) Question form Unit 5 (or)
(b) Question form Unit 5

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER - I – PAPER-1
BASIC PRINCIPLES OF AQUACULTURE

PRACTICALS:

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. Field visit to nursery, rearing and stocking ponds of aqua farms
6. Field visit to hatchery
7. Study of algal blooms and their control
8. Collection & identification of zooplankton and phytoplankton
9. Study of aeration devices
10. Determination of soil nitrogen and phosphorus
11. Collection and study of aquatic weeds
12. Field survey of nearby habitat for dietary dependency on and requirement of aqua-products

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 Company.
4. Bose AN et.al., 1991. Coastal Aquaculture Engineering. Oxford & IBH Publishing Company Pvt.Ltd.

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH

Course Outcomes: By the completion of the course the graduate should able to –

CO1: Describe the general characters and classification of cultivable fishes

CO2: Explain the food, feeding and growth of fish

CO3: Describe the reproductive biology of fishes

CO4: Explain the parental care and development of fishes

CO5: Describe the parental care and development of fishes

Learning objectives

1. To understand the general characters and classification of cultivable fishes .
2. To understand the food, feeding and growth of fish.
3. To understand the reproductive biology of fishes.
4. To understand the parental care and development of fishes.
5. To understand the parental care and development of fishes

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH

UNIT-I: GENERAL CHARACTERS & CLASSIFICATION OF CULTIVABLE FIN & SHELL FISH

- 1.1 General Characters and classification of fishes, crustaceans and molluscs up to the level of Class.
- 1.2 Fish, Crustaceans and Molluscs of commercial importance
- 1.3 Sense organs of fishes, crustaceans and molluscs
- 1.4 Buoyancy in fishes- swim bladder and mechanism of gas secretion

UNIT-II: FOOD, FEEDING AND GROWTH

- 2.1 Natural fish food, feeding habits, feeding intensity, stimuli for feeding, utilization of food gut content analysis, structural modifications in relation to feeding habits, forage ratio and food selectivity index
- 2.2 Principles of Age and growth determination; growth regulation, Growth rate measurement – scale method, otolith method, skeletal parts as age indicators
- 2.3 Genetic, biotic & ecological factors in determining the longevity of fishes, 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
- 2.4 Length-weight relationship, condition factor/Ponderal index, relative condition factor

UNIT-III: REPRODUCTIVE BIOLOGY

- 3.1 Breeding in fishes, breeding places, breeding habits & places
- 3.2 Breeding in natural environment and in artificial ponds, courtship and reproductive cycles
- 3.3 Induced breeding in fishes
- 3-4 Breeding in shrimp, pearl oyster, pila, and cephalopods

UNIT – IV: DEVELOPMENT

- 4.1 Parental care in fishes, ovo-viviparity, oviparity, viviparity, nest building and brooding
- 4.2 Embryonic and larval development of fishes
- 4.3 Embryonic and larval development of shrimp, crabs and molluscs of commercial importance
- 4.4 Environmental factors affecting reproduction and development of cultivable aquatic fin & shell fish

UNIT-V: HORMONES & GROWTH

- 5.1 Endocrine system in fishes

5.2 Neurosecretary cells, androgenic gland, ovary,

5.3 Y-organ, chromatophores, pericardial glands and cuticle.

5.4 Molting, molting stages, metamorphosis in crustacean shell fish

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS
SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH
MODEL QUESTION PAPER

Time : 3 hrs

Max. Marks : 75

SECTION –I

Answer any FIVE of the following

5x5 = 25 Marks

(Draw labelled diagrams wherever necessary)

1. SQ from Unit 1
2. SQ from Unit 1
3. SQ from Unit 2
4. SQ from Unit 3
5. SQ from Unit 3
6. SQ from Unit 4
7. SQ from Unit 5
8. SQ from Unit 5

SECTION –II

Answer ALL the questions each question carries 10 marks

5x10=50 Marks

(Draw diagrams wherever necessary)

9. (a) Question form Unit 1 (or)
(b) Question form Unit 1
10. (a) Question form Unit 2 (or)
(b) Question form Unit 2
11. (a) Question form Unit 3 (or)
(b) Question form Unit 3
12. (a) Question form Unit 4 (or)
(b) Question form Unit 4
13. (a) Question form Unit 5 (or)
(b) Question form Unit 5

