VIDYASAGAR UNIVERSITY

INDUSTRIAL FISH & FISHERIES

(MAJOR)

Under Graduate Syllabus

(3 Tier Examination Pattern)

w.e.f. 2014-2015

Vidyasagar University

Midnapore 721 102

West Bengal

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VIDYASAGAR UNIVERSITY
Course Structure for
INDUSTRIAL FISH & FISHERIES (MAJOR)

Total Marks : 800 (Theory : 500 Marks and Practical : 300 Marks)

Part – I : Theory – 200 Marks

Part – II : Theory – 200 Marks and Practical – 100 Marks

Part –III : Theory – 100 Marks and Practical – 200 Marks

[Examination of Theory Papers (90 Marks) : 4 hours duration and Practical Papers (100 Marks) : 6 hours duration, each theory paper contains 10 Marks Internal Assessment]

Course Design for
Industrial Fish & Fisheries (Major)

PART – I

Paper-I Theoretical : 90 +10 = 100 marks

Gr. A-45+5 : Taxonomy & Biology of Fin-fishes and Shell Fishes

Gr. B-45+5 : Capture Fishery

Paper-II Theoretical : 90 +10 = 100 marks

Gr. A-45+5 : Aquatic Ecology & Environmental Management

Gr. B-45+5 : Principles & Methods in Aquaculture

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PART – II

Paper-III **Theoretical : 90 +10 = 100 marks**

Gr. A-45+5 : Fish and shell fish Nutrition & Biochemistry

Gr. B-45+5 : Fish Genetics & Hatchery Technology

Paper-IV **Theoretical : 90 +10 = 100 marks**

Gr. A-45+5 : Fish Pathology, Microbiology & Immunology

Gr. B-45+5 : Fishing Methods & Post harvest Technology

Paper-V **Practical : 100 marks**

PART – III

Paper-VI **Theoretical : 90 +10 = 100marks**

Gr. A-45+5 : Fisheries Economics, Marketing & Extension

Gr. B-45+5 : Bio-Statistics & Computer Application

Paper-VII **Practical : 100 marks**

Paper-VIII **Practical : 100 marks**

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PART-I

Paper-I: Theory : 100 Marks
(University Examination - 90, Internal Assessment-10)

Group – A (Taxonomy & Biology of Fin-fishes and Shell Fishes)

1. Principles of taxonomy, zoological classifications, binomial nomenclature and Linnaean hierarchy. Classification of fishes, crustaceans and molluscs.

2. Morphology of a typical elasmobranch and a typical teleost fish. Skin, coloration, scales, mouth, jaw, teeth, fin and fin rays and their taxonomic importance. External character of prawn, crab, lobster, bivalve, gastropod and cephalopod.

3. Internal anatomy of a typical elasmobranch and teleost fish. Respiratory and accessory respiratory organs. Heart and circulatory system, reproductive system, sense organs, lateral line system. Ampullae of lorenzini, outlines of skeletal system. Fish migration, Excretion and osmoregulation of catadromous and anadromous fishes.

4. Alimentary canal and associated structures. Food and feeding habits of fish, prawn, crab, bivalve and cephalopod. Mouth parts modification of fishes according to their feeding habit. Gut content analysis – volumetric, gravimetric method.

5. Fish growth- absolute and relative growth, isometric and allometric growth, The cube law, analysis of age and growth through scales and otoliths method. Marking and tagging of fish for growth studies, length-weight relationship, Ponderal index.

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6. Sexual dimorphism in fishes and crustaceans. Endocrine organs in fishes. Hormones and their role in control of reproduction in fishes. Parental care in fishes.

Group – B (Capture Fishery)

1. Importance of capture fisheries of the world, present yield and potentiality. The inland capture fishery resources in India.

2. Major river systems in India, capture fisheries, fishing methods, recent statistics of catches, problems encountered in fisheries development of major rivers. Cold water fisheries- major rivers and species – problems & conservation of cold water fisheries, sports fishery.

3. Reservoir and lake fisheries- Major reservoirs and lakes in India- capture fisheries, fishing methods, recent statistics of catches, problems encountered in fisheries development.

4. Estuarine fisheries- definition and classification of estuaries, capture fisheries- resident and migrant species, fishing methods, recent statistics of catches. Fisheries of brackish water lacks and backwaters. Problems of brackish water fishery.

5. Marine capture fishery resources at inshore, offshore and deep sea. EEZ, PFZ and continental shelf, maritime states in India. Major pelagic resource groups– sardines, mackerel fishes. Major demersal resource groups- pomfrets, bombay duck, prawns, lobsters, molluscan resources. Major deep sea resources - fishes, shrimps, lobsters.

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6. Deep sea fishing policies in India. Problems of over-fishing. Conservation and management of marine fishery resources. Application of remote sensing technology in capture fisheries.

