A.S.D GOVT.DEGREE COLLEGE FOR WOMEN (A)

(Re-Accredited NAAC with "B" Grade)

KAKINADA, EAST GODAVARI, A.P, 533002.

DEPARTMENT OF ZOOLOGY AND AQUACULTURE TECHNOLOGY

2022-2023

AQUACULTURE TECHNOLOGY

A.S.D GOVT. DEGREE COLLEGE FOR WOMEN (A)
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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023

SEMESTER-I – PAPER-I

BASIC PRINCIPLES OF AQUACULTURE

(Course Code: AQ201308)

Periods: 60 **Max. Marks: 100**

UNIT-I: INTRODUCTION

1-1Concept of Blue Revolution-History and definition of Aquaculture Scope of Aquaculture at global Level, India and Andhra Pradesh

1.2 Different Aquaculture systems– Pond, Cage, Pen, Running water, Extensive, Intensive &Semi-Intensive Systems and their significance.

1.3 Monoculture, Polyculture and Mono sex 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

2.4 Importance of Plankton and Benthos in culture ponds, nutrient dynamics and algal blooms

2.5 Concepts of Productivity, estimation and improvement of productivity

UNIT-III: TYPES OF FISH PONDS

3-1 1 Classification of ponds based on water resources– spring, rainwater, flood water, well water, and watercourse ponds

3-2 Functional classification of ponds– head pond, hatchery, nursery, rearing, production, stocking, and quarantine ponds

3-3 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 Layout and arrangements of ponds in a fish farm

4-1 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 sulfide 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

PRESCRIBED BOOK(S):

1. Jhingran VG1998.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. Pillay TVR &M.A.Dill, 1979. Advances in Aquaculture. Fishing NewsBooksLtd.,London
2. StickneyRR 1979. Principles ofWarm WaterAquaculture. John Wiley&SonsInc. 1981
3. Boyd CE 1982. Water QualityManagement forPond Fish Culture.ElsivierScientific Publishing
4. BoseANet.al., 1991.Costal Aquaculture Engineering.Oxford&IBH PublishingCompany

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023
SEMESTER-I PAPER-I

BASIC PRINCIPLES OFAQUACULTURE

(Course Code: AQ201308P)

PRACTICAL SYLLABUS

Periods: 24 **Max. Marks: 50**

PRACTICALS: (Any 8as per the local Industry needs and Requirement)

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. Filed survey of nearby habitat for dietary dependency on and requirement of aqua products

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023
SEMESTER– II PAPER-II
TITLE- BIOLOGY OF FINFISH& SHELL FISH
(Course Code: AQ202308)

Periods: 60 **Max. Marks: 100**

UNIT-I: GENERAL CHARACTERS & CLASSIFICATION OF CULTIVABLE FIN & SHELLFISH

1-1General 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, for age 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 he 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, oysters, mussels, clams, pearl oysters, Pila, freshwater mussels, and cephalopods

UNIT– IV: DEVELOPMENT

4-1Parental care in fishes, ovo-viviparity, oviparity, viviparity, nest building and brooding4-2Embryonicand larval development of fishes

4-3Embryonic and larval development of shrimp, crabs and molluscs of commercial importance

4-4Environmental factors affecting reproduction and development of cultivable aquatic fin & shellfish

UNIT-V: HORMONES & GROWTH

5.1 Endocrine system in fishes

5.2 Neuro secretary cells, androgenic gland, ovary,

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

5.4 Molting, molting stages, metamorphosis in crustacean shell fish

PRESCRIBED BOOK(S):

1. Bone Qet al., 1995. Biology of fishes, Blackieacademic &professional, LONDON
2. SaxenaAB1996.Life of Crustaceans. Anmol Publications Pvt.Ltd., New Delhi

REFERENCES:

1. Tandon KK&Johal MS1996. Ageand Growth in Indian Fresh WaterFishes. Narendra Publishing
2. Raymond T etal., 1990. Crustacean Sexual Biology, Columbia University Press, New York
3. Guil and J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.
4. Barrington FJW1971.Invertebrates:Structure and Function. ELBS
5. Parker F& Haswell 1992. The text book of Zoology, VolI. Invertebrates

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023

SEMESTER– II PAPER-II

BIOLOGY OF FINFISH& SHELLFISH

(Course Code: AQ202308P)

PRACTICAL SYLLABUS

Periods: 24 **Max. Marks: 50**

PRACTICALS: (Any 8 as per the local Industry needs)

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.

