



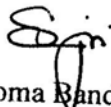
UNIVERSITY OF CALCUTTA

Notification No. CSR/ 01 /17

It is notified for information of all concerned that in terms of the provisions of Section 54 of the Calcutta University Act, 1979, (as amended), and, in exercise of his powers under 9(6) of the said Act, the Vice-Chancellor has, by an order dated 15.12.2016 approved the **Revised Syllabus of Industrial Fish and Fisheries under B.Sc. Major** course of study under this University as laid down in the accompanying pamphlet.

The above shall be effective from the academic session 2017-2018 and onwards.

SENATE HOUSE
KOLKATA-700073
The 2nd January, 2017


(Prof. Dr. Soma Bandyopadhyay)
Registrar (Acting)
02.01.17.

UNIVERSITY OF CALCUTTA

PROPOSED REVISED SYLLABUS

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THREE –YEAR MAJOR DEGREE COURSES OF STUDIES



INDUSTRIAL FISH AND FISHERIES

2016

Proposed Revised Syllabus for three years B.Sc(Major Course) in Industrial Fish and Fisheries, University of Calcutta,2016.

University of Calcutta

Proposed Revised Syllabus Structure for B.Sc(Major)Industrial Fish and Fisheries

Part I	Paper I	Marks
	Unit I IFFMT 01 Bio Systematics and Fish Biology	50
	Unit II IFFMT 02 Capture Fisheries	50
	Paper II	
	Unit I IFFMP 03 Laboratory Course I	50
	Unit II IFFMP 04 Laboratory Course II	50
		200
Part II	Paper III	
	Unit I IFFMT-05 Fish Genetic Engineering and Seed Production Technology	50
	Unit II IFFMT-06 Principles of Aquaculture, Coastal aquaculture, Environmental Management and Aquarium fisheries	50
	Paper IV	
	Unit I IFFMP-07 Laboratory Course III	50
	Unit II IFFMP-08 Laboratory Course IV	50
		200
Part III	Paper V	
	Unit I IFFMT-09 Fish Pathology, Microbiology and Immunology	50
	Unit II IFFMT-10 Fishing methods, Post harvest technology, Fishery economics, Fisheries extension, Biostatistics and Computer application.	50
	Paper VI	
	Unit I IFFMP -11 Laboratory Course V	50
	Unit II IFFMP-12 Laboratory Course VI	50
	Paper VII IFFMP-13 On Job Training	100
	Paper VIII IFFMT-14 Entrepreneurship Development	100
		400
		Total 800

Detailed Syllabus

Part- I

Theory-100 and Practical-100

Paper I

Unit I IFFMT 01 Biosystematics and Fish Biology

Full Marks: 50

1. Fish Biosystematics:
 - (i) Systematics: Definition, component, importance.
 - (ii) Taxonomy: Definition, component, importance, stages of taxonomy, Zoological Nomenclature.
 - (iii) Classification: Definition and types of classification. Classification of Crustaceans, Molluscs and Fishes.
 - (iv) Species concept: Biological and typological. Subspecies and other intraspecific categories. Type concept.
2. Fin fish and Shell fish anatomy:
 - (i) Morphology of skin, colouration, scales, mouth, jaws, teeth, fin and fin rays and their taxonomic importance.
 - (ii) Internal anatomy of a typical elasmobranch and Teleost fish: Alimentary canal and associated structure, Respiratory and accessory respiratory organs, Heart and circulatory system, Reproductive system, sense organs, Lateral line system, outlines of skeletal system
 - (iii) Structure of Digestive system, Respiratory system, Circulatory system, Excretory system, Reproductive and Endocrine system of Prawns.
 - (iv) External Character of Prawn, Crab, Lobster, Bivalves, Gastropods and Cephalopod.
3. Fish Growth: Isometric and allometric growth, Factors affecting the growth of fishes. The cube law, analysis of growth check on hard parts (Scale, otolith, vertebrae), Marking and tagging of fish for growth studies, length-weight relationship, polderal index, relative condition factor and gonadosomatic index.
4. Fish Physiology: Physiology and osmoregulation of fish. Endocrine organs in fishes and their roles in control of reproduction in fishes. Physiology of digestion, respiration (aquatic and aerial) and vision. Bioluminescence in fishes. Physiology of electric organs in fishes. Gametogenesis and fertilization of fishes.
5. Fish Nutrition: Food and feeding habit of fish, prawn, crab, bivalves and cephalopod.

