SEMESTER – III			
Core IX : Aquaculture Biotechnology			
Code : 17PZOC33	**Hrs / week : 6**	**Hrs / sem : 90**	**Credits : 5**

Objectives

- To familiarize and perceive the importance of aquacultural potentials
- To understand the various techniques of seed production and health management
- To acquaint with the techniques in biotechnology as applied to aquaculture industry

Unit I Aquaculture Basics and Management

Scope of aquaculture, aquaculture in India.Farm engineering and equipments: selection of site, lay out , construction ,mechanical and biological filters - role of aeration in culture ponds.

Managementof culture ponds - fertilization,water quality management, control of predatory and weed fishes, aquatic weeds.

Unit II Aquaculture for Stable Environment

Sewage - fed fish culture, sewage treatment , sewage- cum fish culture in India. Recent developments in integrated fish farming - animal husbandry- cum fish culture , paddy cum fish culture, fish culture in cages and pens, race-way fish cultur, culture of air breathing fishes.

Unit III Seed Production and Culture Techniques

Brooders care and management, bundh breeding, hypophysation, in-vitro fertilization, application of synthetic hormones, transport of fish seed and brooders , culture of shrimp, edible and pearl oysters.

Unit IV Nutrition and Health management

Culture of fish feed organisms: diatoms , cladocerans, rotifers, artemia, tubifex , blood worm . artificial feed formulation and management , probiotics in formulated feeds.

Bacterial, viral and fungal diseases, nutritional deficiency diseases, ectoparasites endoparasites, principles of fish health management, fish vaccines.

Unit V **Aquaculture Biotechnology and Economics**

Genetic improvement of stock:selective breeding,hybridization, transgenic fishes, chromosomal manipulation: polyploidy, gynogenesis, androgenesis, production of monosex and sterile fishes, cryopreservation of gametes.Aquaculture economics, fish marketing, involvement of Government organizations in marketing.

Books for Reference

1. Jhingran, U.G. 1997 Fish and Fisheries of India. Hindustan Publ. New Delhi
2. Dubey S. K. and BandandGhosh 2012. Fish Biotechnology. Published by Wisdom Press, New Delhi
3. AmitaSaxena 2011. Fisheries Economics. Daya Publishing House, New Delhi.
4. Schonder, S. L. 1980 Hypophysation in Indian Major Carps. Sathish Book Enterprises Agra.
5. Santhanam R., SukumaranN.and P. Natarajan 1990. A Manual of Fresh Water Aquculture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Pandian I.D., Abhinandan Kumar and Rajbhushan Prasad. 2009 Aquaculture and Biotechnology. A. K. Publ. New Delhi.
7. Agnihotri S. B. 2013 Aquaculture Management and Technology. Swastik Publication, Delhi.
8. Felix S. 2010. Marine and Aquaculture Biotechnology. Published by Agrobios, Jodhpur, India
9. Santhanam R., Ramanathan N. and G. Jegathesan 1990. Coastal Aquaculture in India 1stedn. CBS Publishers, Delhi.

PRACTICALS

Hrs / Week : 2

1. Estimation of dissolved ammonia in water samples
2. Estimation of alkalinity in water samples.
3. Identification of cultivable food fishes
4. Identification of aquatic weeds, predatory fishes and insects.
5. Study of fish parasites and diseases.
6. Decapsulation technique and hatching of artemia cysts
7. Preparation of artificial feed.
8. Report on field visit to aquaculture farm
9. Report on visit to CMFRI / Fisheries Institute.

