GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM

M.Sc. AQUACULTURE

SEMESTER-I

CORE – I PRINCIPLES OF AQUACULTURE

Learning outcomes:

By the completion of this course student can able to

- Get knowledge on principles of aquaculture.
- Applications of aquaculture engineering.
- Identification of various cultivable species.
- Analysis of post stocking management.

EXTRACURRICULAR ACTIVITIES:

- Visit to shrimp form and hatchery/breeding centre.

UNIT – I Aquaculture Systems and Methods:

Definition ,scope,history and development of aquaculture;

1. Culture practices in aquaculture;; Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, monosex culture;

2. Cage culture, pen culture, raft culture, race way culture, culture in recirculatory systems; warm water and cold water aquaculture; sewage – fed fish culture, integrated fish farming

3. Selection of Sites: Survey and location of suitable site – topography; soil characteristics; acid sulphate soils; water source; hydrometerlogical data.

UNIT – II Aquaculture Engineering:

1. Design and construction of pond, layout and design of aquaculture farm, construction, water intake system, drainage system;
2. Advances in aquaculture engineering; tips for better aquaculture practices; design and construction of hatcheries.
3. Hydrology Of Ponds: Types of ponds; sources of water – precipitation, direct run off, stream inflow, ground water inflow, regulated inflow; losses of water– evaporation, seepage,
4. Water exchange and recycling of waste water.

UNIT – III: **Selection of Species**:

1. Biological characteristics of aquaculture species; economic and market considerations;
2. Seed resources, collection and transportation.
3. Pre Stocking Management: Sun drying, ploughing / tilling, desilting, liming and fertilization, eradication of weed fishes.
4. Stocking: Acclimatization of seed and release; species combinations; stocking density; ratio.

<u>UNIT – IV</u>: Post Stocking Management:

1. Water and soil quality parameters required for optimum production, control of aquatic weeds and aquatic insects, algal blooms;
2. Specific food consumption, food conversion ratio (FCR), protein efficiency ratio, true net protein utilization, apparent net protein utilization, biological value of protein.
3. Growth: Measurement of growth; length - weight relationship; methods of determination of age in fishes
4. Shellfish based on length data and growth checks; ponderal index; growth hormones.

ADDITIONAL INPUTS:

- COASTAL ZONE MANAGEMENT: COASTAL RESOURCES FIN FISH, SHELL FISH AND NONLIVING RESOURCES AND THEIR MANAGEMENT
- A ERATION AND AERATORS.

OUTFLOW, CONSUMPTIVE USE, WATER BUDGETS OF EMBANKMENT

PONDS; WATER BUDGET OF ANEXCAVATED POND.

ALGAL BLOOMS.

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM

M.Sc. Aquaculture-I Semester

Model Question Paper CORE I----

--- Principles of Aquaculture

PRACTICAL SYLLABUS

AQC 101. Principles of Aquaculture Lab:

1. Design and layout of fresh water and brackish water farms, fish and shrimp hatcheries
2. Visit to farms and hatchery.
3. Estimation and calculations of production costs of fish/shrimp farm.
4. Different types of filters.
5. Length weight relationship
6. Ponder index.

GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM M.Sc.
AQUACULTURE

SEMESTER-I 2023-24

CORE II--------AQC 102. AQUATIC ECOLOGY

Learning outcomes:

By the completion of this course student can able to

- Get knowledge on basic concepts of aquatic ecology.
- Understand physical properties of water
- Differentiate bio geo chemical cycles.
- Knowledge on concepts of productivity.

UNIT – I Introduction:

1. Definition of ecology, organism and environment; features of organism - environment relations; living and non - living environments; the ecosystem or habitat.
2. Aquatic Ecosystems: Freshwater ecosystems - Lotic and Lentic ecosystems; Marine ecosystems - oceans and seas,
3. Zonation of the seas - rocky, sandy and muddy shores;
4. Classification of marine habitat - pelagic, benthic, neritic, oceanic, littoral and abyssal.

