

**Department of Marine Living Resources
Andhra University**

**M.Sc. Coastal Aquaculture and Marine Biotechnology – I Semester syllabus
Paper 1.1 : Oceanography and Marine biology**

Physical parameters of sea: tides, waves, light, temperature, currents, density & pressure.

Chemical parameters of sea: salinity, dissolved oxygen, carbondioxide, pH, nutrients and trace elements

Composition seawater and brackishwater..

Classification of marine habitats and ecological divisions in ocean.

Plankton, nekton and benthos and their adaptations.

Ecology of coral reefs and mangrove habitats; their special features.

Law pertaining to the seas.

Remote sensing applications in oceanography and marine biology.

References

Svedrup et al	The Oceans	Prentice Hall
Tait RV	Elements of marine ecology	Butterworths
Riley & Skirrow	Chemical Oceanography	Academic Press
Newell RC	Biology of intertidal animals	Logos Press
Kinne O (Ed)	Marine ecology	John Wiley & Sons
Mann KH	Ecology of coastal waters	
King CAH	Introd. Phys. & Biol. Oceang.	ELBS

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – I Semester syllabus
Paper 1.2 : Finfish Culture**

Important cultivable finfish species and their life histories.

Criteria for selection of finfish for culture.

Classification of culture systems: ponds, pens, cages, raceways

**Pond preparation and fertilization; eradication of weed and
Predatory finfishes.**

Culture practices of milkfish, mullets, seabass and yellowtail.

Monoculture and polyculture : principles and practices.

Integrated farming, organic farming and their management.

Harvesting and post-harvesting technology of cultured finfish.

Production, quality control, marketing and economics.

References:

Bardach JE et al	Aquaculture	Wiley Interscience
Huet & Timmermans	Textbook of fish culture	FNB
Pillay TVR	Aquaculture: principles and practices	FNB
Santhanam R et al	Coastal aquaculture	CBS

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – I Semester syllabus
Paper 1.3 : Crustacean Farming**

Status of crustacean farming.

Important cultivable species of shrimps and prawns, their food and feeding habits and their reproductive biology.

Types of farming: traditional, extensive, semi-intensive and intensive methods; their management techniques.

Crustaceans culture in cages, re-circulatory systems, rice fields and super-intensive and ultra-intensive systems.

Supplementary feeding: dry feeds, wet feeds, role of artificial feeds; feed ingredients and nutritional quality.

Farming of prawn, shrimp, crab and lobster.

References:

Shigueno K	Shrimp culture of Japan	AITP, Tokyo
Milne PH	Fish & shellfish farming in coastal waters	FNB
McVey JP	Crustacean aquaculture CRC handbook	CRC press
Korringa P	Farming of marine fishes & shrimps	Elsevier
Walne PR	Culture of bivalve mollusks	PNB

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – I Semester syllabus
Paper 1.4 : Aquaculture Engineering**

Scope and importance of aquaculture engineering.

Types of soils, important soil properties; soil texture & structure, soil-water Relationships.

Computation of area by various survey methods (chain, plane table, magnetic compass) and levelling (auto leveler) , earth work estimations.

Properties of fluids, monk sluices; computation of time to fill/drain pond/tank.

Fundamentals of waves & tides; their effects on aquaculture installations.

Engineering properties of materials. Types of materials used in aquaculture.

Technical considerations in site selection for hatchery/farm/cages

Design and construction of a hatchery (carp/shrimp), pond, cages, pens, raceways.

Water treatment: Filtration of water for aquaculture; water re-circulation methods.

Working principles o pH meter, salinometer, spectrophotometer, D.O. meter, Secchi disc, heaters, ozonisers, UV filtration unit, pumps and aerators (types, selection and positioning).

References:

Lawson TB	Fundm. Aquaculture engineering	CBS
Whaton FW	Aquaculture engineering	John Wiley
Timmon	Aquaculture engineering	Blackwell
Bose & Mitra	Coastal aquaculture engineering	Oxford & IBH
Punnima	Surveying	Laxmi publishers
AGOR	Elements of Civil Engg.	Khanna
BC mal	Soil & Water Conservation Engg.	Kalyani

**Department of Marine Living Resources
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**M.Sc. Coastal Aquaculture and Marine Biotechnology – II Semester syllabus
Paper 2.1 Mariculture**

Coastal and open sea farming : Overview and global development in mariculture.

Perspectives in mariculture; Science and technology important to open sea mariculture

Crop selection, controlling the biological environment; platforms, housing and energy for mariculture

Culture practices in brackishwater farm ponds. Pond management in tropical waters: pond preparation, eradication of predators, stocking.

Role of chemical fertilizers and organic manures in farm ponds.

Water quality management in ponds.

Nutritional requirements of finfish and shellfish.

Prospects for the future; Laws pertaining to aquaculture & exploitation of living resources.