6. Fish behavior: Parental care of fishes. Fish Migration.
7. Fundamentals of Biochemistry:
 - (i) Elementary idea of structure and classification of carbohydrate, protein and lipid.
 - (ii) Carbohydrate metabolism: Process of Glycolysis, TCA cycles, Glycogenolysis, Glycogenesis, Gluconeogenesis.
 - (iii) Elementary idea of biological oxidation, oxidative phosphorylation and electron transport chain.
 - (iv) Lipid metabolism: synthesis and oxidation of fatty acid.
 - (v) Protein Metabolism: Transamination and Deamination.
 - (vi) Enzymes: Classification, Kinetics(Michaelis-Menten Concept), Factors affecting enzymatic action.

Unit II IFFMT-02 Capture Fisheries

50 Marks

1. Riverine fisheries: Major river system in India. Fishing methods, representative ichthyofauna, recent catch statistics. Problems encountered in fisheries development of major rivers.
2. Cold water fisheries: Cold water fisheries resources of India. Ecological characters of cold water bodies of India. Representative species of fishes of cold water bodies of India. Present status, Prospect, Problems and development of cold water fisheries in India.
3. Reservoir and Lacustrine fisheries: Definition and ecological features of reservoirs and lakes. Major reservoirs and lakes in India with emphasis on capture fisheries. Development of reservoir fisheries in India.
4. Estuarine fisheries: Definition and classification of estuaries, capture fisheries-resident and migrant species, fishing methods, recent catch statistics. Fisheries of brackish water lake and backwaters. Problem of brackish water fishery.
5. Marine fishery resources in India: Marine capture fishery resources at inshore, offshore and deep sea. EEZ, PFZ and continental shelf, maritime states in India. Biology and fisheries of Oilsardine, Hilsa, Pomfret, Bombayduck, Mackerel, ribbon fish, sole fish, eel, catfishes, prawns, lobsters, mollusks.
6. Conservation of marine fishery resources: Deep sea fishing policies of India. Problems of overfishing. Conservation and management of marine fishery resources. Application of remote sensing technology in capture fisheries.

Paper-II

Unit I IFFMP-03 Laboratory Course-I

50

1. Major Dissection: 15
 - (i) Urinogenital system of Mrigal, Tilapia and Lata.
 - (ii) Afferent and efferent arteriole system of Lata.
 - (iii) IXth and Xth Cranial nerve of Lata.
 - (iv) Weberian ossicles of Rohu.
2. Minor Dissection: 05
 - (i) Digestive system of Mrigal, Tilapia and Lata.
 - (ii) Accessory respiratory organs of Singi, Magur, Koi.
 - (iii) Mounting of appendages of Prawn/Shrimp.
 - (iv) Study of the different types of scales of fishes.
 - (v) Gill rakers of fishes of different feeding habit.
 - (vi) Pharyngeal teeth in fishes.
 - (vii) Otolith of Tilapia.
3. Identification of fresh water, brakish water and marine water fishes. 5x5=25
4. Identification of Prawn/Shrimp, Lobster, Bivalves, Cephalopods. 5x1=5

Unit II IFFMP-04 Laboratory Course-II

50 Marks

1. Determination of RLG and Gut content analysis of atleast three species of fishes(Preferably of different feeding habits)/ Gonado Somatic Index/Fecundity. 10
2. Analysis of Data, Drawing of Graphs, Charts, Histograms in relation to abundance and catch particular of fish. 15
3. Field visit of different fish farm(Fresh and Brakish water) and sea coast. 10
4. Laboratory Note Book. 05
5. Viva-Voce 10