UNIT – II Physical Characteristics of Water:

1. Light - penetration of sunlight into aquatic media, effect of light on productivity, photoperiodicity in animals; Temperature - annual temperature cycles,
2. Thermal stratification of water bodies, thermal optimum, maximum and minimum, water movements, periodic and aperiodic current systems; Turbidity - causes, variations and effects.
3. Chemical Characteristics of Water: Atmosphere and atmospheric gases dissolved in water; Oxygen - oxygen and life, hypoxia, anoxia and hyperopia, adaptations of animals to varying oxygen tensions; Carbon dioxide - sources of Co2, its ecological effects; pH or hydrogen ion concentration - its significance.
4. Inorganic Salts: Salts as liming factors; basic nutrient salts; ecological effects of salinity; effect of salinity on animals; total hardness and total alkalinity.

UNIT – III Biogeochemical Cycles:

1. Nitrogen cycle; phosphorus cycle; sulphur cycle; carbon cycle; trace

elements - manganese and copper.
2. Organic Matter: Aquatic vegetation – zones of aquatic vegetation; Plankton - classification of plankton, factors affecting plankton distribution, plankton counting and sampling;
3. Phytoplankton - zooplankton relationship, plankton productivity;
4. Benthos - phytobenthos and zoo benthos.

UNIT – IV Productivity:

1. Concept of productivity – standing crop, rate of production and rate of removal; primary and secondary productivity;
2. Classification of water bodies on the basis of productivity.
3. Dynamics of Aquatic Ecosystem: Principal steps and components – niches, trophic levels and relations; producers, consumers, decomposers and transformers;
4. Food chain and food web; pyramid of biomasses; pyramid of numbers; energy transfer in the ecosystem.

ADDITIONAL INPUTS:

- **Effect of physical and chemical parameters of water on migration on fish.**

Suggested reading:

1. Santhanam, R. 1993. A Manual of Fresh Water Ecology: An Aspect of Fishery Environment. Daya Publishing House, New Delhi.

2. Pillai, N. K. 1993. Marine Biology and Ecology. Daya Publishing House, New Delhi.

3. Reid, G. K. and R. D. Wood. 1976. Ecology of Inland Waters and Estuaries
D. Van Nostrand Company. 4. Kormondy, E. J. 1996. Concepts of Ecology. Prentice Hall of India Pvt. Ltd. New Delhi.

5. Cole, G. L. 1954. Text Book of Limnology. The C. V. Mosloy Co.,

6. Odum, E. P. 1996. Fundamentals of Ecology. 3rd Edn. Natraj Publishers, Dehradun.

7. Santhanam, R. and A. Srinivasan. 1994. A Manual of Marine Zooplankton. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

8. Pillai, N. K. 1986. Introduction to Planktonology. Himalaya Publishing House, Mumbai.

9. Balakrishnan Nair, N and D. M. Thampy. 1980. A Text Book of Marine Ecology. Mc Millan Co. of India Lt

GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM M.Sc.
AQUACULTURE
SEMESTER-I
CORE II-------AQC 102. AQUATIC ECOLOGY

PRACTICAL SYLLABUS

AQC 102 .Aquatic Ecology Lab:

1. Identification of phytoplankton and zoo plankton – Fresh water and brackish water.
2. Predaceous freshwater insects.
3. Identification of common fresh water benthic organisms Macrophysics in freshwater.
4. Shore fauna.

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM

M.Sc. AQUACULTURE

SEMESTER-I

CORE III-------AQC 103. WATER QUALITY MANAGEMENT

Learning outcomes:

By the completion of this course student can able to

- Get knowledge on water quality parameters.
- Applications of aerators in emergency conditions.
- Understanding of hatchery management.
- EMPLOYIBILITY OPPORTUNITY IN AQUACULTURE LABS

EXTRACURRICULAR ACTIVITY

- Vist to hatchery/aquaculture lab.

Unit-I

1. Water quality: Constituents of water, Water quality parameters – optimal levels and their management in freshwater fish and brackish water shrimp culture.
2. Fertilizers and manures: Different kinds of fertilizers and manures, fertilizer grade, source, rate and frequency of application; Ecological changes taking place after fertilizing;
3. Bio fertilizers; Role of inorganic, organic and bio fertilizers in aquaculture practices; Utilization of bioactive compounds by microorganisms.
4. Liming: Properties of liming materials, lime requirements and application of liming Materials to ponds, effects of liming on pond ecosystem

Unit-II

1. Dynamics of dissolved oxygen: Dial changes in dissolved oxygen concentration, oxygen budget of culture ponds;
2. Algal die-off, overturns, identification of oxygen problems.
3. Aeration: Principles of aeration, emergency aeration,
4. DE stratification and practical considerations.

