General Account of systematic classification of fishes. Classification based on degrees of movement, zones inhabited and manner of reproduction.

Economically important groups of fishes: general and brief account of elasmobranches, clupeoids, salmonoids, scombroids, gadoids, heterosomata, sciaenids, carangids. Trichiurids, cat fishes, crustaceans and molluscs.

Natural populations or stocks as biological entities; factors limiting abundance of stocks. Criteria for distinguishing units or multistock species. Idea of unit stock – its relevance to tropical marine fish.


General account of life history of Indian fishes: oil sardines, Indian shad, mackerel, Bombay duck and Malabar sole.

Food and feeding habits of fishes (general account), reproduction and spawning (general account); fish eggs and larvae.

Age determination of fishes; general account. Movement and migration in fishes: eel, salmon, Indian shad. Marking and Tagging of fishes (general account).

Reference Books:
Paper 3.2: Aquaculture – 1

Role, status and importance of Aquaculture
Criteria of selection of species for aquaculture.
Culture practices of carps, milkfish and mullets.
Monoculture, polyculture and integrated farming.
Culture practices of tiger shrimp, Macrobrachium rosenbergi, crabs and lobsters –
Extension activities in aquaculture.
Culture practices of edible oyster, mussel, cephalopod, clams, and Marine finfish.
Culture practices of Seaweeds in India and abroad. Significance of mariculture in India.

References:
2. IMAI t.: Aquaculture in shallow seas, Amerind Pub. Co. 1977
Paper 3.3: Biochemistry and Physiology


Enzymes – Classification, factors influencing enzyme activity, Role of enzymes in metabolism.

Biological Oxidation – Metabolism of Carbohydrates, Proteins and Lipids with reference to fishes.


References:
Paper 3.4: Marine Pollution

Marine Pollution: Definition by GESAMP, major sources of pollution, dynamics, transport paths and agents.

Toxicology: Lethal and sub lethal effects of pollutants on marine organisms, evaluation of toxicity tolerance, bioassay.

Enzymatic removal of hazardous organic substances from aqueous effluents.

Sewage: Domestic, Industrial, agricultural and aquacultural discharges, their composition and fate in the marine environment, toxicity and treatment methods, sewage disposal system.

Environmental Impact Assessment Methods of aquaculture activities.

Oil pollution: Sources and fate of oil, composition and toxicity of oil, biological effects treatment procedures.

Thermal and radioactive pollutants: Source and characteristics, strategies for disposal of RNA and Heated effluents, biological effects and alternative uses of waste dumping, mining and dredging operations, their effects on the organisms and marine environment.

Text Books/References:

2. A.M.Chakravarthy Biodegradation and detoxification of Environmental pollutants, CRC Press, 1928.
Evolution of fishing crafts: Boat types and their classification, types of boats used in India.

Evolution of fishing hooks and baits.

Evolution and classification of fishing gears; description of hand-line, troll line and pole line; description, design and fabrication of trawl nets, purse-seine, gill nets.

Fisheries oceanography: General account of effects of environmental parameters like temperature, currents, light and salinity on fish biology, behaviour and abundance.

Stock assessment: Collection of basic data, stock size, yield models.

The effects of exploitation. The over fishing problem. Management techniques, fishing regulations.

The future of fisheries research; development and management strategies.

Text Books:

1. R.R.Colwell (ed) Biotechnology in Marine Science. 1982
2. Aitikin, A. Fish handling & processing. 2nd edition, 1982
6. connell, J.J Control of fish quality, Fishing News Books Ltd 1975
References:

Paper 4.2: Fish Processing Technology

Chemical composition of fish and shellfish: moisture, protein, fat, carbohydrates, ash etc.

Microbiology of fresh and processed fish: Morphology of bacteria: growth and reproduction of bacteria: effect of environmental factors like temperature, pH, oxygen, moisture, etc.

Common bacteria present in fish; identification and isolation. Bacteria of sanitary significance.

Handling of fish: spoilage of fish and shellfish; effect of temperature on fish spoilage, use of ice;

Solid carbon dioxide and liquid nitrogen in fish preservations; containers for packaging and transportation of fish, handling on board fishing vessels and on shore ;use of chemical preservatives and irradiation in extending shelf life of fish and shell fish.

Canning : Principles of canning; canning materials; handling and preparation of fish and shellfish for canning; spoilage of canned fish; chemical and microbiological spoilage and their prevention.

Curing: Salting of fish-principles and practices; pickling; smoked fish; spoilage of cured fish.

Freezing of fish: techniques of freezing; different types of freezers; changes during freezing and storage of fish; effects of freezing on proteins, lipids and bacteria, spoilage of frozen fish and shellfish; denaturation of proteins, lipid hydrolysis; fat oxidation, protection of frozen fish; glazing and wrapping; use of anti-oxidants; thawing of frozen fish, double freezing of fish; storage, transportation and distribution of frozen fish, industrial methods of freezing fish and shellfish; production and freezing of fish fillets, minced meat and fish fingers.

Byproducts: processing of low cost fish, minced meat, fish oil, fish meal, fish sausages, isinglass, glue, fish silage, chitosan, chitin pearl essence, alginates, agar and corals.

Text Books:

References:
Paper 4.3.: Aquaculture II

Design, construction and management of aquaculture i.e. pond, cages, pens, rafts and long lines.

Technical and non technical considerations in site selection.

Engineering survey principles and procedures. Selection of material and equipment.

Finfish and shellfish hatcheries – Seed production.

Diseases in aquaculture organisms, Prevention and treatment methods

Environmental impact assessment in Aquaculture.

Reference Books:

Paper 4.4.: Biotechnological Applications in Aquaculture

Role of biotechnology in aquaculture.

Reproductive Biotechnology: Breeding biology and endocrine control of reproduction in fin fishes and shell fishes – in induced breeding – egg incubation and larval rearing.

Principles of genetics – fish cytogenetics – application of genetics in aquaculture – genetic selection, hybridization, inbreeding and cross breeding, sex control, cryopreservation, in vitro fertilization, artificial insemination, polyploidy, transgenesis.

Development of disease resistant and high quality strains.

References:
Paper 4.5: Environmental Monitoring and Biodeterioration

Global environmental monitoring methods: Status and objectives, limitations for monitoring critical pollutants.

Role of biotechnology in environmental pollution control: Indicator organisms, Test organisms, Monitoring organisms, Enzymes.

Coastal developmental activities-environmental issues.

Micro and Macro fouling, corrosion of metals and alloys in the sea, effects of bio-fouling and bio deterioration on marine structures.

Protection methods against corrosion and fouling Application of biotechnology in controlling the bio deterioration of wood and synthetic substances in the sea.

Red tides: Cause character and effects on the organisms of Marine environment

Text Books/References: