B.Sc. FISHERIES BIOLOGY SYLLABUS UNDER CBCS

(With effect from 2016-2017)

VI - SEMESTER

PAPER: GE-2

AQUARIUM (Theory)

Max. Marks: 80

UNIT – I Introduction to Aquarium

1.1. History of animal keeping and present-day aquatic animal husbandry industries.
1.2 Physical, chemical and biological processes occurring in the aquarium environment.
1.3 Proper set-up and maintenance of home aquaria.
1.4 Current internal and external factors that impact the operational role and function of zoological facilities with aquatic animal collections.

UNIT – II Selection and maintenance of Aquarium

2.1. Introducing and Caring for Saltwater Fish and Freshwater Fish
2.2. Selecting Appropriate Fish and Appropriate Placement and Equipment
2.3. Diversity, anatomy, physiology, sensory biology, and behavior of freshwater and marine fishes and the constraints placed upon them in a controlled environment.
2.4. Common Fish Diseases.

UNIT – III AQUARIUM FISH BREEDING

3.1. Basic patterns of aquatic environment, biological balance, nitrogen cycle in the water, water features, Equipment, types of aquariums,
3.2.Factors influencing breeding and fish keeping.
3.3 Principles of aquarium fish breeding, rearing principles.
3.4. Fish nutrition and feed sources. Commercialization opportunities in aquaristic practice.

UNIT – IV Life Support System, Design and Operation of Aquarium

4.1. Role of life support systems in maintaining a balanced, stable aquatic environment.
4.2. Design, construct and maintain semi-closed, closed and open systems.
4.3. Maintenance of Aquarium – Cleaning, Water and Troubleshooting
4.4. Selection of aquarium fishes and plants

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Practical-40 Marks

1 Aquarium design and construction. Culture of live fish food organisms (Phytoplankton and Zooplankton).
2 Aquarium fish disease and their treatment.
3 Fabrication of public & home aquarium
4 Water quality analysis.
5 Culture of common aquarium fish feed.
6 Study of common aquarium fish
7 Identification of common freshwater aquarium fishes and breeding trials of selected freshwater fishes
8 Aquarium fabrication, setting and maintenance.
9 Preparation of powdered and pelleted feed for ornamental fishes.
10 Field visit to aquarium plant, experimental treatment, assessment of water quality.

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PAPER VII – FISH PROCESSING TECHNOLOGY (Theory)

Max. Marks: 50

UNIT – I: Process Biochemistry

1.1. Major and minor constituents of fish, their distribution and function - moisture, proteins, Lipids, carbohydrates, vitamins and minerals.
1.2. Post-mortem biochemical changes in fish - rigor mortis, autolysis, auto-oxidation and their significance.
1.3. Oxidative deterioration
1.4. Toxins and toxic substances in fish.

UNIT – II: Microbiology

2.1. Biochemical and microbial spoilage of fish;
2.2. Factors affecting spoilage of fish.
2.3. Role of bacteria and moulds in fish preservation
2.4. Pathogenic organisms encountered in fish products, fecal indicator organisms.

UNIT – III: Handling and Fish Preservation

3.1. Handling, storage and transport of fresh fish, sanitary and phyto-sanitory requirements for maintenance of quality.
3.2. Principles of fish preservation; preservation of fish by curing, drying, salting and smoking; chilling and freezing of fish; canning of fish and fish products.
3.3. Modern techniques employed in fish preservation: Accelerated Freeze Drying (AFD), Irradiation.
3.4. Fishery by-products and waste utilization.

UNIT – IV: Quality Management and Certification

4.1. HACCP (Hazard Analysis and Critical Control Points) and Good Manufacturing Practices:
4.2. HACCP Principles, Practical aspects of planning and implementation,
4.3. Verification, Validation and Audit.
4.4. National and International Standards - ISO 9000 Series, 2000 Series of Quality Assurance System, Codex Alimentarius Commission, Food Safety and Standards Act of India 2006.

