

SPECIFIC PAPER SYLLABUS FOR THE POST OF ASSISTANT DIRECTOR (GRADE-II)

IN THE DEPARTMENT OF FISHERIES

1. Introduction to fisheries science – scope and importance. Water- sources, properties and composition of surface, ground and sea water. Physical and chemical characteristics of aquatic environment – sea, river, lake, reservoir, estuaries, mangrove and coral reef. Physical phenomenon in sea- upwelling, mud banks, ocean gyre, thermocline, circulation and mixing of water.
2. Biological productivity – primary production, food chain, food web, food pyramids, energy transfer, nutrient cycles, eutrophication, standing crop, trophic dynamics, algal blooms and red tide. Environmental factors affecting life in the oceans - salinity, temperature, light, currents, waves, tides, oxygen and carbon dioxide. Major groups of phytoplankton, zooplankton and seaweeds.
3. Aquatic biodiversity- importance, species diversity, genetic diversity, habitat diversity and diversity indices. Aquatic pollution- sources, types and effects of metal, pesticide, oil, sewage, industrial and agricultural pollution. Domestic sewage – characteristics and treatment. Environmental impact assessment, water quality standards and water quality criteria for aquaculture
4. Fisheries of major riverine and estuarine systems of India. Major brackish water lakes/ bodies and their fisheries. Cold water fisheries. Fisheries of major reservoirs and natural lakes of India. Estimation of inland fish catch – methods and problems. Important pelagic, demersal and marine fisheries, and seaweed resources of India. FAO code of conduct for responsible fisheries. Potential fishing zones. Application of GIS and remote sensing in fisheries. Management of inland and marine fisheries.
5. Food and feeding habits of finfishes and shellfishes. Age and growth determination by direct and indirect methods. Physiology of reproduction, reproductive biology, maturity stages, gonado-somatic index, fecundity, sex ratio, spawning and ova diameter studies. Migration of fishes- types and significance.
6. The concept of yield, maximum sustainable yield (MSY) and maximum economic yield (MEY). Biological symptoms of under-fishing and over-fishing. Growth over-fishing and recruitment over-fishing. Estimation of total, fishing and natural mortality.

7. Aquaculture production at global and national level. Major cultivable fish and shellfishes- their characters and importance. Carp seed production methods, types of hatcheries, carp seed and brood fish transportation. Preparation and management of nursery, rearing and stocking ponds. Common aquatic weeds, predatory and weed fishes, insects and their control. Liming and fertilization. Seed stocking and supplementary feeding. Nutritional requirements of carps and prawns. Feed preparation, evaluation and feeding methods of fish and shellfish in monoculture and polyculture. Culture of fish food organisms. Site selection for aqua farms, design and construction of fish ponds. Water budgeting in aquaculture.
8. Culture of cold water fishes, carps, catfish, freshwater prawn etc. Composite fish culture, and integrated fish farming. Common diseases of cultured fish and shellfish, diagnosis and treatment. Breeding and hatchery seed production of freshwater prawn, shrimps, crabs, lobsters, mussels and oysters. Breeding and hatchery seed production of marine fishes (Asian seabass, groupers, pearl spot, milk fishes, grey mullet, cobia and silver pompano). Mariculture of finfishes, shellfishes (shrimps, crabs, lobsters, clams, mussels, edible oysters). Seaweed culture. Pearl culture - production of marine and freshwater pearls.
9. Ornamental fishes and their breeding and production, fabrication and setting up of aquarium, aquarium accessories, feeds and feeding of ornamental fishes, diseases and parasites of ornamental fishes, packing and transportation.
10. Contribution of fisheries to Indian agriculture and total GDP. Credit requirements for fisheries development – sources and types, role of NABARD in fisheries development. Insurance coverage for fish and shrimp farming and other fisheries related activities. Fish markets and marketing management - marketing concepts, market structure, functions and types, marketing channels and supply chain management. Implementation of community based resource management plans. Fisheries and aquaculture legislation in India, environmental legislations in India. Fisheries regulatory agencies - Coastal Regulatory Zone (CRZ) and Coastal Aquaculture Authority of India (CAA).
11. Composition of fish and its importance in human and animal nutrition, importance of fish as food. Post-mortem changes in fish, spoilage of fish – physical, biochemical and microbiological spoilage. Sources and types of microorganisms to fish. Intrinsic and extrinsic factors affecting microorganisms in foods, handling of fresh fish on-

board the fishing vessel and at landing centers. Chilling of fish – methods, principles and importance.