Part II

Theory-100 and Practical-100

Paper-III

Unit I IFFMT-05 Fish genetic Engineering and seed production technology

50 marks

1. Fundamentals of Fish Genetics, Molecular Biology and Biotechnology
 - (i) Structure, Composition and Properties of DNA and RNA.
 - (ii) Replication, Transcription and Translation in Prokaryotes and Eukaryotes.
 - (iii) Gene structure and Function- Gene complementation, Cistron, muton, recon, molecular recombination, gene regulation.
 - (iv) Principle of Genetic Engineering- Isolation of DNA and RNA, Recombinant DNA Technology, Cloning, Plasmids, Cosmids, Bacteriophages, Transformation and Transduction. Construction of genomic and cDNA library.
 - (v) Molecular hybridization- Labelling of Nucleic acid, molecular markers, amplification of DNA, Blotting techniques- Southern, Northern and Western blotting, DNA sequencing.
 - (vi) Chromosomal types and composition in fish. Chromosomal manipulation in fish, Hybridization. Polyploidy, androgenesis and gynogenesis.
 - (vii) Transgenic fish production.
 - (viii) Cryopreservation of gametes.
 - (ix) Production of monosex and sterile fishes and their significance in aquaculture.
2. Seed production technologies
 - (i) Induced breeding of IMC and Exotic carps using pituitary gland and other ovulating agents.
 - (ii) Bundh breeding- types and problems.
 - (iii) Riverine seed production techniques.
 - (iv) Different stages of seed- Spawn, Fry and Fingerlings.
 - (v) Endocrine glands in fish with special emphasis on pituitary, role of gonadotropin in fish breeding. Brood stock maintenance and breeding of Carps and other cultivable fishes (IMC, Common carp, Chinese carps, milk fish, Grey mullet, sea bass). Transportation of fish seed and brood fish.
 - (vi) Hatchery technology- Components and general design of hatcheries. Different carp hatcheries.
 - (vii) Design of shrimp hatcheries. Seed production and nursery rearing of *Penaeus monodon* and *Macrobrachium rosenbergii*. Various components, equipments and infrastructure facilities required.

Unit II IFFMT-06 Principles of Aquaculture, Coastal aquaculture and Environmental management.

50 Marks

1. Principles of Aquaculture:
 - (i) Scope and present status of aquaculture.
 - (ii) Principles of site selection of various kinds of fish farms- quality and productivity of water, soil characteristics and other parameters.
 - (iii) Different systems of aquaculture- Monoculture, Polyculture, Integrated fish farming, cage culture, pen culture, raft culture, extensive, semi intensive and intensive fish culture, raceway culture, culture in recirculatory systems, cold water aquaculture,
 - (iv) Carp Culture: Pre stocking, Stocking and Post stocking management of Nursery, Rearing and Stocking pond. Criteria for selection of species for culture. Feed management.
 - (v) Culture of Catfish, Eel and Tilapia.
 - (vi) Sewage fed fish culture.
2. Coastal aquaculture:
 - (i) Characteristic feature of Brakish water. Brakish water resources of India. Brakish water aquaculture, existing culture practices in Bheris(Milk fish, grey mullets, pearl spot) and mariculture(edible oyaster, pearl oyster, mussels, clams and culture of sea weeds)
 - (ii) Important species of cultivable penaeid prawns, life history of a typical penaeid prawn, hatchery production of seed and nursery rearing. Transportation of seed. Preparation of stocking pond: stocking, management and harvesting.
3. Environmental Management:
 - (i) Physical and chemical properties of water. Distribution of fresh water. Lentic and Lotic system and their biotic community with special emphasis on phytoplankton, Zooplankton and benthic fauna. Wetland fresh water biomes- Ecology of tropical fresh water lakes, Reservoirs and ponds. Ecology of estuarine ecosystem and brakish water lagoons. Ecology of mangroves.
 - (ii) Physical and chemical properties of soil. Classification of soil. Distribution of different types of soil in india with special emphasis on aquaculture. Oraganic manure, inorganic fertilizers and liming- their interaction with soil. Macrovegetation. Nitrogen and carbon cycle.
 - (iii) Human impact on fresh water ecosystem. Fresh water and marine water pollution. Eutrophication and Biomagnification.
 - (iv) Sustainability and environmental management. Pollutionary effect of waste discharges from aquatic farms. Controlled use of natural resources. Selection of sites and farming practices. Guidelines for sustainable aquaculture.