References:

Bardach JE et al	Aquaculture	Wiley Interscience
Pillay TVR	Aquaculture: principles & practices	FNB
Imai T	Aquaculture in shallow seas	Amerind
Stickney RS	Principles of aquaculture	John Wiley
Pillay & Dill	Advances in aquaculture	FAO

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – II Semester syllabus
Paper 2.2 : Molluscan & Seaweed farming**

Present status of molluscan farming: life cycles of cultivable mollusks.

Oyster and mussel farming: growth, fattening and greening.

Culture of pearl oyster and pearl production.

Culture of cephalopods.

Water quality management and biofouling.

Harvesting, post-harvest technology, management, production and economics.

Seaweed farming: present status.

Life cycles of cultivable seaweeds.

Culture practices of seaweeds in India and abroad: improvement of breed.

References:

Bardach JE et al Milne PH	Aquaculture Fish and shellfish farming in coastal waters	Wiley Interscience FNB
Walne PR Pillay & Dill Korringa P	Culture of bivalve mollusks Advances in aquaculture Farming of the oyster	PNB FAO Elsevier

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – II Semester syllabus
Paper 2.3 : Reproduction and Genetics in Aquaculture**

Genetic principles and cytogenetics

Reproductive biology of Finfishes (mullets, milkfish, seabass, tilapia & groupers), Crustaceans (shrimps, prawns, crabs and lobsters) and Mollusks (oysters, mussels and cephalopods) and Echinoderms (sea cucumbers).

General account of physiology of reproduction in finfish and shellfish.

Induced breeding in finfish and shellfish

Sex control and its role in aquaculture; Cryobiology and cryopreservation.

IN-VITRO fertilization and artificial insemination.

.Role of genetics in aquaculture; genetic selection, inbreeding, cross-breeding and hybridization.

Induction of chromosomal ploidy: polyploidy and aneuploidy.

Transgenesis and its application in aquaculture.

Genetic modifications in seaweeds.

References:

Pillay TVR	Aquaculture: principles & practices	FNB
Kirpichnikov VS	Genetic basis of fish selection	Springer
Imai T	Aquaculture in shallow seas	Amerind
Jhingran VG	Fish & fisheries of India	Hindusthan

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – II Semester syllabus
Paper 2.4 :Seed production & Hatchery Management**

**Seed production: wild seed collection methods of mullets, milkfish, seabass
shrimps, crabs, lobsters, oysters, pearl-oysters, mussels and seaweeds.**

**Impact of exploitation of wild seed and broodstock on environment
and on sustainable yields.**

**Hatchery management and seed production of mullets, milkfish, seabass,
shrimps, crabs, lobsters, oysterd, pearl-oysters, mussels and seaweeds.**

Feed and nutrition.

Harvesting of fry, packaging and transport of fry; Small scale hatcheries.

**Nursery Management: preparation of nurseries; effect of physico-chemical
factors, feeding and control of predators**

References:

Bromage & Roberts	Broodstock management and egg and larval quality.	Blackwell
Bardach JE et al	Aquaculture	Wiley
Interscience		
Pillay TVR	Aquaculture: principles & practices	FNB
Santhanam R et al	Coastal aquaculture	CBS
Stickney RR	Principles of Aquaculture	John Wiley

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – III Semester syllabus
Paper 3.1 : Marine Microbiology**

Microscopes : types and basic principles.

**Microbes in the sea: viruses, bacteria, fungi, microalgae and protozoans
distribution in the marine environment.**

Sterilization techniques employed in microbiological studies.

Viruses: morphology, isolation, culture and classification.

Bacteria: morphology, enumeration, culture, classification and preservation.

Marine microalgae, fungi and protozoans: culture and classification,

Role of microbes in the marine environment,

**Methods of controlling microbes: physical, chemical & chemotherapeutic
methods.**

Microbial decomposition of carbohydrates, proteins and lipids.

Mangrove microbiology; mangrove microbial processes and organisms involved.

References:

**Litchfield CD
Pelczar ECS et al**

**Marine microbiology
Microbiology**

**Hutchinson & Ross
Tata-McGraw Hill**

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – III Semester syllabus
Paper 3.2 : Principles of Biochemistry**

Biomolecules: carbohydrates, lipids, proteins, vitamins and minerals – structure, biological significance, role in metabolism, bioenergetics.

Metabolism: Carbohydrates, proteins and lipids metabolism.

Biological membranes: transport of molecules.

Analytical techniques for biomolecules separation, isolation & purification.

Centrifugation, spectroscopy, fluorescence, nanometry and microtomy.

Enzymes: classification, types, factors affecting enzyme catalysis, control of enzymatic action and immobilization of enzymes.

Structure and general properties of prostaglandins, thromboxanes, interferons, interleukins and antibiotics.

References

Stryer H	Biochemistry	
Lehninger AL	Principles of biochemistry	CBS
Plummer	An introduction to practical biochemistry	

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**M.Sc. Coastal Aquaculture and Marine Biotechnology – III Semester syllabus
Paper 3.3 : Bioactive Marine Natural products**

Introduction: Significance of marine natural products.