Unit-III

1. Hatchery management: Fish hatchery - Hatchery protocols, seed rearing technology; Packaging and transport of seed.
2. Shrimp hatchery – Larval rearing; culture and use of different live feed; different chemicals and drugs used; water quality and feed management.
3. Water discharge standards; Effluent treatment in hatcheries.
4. Aquatic weed management: Common weeds and problems in culture ponds; Chemical, biological and mechanical control methods; Algal bloom control.

Unit-IV

1. calcium hydroxide; 2.Reduction of pH, control of turbidity, salinity, hardness, chlorides,
2. Water exchange, chlorine removal; rotenone, formalin and malachite green; methods of applying chemicals.
3. Pollution in relation to aquaculture practices.

REFERENCE BOOKS

1. Adhikari S & Chatterjee DK. 2008. Management of Tropical Freshwater Ponds. Daya Publ.

2. Boyd CE and Tucker CS. 1992. Water Quality and Pond Soil Analyses for Aquaculture. Alabama Agricultural Experimental Station, Auburn University.

3. Boyd CE. 1979. Water Quality in Warm Water Fish Ponds. Auburn University

4. Boyd, CE. 1982. Water Quality Management for Pond Fish Culture. Elsevier Sci. Publ. Co.

5. Hepher B & Pruginin Y. 1981. Commercial Fish Farming. John-Willey & Sons Inc.

6. Jhingran VG. 1982. Fish and Fisheries of India. Hindustan Publishing Corporation, India.

7. Midlen & Redding TA. 1998. Environmental Management for Aquaculture. Kluwer.

8. Pillay TVR & Dill WMA.1979.Advances in Aquaculture. Fishing News Books, Ltd.England.

9. Rajagopalsamy CBT & Ramadhas V. 2002. Nutrient Dynamics in Freshwater Fish Culture System. Daya Publ.

10. Sharma LL, Sharma SK, Saini VP & Sharma BK. 2008. Management of Freshwater Ecosystems. Agrotech Publ. Academy.

11. Stickney RR. 1979. Principles of Warm water Aquaculture. John-Willey & sons Inc.

12. Tucker C.S. 1985. Channel Catfish Culture. Elsevier.

GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM M.Sc.
AQUACULTURE

SEMESTER-I

CORE III AQC 103 Water Quality Management Lab:

PRACTICAL SYLLABUS

1. Determination of Temperature, pH, Salinity.
2. Total Alkalinity and total Hardness.
3. Dissolved Oxygen, Phosphates, COD and BOD
4. Estimation of Primary Productivity, Nitrites and Nitrates.

GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM M.Sc.
AQUACULTURE

SEMESTER-I

SEC-I (A): FISH PATHOLOGY

Learning outcomes:

By the completion of this course student can able to

- Get knowledge on different types of fish diseases.
- Classify different causative agents responsible for fish diseases.
- Identify infected fish.
- Generalize precautions to be taken to prevent diseases.

UNIT – I:

Viral diseases

1. Fish Diseases: Clinical symptoms, pathology and control measures of Viral Haemorrhagic Septicemia (VHS)
2. Infectious Hematopoietic Necrosis (IHN).
3. Shrimp Diseases: Pathology, clinical symptoms, prevention and treatment of Monodon Baculoviral disease (MBV), Infectious Hypodermal and Hematopoietic Necrosis (IHHN), Hepato
4. Pancreatic Parvovirus disease (HPPV), Yellow-head virus disease, Taura syndrome and White spot syndrome.

UNIT – II:

Bacterial and Fungal diseases

1. Fish Diseases: Clinical symptoms, pathology, prevention and control measures of Bacterial Hemorrhagic Septicemia (BHS), Bacaterial gill disease and Tail and fin rot.
2. Pathology, clinical symptoms, prevention and control measures of Saprolegniasis and Branchiomycosis.
3. Shrimp Diseases: Clinical symptoms, pathology, prevention and control measures of Black gill disease, Filamentous bacterial gill disease.
4. Clinical symptoms, pathology, prevention and control measures of Lagenidium disease (Larval Mycosis) and Brown gill disease.

