## M.Sc. AQUACULTURE

**SEMESTER –I**
**COURSE:101 TOOLS AND TECHNIQUES FOR BIOLOGY (THEORY PAPER)**

| CO | COURSE OUTCOME | LEVEL |
|-----|----------------|-------|
| CO1 | Categorize the application of biological and chemical assays in various fields. | L4 |
| CO2 | Analyze the fundamental principles of centrifugation | L4 |
| CO3 | Apply different sterilization techniques to ensure aseptic conditions. | L3 |
| CO4 | Understand different phases of microbial growth | L2 |

## COURSE: 105 - TOOLS AND TECHNIQUES FOR BIOLOGY (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|-----|----------------|-------|
| CO1 | Discuss theory behind separation techniques and apply to paper chromatography | L6 |
| CO2 | Assess the techniques in centrifugation. | L5 |
| CO3 | Prepare phosphate buffer solutions using appropriate salts. L1 | L1 |
| CO4 | Determine absolute and relative counts of WBCs and RBCs. L5 | L5 |

## COURSE: 102 BIOSYSTEMATICS, BIODIVERSITY AND EVOLUTION(THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Apply ethical principles in the practice of biosystematics. | L3 |
| CO2 | Analyze the methods used to reconstruct evolutionary relationships among taxa. | L4 |
| CO3 | Understand the basic principles of evolutionary theory. | L2 |
| CO4 | Illustrate the concept of a gene pool and its significance | L2 |

## COURSE: 106 BIOSYSTEMATICS, BIODIVERSITY AND EVOLUTION (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Interpret the evolutionary relationships among invertebrate and vertebrate taxa | L5 |
| CO2 | Identify different types of speciation | L1 |
| CO3 | Evaluate deviations from Hardy-Weinberg equilibrium caused by evolutionary forces | L5 |
| CO4 | Elaborate the factors that influence gene frequencies in populations. | L6 |

## COURSE: 103 BIO MOLECULES (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Analyze the mechanisms involved in protein denaturation | L4 |
| CO2 | Illustrate the properties of different carbohydrates | L2 |
| CO3 | Classify different types of lipids and fatty acid | L3 |
| CO4 | Analyze the role of DNA-binding proteins | L4 |

## COURSE:BIO MOLECULES (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Evaluate the impact of monosaccharide metabolism | L5 |
| CO2 | asses chemical reaction involved in the formal titration of glycine | L1 |
| CO3 | Describe the chemical reaction between reducing sugars and DNS reagent. | L1 |
| CO4 | Determine visualization technique in detecting amino acids on TLC plates | L5 |

## COURSE: MOLECULAR CELL BIOLOGY(THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Understand the basic principles of cell biology | L2 |
| CO2 | Compare the structural properties of microfilaments and microtubules | L4 |
| CO3 | Analyze the structure and function of cyclins and CDKs. | L4 |
| CO4 | Illustrate the roles of MAP kinase pathways in tissue homeostasis | L |

## COURSE:MOLECULAR CELL BIOLOGY(PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Asses squash preparation techniques in microscopy | L5 |
| CO2 | Describe the components and functions of a light microscope. | L1 |
| CO3 | Compare the processes of mitosis and meiosis in terms of chromosome number | L6 |
| CO4 | Define macromolecules and describe their structural and functional diversity. | L1 |

## COURSE: 201 BIOSTATISTICS & BIO INFORMATICS(THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Apply measures of central tendency in analyzing real-world datasets | L3 |
| CO2 | Understand the properties & characteristics of probability distributions. | L2 |
| CO3 | Examine database concepts and explore the Microsoft Office Access | L4 |
| CO4 | Understand the types of biological data stored in databases | L2 |

## COURSE: 205 BIOSTATISTICS & BIOINFORMATICS (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Choose appropriate graphical representations based on the nature of the data. | L6 |
| CO2 | Describe different types of sampling methods. | L1 |
| CO3 | Assess the implications of these measures for understanding data distribution and making inferences. | L5 |
| CO4 | Interpret the meaning of the correlation coefficient in the context of the data. | L5 |