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023

SEMESTER III– PAPER-III

FISH NUTRITION & FEED TECHNOLOGY

(Course Code: AQ203308)

Periods: 60 **Max. Marks: 100**

UNIT-I: NUTRITIONAL REQUIREMENTS OF CULTIVABLE FISH

1-1 Requirements for energy, proteins, carbohydrates, lipids, fiber, micro nutrients for different stages of cultivable fish and prawns
1-2 Essential amino acids 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 & 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 adeaqua 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 INCULTIVABLEFISH

5-1 Protein deficiency, vitamin and mineral deficiency symptoms
5-2 Nutritional pathology and ant nutrients
5-3 Importance of natural and supplementary feeds, balanced diet

PRESCRIBEDBOOK(S):

1. HALVERJE 1989. Fish nutrition. Academic press, San diego

REFERENCES:

1.Lovellrt 1998. Nutrition andfeedingoffishes,Chapmann&Hall, NewYork

2. Sena de silva,trevoraanderson 1995.Fish nutrition in aquaculture**.**Chapmann &Hall,

3. Guiland J.A (ed) 1984. Penaeid shrimps- TheirBiologyand Management.

4. Jhingran VG1998.Fish and Fisheries ofIndia.Hindusthan PublishingCorporation,NewDelhi

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023
SEMESTER III– PAPER-III
TITLE- FISH NUTRITION &FEEDTECHNOLOGY
(Course Code: AQ203308P)
PRACTICAL SYLLABUS

Periods: 24 **Max. Marks: 50**

PRACTICALS: (Any 8as per the local Industry needs and Requirement)

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.

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023
SEMESTER IV– PAPER-IV
TITLE- FRESH WATER & BRACKISH WATER AQUACULTURE
(Course Code: AQ204315)

Periods: 60 **Max. Marks: 100**

UNIT-1: INTRODUCTION TO FRESHWATERAQUACULTURE

1-1.1 Status, scope and prospects of fresh water aquaculture in the world, India and AP
1-1.2 Different freshwater aquaculture systems

UNIT-II: CARPCULTURE

2-1 Major cultivable Indian carps– Labeo, Catla and Cirrhinus &Minor carps
2-2 Exotic fish species introduced to India– Tilapia, Pangassius and Clariussp.
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 OFAIR-BREATHING ANDCOLDWATERFISH

3-1 Recent developments in the culture of clarius, anabas, murrels,
3-2 Advantages and constraints in the culture of air-breathing and coldwater 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, morphotypes and harvesting

UNIT-V: CULTURE OF BRACKISH WATER SPECIES

5-1 1 Culture of P.mondon– Hatchery technology and Culture practices including feed and disease management
5-2 2 Culture of L.vannamei– hatchery technology and culture practices including feed and disease management.
5-3 3 Mixed culture of fish and prawns

PRESCRIBEDBOOK(S):

1. Jhingran VG1998.Fish and Fisheries of India .Hindusthan PublishingCorporation,NewDelhi2.Sena de silva,trevoraanderson 1995.Fish nutrition in aquaculture**.** Chapmann &Hall,
3. Guil and J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.
4. Barrington FJW1971.Invertebrates:Structure and Function.ELBS
5. ParkerF&Haswell 1992. Thetext book of Zoology,VolI.Invertebrates

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023
SEMESTER IV– PAPER-IV
FRESH WATER & BRACKISH WATER AQUACULTURE
(Course Code: AQ204315P)
PRACTICALS SYLLABUS

Periods: 24 **Max. Marks: 50**

PRACTICALS :(Any 8as per the local Industry needs)

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– Scyllacerrata, Portunuspelagicus,
    a. P.sanguinolentus, Neptunuspelagicus, N.Sanguinolentus
8. Identification of lobsters– Panuliruspolyphagus,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.

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023
SEMESTER IV– PAPER-V
TITLE- FISH HEALTH MANAGEMENT & FISHERIES ECONOMICS
(Course Code: AQ204316)

Periods: 60 **Max. Marks: 100**

UNIT I: Diseases of Fin Fish

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

1.2 Viral diseases – Emerging viral diseases in fish, haemorrhagic scepticemia, 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 Baterial diseases – Emerging bacterial diseases, Aermonas, 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 – Bacculovirus penaeii, Monodon Bacculovirus, Bacculoviral midgut necrosis, Infectious hypodermal and haematopoietic necrosis virus, Hepatopancreatic parvo like virus, Yellow head bacculovirus, white spot bacculovirus.

2.2 Bacterial diseases of shell fish – aeromonas, pseudomonas and vibrio infections, luminous bacterial disease, and 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

1.1 Socio-economic conditions of fishermen in Andhra Pradesh

1.2 Role of Matsya fed and NABARD in uplifting fishermen's conditions, fishermen cooperatives.

Contribution of fisheries to the national economy

1.3 Economic analysis preparation of project and project appraisal

PRESCRIBED BOOKS:

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 BOOKS:.