Paper-II: Theory : 100 Marks

(University Examination - 90, Internal Assessment 10)

Group – A (Aquatic Ecology & Environmental Management)

1. Ecosystems and productivity, biotic interaction within ecosystems and ecological homeostasis. Structure and productivity of aquatic ecosystem. Population growth and regulation, community structure interrelation, Food chain food web. Fishes and their relationship with abiotic and biotic environment.

2. Physical and chemical characteristics of water. Distribution of fresh water. Lotic and Lentic system and their biotic community with special emphasis on Phytoplankton, zooplankton and benthic fauna. Wetland and freshwater biomes - ecology of tropical freshwater Lakes, Reservoir and Ponds. Ecology of estuarine ecosystem and brackish water lagoons. Ecology of Mangroves.

3. Physical and chemical properties of soil. Classification of soils, distribution of different types of soil in India with special emphasis on aquaculture. Organic manures, inorganic fertilizers and liming – their interaction with soil. Macro vegetation. Nitrogen cycle, Carbon cycle.

4. Human impact on fresh water eco-system; Fresh water and Marine water pollution. Eutrophication. Biomagnification. Waste water

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discharge, its quality and quantity; impacts of effluents on ecosystems, chemical degradation of soil and water.

5. Problems and preventive measures of antibiotic and drug residues, salination of soil and water, Environment impact assessment, toxicity assessment. Conservation of aquatic resources; Problems and Prospects, strategies for conservation of aquatic resources.

Group – B (Principles & Methods in Aquaculture)

1. History, definition, scope and significance of aquaculture. Different aquaculture systems. Aquaculture - Global and Indian Scenario.

2. Type of ponds – hatching, nursery, rearing, stocking and broodstocks –construction and management of culture system, size and depth of ponds, positioning of different types of ponds in a fish farm. Criteria for the selection of species, Cultivable freshwater fishes- carps, airbreathing fishes, tilapia, trout, freshwater prawn. Composite fish culture.

3. Recent development in integrated farming – Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and Pig cum fish culture. Organic aquafarming. Fish culture in cages and pens. Running water fish culture.

4. Present status of brackishwater farming in India. Basabhanda fishery, general planning and design of brackish water farms. Monoculture of *Lates calcarifer* and *Peneaus monodon*. Crab culture. Mariculture : sea weed culture, pearl oyster farming.

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5. Introduction to aquarium and aquariculture, different types of ornamental fishes and aquarium accessories. Ornamental plants. Design and construction of home aquarium. Management of home aquarium. Ornamental fishes in marine aquarium. Marketing of ornamental fishes –problem and prospects.

6. Sewage fed fish culture, sewage treatment and Sewage fed fish culture in India.

PART-II

Paper-III: Theory : 100 Marks
(University Examination - 90, Internal Assessment 10)

Group – A (Fish and shell fish Nutrition & Biochemistry)

1. Major biomolecules in fish foods and their requirements and important functions. Classification of carbohydrates. Glycolysis and TCA cycle. Essential amino acids and their function. Classification, structure, functions of lipids. Essential fatty acids. Significance of Omega 3 and 6 fatty acids. Beta oxidation. Mechanism of enzyme action; Kinetics and regulation of enzyme activity.

2. Different live foods and their nutritional value. Candidate species of phytoplankton and zooplankton for fish and shell fish culture - diatoms, micro algae, nano planktons, artemia, daphnia and brachionus. Enrichment of live food. Micro encapsulated feed. Importance of natural food for larval development.

3. Animal and plant origin different conventional and non-conventional fish feed ingredients. Anti nutritional factors in feed

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ingredients. Feed additives, pigments, non-nutritional feed additives - chemoattractants, feeding stimulants, growth promoters, preservatives.

4. Different forms of feed - pellets, floating and sinking feeds, Feed formulation – methods -square method. Feed manufacturing processes - extrusion, pelletization. Different size and grades of fish / shrimp feeds - starter, grower and finisher feeds. Storage and transportation of feeds. Quality problems- toxins, pests, rancidity, quality standards.

5. Practical feeding in grow-outs of fishes & shrimps. Feed ration, feeding frequency, demand feeders, automatic feeders, feed dispensers. Farm made feeds, factory made fish & shrimp feeds in India. Fish growth study. Feed conversion efficiency, protein efficiency ratio; feed conversion ratio, leaching, water stability of fish feed.

Group – B (Fish Genetics and Hatchery Technology)

1. Principle of Genetics, mutation, sex determination, mechanism of inheritance, hybridization, transgenic fish, gynogenesis, androgenesis, polyploidy. Production of monosex and sterile fishes and their significance.