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH

PRACTICALS:

1. Study of mouth parts in herbivorous 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 oyster eggs
8. Embryonic and larval development of fish
9. Study of gonadal maturity and fecundity in fishes and shellfish
10. Observation of crustacean larvae
11. Observation of molluscan larvae
12. Study of nest building and brooding of fishes

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 KK & Johal MS 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing House, New Delhi.
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, Voll. Invertebrates (eds. Marshal AJ & Williams). ELBS & Mc Millan & Co.

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER III – PAPER-III
FISH NUTRITION & FEED TECHNOLOGY

Course Outcomes: By the completion of the course the graduate should able to –

- CO1:** Describe the nutritional requirements of cultivable fishes
- CO2:** Explain the different types of feed and feeding methods of fish
- CO3:** Describe the techniques of fish feed manufacturing and storage methods
- CO4:** Explain the concept of fish feed additives, non nutrient ingredients.
- CO5:** Describe the different nutritional deficiency symptoms of fish

Learning objectives

1. To understand the nutritional requirements of cultivable fishes.
2. To understand the different types of feed and feeding methods of fish.
3. To understand the techniques of fish feed manufacturing and storage methods.
4. To understand the concept of fish feed additives, non nutrient ingredients.
5. To understand the different nutritional deficiency symptoms of fish.

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER III – PAPER-III
FISH NUTRITION & FEED TECHNOLOGY

UNIT-I: NUTRITIONAL REQUIREMENTS OF CULTIVABLE FISH

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

UNIT-II: FORMS OF FEEDS & FEEDING METHODS

- 2.1 Feed conversion efficiency, feed conversion ratio and protein efficiency ratio
- 2.2 Wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets, advantages of pelletization
- 2.3 Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding and tray feeding
- 2.4 Frequency of feeding

UNIT-III: FEED MANUFACTURE & STORAGE

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

UNIT-IV: FEED ADDITIVES & NON-NUTRIENT INGREDIENTS

- 4.1 Binders, anti-oxidants, probiotics
- 4.2 Feed attractants and feed stimulants
- 4.3 Enzymes, hormones, growth promoters and pigments
- 4.4 Anti-metabolites, aflatoxins and fiber

UNIT-V: NUTRITIONAL DEFICIENCY IN CULTIVABLE FISH

- 5.1 Protein deficiency, vitamin and mineral deficiency symptoms
- 5.2 Nutritional pathology and ant-nutrients
- 5.3 Importance of natural and supplementary feeds,
- 5.4 Importance of balanced diet

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS
SEMESTER III – PAPER-III
FISH NUTRITION & FEED TECHNOLOGY

MODEL QUESTION PAPER

Time : 3 hrs

Max. Marks : 75

SECTION –I

Answer any FIVE of the following

5x5 = 25 Marks

(Draw labelled diagrams wherever necessary)

1. SQ from Unit 1
2. SQ from Unit 1
3. SQ from Unit 2
4. SQ from Unit 3
5. SQ from Unit 3
6. SQ from Unit 4
7. SQ from Unit 5
8. SQ from Unit 5

SECTION –II

Answer ALL the questions each question carries 10 marks

5x10=50 Marks

(Draw diagrams wherever necessary)

9. (a) Question form Unit 1 (or)
(b) Question form Unit 1
10. (a) Question form Unit 2 (or)
(b) Question form Unit 2
11. (a) Question form Unit 3 (or)
(b) Question form Unit 3
12. (a) Question form Unit 4 (or)
(b) Question form Unit 4
13. (a) Question form Unit 5 (or)
(b) Question form Unit 5

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER III – PAPER-III
FISH NUTRITION & FEED TECHNOLOGY

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. 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 a 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 rt 1998. Nutrition and feeding of fishes, Chapmann & Hall, New York
2. Sena de silva, trevor a anderson 1995. Fish nutrition in aquaculture. Chapmann & Hall, New York

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f., 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER IV – PAPER-IV
FRESH WATER & BRACKISHWATER AQUACULTURE

Course Outcomes: By the completion of the course the graduate should be able to –

CO1: Describe the prospects and scope of fresh water aquaculture at various levels

CO2: Explain the practices involved in carp culture

CO3: Describe the culture of cold water and air breathing fish

CO4: Explain the culture practices of prawn.