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

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AQUACULTURE TECHNOLOGY BOARD OF STUDIES: 2022-2023

SEMESTER IV– PAPER-V (Course Code: AQ204316P)

TITLE- FISH HEALTH MANAGEMENT & FISHERIES ECONOMICS

Practical Syllabus

Periods: 24 **Max. Marks: 50**

1. Enumeration of Bacteria by TPC Method
2. Enumeration of total Coliforms
3. Observation of gross pathology andexternallesionsoffishandprawnwithreferencetothecommondiseases 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 epedemeiological investigations of viral diseases
7. Bacterial pathogens– isolation, culture and characterization
8. Identification of parasites in fishes: Protozoan, Helmiths, Crustaceans
9. Antibiograms– 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 shellfish
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

ASD GOVT. DEGREE COLLEGE FOR WOMEN (A)

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Jagannaickpur, Kakinada, East Godavari, AP – 533002

AQUACULTURE TECHNOLOGY (2022-2023)

SEMESTER: V PAPER-6A

SOIL AND WATER QUALITY MANAGEMENT

(Course Code: AQ205315-6A)

Credits: 4 **Hrs. /Wk.: 4**

UNIT I: Soil quality (10h)

1. Soil types and their distribution. Physical and chemical properties of soil: Soil colour, texture, structure, pore space, bulk density, and water holding capacity; Conductivity, pH, redox potential, soil salinity, calcium carbonate, organic carbon, available nitrogen, available phosphorus, Carbon-Nitrogen ratio, organic matter and soil fertility.
2. Properties of water logged soils, methane and hydrogen sulphide formation. Problem soils: Saline soils, Alkali soils, Acid sulphate soils (ASS), and their reclamation.
3. Pond Seepage and its control. Soil qualitycriteria/requirements for aquaculture.

UNIT II: Water quality (10h)

1. Water quality parameters: Temperature, transparency, salinity, dissolved oxygen, carbon dioxide, pH, alkalinity, hardness, conductivity, ammonia, nitrites, nitrates, orthophosphates and hydrogen sulphide; phytoplankton, zooplankton and benthos.
2. Role of aquatic microorganisms in carbon, nitrogen, phosphorus and sulphur cycles.
3. Water quality criteria for freshwater and brackish water aquaculture.

UNIT III: Soil and Water amendments *(10h)*

1. Liming: Liming materials, effects of liming on pond ecosystem, liming rates for ponds, calculation of lime requirements and application of liming materials to ponds.
2. Manures and Fertilizers: Types of manures and fertilizers, primary nutrients, micronutrients, fertilizer grades, quantity and method of application; Bio fertilizers.
3. Pond fertilization: Role of organic and inorganic fertilizers in aquaculture; Problems in ponds with indiscriminate fertilization.

UNIT IV: Pond water management *(10h)*

1. Dial changes in dissolved oxygen concentration, oxygen depletion in ponds, Aeration, Water exchange, and Bio-floc technology.
2. Water treatment, Water filtration devices, Waste water treatment practices, Waste

discharge standards, Re circulatory aquaculture system (RAS).

3. Water quality management in freshwater carp culture; brackish water shrimp culture; and hatcheries.

UNIT V: Pond treatments *(10h)*

1. Pond conditioners and Chemical treatments: Potassium permanganate, Hydrogen peroxide, Calcium hydroxide, Rotenone, Formalin and Malachite green. Methods of applying chemicals.
2. Reduction of pH; Control of turbidity, salinity, hardness and chlorides; Chlorine removal; Removal of toxic gases.
3. Control of algal blooms and aquatic weeds. Bioremediation: Soil and water probiotics for aquaculture ponds.

ADDITIONAL INPUTS: Classification of Aquatic weed plants

REFERENCES:

1. Boyd, C.E. (1982). Water Quality Management for Pond Fish Culture. Elsevier Sci. Publishing Co.
2. Boyd, C.E. and Tucker, C.S. (1992). Water Quality and Pond Soil Analyses for Aquaculture. Alabama Agricultural Experimental Station, Auburn University, USA.
3. Boyd, C.E. and Tucker, C.S. (2012). Pond aquaculture water quality management. Springer Science & Business Media. ICAR. (2006). Hand Book of Fisheries and Aquaculture. ICAR.
4. MPEDA: Handbooks on culture of carp, shrimp, etc.
5. Training Manual on Recent advances in soil and water management in brackishwater aquaculture (2018). Saraswathy, R., Kumararaja, P., Lalitha, N., Suvana, S., SatheeshaAvunje, Muralidhar,