**SEMESTER –II**
**COURSE: 202 ANIMAL PHYSIOLOGY (THEORY PAPER)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Compare respiration in different species | L2 |
| CO2 | analyze composition of blood | L4 |
| CO3 | illustrate osmoregulatory mechanisms in various organisms | L3 |
| CO4 | Summarize common respiratory disorders and diseases. | L2 |

**COURSE:206 ANIMAL PHYSIOLOGY (PRACTICAL PAPER)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Prepare pituitary gland extract for different fish species | L6 |
| CO2 | Describe the relationship between metabolic rate and temperature. | L1 |
| CO3 | Examine morphology and function of different types of neurons in the prawn nervous system. | L1 |
| CO4 | Explain the general principles of enzyme function. | L5 |

**COURSE: 203  IMMUNOLOGY (Theory Paper)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Summarize major cellular components of the innate immune system. | L2 |
| CO2 | Understand the relationship between allotypes, idiotypes | L2 |
| CO3 | illustrate structure of antibodies and antigens | L3 |
| CO4 | Analyze the contribution of B cells to various diseases. L4 | L4 |

## COURSE: 207  IMMUNOLOGY (Practical Paper)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Explain the importance of quality assurance and control measures in VDRL testing. | L5 |
| CO2 | Analyze quality control measures in immunoelectrophoresis | L4 |
| CO3 | Design and optimize RIA assays. | L6 |
| CO4 | Examine various blood groups | L5 |

## COURSE:204 MOLECULAR BIOLOGY  (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Compare DNA replication in prokaryotic and eukaryotic cells. | L2 |
| CO2 | Classify the different types of RNA polymerases found in cells. | L2 |
| CO3 | Analyze hypotheses regarding the origin and evolution of the genetic code. | L4 |
| CO4 | Develop the ability to evaluate primary research articles in the field of DNA repair | L3 |

## COURSE: 208 MOLECULAR BIOLOGY   (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Estimate RNA in tissue under Colorimetric method. | L6 |
| CO2 | Analyze DNA purity using quantitative PCR (qPCR) | L4 |
| CO3 | Interpret SDS-PAGE gel results. | L5 |
| CO4 | Examine SDS-PAGE of serum proteins in biomedical research and diagnostics. | L5 |

**SEMESTER –III**

**COURSE: 301 CONCEPTS OF AQUATIC ECOLOGY THEORY PAPER)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Classify various aquatic ecosystems and their habitats | L2 |
| CO2 | Analyze physical and chemical characteristics of water in aquatic habitat | L4 |
| CO3 | Compare functions of biogeochemical cycles in aquatic environment | L2 |
| CO4 | Distinguish the factors that influence dynamics in aquatic ecosystems | L4 |

**COURSE: 301 CONCEPTS OF AQUATIC ECOLOGY (PRACTICAL PAPER)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Identify various zoo and phyto planktons | L1 |
| CO2 | Estimate Primary Productivity | L5 |
| CO3 | Determine Shore fauna | L6 |
| CO4 | Estimate Co2 of aquatic habitat | L5 |

**COURSE: 302 PRINCIPLES OF AQUACULTURE   (THEORY PAPER)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Simply different types of aquaculture systems and methods | L4 |
| CO2 | Understand the principles of aquaculture engineering as applied to aquaculture | L2 |
| CO3 | Illustrate pre stocking and stocking management in shrimp culture | L3 |
| CO4 | Estimate water quality parameters for post stocking management | L2 |

## COURSE: 302 PRINCIPLES OF AQUACULTURE    (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Estimate and calculate of production costs of fish/shrimp farm | L6 |
| CO2 | Examine various aquatic weeds and their control | L4 |
| CO3 | Assess Length weight relationship | L5 |
| CO4 | Determine various types of filters | L5 |

COURSE: 303

## COURSE: 303 NUTRITION AND FEED TECHNOLOGY (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Illustrate the principles of fish nutrition for fin fish and shellfish | L3 |
| CO2 | Understand how nutrients are metabolized to produce energy for fish production | L2 |
| CO3 | Use of feed additives in supplementary feeds | L3 |
| CO4 | Summarize the feeding strategies and storage methods of feed | L2 |