12. Faecal coliforms, *E. Coil* as indicator of faecal pollution and its significance in seafoods. Human pathogenic bacteria in food – *Salmonella*, *Vibrios*, *Staphylococcus*, *Listeria*, *Clostridium* - their source, growth, survival, problems caused and preventive measures. Toxins in seafoods - algal toxins, tetradoxin and histamine toxicity.
13. Freezing of fish, methods of freezing, mechanism of ice crystal formation and cell damage, rate of freezing, slow freezing versus quick freezing. Styles of frozen fish, methods of thawing, thawing curve, glazing and packaging of frozen fish. Quality of raw material and its effect on final products, quality control during processing and storage of frozen fish and fishery products.
14. Traditional fish preservation methods- salting, drying, smoking and marinating. Canning of fish, principles of thermal processing, methods of canning, spoilage of canned products- types, causes and prevention.
15. Principles and methods of preparation of various fish paste products -fish sausage, fish ham, etc., Suitability of different varieties of fish for the preparation of fish paste products. Additives and preservatives used in fish paste product preparation. Production of minced meat- method of preparation, preservation and uses; marinating of fish- method of preparation, preservation and uses. Surumi –definition and methods of preparation.
16. Fish meal - raw material, preparation of fish meal- types and characters, storage, use of fish meal in animal nutrition. Fish oil and its use in foods, non-edible uses of fish oil. Fish silage and its use in animal nutrition. Fish protein hydrolysates, fish protein concentrate, gelatin, chitin, chitosan, shark fin rays and fish maws - methods of preparation and uses. Seaweeds-processing and utilization.
17. Indices of fish sanitary quality, concept of quality management – total quality management (TQM), standard sanitation operating procedures (SSOP), good manufacturing practices (GMP), hazard analysis and critical control points (HACCP). Process water quality, fish plant sanitation, cleaning, disinfectants and detergents.

Packaging and labeling – importance, types of packaging material for fish and fishery products. Waste management in fish processing industries. Quality standards for processed fish and fishery products.

18. Indigenous and mechanized fishing crafts in India. Materials used for the construction of fishing craft. Fishing gears - types, synthetic and natural fishing gear materials – their properties and identification. Design and construction of commercial fishing gears, construction of knotted and knotless webbing - types of mesh and their measurements. Webbing and shaping, hanging ratio, hung depth, net mounting methods, mending and net shooter of webbing. Model testing methods for fishing gears.
19. Otter boards – types and uses. Types of floats, buoys, hooks and sinkers. Deck equipments-winch, towing blocks, gallows; net handling devices - power blocks, triplex drums, net reels, rollers, line hauler and gurdies. Commercial fishing methods-trawling, line fishing, seining, gill-netting, trap fishing. Fish finding, net monitoring and navigational devices on-board fishing vessels.
20. Principles of refrigeration. Simple vapour compression refrigeration system. Freezers – types and their uses. Ice making units – types and their uses. Refrigerants used in commercial refrigeration plants and their properties, leak detection of refrigerants.
21. Role of extension in fisheries development. Fisheries extension methods- individual, group and mass contact methods and their effectiveness Adoption and diffusion of innovations and barriers. Characteristics and process involved in technology transfer. Participatory extension approaches – importance and steps involved. Public private partnership in fisheries. Role of KVK, NGOs and SHGs in fisheries. Role of local leaders in fisheries development. Addressing social problems, fisheries conflicts, gender issues and globalization in fisheries.