M. (Eds.), CIBA-TM Series –No.8 (2nd Ed), ICAR–Central Institute of Brackishwater Aquaculture, Chennai, India pp.137.

6. Boyd, C.E. (1995). Soil and water quality management in aquaculture ponds. INFOFISH international, *5*(95), 29-36.
7. Boyd, C.E. (1995). Bottom soils, sediment, and pond aquaculture. Springer Science & Business Media.
8. Pillay, T.V.R. and Kutty, M.N. (2005). Aquaculture- Principles and Practices. 2nd Ed. Blackwell
9. Dhevendaran, K. (2008). *Aquatic Microbiology*,Daya Publ. House.
10. APHA, AWWA, WPCF. (1998). Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

11. Chattopadhyay, G.N. (1998). Chemical analysis of Fish Pond Soil and Water. Daya Publishing House, Delhi.
12. Ramadhas, V. and R. Santhanam (1996). A Manual of Methods of Seawater and Sediment analysis. Fisheries College & Research Institute, Tuticorin.
13. Adhikari, S and Chatterjee, D.K. (2008). Management of Tropical Freshwater Ponds.Daya Publication.
14. Boyd, C.E. (2003). Guidelines for aquaculture effluent management at the farm-level. Aquaculture, 226(1-4), 101-112.
15. Harry, O. Buckman and Nyle, C. Brady. (1963). The Nature and Properties of Soils. The Macmillan Company, NewYork.
16. Rajagopalsamy, C.B.T. and Ramadhas, V. 2002. Nutrient Dynamics in Freshwater Fish Culture System. Daya Publication.
17. Stickney, R.R. (1979). Principles of Warm water Aquaculture. John-Willey & sons Inc.
18. Sverdrup, H.V., Johnson, M.W. and Fleming, R.H. *(*1942).The Oceans: their physics, chemistry and general biology. Prentice Hall, Inc. New York.
19. *Web resources suggested by the teacher concerned and the college librarian including reading material.*

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AQUACULTURE TECHNOLOGY SEMESTER: V PAPER-6A (2022-2023)

Course 6A: SOIL AND WATER QUALITY MANAGEMENT

(Course Code: AQ205315-6AP)

Practical Syllabus

Credits: 1 **Hrs. /Wk.: 2**

Practical Syllabus:

1. Demonstration of laboratory glassware and equipment used in water and soil analysis.
2. Principles of Titrimetry, Gravimetry, Potentiometry, Conductometry, Refractometry, Colorimetry, Turbidimetry, Spectrophotometry (Vis, UV-Vis, Flame, Atomic Absorption Spectrophotometer (AAS)).
3. Solutions: Standard, and dilute solutions; units of concentration; standard curve.

Soil Analysis:

4. Collection and Processing of soil samples
5. Determination of Soil texture, pH, Redox potential and Conductivity.
6. Determination of Organic carbon, available nitrogen and available phosphorus.

Water Analysis:

7. Measurement of Temperature, Transparency, Turbidity, and Salinity of water.
8. Estimation of Dissolved oxygen, Free carbon dioxide, Total alkalinity and Total hardness in water.
9. Estimation of ammonia, nitrites, nitrates, and orthophosphates.
10. Collection and identification of phytoplankton, zooplankton and benthos
11. Calculation of doses of lime and fertilizers for ponds
12. Design and fabrication of different filters.

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Jagannaickpur, Kakinada, East Godavari, AP – 533002

AQUACULTURE TECHNOLOGY SEMESTER: V PAPER-7A (2022-2023)

ORNAMENTAL FISH CULTURE

(Course Code: AQ205316-7A)

Credits: 4 **Hrs. /Wk.: 4**

UNIT I: Status of Ornamental fish farming and trade *(10h)*

1. Global status of ornamental fish trade and export potential.
2. Present status and prospects of ornamental fish farming and trade in India. Indian ornamental fish diversity and its status. Major marine ornamental fish resources of India. Method of collection of live fish.
3. Types of aquaria – Home and Public aquaria (freshwater and marine), Oceanarium.

UNIT II: Ornamental fishes *(10h)*

1. Origin and Benefits of ornamental fish keeping as a hobby.
2. Freshwater ornamental fishes – their taxonomy and biology - varieties of Gold fish Koi, Barbs, Danios (cyprinids); Gourami, Betta (anabantids); Tetras (characins), Live bearers (Guppy, molly, sword tail, platy); Angel fish and other Cichlids, Catfishes, Loaches.
3. Marine ornamental fishes– varieties and their habitats. Other ornamental organisms– anemones, worms, lobsters, shrimps, octopus, starfish.