4. Aquarium fisheries: Design and construction of aquarium. Water quality management and maintenance of aquarium. Use of aerators, filters and other important accessories. Different kinds of feeds. Culture of fish food organisms. Different types of ornamental fish and plant. Ornamental fishes in marine aquarium. Marketing of ornamental fishes- Problem and prospect. Maturation/secondary sexual characters, breeding habits, spawning and parental care of aquarium fishes. Induced breeding.

Paper-IV

Unit I IFFMP -07 Laboratory Course III

50

1. Histological study of fish endocrine glands(Pituitary, Liver, Stomach, Intestine, Kidney, Testis, Ovary):
 - (i) Staining and identification of supplied histological slide. 12
 - (ii) Submission of permanent histological slide (6). 3
2. Dissection and collection of fish pituitary gland, preservation, extract preparation, doses determination and injection to the brood fishes. 10
3. Identification of aquatic insect, aquatic weeds, fish seeds of cultivable fish species, fish food organisms. 05
4. Estimation of Nucleic acid- DNA/RNA, experiment of eye stalk ablation. 10
5. Submission of field note book. (Atleast three field study tours covering fresh water, brakish water, hatchery and mariculture centre). 10

Unit II IFFMP-08 Laboratory Course-IV

50

1. Identification of common Fresh and marine water aquarium fishes (Identification with reason) 6x2=12
2. Identification of aquarium plants(Scientific name and comment). 2x3=6
3. Analysis of water parameters(Pond water, riverine water, lake water, Marine water) by titration method: D.O, Free CO₂, Total alkalinity, Total Hardness, Salinity, Organic Carbon, Nitrogen, Phosphate, Sulphate, Chloride, BOD, COD. 12
4. Analysis of Soil parameters: pH, Nitrate, Potassium and Organic Carbon. 5
5. Construction of aquarium. 5
6. Submission of Laboratory Note Book. 5
7. Viva- Voce 5

Part-III

Theory-200 and Practical 200

Paper V

Unit I IFFMT-09 Fish Pathology, Microbiology and Immunology:

50

5. Fish Pathology: Causative agents, symptoms and control of some infectious diseases of fish- Fungal Diseases(Saprolegniasis, Branchiomycosis), Bacterial Diseases(Fin and Tail rot, Ulcer diseases, Dropsy, Eye diseases, Ferunculosis, Bacterial Gill diseases, ERM, Edwardsiellosis, Vibriosis), Protozoan Diseases(White spot diseases, Costiasis, Trichodinosis, Whirling disease), Metazoans(Dactylogyruis, Gyrodactylus, Hirodinosis, Lernaea, Argulus)- Morphology, life cycle, symptom and control. Viral diseases(IPN, IHN, VHS, CCVD). EUS. Some common diseases of prawns – pathogens, symptoms and control- IHN, Baculovirus, Black gill disease, brown spot disease.
6. Microbiology: Biological characters of Virus, Bacteria, and Fungi. Culture of bacteria. Bacterial growth, classification of bacteria- gram +ve and gram–ve bacteria. Biological nitrogen fixation, antagonism, rhizosphere, mycorrhiza, organic matter recycling, biodegradation of pesticides.
7. Immunology: Antigen and antibody, Different types of immunoglobulins. Cells and organs of immune system in fish. Innate and adaptive immunity. Humoral and Cell mediated immunity. MHC, Antigen presentation. Vaccination.