CO5: Describe the culture of different brackish water species

Learning objectives

1. To understand the prospects and scope of fresh water aquaculture at various levels.
2. To understand the practices involved in carp culture.
3. To understand the culture of cold water and air breathing fish.
4. To understand the culture practices of prawn.
5. To understand the culture of different brackish water species

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER IV – PAPER-IV
FRESH WATER & BRACKISHWATER AQUACULTURE

UNIT-1: INTRODUCTION TO FRESHWATER AQUACULTURE

- 1.1 Status, scope and prospects of fresh water aquaculture in the world, India and AP
- 1.2 Different fresh water aquaculture systems

UNIT-II: CARP CULTURE

- 2.1 Major cultivable Indian carps – *Labeo*, *Catla* and *Cirrhinus* & Minor carps
- 2.2 Exotic fish species introduced to India – *Tilapia*, *Pangassius* and *Clarius* sp.
- 2.3 Composite fish culture system of Indian and exotic carps
- 2.4 Impact of exotic fish, Compatibility of Indian and exotic carps and competition among them

UNIT-III: CULTURE OF AIR-BREATHING AND COLD WATER FISH

- 3.1 Recent developments in the culture of *Clarius*, *Anabas*, *Murrels*,
- 3.2 Advantages and constraints in the culture of air-breathing and cold water fishes- seed resources, feeding, management and production
- 3.3 Special systems of Aquaculture- brief study of culture in running water, re-circulatory systems, cages and pens, sewage-fed fish culture

UNIT-IV: CULTURE OF PRAWN

- 4.1 Fresh water prawns of India - commercial value
- 4.2 *Macrobrachium rosenbergii* and *M. Malcomsonii* – biology, seed production,
- 4.3 Pond preparation, stocking, management of nursery and grow-out ponds, feeding, and harvesting

UNIT-V: CULTURE OF BRACKISHWATER SPECIES

- 5.1 Culture of *P.mondon* – Hatchery technology and Culture practices including feed and disease management
- 5.2 Culture of *L. vannamei* – hatchery technology and culture practices including feed and disease management.
- 5.3 Mixed culture of fish and prawns

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS
SEMESTER IV – PAPER-IV
FRESH WATER & BRACKISHWATER AQUACULTURE

MODEL QUESTION PAPER

Time: 3 hrs

Max. Marks: 75

SECTION –I

Answer any FIVE of the following

5x5 = 25 Marks

(Draw labelled diagrams wherever necessary)

1. SQ from Unit 1
2. SQ from Unit 1
3. SQ from Unit 2
4. SQ from Unit 3
5. SQ from Unit 3
6. SQ from Unit 4
7. SQ from Unit 5
8. SQ from Unit 5

SECTION –II

Answer ALL the questions each question carries 10 marks

5x10=50 Marks

(Draw diagrams wherever necessary)

9. (a) Question form Unit 1 (or)
(b) Question form Unit 1
10. (a) Question form Unit 2 (or)
(b) Question form Unit 2
11. (a) Question form Unit 3 (or)
(b) Question form Unit 3
12. (a) Question form Unit 4 (or)
(b) Question form Unit 4
13. (a) Question form Unit 5 (or)
(b) Question form Unit 5

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER IV – PAPER-IV
FRESH WATER & BRACKISHWATER AQUACULTURE

PRACTICALS:

1. Identification of important cultivable carps
2. Identification of important cultivable air-breathing fishes
3. Identification of important cultivable fresh water prawns
4. Identification of different life history stages of fish
5. Identification of different life history stages of fresh water prawn
6. Collection and study of weed fish
7. Identification of commercially viable crabs – *Scylla cerrata*, *Portunus pelagicus*, *P.sanguinolentus*, *Neptunus pelagicus*, *N. Sanguinolentus*
8. Identification of lobsters – *Panulirus polyphagus*, *P.ornatus*, *P.homarus*, *P.sewelli*, *P.penicillatus*
9. Identification of oysters of nutritional significance – *Crossostrea madrasensis*, *C.gryphoides*, *C. cucullata*, *C.rivularis* , *Picnodanta*
10. Identification of mussels and clams
11. Identification of developmental stages of oysters
12. Field visit to aqua farm and study of different components like dykes etc.