UNIT III: Aquarium Management (10h)

1. Fabrication, setting up and maintenance of freshwater and marine aquarium - Lighting and aeration - Aquarium plants and their propagation methods - Aquarium accessories and decoratives. Selection of fishes and Species compatibility for aquarium keeping.
2. Water quality management for freshwater and marine aquariums. Water filtration systems – biological, mechanical and chemical. Types of filters.
3. Aquarium fish feeds – Live feeds, Dry and wet feeds. Pigmented feeds for color enhancement, larval feeds and feeding.
4. Common diseases of aquarium fish - diagnosis and treatment. Control of snail and algal growth. Medicines and chemicals used in aquaria.

UNIT IV: Breeding and Rearing of ornamental fishes *(10h)*

1. Breeding of Live bearers and Egg layers – sex identification, conditioning of parent fish, stimulating spawning, parental care, hatching, and fry rearing.
2. Breeding of marine ornamental fishes (clown and damsel fishes) and larval rearing.
3. Application of genetics and biotechnology for quality strain production.

UNIT V: Commercial Production of Aquarium fish and Plants *(10h)*

1. Commercial production units of ornamental fish - requirements and design
2. Commercial production of live bearers, goldfishes, gouramies, barbs, angels and tetras.
3. Mass production of aquarium plants
4. Fish conditioning, packing, transport and quarantine methods. Retail marketing and export of ornamental fish.

ADDITIONAL INPUTS

Aquatic weeds, Marine Plankton, Sea weed products.

REFERENCES:

1. Ramachandran, A. (2002). Manual on breeding, farming and management of ornamental fishes. School of Industrial Fisheries, Cochin, India.
2. Biswas, SP., Das, JN., Sarkar, UK and Lakra, WS (2007). Ornamental Fishes of North East India: An Atlas. ICAR, National Bureau of Fish Genetic Resources, Lucknow, India.
3. Dick Mills (1998). Aquarium Fishes, Dorling Kindersly Ltd., London.
4. Spotte, S. (1993). Marine Aquarium Keeping. John Wiley and Sons, USA. Kurup, BM., Harikrishnan, M. and Renjithkumar, CR (2012). Breeding, farming and trade of ornamental fishes in India-Prospects and challenges. Souvenir- Ornamentals Kerala 2012.
5. Jameson, JD. andSanthanan, R. (1996). Manual of Ornamental Fishes and Farming Technologies, Fisheries College and Research Institute, Tuticorin.
6. Murthy, VS. (2002). Marine ornamental fish resources of Lakshadweep. CMFRI special publication, 72, 1-134.
7. Olivier, K. (2003). World trade in ornamental species (pp.49-63). Iowa State Press.
8. Van Ramshorrt, JD. (1978). The complete aquarium encyclopedia, Elsevier publishers.
9. Zaidi, S.G.S. Training manual on Ornamental fish culture. CIFE-ICAR, Mumbai.
10. Cato, JC. And Brown, CL. (Eds.) (2008). Marine ornamental species: collection, culture and conservation. John Wiley & Sons.

11. Bunting, BW., Holthus, P. and Spalding, S. (2003). The marine aquarium industry and reef conservation. Marine Ornamental Species: Collection, Culture and Conservation, 109- 124.

12. Santhanam, R., Sukumaran, N. and Natarajan, P. (1987). Manual of Freshwater Aquaculture. Oxford & IBH Publishing.
13. Sirajudheen, TK., Salim, SS., Bijukumar, A. and Antony, B. (2014). Problems and prospects of marine ornamental fish trade in Kerala, India. J. Fish. Eco. Dev., 1151:14-30.
14. *Web resources suggested by the teacher concerned and the college librarian including reading material.*

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AQUACULTURE TECHNOLOGY SEMESTER: V PAPER-VIIA (2022-2023)

(Course Code: AQ205316-7AP)

ORNAMENTAL FISH CULTURE PRACTICAL

Credits: 1 Hrs. /Wk.: 2

Practical Syllabus:

1. Identification of common freshwater and marine aquarium fishes
2. Construction of a glass aquarium
3. Setting up and maintenance of aquarium (maintained by students can be evaluated after one month)
4. Water quality management in freshwater and marine aquariums
5. Identification of Aquarium plants and live food organisms, and decoratives
6. Aerators and Types of Filters
7. Breeding of egg layers (Gold fish), live bearers (Guppy) and bubble nest builder (Gourami)
8. Ornamental fish diseases and their diagnosis and treatment. Calculation of medicine/ chemical treatment dosages.
9. Conditioning and packing of ornamental fishes.