Unit II IFFMT-10 Fishing methods, Post Harvest Technology, Fishery Economics, Fishery

extension, Biostatistics, Computer application, remote sensing and GIS

50

1. Fishing methods: Different types of fishing crafts in India- inland and marine-traditional, motorized and mechanized. Boat building material- wood, steel, FRP, Ferro-cement, aluminium etc. Fouling organisms. Fish finding device- sonar, echosounder. Fishing gears- classification/types- net fishing gear(cast net, gill net, seine net, trawl net, stationary lift net, push net, drag net etc), Tackles(Hook –line and others),Miscellaneous (Electrofishing, spearfishing etc)- structure and mode of operation. Impact of indiscriminate on the waterbodies. Mesh size regulation and turtle exclusion device(TED), Gear preservation.
2. Post Harvest Technology: Principles and importance of fish preservation. Fish spoilage- post mortem changes and rigor mortis, post rigor spoilage. Methods of fish preservation- Icing, Freezing, Cold storage, Drying, Salting, Smoking, Canning and Fish

Pickling. Fish product and Byproduct- Fish Oil, Fish liver oil, Fish meal, Fish manure, Fish flour, fish glue, isinglass.

3. Fishery Economics: Role of fisheries in Indian economy. Cooperatives and their importance in fish production and marketing. Role of fishery co-operative societies in the welfare of fishermen. Planning and financing schemes for fisheries. Export market.
4. Fishery extension: Extension education- objective and principles. Role of extension in community development. Integrated rural development strategies. Programmes for weaker section of the community.
5. Biostatistics: Preliminary concept, definition and application of Biostatistics. Measures of Central Tendency- Mean, Median, Mode. Measures of variation-Range, mean deviation, standard deviation, coefficient of variation. Testing of hypothesis- Chi-square test and student T-Test. Probability theory, correlation, regression.
6. Computer Application: Introduction to computer, advantages, limitations, classification of computer, elementary idea of desktop, input-output devices-CPU, Key Board, Mouse, FD drive, CD/DVD Rom drive, RAM, Hardware and software. Office application-software: Introduction to windows, MS Word, MS-Excel and Powerpoint Presentation. Concept of Internet and its application in information collection. Basic ideas of www.
7. Remote sensing and GIS: Definition and principle of remote sensing and GIS. Sensing mechanism. Analysis of images and data. Fisheries forecasting system in India and other countries. GPS. Application of remote sensing and GIS in fisheries conservation and management of fish faunal diversity and exploitation of capture fisheries.

Paper-VI

Unit I IFFMP-II Laboratory Course-V

50

1. Identification of some common fish diseases . 5x2=10
2. Identification of some common fish pathogen(Identification with reason) 5x2=10
3. Gram staining of bacteria 5x1=5
4. Blood film preparation(Giemsa staining) and differential count of WBC. 15
5. Laboratory Note Book. 5
6. Viva-Voce 5

Unit II IFFMP-12 Laboratory Course – VI

50

1. Identification of fishing crafts and gears. 3x4=12
2. Quality control of fish: Crude protein analysis of fish muscle by Lowry method.
Detection of organoleptic changes in fish. 12
3. Statistical analysis. 10
4. Seminar on Fisheries extension/rural economics/remote sensing(Hard copy 10+
Presentation 6) 16

Paper-VII IFFMP-13 On-the- Job Training

100

Written report- 70

Comprehensive Viva-Voce- 30

(A) Entrepreneurship Building:

1. Meaning, Importance, Psychological, Sociological factors and distinctive competence. Entrepreneurship process. Identification of opportunities. Choice of technology. Make or buy decision. Biography of Indian Entrepreneurship. Status of world wide Entrepreneurship.
2. Need, scope and characteristics of Entrepreneurship. Special scheme for Technical Entrepreneurs. STED.
3. Social responsibility and business ethics.
4. Environmental awareness.
5. Human resource management, Management of self and understanding, human behavior, Leadership, Motivation attitude, Belief, communication, Group dynamics, Delegation, Setting of goals, Self assessment, Transactional analysis, Creativity, Problem solving, Strength weakness opportunity and threat (SWOT) Techniques, Decision making, Stress management, Positive reinforcement, Recruitment, Selection, Training.