PRESCRIBED BOOK(S):

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

REFERENCES:

1. Santharam 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

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER IV– PAPER-V
FISH HEALTH MANGEMENT & FISHERIES ECONOMICS

Course Outcomes: By the completion of the course the graduate should able to –

CO1: Describe the diseases of fin fish

CO2: Explain the diseases of shell fish

CO3: Describe the fish health management strategies

CO4: Explain different fisheries economic policies

CO5: Describe the various schemes for the welfare of fishermen community

Learning objectives

1. To understand the diseases of fin fish
2. To understand the the diseases of shell fish.
3. To understand the fish health management strategies.
4. To understand the different fisheries economic policies .
5. To understand the various schemes for the welfare of fishermen community

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER IV– PAPER-V
FISH HEALTH MANGEMENT & FISHERIES ECONOMICS

UNIT I: DISEASES OF FIN FISH

- 1.1 Fungal diseases– Saprolegniosis, brachiomyxosis, ichthyophorus diseases – Lagenidium diseases – Fusarium disease, prevention and therapy
- 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
- 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

UNIT II: DISEASES OF SHELL FISH

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

UNIT III : FISH HEALTH MANAGEMENT

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

UNIT-IV FISHERIES ECONOMICS- I

- 4.1 Methods of economic analysis of business organizations
- 4.2 Aquaculture economics- application of economics principles to aquaculture operations
Various inputs and production function laws of variable proportions
- 4.3 Cost and earnings of aquaculture systems – carp culture, shrimp farming systems,

UNIT-V FISHERIES ECONOMICS- II

5.1 Socio-economic conditions of fishermen in Andhra Pradesh

5.2 Role of Matsyafed and NABARD in uplifting fishermen's conditions, fishermen cooperatives

Contribution of fisheries to the national economy

5.3 Economic analysis preparation of project and project appraisal

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS
SEMESTER IV– PAPER-V
FISH HEALTH MANGEMENT & FISHERIES ECONOMICS

MODEL QUESTION PAPER

Time: 3 hrs

Max. Marks: 75

SECTION –I

Answer any FIVE of the following

5x5 = 25 Marks

(Draw labelled diagrams wherever necessary)

1. SQ from Unit 1
2. SQ from Unit 1
3. SQ from Unit 2
4. SQ from Unit 3
5. SQ from Unit 3
6. SQ from Unit 4
7. SQ from Unit 5
8. SQ from Unit 5

SECTION –II

Answer ALL the questions each question carries 10 marks

5x10=50 Marks

(Draw diagrams wherever necessary)

9. (a) Question form Unit 1 (or)
(b) Question form Unit 1
10. (a) Question form Unit 2 (or)
(b) Question form Unit 2
11. (a) Question form Unit 3 (or)
(b) Question form Unit 3
12. (a) Question form Unit 4 (or)
(b) Question form Unit 4
13. (a) Question form Unit 5 (or)
(b) Question form Unit 5

AP STATE COUNCIL OF HIGHER EDUCATION
w.e.f. 2020-21 (Revised in April, 2020)
AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER IV– PAPER-V
FISH HEALTH MANGEMENT & FISHERIES ECONOMICS

PRACTICALS:

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, hepatopncreas, lymphoid organ, muscles and nerves of prawn and shrimp
6. Collection, processing and analysis of data for epedemeiological investigations of viral diseases
7. Bacterial pathogens – isolation, culture and characterization
8. Identification of parasites in fishes: Protozoan, Helmiths, 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

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, New Delhi
8. Korakandy R 1996. Economics of Fisheries Mangement. Daya Publishing House, Delhi
9. Tripathi SD 1992. Aquaculture Economics. Asian Fisheries Society, Mangalore.