UNIT – III:

Protozoan, Helminthic and Crustacean diseases

1. Fish Diseases: Clinical symptoms, pathology and control measures of Ichthyophthiriasis, Enterococcidiasis, Whirling disease and Nodular disease.
2. Clinical symptoms, pathology and control measures of Gyrodactylosis and Dactylogyrosis. Clinical symptoms, pathology and control measures of Argulosis and Lernaeasis.
3. Shrimp Diseases: Etiology, morphology and control measures of

ectocommensal protozoa – Zoothamnium and Acineta.
4. Clinical symptoms, pathology and control measures of Microsporidiasis.

UNIT – IV:

Nutritional and Ecological diseases

1. Fish Diseases: Diseases of vitamin deficiency and Fatty liver degeneration.
2. Clinical symptoms, pathology and control measures of gas bubble disease and lack of oxygen.
3. Shrimp Diseases: Clinical symptoms, pathology and control measures of Cramped tails, Muscle Necrosis, Gas bubble disease.
4. Black death disease, Chronic soft shell syndrome and Blue shell syndrome.

REFERENCE BOOKS

1. Cheng TC. 1964. The Biology of Animal Parasites. W.B. Saunders Company, Philadelphia, Pennsylvania, USA.

2. Conroy CA and Herman RL. 1968. Text book of Fish Diseases. TFH (Great Britain) Ltd, England.

3. Lightner DV. 1996. A Handbook of Shrimp Pathology and Diagnostic Procedures for Diseases of Cultured Penaeid Shrimp. World Aquaculture Society, Lousiana, USA.

4. Reichenbach KH. 1965. Fish Pathology. TFH (Gt. Britain) Ltd, England.

5. Ribelin WE and Miguki G. 1975. The Pathology of Fishes. The Univ. of Wisconsin Press Ltd, Great Russel Street, London, UK.

6. Shuzo Egusa.1978. Infectious Diseases of Fish. Oxonian Press Pvt. Ltd. New Delhi.

7. Van Duijn, C. 1973. Diseases of Fishes. Cox and Wyman Ltd. London.

GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM M.Sc.
AQUACULTURE

SEMESTER-I

SEC-I Fish Pathology Lab

PRACTICAL SYLLABUS

1. Identification of Fish and Shrimp disease.
2. Examination of normal and diseased fish.
3. External examination on diseased fish diagnostic features and procedure.
4. Atrophy of organ of diseased fish, Host examination – collection of parasitesHistopathology of organs of diseased fish.

Slides of fish parasites.

5.Fish diseases- Album preparation

GOVERNMENT COLLEGE (A) RAJAMAHENDRVARAM

M.Sc., AQUACULTURE

SEMESTER-I

SEC-2 FISH IMMUNOLOGY AND MICROBIOLOGY

Unit I: Introduction

1. Background and History of Immunology
2. Fish Health and Management
3. Lymphoid system: Lymphoid organs and Cells
4. Antibody: Structure and function of Ig M its properties and diversity

Unit – II: Immune Response

1. Types of Immune Response in various Representative fish groups

2. Cell mediated immunity and Humoral immunity
3. Immuno toxicology in Fish – Immuno-suppression & Immuno-modulation in Response to various toxicants.

4. Immunization: Routes of immunization – Principles of vaccination, Vaccines: Types of Vaccines – Live and Attenuated vaccines, peptide vaccines and DNA vaccines.

Unit – III:

1. Importance of microbiology in aquaculture. . Nutritional requirements of microorganisms; Constituents of growth media Types of cultures. Maintenance of culture and preservation - growth Curve.

2. Bacteria species: salmonella, vibrio cholerae, clostridium botulinum their Occurrence; Pathogenicity & prevention of bacterial hazards.Bacterial pathogens growth and inactivation.

3. Viral hazards: Enter viruses - polio myletis , Norwalk viruses. Viruses occurrence, importance, Pathogenecity & control.

Unit – IV:

1. Laboratory techniques in Microbiology: prevention of contamination.

2. Sterilization - principles of various physical and chemical methods.

3. Microscopy - bright field , fluorescence , phase - contrast.

4. Staining techniques - Types of strains and chemistry of staining.

PRACTICALS:

1. Immunization –routes of immunization, preparation of Inoculum
2. Bleeding of fish –different methods adopted
3. Differential count of W.B.C
4. Cell viability test
5. Identification of salmonella, vibrio cholerea, v-parahaemolyticus Clostridium botulinum
6. Identification of lymphoid organs and cells
7 . Determination of chlorinated pesticides by gas chromatography.
8. Detection of mycotoxins by TLC & fluorometer.