2. Natural resource of carp seed, *Penaeus monodon* and *Macrobrachium rosenbergii* seed. Bundh breeding, types of bundh breeding techniques. Problems of bundh breeding.

3. Components and general design of hatcheries. Different carp hatcheries. Selection criteria for brood stock and brood stock

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management. Water quality monitoring and management. Quarantine and disease management in hatcheries. Quality assessment of seeds.

4. Hypophysation of Indian major carps and exotic carps. Pituitary gland, collection and preservation of gland. Other ovulating agents. Sexing, dosage for injection, mechanism of ovulation. Cryopreservation of gametes. Development of carp eggs. Nursery rearing of carp seed. Gonado Somatic Index and Fecundity of fishes.

5. Transport of fish seed and brood fishes. Causes of mortality during transport, techniques of transport, open and closed systems, methods of transportation, use of anaesthetics.

6. Design of shrimp hatcheries. Seed production and nursery rearing of *Penaeus monodon* and *Macrobrachium rosenbergii*. Various components, equipments and infrastructure facilities required.

Paper-IV: Theory : 100 Marks
(University Examination - 90, Internal Assessment 10)

Group – A (Fish Pathology, Microbiology & Immunology)

1. Introduction to fish diseases –definition and categories of diseases. Disease and environment. Stress as a factor in the occurrence of diseases. Parasitism – host-parasite relationship. General preventive methods and prophylaxis against the occurrence of diseases. Probiotics in health management of fish and shell fishes. Argulosis and Larnaeosis.

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2. Bacterial disease (finfish) – furunculosis, columnaris, bacterial gill disease, gill rot, Edwardsiellosis, vibriosis, tail and fin rot, EUS. Shrimp disease – brown spot, black gill, filamentous bacterial disease. Protozoan diseases (finfish) – Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis. Shrimp diseases – Microsporidiosis, Gregaria disease.

3. Fungal diseases (finfish) – Saprolegniosis, brachiomycosis, ichthyophorus. Viral diseases (finfish) – IPN, IHN, Viral Hemorrhagic Septicemia, Spring Viremia of carps. Major shrimp viral diseases-Monodon Bacculovirus, Bacculoviral midgut necrosis, Yellow head bacculovirus, white spot bacculovirus.

4. Nutritional pathology – lipid liver degeneration, Vitamin and mineral deficiency diseases. Aflatoxin and dinoflagellates.

5. Immunology - antigen and antibody. Different types of immunoglobulins. Macrophages – phagositosis. Defense mechanism in fish and shell fishes. Humoral and cell mediated immunity. Application and development of vaccines.

6. Biological characters of bacteria, virus and fungi. Culture of bacteria – culture media – common ingredients in media. Different types of media - synthetic and non-synthetic media. Bacterial growth – growth phase and multiplication rate – effect of temperature and medium on growth. Gram +ve and –ve bacteria.

Group – B (Fishing Methods & Post harvest Technology)

1. Different types of fishing crafts in India- inland and marine– traditional, motorized and mechanized. Boat building materials -

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wood, steel, FRP, ferro-cement, aluminum etc. Fouling organisms. Fish finding device – Sonar, Echo-sounder.

2. Introduction to netting materials - natural and synthetic fishing gear materials. Active, passive and traditional fishing gears. Principles and operations of different gears like shore seine, gill net, trawl net, line fishing, fishing traps. Mesh size regulation and turtle exclusion device (TED). Gear preservation.

3. Principles of fish preservation. Drying of fish and prawns. Different types of drying. Factors affecting drying. Principles of smoking and freeze drying. Fundamental principles involved in chilling and freezing of fish and fishery products. Various freezing methods. Principals involved in canning of fish. HACCP.

4. Fish byproducts - fish meal, fish protein concentrate, shark fin rays, isinglass, fish liver oil, fish body oil, chitin, chitosan, gelatin, fish silage, seaweed products like agar.

5. Value addition in sea food. Different types of value added products from fish and shell fishes. Preparation procedure of Surimi, fish / prawn pickle, fish soup powder, fish curry. Preparation of coated fishery products. Different types of batter and breading products.

Paper - V: Practical : 100 Marks

1. Morphometric analysis of fishes.
2. Identification of important fresh water, brackish water, marine water fin fishes and shell fishes.
3. Identification of prawns, shrimps, lobster, molluscs.