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REFERENCE BOOKS

1. Balachandran KK. 2001. *Post-harvest Technology of Fish and Fish Products*. Daya Publ.
2. Bond, et al. 1971. *Fish Inspection and Quality Control.* Fishing News Books, England.
3 Clucas IJ. 1981. *Fish Handling, Preservation and Processing in the Tropics*. Parts I, II. FAO.
4. Gopakumar K. (Ed.). 2002. *Text Book of Fish Processing Technology*. ICAR.
5. Govindan, TK. 1985. *Fish Processing Technology,* Oxford-IBH.
6. Hall GM. (Ed). 1992. *Fish Processing Technology*. Blackie.
7. Huss HH, Jakobsen M & Liston J. 1991. *Quality Assurance in the Fish Industry.* Elsevier.
8. John DEV. 1985. *Food Safety and Toxicity*. CRC Press.
9. Krenzer R. 1971. *Fish Inspection and Quality Control.* Fishing News.
10. Larousse J & Brown BE. 1997. *Food Canning Technology*. Wiley VCH.
11. Nambudiri DD. 2006. *Technology of Fishery Products*. Fishing Chimes.
12. Regenssein JM & Regenssein CE.1991. *Introduction to Fish Technology*.Van Nostrand Reinhold.
13. Rudolf K. 1969. *Freezing and Irradiation of Fish.* Fishing News (Books).
14. Sen DP. 2005. *Advances in Fish Processing Technology*. Allied Publ.

PRACTICALS-30 Marks

1. Determination of moisture content in fish and fishery products
2. General description – freezing
3. Processing shrimp
5. Drying of fish
6. Organoleptic analysis of fish
7. Preparation of fishery byproducts
8. Preparation of shark fin rays, fish maws, chitin and fish wafer
9. Fish pickling and Value added fishery products, fish curry, cutlets, fish finger.
11. Filleting of fish, treatments, glazing, packaging, freezing, Processing of Prawns, Lobster, Squid, Cuttle Fish, Crab etc. in different styles. Packaging and Freezing, Freezing curve, determination of freezing point.

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PAPER VIII – FISHERIES ECONOMICS & EXTENSTION (Theory)

Max. Marks: 50

UNIT I – Economics - production and cost benefit analysis

1.1. The basis of production; Interrelationships of aquaculture systems.
1.2. Production Economics: Basic economic principles applied to fish production;
1.3. Input-output relationships, maximum level of input, least-cost combination of inputs, Maximum level of output, combination of products, economies of size.
1.4.Cost-Benefit Analysis: Production costs - fixed costs, variable costs, gross revenue, economic analysis; Partial budget analysis; Cash flow analysis.

UNIT II – Marketing economics and economic feasibility of investment analysis

2.1. Marketing Economics: Fish marketing methods in India;
2.2. Basic concepts in demand and price analysis; demand, supply and fish prices, elasticity of demand (price elasticity of demand, income elasticity of demand, cross elasticity of demand).
2.3. Economic feasibility of investment analysis: Methods of feasibility analysis; the payback period, average rate of return, discounting method,
2.4. Net Present Value, Benefit-cost Ratio, Internal Rate of Return.

UNIT III – Economics of unit costs

3.1. Economics of fish production farm (Unit costs).
3.2. Fresh water fish farming in ponds – a small scale business
3.3. Composite fish culture – large scale
3.4. Technical parameters that needs to be considered

UNIT IV – Fisheries extension.

4.1. Fisheries training and Education in India: Training Institutes, Universities, Research organizations.
4.2 Institutional funding to fisheries and aquaculture sector.
4.3. Socio-economic conditions of fishermen and fish farmers.
4.4. Fishermen Co-operative societies.

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REFERENCE BOOKS

1. Adcock D, Bradfield R, Halborg A & Ross C. 1995. *Marketing Principles and Practice*. Pitman Publ.
2. Allen, et al.(Eds). 1984. *Bio-Economics of Aquaculture*. Elsevier Publication
3. Chaston I. 1984. *Business Management in Fisheries and Aquaculture,* Fishing News Books.
4. Hepher B and Pruginin Y. 1989. *Commercial Fish Farming*. Wiley-Interscience.
5. Ian C. 1984. *Marketing in Fisheries and Aquaculture*. Fishing News Books.
6. Kumar D. 1996. *Aquaculture Extension Services Review: India.* FAO Fisheries Circular No. 906, Rome.
7. Meade JW. 1989. *Aquaculture Management* Van Nostrand, New York.
8. Pillay TVR. 1990. *Aquaculture Principles and Practices*. Fishing News Books Ltd. London
9. Ray GL. 2006. *Extension, Communication and Management*. 6th Ed. Kalyani Publ. Delhi.
10. Shang YC. 1990. *Aquaculture Economic Analysis - An Introduction.* World Aquaculture Society, USA.

Practicals-30 Marks

1. Estimation of costs and returns of different aquaculture systems – planning and budgeting – linear programming production function analysis – cost function analysis – financial and farm business analysis – risk programming – case studies.
2. Visit to fish farms, prawn farms and hatcheries – discussion on socio economic issues in aquaculture development.
3. Data collection on cost and returns of different fishing methods (instead of economics of capture fisheries);
4. Structural Change in the seafood export of India-Estimation of DRC, NPC for selected groups of exports.

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