MARINE BIOLOGY

Meteorology: Rotation and revolution of the earth; Seasons; Atmosphere - temperature, humidity, solar radiation and budget, mixing; Clouds, precipitation and air masses; Artificial rains; Air masses and fronts; Monsoons and cyclones; Air circulation; Indian monsoons.

Oceanography: Instruments, Oceans - origin, division, expeditions; Physical properties of seawater; Dynamics of the oceans - waves, tides, currents, circulation, sediments; Chemical properties of sea water - ionic/ major/ minor/ trace constituents, constancy of composition, *potentio hydrogeni*, chlorocity, radio nuclides; dissolved gases; Inorganic nutrients - fertility of the seas, C: N: P ratio, mineral wealth, desalination, chemicals recovery; Organic matter - composition, distribution, seasonal variation, ecological significance, biogeochemical cycle.

Marine Geology: Topography - continental shelf/ slope, abyssal plain, oceanic islands, seamount and guyots, mid oceanic ridges, trenches, submarine canyons; Sea floor measurement; Indian Ocean floor - salient features; Sea coast; Beach; Coastal landforms - deltas, estuaries, other landforms; Coastal dynamics; Polar seas; Hydrothermal vents.

Marine Biology: Plankton – Types, adaptations, structural/ physiological mechanisms, role in productivity, interrelationship, microbial loop, indicator species, red tides; Seaweeds/ Seagrasses/ Mangroves/ Salt marshes/ Sand dune vegetation, adaptations, importance, ecological role, conservation, distribution in India; Invertebrates/ Vertebrates - classification, salient features of various phyla and classes, significance of Prochordates, food/ economics; Evolution; Adaptive radiation; Developmental biology; Embryology, Larval histories.

Physiology of Marine Animals: Food and feeding habits; Digestion - systems, enzymes, processes; Respiration - systems, oxygen and carbon dioxide transport, respiration in fishes; Osmoregulation - osmotic conditions, adaptations, ions in body fluids and regulation; Nervous systems - impulse generation, conduction, transmission, integration of information; Sensory organs - structure, properties, functions; Hormones - hormone controlled functions.

Marine Ecology: Ecology abiotic - light, temperature, salinity, pressure; Ecology biotic - producers, consumers, deteriogens, decomposers; Life in benthic/ pelagic provinces and adaptations; Production - primary/ secondary, productivity of Indian seas; Niche concept; Population/ community ecology; Animal associations; Ecosystem concepts - marine food chains, trophic structure, food webs/ pyramids, energy flow, evolution; Large marine ecosystems; Management - modelling, system ecology; Marine zoogeography.

Fish and Fishery Science: Habit and habitat; Morphology; Classification; Major groups in World and India; Identification; Food and feeding habits; Age determination; Anatomy; Maturation and spawning in marine fishes; Population dynamics; Marine fisheries of India - resources survey, fishing grounds, population features, exploitation; Fish as food - spoilage, causatives, preservation, processing; Fish products/ by-products; Export of fin fish and shell fish; Fishing and infrastructure, Socioeconomics of fishing in India.

Coastal Aquaculture: Importance - global scenario, present status in India, prospects and scope; Aqua-farming systems; Site selection; Cultivable species - brackishwater finfishes and shellfishes, marine flora, marine finfishes and shellfishes; Culture techniques; Sea farming; Sea ranching; Marine animal husbandry; Seed production; Management - farm conditioning, feed and feeding, live feed culture; Bioenvironmental monitoring - harvesting, control of predators/ parasites/ diseases; Best management practices.

MARINE MICROBIOLOGY: Significance; Classification - natural, polyphasic, phonetic, phylogenetic, genotypic; Diversity; Habitats; Identification; Role in nutrient cycles; Microbial diseases, diagnosis, control; Processed sea-foods, quality, prevention/ control of water pollution; Microbial biodegradation.

Cell Biology: Prokaryotic and eukaryotic cells; Cell wall; Plasma membrane - lipid and protein transport; Cytoplasm - endoplasmic reticulum, mitochondria, lysosome, ribosome, centriole, Golgi complex, fluid mosaic model membranes, endocytosis, exocytosis, plant cell vacuoles, chloroplast; Nucleus; Cell division.

Biochemistry: Biochemical basis of life; Carbohydrates; Proteins/ amino acids; Enzymes; Lipids; Nucleic acids; Micromolecules; Micronutients; Biochemical methods/ instruments.

Molecular Genetics: Features of inheritance - discrete inheritance, notation, diagrams, multiple gene interactions; Molecular basis for inheritance - gene, prokaryotic/ eukaryotic genomes; Gene expression - genetic code, nature and nurture, regulation in prokaryotes/ eukaryotes; Genetic change - mutations and mutagenesis, chromosomal manipulation; Genetics of bacteria and viruses - transformation, conjugation, cross conjugation, transduction; Gene/ chromosomal mapping; Germplasm conservation; Research methods.

Marine Pollution and Toxicology: Major pollutants - sources, dispersion, pathways; Ocean dumping; Radioactive pollution; Biological impact; Treatment. Effects on biota; Bio-

concentration/ accumulation/ magnification; Toxicity influence/ testing; Synergistic/ antagonistic effects; Micro-/ meso- cosms; Environmental monitoring - objectives, status, limitations, bio-indicators, natural bioaccumulations, Bioremediation - sewage, pesticides, plastics, oil, ores, metals, heavy metals, xenobiotics; Analytical instruments.

Marine Biotechnology: Application - aquaculture, pharmaceuticals, environmental remediation, biofouling, bio corrosion; Developmental biotechnology - induced breeding, in-vitro fertilization, cryopreservation; Biotechnological tools; Biosafety ethics; Marine bio actives; Marine natural products - chitin and chitosan, commercial development; Algal biotechnology - single cell protein, hydrocolloids, other by-products; Marine enzymes - sources and their application; Marine lipids - sources and their application.

Ocean Management: Oceans as heritage; Sea wealth; Coastal areas - regulatory zones, management; Exclusive economic zone; Strategic straits; Laws of the sea - various conventions; Regional Seas Programme - Antarctic treaty, biosphere reserves/ parks, endangered species, trade; Beach mineral deposits in India; Seabed exploration - treaty, oil, gas, minerals, metals, exploration; Ocean policy of India - policy, research and management.

Basic Statistics and Bioinformatics: Sampling methods – Probability/ Non-probability sampling; Data collection; Measurement of fish; Data presentation; Data analysis - Measures of dispersion; Hypothesis framing; Correlation and regression; Tests of significance; Multivariate analysis. Computers; Internet; Bioinformatics; Bioinformatics servers.

Remote Sensing and Geographic Information System: RS - techniques, platforms, sensors, radiometers; Thermal radiation - imageries, materials properties, atmospheric windows, scanners, interpretation, application; Electromagnetic radiation; Digital images - characteristics, processing, analysis, filtering, classification; Microwave sensing; GIS - spatial data, vector/ raster methods, data input/ output; Application - ocean colour, chlorophyll estimation, sea surface temperature, potential fishing zones, data dissemination; environmental monitoring, coastal zone management.