**Isolation techniques: liquid-liquid extraction, membrane separation methods,
Chromatography (paper, TLC, HPLC) techniques.**

Characterisation techniques: IR, UV, NMR and Massspectra

**Types of important products: Antibiotic, anti-tumour, tumour-promotor,
anti-inflammatory, analgesic, cytotoxic, anti-viral anti-fouling
compounds of marine origin.**

Marine toxins: Saxitoxin, brevitoxin and ciguatoxin

**Marine peptides & alkaloids: pyridoacridine, pyrrolocridine indole,
pyrrole, isoquinoline alkaloids.**

Marine prostaglandins and marine cosmetic products.

Theories of drug action and factors affecting drug action.

References:

David HA et al	Marine Biotechnology	Plenum
Scheur PJ	Marine Natural Products	Academic
DS Bhakuni DS Rawat	Bioactive marine natural products	Springer& Anamaya

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**M.Sc. Coastal Aquaculture & Marine Biotechnology – III Semester Syllabus
Paper 3.4 : Marine Pollution and Biodeterioration**

Sources of marine pollution, its dynamics, transport paths and agents.

Composition of domestic, industrial and agricultural discharges. Their fate in the marine environment. Toxicity and treatment methods.

Oil pollution: Sources, composition and its fate in marine habitats. Toxicity and treatment methods.

Thermal and radioactive pollution: sources, effects and remedial measures.

Solid dumping, mining and dredging operations: their effects on marine ecosystem.

Role of biotechnology in marine pollution control.

Biofouling and biodeterioration: Agents and protection methods.

Global environmental monitoring methods: status, objectives and limitations.

References:

Nielsen SE	Tropical pollution	
Kinne O	Marine Ecology Vol. V	John Wiley
Johnson R (Ed)	Marine pollution	Academic Press
Patin SA	Pollution and boil. Resources of oceans	Butterworths

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**M.Sc. Coastal Aquaculture & Marine Biotechnology – IV Semester Syllabus
Paper 4.1 : Pathology & Immunology**

Disease causing agents: physical, chemical and biological agents.

Disease diagnostics: Epidemiology, laboratory studies, microbiological and histopathological studies.

Viral, bacterial, fungal and protozoan diseases in marine organisms and their control methods.

Chemotherapeutic agents: types and modes of action.

Applications of biotechnology in the diagnosis and control of diseases.

Antigens and their general properties.

Immunoglobulins: structure and properties.

Immunity: natural and acquired immunity;

Cytotoxicity mechanisms.

Immunology of invertebrate marine organisms

References:

Schoperclans W	Fish diseases	Oxian press
Riott I M	Essentials of immunology	Blackwell

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**M.Sc. Coastal Aquaculture & Marine Biotechnology – IV Semester Syllabus
Paper 4.2 : Molecular Biology**

**Molecular basis of nucleic acids (DNA and RNA), mitochondria, plastids and
and ribosomes: structure, replication, damage & repair.
Gene amplification, rearrangement.**

**Biological membranes : cell membranes, nuclear membrane, model membranes,
complex membranes, structures and conservatives. Glyco-conjugates
and proteins in membrane systems, Ion transport, Na/K phase,
Molecular basis of signal transduction..**

**Regulation of gene expression in pro- and eu-karyotes., attenuation and
antitermination.**

**Operon concept, DNA methylation, heterochromatinization, regulatory
sequences and transacting factors. Environmental regulation
of gene expression.**

Mechanism of transcription in prokaryotes and eukaryotes.

RNA processing., ribonucleoproteins, genetic code, protein synthesis.

References:

Paul J	Cell Biology	Hinemanu
Friefelder D	Microbial genetics	
Albert et al	Molecular biology of Cells	
DeRoberties	Cell and molecular biology	
Watson et al	Molecular biology of the gene	B Cummings

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**M.Sc. Coastal Aquaculture & Marine Biotechnology – IV Semester Syllabus
Paper 4.3 : Marine Biotechnology**

Microbial fermentation, microbes in decomposition and recycling processes, Applications biofermenters and biofertilizers, microbial transformation process, the structure of fermentation process.

Genetic engineering: gene targeting approaches in biotechnology, isolation of nuclear and extra nuclear DNA, gene modification; introduction to Southern, northern and south-western blots; hybridization, colony hybridization and sequencing of proteins and nucleic acids; Polymerase Chain Reaction.

Recombinant DNA and genome analyses, gene manipulation, molecular cloning. Application of DNA technology in aquaculture, transgenic biology, allopheny.

Cell and tissue culture: primary and secondary cultures, cell lines, cell clones callus culture somaclonal culture, micripropagation, somatic embryogenesis, haploidy, protoplast fusion, somatic hybridization and cybrids.

Single cell proteins: *Spirulina*

Live feed organisms culture: phytoplankton, zooplankton & chironomid larvae.

References:

**Litchfield CD
Bye & Ponnaiah
Travan et al**

**Marine Micribiology
Application of genetics in aquaculture
Biotechnology**

**DHR
CMFRI
Tata-NcGraw**