Tamil Nadu Public Service Commission
Syllabus
Fisheries Science, Marine Biology and Zoology
(PG Degree Standard)

Code:588

Unit I: Taxonomy, Physiology and Developmental Biology of Invertebrata and Chordata: (20 Questions)

Invertebrata: General organization – Classification up to Class Level, Molecular Taxonomy. Origin of Metazoa – Theories and Evolution. Origin and Types of Coelom in Bilateria. Larval forms and its Evolutionary Significance. Systematics – Commercially important aquatic fauna and flora – marine plants, corals, crustaceans, molluscs, echinoderms, finfishes, turtles and marine mammals - external morphology – Anatomy of finfish, shrimps, crabs, bivalves, gastropods and cephalopods. Chordata: General Characters of Chordata and its Outline Classification upto Order Level. Origin of Chordates. - Circulatory, respiratory, nervous, urinogenital, endocrine and skeletal systems - sensory organs - reproductive biology, maturity stages, gonodo somatic index, ponderal index, fecundity, sex ratio and spawning - eggs and larval stages and developmental biology - Fish biology – food and feeding habits – age and growth length / weight relationship – reproduction, maturation, breeding, spawning, fecundity, eggs and larvae and development – fish physiology, functions of different organ systems of finfish and shellfish. Retrogressive Metamorphosis and Neoteny. Parental Care in Fishes and Amphibians. Adaptation in Aquatic Animals. Migration and Flight Adaptation in Birds. Comparative account of Digestive, Respiratory, Circulatory and Excretory Organs. Developmental Biology: Gametogenesis, Fertilization, Patterns of Cleavage, Gastrulation, Organogenesis in Fish. Regeneration and its Significance.

Unit II: Aquaculture and Genetics (30 Questions)

Freshwater aquaculture – Farm construction – cultivable species – culture techniques - management practices - Cage and pen culture - Advanced aquaculture systems - use of agro - industrial waste and biofertilizer in aquaculture - water recirculation system – commercial fish feed formulation, feeding methods – Live feed organism - Coastal aquaculture – Farm construction – cultivable finfish and shell fishes - seaweed – Advanced culture techniques – Management of coastal aquaculture farms – sea ranching; Mariculture - open water cages - candidate species for mariculture; Integrated Aquaculture Multi-Trophic Aquaculture System - Ornamental fish culture and breeding techniques. Brood stock management of finfish and shellfish – induced breeding - sexual maturity and breeding season of different species – off season breeding of carps - hatchery management - food and feeding - water quality management in hatcheries – nursery management – seed transport techniques.

Unit III: Fish Pathology and Health Management (10 Questions)

Fish pathology - Prognosis and diagnosis – bioremediation – probiotics - importance of biofilm, biofloc and periphyton in aquatic health management prophylactic measures – Molecular and immunological Techniques; Pharmacology - Drugs - principles of drugs action - adverse drugs effect – anti bacterial agents - antibiotics - antiseptics Antimicrobial resistance and disinfectants parasites – bacterial, fungal and viral diseases – therapeutants in aquaculture - pesticides, fungicides, algicides, hormones, anesthetics, flesh colour enhancer; Fish toxicology - phytotoxins - mycotoxins - maximum residual limits.

Unit IV: Fish Biotechnology and Microbiology (20 Questions)

Modern trends in fish genetics – hybridization cryopreservation of fish gametes – pleiotropism, lethal genes - mutation-sex linked genes-chromosomal structure – aberrations - manipulation techniques - genetically and environmentally induced abnormalities - androgenesis - gynogenesis - polyploidy – genetic engineering – sex reversal – cloning – transgenic fishes – sex determination - cross breeding. Marine microorganisms — bacteria, archaea, fungi, protozoa, viruses; biogeochemical roles — nitrogen fixation, sulfur oxidation, carbon cycling; extremophiles — thermophiles, halophiles, barophiles; marine biotechnology — bioactive compounds, marine enzymes, pharmaceuticals (antibiotics, antivirals, anticancer); molecular tools — gene cloning, Polymerase Chain Reaction (PCR), DNA barcoding, genomics; marine bioproducts — seaweeds,

microalgae for biofuels, nutraceuticals, pigments; bioremediation — microbial and algal use; aquaculture biotechnology — probiotics, vaccines, disease diagnostics, selective breeding; biosafety and bioethics — Genetically Modified Organism (GMO) risks, international protocols.