## COURSE: 303 NUTRITION AND FEED TECHNOLOGY (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|----|----------------|-------|
| CO1 | Estimate total proteins, carbohydrates and lipids in fish feeds | L6 |
| CO2 | Determine amino acid profiles through paper chromatography (AI) | L5 |
| CO3 | Identify different feed ingredients (AI) | L1 |
| CO4 | Assess feed formulation | L5 |

## COURSE: 304 WATER QUALITY MANAGEMENT (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Categorize different kinds of fertilizers and manures in shrimp culture | L4 |
| CO2 | Understand the factors influencing dissolved oxygen dynamics in aquatic environments | L2 |
| CO3 | Outline the techniques for maintaining water quality conditions in hatchery systems | L2 |
| CO4 | Analyze various types of chemical treatments used in aquaculture | L3 |

## COURSE: 304 WATER QUALITY MANAGEMENT (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Analyze Plankton in water bodies | L4 |
| CO2 | Determine Temperature, pH, Salinity, Turbidity. | L5 |
| CO3 | Estimate water quality parameters | L6 |
| CO4 | Evaluate total nitrates and nitrites | L5 |

## SEMESTER –IV

## COURSE: 401 AQUACULTURE (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Illustrate breeding methods and Management of fish culture ponds | L3 |
| CO2 | Understand giant freshwater prawns hatchery management | L2 |
| CO3 | Compare blackish water fishes and pearl oysters | L2 |
| CO4 | Classify various seaweed species. | L4 |

## COURSE: 405 AQUACULTURE   (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Identify major cultivable species - fin fish and shell fish, molluscs. | L1 |
| CO2 | Prepare Pituitary gland extract | L6 |
| CO3 | Compare fresh water and Marine water ornamental fishes | L4 |
| CO4 | Identify of common ornamental aquarium plants. | L1 |

## COURSE: 402 FISH PROCESSING TECHNOLOGY (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Categorize the post-mortem biochemical changes in fish | L4 |
| CO2 | Outline the role of bacteria and moulds in fish preservation | L2 |
| CO3 | Distinguish principles and modern techniques employed in fish preservation | L4 |
| CO4 | Illustrate various quality standards and tools used in quality assurance | L3 |

## COURSE: 406 FISH PROCESSING TECHNOLOGY (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Analyze Biochemical constituents of fish | L4 |
| CO2 | Evaluate freshness of fish | L5 |
| CO3 | Prepare Fishery by products | L6 |
| CO4 | Examine salt, protein, moisture in dried / cured products. | L4 |

## COURSE: 403 FISH PATHOLOGY (THEORY PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Classify various types of fish and shrimp diseases | L2 |
| CO2 | Distinguish symptoms, prevention and control measures of bacterial and fungal diseases | L4 |
| CO3 | Illustrate etiology and morphology of ectocommensal protozoa | L3 |
| CO4 | Understand diagnostic techniques for detecting diseases caused by vitamin deficiencies | L2 |

## COURSE: 407 FISH PATHOLOGY (PRACTICAL PAPER)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Identify Fish and Shrimp disease | L1 |
| CO2 | Compare normal and diseased fish. | L4 |
| CO3 | Examine diseased fish diagnostic features and procedure | L1 |
| CO4 | Analyze organ of diseased fish, collection of parasites | L5 |

**Semester –III**

## COURSE: 404 Aquaculture Biotechnology (Theory paper)

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Simply various techniques used in genetic engineering. | L4 |
| CO2 | Describe various cryopreservation of gametes and Embryo transfer technology. | L2 |
| CO3 | Illustrate application of Nanotechnology in aquaculture | L3 |
| CO4 | Analyze nitrogen fixation in aquatic environment | L4 |

**Semester –IV**

**COURSE: 404 Aquaculture biotechnology (Practical Paper)**

| CO | COURSE OUTCOME | LEVEL |
|---|---|---|
| CO1 | Enumerate molecular diagnosis of disease- PCR method. | L5 |
| CO2 | Examine Induced breeding in fishes | L1 |
| CO3 | Estimate probiotics in aquaculture farms. | L5 |
| CO4 | Enumerate eyestalk ablation procedure in crustaceans. | L5 |