

Advanced Aquaculture (Theory)

Unit 1: Modern Aquaculture Practices:

Recent advances in aquaculture. Cage and Pen culture; Site selection, design, species selection, stocking density, feeding and management. Raceways. Trout farming: design and management of a trout farm. Rearing of game and larvicidal fishes.

Unit 2: Fish Nutrition:

Natural food of fishes, feeding habits and feed conversion ratio. Different types of feed ingredients used in fish culture; nutrition and energetics. Larval and brood-stock nutrition. Artificial balanced feed composition and formulation.

Unit 3: Sewage-fed Fisheries and Air-breathing Fish Culture:

Physico-chemical and biological characteristics of sewage water. Sewage treatment for fish culture. Management of sewage fed fisheries and its scope.

Culturable air-breathing fishes of India. Prospects of air-breathing fish culture.

Unit 4: Brackish Water Aquaculture and Mariculture:

Ecology of brackish water ponds. Culturable species of brackish water fishes and prawns. Construction and management of brackish water farm. Procurement of seed, stocking and scope of brackish water farming. Mariculture: Concepts and prospects, Introduction to prawn, oyster, pearl, clam and seaweed fisheries.

Unit 5: Ornamental and Aquarium Fishes:

Ornamental and aquarium fishes and their economic importance. Ornamental fishes of India with special reference to the North East. Scope of ornamental fish breeding. Role of Marine Product Export Development Authority (MPEDA) and its activities. Aquaria: Setting and management.

Suggested Reading:

1. Billard, R. (1994). Carp Biology and Culture. Springer & Praxis Publishing House, U. K.
2. Datta Munshi, J. S. & Hughes, G. M. (1992). Air-breathing Fishes of India. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Jhingran, V. G. (2007). Fish and Fisheries of India. Hindustan Publishing Corporation (India), Delhi – 110 007.
4. Kumar, H. D. (2003). Sustainability and Management of Aquaculture and Fisheries. Daya Publishing House, Delhi –35.
5. Mathew, L. (1997). Introduction to Aquaculture. John Wiley & Sons, Inc.
6. Singh, H. R. (1999). Cold Water Aquaculture and Fisheries. Narendra Publishing House, Delhi-6.
7. Srivastava, C. B. L. (1992). Fishery Science and Indian Fisheries. Kitab Mahal, Allahabad.
8. Stickney, R. R. (1994). Principle of Aquaculture, John Wiley & Sons, Inc.
9. The Macdonald Encyclopedia of aquaria (1972). A handbook of fishes, plants and all creatures for your aquarium.
10. Vass, K. K. *et al.* eds (2006). River Fisheries in India: Issues and Current Status. Daya Publishing House, Delhi – 35.

Advanced Aquaculture (Practical)

1. Identification of live feed.
2. Identification of ornamental and aquarium fishes.
3. Setting up an aquarium.
4. Identification of fish feed ingredients and formulation and preparation of fish feed by Square Method.
5. Analysis BOD of sewage water.
6. Project.

DISTRIBUTION OF MARKS:

1. Identification of ornamental fish/live feed
2. Setting up an Aquarium/ Analysis of BOD of sewage water
3. Identification of fish feed ingredients, feed formulation and preparation
4. Project report
5. *Viva voce*
6. Laboratory record

Fish Breeding and Hatchery Management (Theory)

Unit 1: Reproduction and Breeding Behaviour:

Reproductive organs: structure and function. Types of reproduction, sexual dimorphism, courtship and spawning behaviour. Parental care. Migration of fishes: Types, causes and significance.

Unit 2: Developmental Biology:

Breeding cycles, fecundity and gonado somatic Index. Maturation of gonads, gametogenesis, fertilization, cleavage, blastulation, gastrulation, hatching and post larval development.

Unit 3: Procurement of Fish Seed:

Procurement and transportation of carp and air-breathing fish seed from natural sources. Advantages and disadvantages of fish seed from natural resources with respect to its quality and quantity.

Unit 4: Induced Breeding of Carps and Air-Breathing Fishes:

Criteria of selection of brood fishes, collection, transportation and rearing of brood fish. Factors affecting induced breeding. Identification of male and female brood fish. Hypophysation technique. Hormones/Chemical use for induced breeding. Importance of Induced breeding. Wet and dry *bundh* methods for induced breeding of carps.

Unit 5: Hatchery Management:

Types of carp hatchery. Design of Eco Hatchery and portable hatchery. Physical and chemical factors affecting induced breeding of carps and cat fishes. Management of brood stock.

Suggested Reading:

1. Atre, P. K. (2008). Fish Genetics and Aquatic Environment. Navyug publishers, New Delhi.
2. Das, P. and Jhingran A. G. (2005). Fish Genetics in India. Today & Tomorrows Printers & Publishers. New Delhi.
3. Ghosh, R. (2007). Fish genetics and endocrinology. Sawstic publishers and distributors, Delhi
4. Jhingran, V. G. (2007). Fish and Fisheries of India. Hindustan Publishing Corporation (India), Delhi – 110 007.
5. Kamler, E. (1992). Early Life History of Fish, an Energetics Approach. Chapman & Hall.
6. Nair, P. R. (2008). Biotechnology and Genetics in Fisheries and Aquaculture. Daya Publishing House, Delhi -35.
7. Parihar, R. P. (1992). A Text Book of Fish Biology and Indian Fisheries. Central Publishing House, Allahabad.
8. Reddy, P. V. G. K. (2005). Genetic Resources of Indian Major Carps. FAO Publications by Daya Publishing House, Delhi -35.
9. Srivastava, S. (2009). Genetics, embryology and fishes. Delhi Magalam Publications, Delhi.

Fish Breeding and Hatchery Management (Practical)

1. Hypophysation technique: Collection of pituitary gland, preparation of extract and demonstration of hypophysation.
2. Study of maturity stages and gonado-somatic index of carps.
3. Determination of Physico-chemical parameters of hatchery water (temperature, dissolved oxygen, pH, alkalinity, free carbon dioxide and turbidity).
4. Designing of Eco- hatchery.
5. Study of post larval development of fish from permanent slide.

DISTRIBUTION OF MARKS:

1. Hypophysation techniques/ preparation of extract/
Designing of Eco-hatchery
2. Estimation physico chemical parameters of hatchery water/
maturity stages and gonado-somatic index
3. Study of Post larval development/
4. *Viva voce*
5. Laboratory Record