Unit V: Immunology, Evolution, Economic Zoology and Biostatistics (15 Questions)

Immunity: Types. Immune response – Primary, Secondary and Theories. Organs of the Immune System. Structure and Functions of Immunoglobins. Fish immunology - antigens antibody interactions, defense mechanisms in fin fish and shell fish - vaccine development - whole cell vaccine - purified macro molecules - DNA vaccines - immuno - stimulants. Evolution: Origin of Life - Theories of Evolution- Geological Time Scale. Economic Zoology: Beneficial and Harmful Insects. Sericulture, Apiculture, and Vermiculture. Biostatistics: Collection of Data. Primary and Secondary – Sampling Methods – Diagrammatic Representation of Data. Measures of Central Tendency – Mean, Median and Mode. Measures of Dispersion – Range, Variation, Standard Deviation, Standard Error and Coefficient of Variation. Hypothesis testing, Correlation, Regression, Student's "t" test, Chi-square test and Analysis of Variance (ANOVA), Use of software tools in data analysis.

Unit VI: Limnology and Oceanography (15 Questions)

Physico – chemical features of freshwater systems – ponds – lakes - streams - rivers - indices of productivity of lakes – reservoir - estimation of primary productivity - fresh water aquatic plants ; Aquatic ecology: Energy flow - food chain - nutrient cycle - animal relationships: symbiosis, commensalism , parasitism prey predator relationship, host parasite relationship; Aquatic biodiversity: species diversity – genetic diversity - habitat diversity - diversity indices – ecological niches - Ocean structure — temperature, salinity, density; vertical zonation — thermocline, halocline, pycnocline; ocean movements — currents, tides, waves, thermohaline circulation, global conveyor belt; ocean-atmosphere interaction — heat exchange, energy balance, climate regulation; seawater chemistry — dissolved gases (O_2, CO_2), pH, nutrients (nitrogen, phosphorus, silicon), trace elements; hypoxic zones — deoxygenation, formation; marine meteorology — trade winds, monsoons, tropical cyclones, El-Nino Southern Oscillation (ENSO); satellite remote sensing; marine productivity — phytoplankton, nutrient and light availability, oceanic fronts, eddies; coastal and deep-sea hydrodynamics — upwelling, downwelling, sea ice formation – Foulers and Borers.

Unit VII: Environmental Management and Conservation (20 Questions)

Aquatic pollution – sewage and domestic wastes - sewage treatment – Biological Oxygen Demand (BOD) – Chemical Oxygen Demand (COD) - Eutrophication - red tides - pesticide pollution - organo chlorine and organo phosphate pesticides – Persistent Organic Pollutants – bioaccumulation - heavy metal pollution - oil pollution - microbial pollution – micro plastic pollution - radioactive pollution thermal pollution bioremediation and phyto-remediation , physical and chemical treatments - beach cleaning, - Bio-corrosion - Integrated coastal zone management ; coastal processes — sediment transport, coastal erosion, sea-level rise; coastal ecosystems — mangroves, coral reefs, seagrasses and their role in coastal protection; management — Integrated Coastal Zone Management (ICZM), Marine Spatial Planning (MSP), ecosystem-based management (EBM); climate change effects - ocean warming, coral bleaching, acidification, species migration; marine invasion — threats to coastal habitats, management and control strategies; monitoring — GIS, remote sensing; governance – International and National policies, NGOs; species conservation — sea turtles, dugongs, marine mammals, sharks, endangered aquatic animals - Marine Protected Areas (MPAs); disaster management — tsunami, cyclone, storm surge, early warning systems; Fisheries resources – important capture fisheries of the world, India, Tamil Nadu – Distribution, population dynamics, stock assessment, modeling, Maximum Sustainable Yield (MSY), Maximum Economic Yield (MEY).