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4. Dissection of different finfishes (Indian Major carps, *Channa* sp; *Clarias* sp; *Anabas* sp; *Tilapia* sp) and Shell fishes (Prawns, Cephalopods, Gastropods and Bivalves) to understand their internal organization.
5. Gastro Somatic Index, Gut content analysis.
6. Study the different types of scale of fish.
7. Mounting of appendages of Prawn/shrimp
8. Length – weight analysis of fishes.
9. Study the common zooplankton and phytoplankton from fresh water pond.
10. Water quality analysis of fresh water (pH, Temperature, Free CO_2, Dissolved Oxygen, Alkalinity, Hardness, BOD, Ammonia).
11. Calculation of lime requirement
12. Turbidity and Transparency analysis of water.
13. Soil analysis (pH, Organic carbon, Water holding capacity, Nitrogen).
14. Identification of common aquatic weeds.
15. Identification of aquatic insects.
16. Preparation of Chart & Model on any fishery topic.
17. Visit to a fish landing centers/Cold water Fishery area,

PART - III

Paper-VI: Theory : 100 Marks
(University Examination - 90, Internal Assessment 10)

Group – A (Fisheries Economics, Marketing & Extension)

1. Definition, subject matter and scope of economics. Law of diminishing returns, laws of increasing, constant and decreasing

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utility and returns. Law of equimarginal returns. Importance of economics in aquaculture development. Fishermen populations, GDP from fisheries sector, foreign exchange earnings and employment potential of fishery industry. Socioeconomic condition of fisherman.

2. Markets and their kinds. Law of demand and supply, price determination, problems of fish marketing in India. Exports of fish and fishery products and problems therein. Role of MPEDA in exports of fish and fishery products.

3. Fishery development plans and various schemes in India, with particular reference to Fish Farmer's Development Agencies. Role of fisheries corporations and Missionary Organizations in fisheries development. Role of NABARD and different banks in fisheries sector.

4. Fisherman Co-operative- basic principles, co-operative legislation and its administrative structure. Fishermen co operatives, its functions. Financing and special problems of fishermen co=operatives and remedial measures.

5. Extension education – its meaning, importance and scope in fisheries. Various methods of extension – individual, group and mass methods, farm and home visits, seminars, discussions, exhibition and personal contacts. Extension and rural development – rural sociology, social structure and stratification, social institutions and community organizations.

6. Different organizations and institutes involved in fisheries and aquaculture research and development – FAO, NACA, World Fish Centre, Fisheries Research, Institutes under ICAR. Aquaculture

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Authority of India, State Fisheries Department. Fisheries legislation in India.

Group – B (Bio-statistics and Computer Application)

1. Preliminary Concept, definition and application of Biostatistics. Methods of data collection. Biological data collection. Sampling methods. Biological sampling. Frequency distribution - class limit, class boundary, class mark & class width, tabulation of data.

2. Graphical representation of data- Line diagram, bar diagram, Pie chart, Histogram, Frequency polygon.

3. Measures of Central Tendency: Mean, Median, Mode. Measurement of Variation: Range Mean deviation, Standard deviation, Co-efficient of variation. Testing of Hypothesis: Chi square Test and Student t-test.

4. Introduction to computer, advantages, limitations, Classification of Computer, Elementary idea of Desktop, Input-Output devices- CPU, Keyboard, Mouse, FD drive, CD/DVD ROM drive, RAM. Hardware and software;

5. Office application software- Introduction to Windows, MS-Word, MS-Excel and Power Point Presentation.

6. Concept of internet & its application in information collection. Basic ideas of World Wide Web.

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Paper-VII: Practical : 100 Marks

1. Collection and study of predatory fishes, weed fishes.
2. Identification of eggs and larvae of common cultivable fishes and shell fishes.
3. Identification of common ornamental fishes and ornamental plants.
4. Identification of aquarium materials.
5. Identification of different fish feed ingredients.
6. Preparation of artificial feed for aqua cultured organism
7. Study the Gonado Somatic Index and Fecundity of fishes.
8. Dissection of Pituitary gland and pituitary extraction preparation.
9. Live food culture of Zooplankton / Phytoplankton.
10. Estimation of water salinity.
11. Estimation of protein, carbohydrate and fat.
12. Preparation of chart/ model on different Aquaculture system/Hatchery
13. Visit at any Ornamental fish farm / Carp and shrimp farm.
14. Hands on training on seed production of fish/prawn

Paper-VIII: Practical : 100 Marks

1. Identification of traditional fishing crafts and gears
2. Identification of fishing accessories (Floats/sinkers/hook/ synthetic and natural fibres, twines, ropes, iron wares).
3. Identification of different common fish/shellfish disease and disease producing organisms.
4. Preparation and identification of fish by products
5. Preparation of value added products
6. Preparation of fish fillet.

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7. Sterilization technique- dry heating, autoclaving. Preparation of Media. Plate count method.
8. Identification gram +ve and gram –ve bacteria.
9. Preparation of chart, graphs and Power point presentation in computer.
10. Identification of computer accessories.
11. Market Survey report / Data preparation and presentation/ Economic analysis of carp farming & shrimp farming
12. Visit to Fish Processing Centre/Fishery Co-operative Society/Fishery Institute

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