(B) Financial Management:

1. Institutions, Financing procedure and Financial incentives, Banking norms as in vogue.
2. Financial rationale & and their significance, Costing and Pricing.
3. Knowledge of capital market and mobilization thereof.
4. Fund flow and Cash flow concept.

(C) Technology Management :

1. Criteria for principles of product, selection and development.
2. Choice of technology, plant and equipment.
3. Energy requirement and utilization.
4. Resource management-Men, Machine & Material.
5. Critical Path Method (CPM) & Project Evaluation Review Techniques (PERT) as planning tools for establishing SSI.
6. Plant Layout & Process Planning for the product.
7. Quality control / quality assurance and testing of product.
8. Production Management : Elements of production process, Production Planning and control, Product development, Testing facilities, Patents, Quality Assurance, Time control and Cost control, Total Quality Management.
9. Materials Purchasing Management : Material Planning and Budgeting, Source selection, Public buying, Value engineering, Value analysis, Economic ordering quantity, Inventory control, Linkage with Import and Export Management.

(D) Marketing Management :

1. Exposure to demand based, resource based, service based, Import substitute & Export promotion Industries. Market survey techniques.
2. Elements of marketing & sales management.
3. Nature of product and market strategy – Packing & advertising – After sales service.

4. Touch on Import – Export procedure and methods.
5. Analyzing marketing opportunities, Planning marketing strategy, Forecasting, Marketing mix, Advertising the marketing programme & sales management.

(E) Monitoring and Follow up :

1. Sickness in small scale Industries and their remedial measures.
2. Coping with uncertainties, Stress management and positive reinforcement.

(F) Project Formulation:

1. Needs, Scopes and Approaches.
2. Stages and methodology in Project identification, Selection of a project format, Project report writing.
3. Analysis and evaluation of a Project report.
4. Critical decision making areas – Money – Market – People.
5. Interaction with Appraisal authority and Financial institutions, Project outline of relevant professions.
6. Economic viability and Financial feasibility.
7. Business and Industrial laws, Labour relations.
8. Entrepreneurs and Society, Changing concept of social responsibility, Shift to ethics, Institutionalizing & challenge of relationism.

(G) Statutory provisions:

1. Licensing, Registration – Municipal bye laws and Insurance coverage.
2. Important provisions of Factory Act, Sales of Goods Act, Partnership Act.
3. Pollutional control & Environmental Act.
4. Income Tax, Sales Tax and Excise Rules.

(H) Knowledge input:

1. Industrial and Economic policy declared by Government from time to time.

(I) Data Base management:

1. Books of accounts, Financial statements.
2. Creation of Data Base / Management Information System (MIS).

(J) Additional Topics:

1. Break-even analysis, Cash flow & Fund flow.
2. Organization Psychology – Transaction approach.
3. Visit to linked institutions & promotional agencies like Commercial Banks, WBFC, SISI, DIC, Commercial Tax offices, WBPCB and some Testing centers.

Reference Books and Journals :

BOOKS

1. Marketing Management - Philip Kotler, Prentice Hall of India.
2. Fundamentals of Financial Management - James. C. Van Horne, ' Do '
3. Organisation Psychology - Edgar H. Schein, ' Do '
4. Material Management - A. K. Datta, ' Do '

Journals

1. Monthly Bulletin – Reserve Bank of India.
2. Industrial Survey of India - The Hindu Group.
3. Business Today – Indian Express Group.
4. Economic Times.

Abbreviation used: IFFMT=Industrial Fish and Fisheries Major Theory
IFFMP=Industrial Fish and Fisheries Major Practical

End of Syllabus