Unit VIII: Fishing Gear and Craft Technology, Equipment Engineering, Marine Engines, Navigation and Seamanship (25 Questions)

Classification of fishing gears – gear materials - properties of netting material - twist - breaking strength - tensile strength - yarn numbering systems - selection of gear materials for different gear - Designing and fabrication of gears: gill nets, trawls, longlines, purse seines, fish traps, trolling lines, light fishing, electrical fishing, fishing gear accessories - floats, sinkers, buoysandanchors - shakles, thimbles – otterboards – Glink - killey'seye - shaping of webbing by

braiding, cutting. Craft technology: Law of floatation - Archimedes principle - form co-efficient - Simpson's rule, ships equilibrium, trim, gross tonnage, net tonnage, backbone assembly of wooden board, steel board construction, Fiberglass Reinforced Plastic (FRP) boat construction, deck layout of trawler, gill netter, long liner, purse seiner, views of boat - profile view-half breadth plan view, sectional view, offset table –water plane area, bulk head, stern tube, types of propeller, types of rudder, facilities required for boat building yard. Equipment engineering: deck equipments, winch, power block, net hauler, longline hauler, squid jigger; Electronic equipments: echo sounder, SONAR, RADAR, Radio telephone, GPS and other advanced communication tools. Types of diesel engines – two stroke and four stroke engine; starting, ignition, fuel supply, cooling, lubrication systems - Operation and maintenance; Navigational charts - Mercator projections - earth co-ordinates - Chart reading and fixing position - bearing, position, fix, light house - chart symbols - dead reckoning - piloting – parts of magnetic compass - magnetic errors – sextant - rules of the road applicable to fishing vessels - navigational lights - life saving devices - weather warning signals - storm signals- man over board procedures, distress signals - fog signals - navigational code flags - buoyage system, cardinal and lateral marks, colours.

Unit IX: Fish Processing and Quality Assurance (25 Questions)

Fish biochemistry – proximate composition of fish – protein metabolism - de-amination de-carboxylation - free amino acids - essential amino acids - types of fish protein - non-protein nitrogen in fishes - fatty acids – Poly Unsaturated Fatty Acid - oxidation of fatty acids - Millard reaction; Fisheries Microbiology: microbial spoilage of fresh fish - indicators of microbiological quality - food borne pathogens - Occurrence, growth, survival, pathogenicity and control measures, Scombroid toxin, Shell fish toxins, ciguatera toxin and puffer fish toxin, mycotoxin; microbial spoilage of canned and frozen products.

Hygienic handling of fish – freshness testing - Rigor Mortis – fish processing methods: Drying, saltcuring, smoking, icing, Refrigerated Seawater, freezing, glazing, thawing, types of freezers - freeze drying, transportation of frozen fish – canning - Fish byproducts: fermented fish products, Fish sausage, Extruded products, battered and breaded products; fish waste utilization : chitin, chitosan, fish hydrolysate, Fish Protein Concentrate FPC, fish ensilage, fish maws, isinglass, shark fin rays, fish gelatin, seaweeds, agar agar, algin, carrageenan, fucoidan, fish meal, fish oil; application of microwave technology in product development; Fish processing equipments: deboner, deskinner, fish sausage machine, canning machineries; Fish quality assurance: Application of Hazard Analysis Critical Control Point (HACCP) concept in surveillance and quality assurance programmes for raw, frozen, canned, cured, cooked, chilled, and Modified Atmospheric Packaging products; Fish packaging technology: Types of packages and packing materials, Testing, labeling – packaging for retail sale and storage. Transport and handling devices – safety and legislation aspects of packing, labeling and bar coding. Seafood safety authenticity and traceability. Certification system for fish and fishery products. Seafood standards and regulations.

Unit X: Fisheries Economics, Extension and Administration (20 Questions)

Economics of marine capture fisheries and fish production systems – domestic and export marketing – Contribution of fisheries to GDP-marine fishery regulations – types of primary and secondary data for statistical analysis for policy making – fisheries investment projects, finance and project planning – Socio-economics of fisher folk. Fisheries extension methods - Extension services for fisheries development – Important fisheries developmental schemes – Advancements on Information Communication Technological services for Fisheries. Entrepreneurship Development in Fisheries. Recent policies in Fisheries sector. Functions and functionaries of various Fisheries Central and State level Organizations, Fisheries Corporation and Co-operatives, fishermen associations, NGOs and SHGs in fisheries development – Fisheries Co – management. Fisheries regulatory measures: Coastal Aquaculture Authority (CAA) and Coastal Regulation Zone (CRZ). Fisheries and Aquaculture legislations in India. Indian Fisheries Act. Tamil Nadu Marine Fisheries Regulation Act, Laws relating to marine fisheries resources, conservation, marketing and fishery products.

Dated:13.08.2025