SEMESTER – III			
Core X : Aquaculture Practices and Farm Management			
Code : 19PZOC32	**Hrs / week : 6**	**Hrs / Sem : 90**	**Credits : 4**

Vision

To develop a comprehensive knowledge and transferable professional skills for career in aquaculture industry

Mission

To acquaint with technical and general knowledge for competent fisheries management

Course Outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	design aquaculture systems	1	Cr
CO-2	develop practical skills for management of culture ponds	3	Ap
CO-3	apply techniques involved in breeding and culture of various organisms	1,2	Cr,Ap
CO-4	demonstrate competency in live feed culture and feed formulation	2,3	Un,Ev
CO-5	evaluate and manage aquaculture diseases, health and safety issues in aquaculture ventures	1,6	Un Ev
CO-6	discuss important factors for performing a sustainable aquaculture	1,3	Un, Ap
CO-7	compare the principles of genetic improvement of fish stock	1	Un
CO-8	analyse aquaculture economics and marketing strategies	1,3	An,Ap

SEMESTER – III			
Core X : Aquaculture Practices and Farm Management			
Code : 19PZOC32	**Hrs / week : 6**	**Hrs / Sem : 90**	**Credits : 4**

Unit I **Aquaculture Basics and Management**

Scope of aquaculture, aquaculture in India, Fishery resources of India in general and Tamil Nadu in particular. Selection of site,construction of fish farm, soil chemistry. Designing layout and construction of different types of fish ponds. Management of culture ponds - fertilization, water quality management, predators and weed management

Unit II **Seed Production and Culture Techniques**

Carp culture : Carp: Brooders care and management seed collection from natural sources, bundh breeding, hypophysation, in-vitro fertilization. Fish seed transport, hatching and rearing techniques. Culture of edible oyster, pearl oyster and seaweed.

Unit III **Nutrition and Health management**

Culture of fish feed organisms: diatoms,cladocerans,rotifers, artemia, artificial feed formulation and management, probiotics in formulated feeds. Bacterial (gill rot & Furunculosis),viral (EUS & Erythrocytic necrosis) fungal diseases (Saprolegniasis & Erythroderma) nutritional deficiency diseases, ectoparasites, endoparasites, principles of fish health management, fish vaccines.

Unit IV **Aquaculture for Stable Environment**

Water pollution, its effect on fisheries and methods of its abatement. Sewage - fed fish culture, sewage treatment , sewage- cum fish culture in India. Integrated fish farming: animal husbandry cum fish culture, paddy cum fish culture, fish culture in cages and pens. Culture of air breathing fishes.

Unit V **Aquaculture Biotechnology and Economics**

Genetic improvement of stock: selective breeding, hybridization, polyploidy, production of monosex, sterile fish, transgenic fish, sex manipulation, gynogenesis, androgenesis, role of biotechnology in conservation of fish. Aquaculture economics, fish marketing, involvement of government organizations in marketing. Role of CMFRI, NIOT,CIBA & NABARD.

Books for Reference

1. Dubey, S. K. and Bandand Ghosh. 2012. *Fish Biotechnology*. Wisdom Press, New Delhi.
2. Amita Saxena, 2011. *Fisheries Economics*. Daya Publishing House, New Delhi.
3. Schonder, S. L. 1980. *Hypophysation in Indian Major Carps*. Sathish Book Enterprises Agra.
4. Pandian, I.D. Abhinandan Kumar and Rajbhushan Prasad. 2009. *Aquaculture and Biotechnology*. A. K. Publ. New Delhi.
5. Agnihotri. S. B. 2013. *Aquaculture Management and Technology*. Swastik Publication, Delhi.

6. Felix, S. 2010. *Marine and Aquaculture Biotechnology*. Agrobios, Jodhpur, India

7. Santhanam, R., Ramanathan, N. and G. Jegathesan. 1990. *Coastal Aquaculture in India.* 1st edn. CBS Publishers, Delhi.

8. Shagufta. 2012. *Fish Health and Diseases*. APH Publishing.,Corpoartion, NewDelhi

9. Yougesh Kumar and Rajeev Tyagi. 2013. *Aquaculture Fisheries Biotechnology and Genetics*. Mangalam Publishers & Distributors, Delhi

10. ChandraSekar. Y.S . 2012. *Fish Nutrition in Aquaculture*. Swasthik Publishers &Distributers, Delhi.

11. Rajendra Kumar Rath. 2011. *Freshwater Aquaculture*. Scientific Publishers, Jodhpur.

12. Singh, V.B. 2010. *Fish Farming*. ALP Books, New Delhi.

13. *Economics of Fish Culture Operations*. FAO- www.fao.org.docrep

PRACTICALS

Hrs / Week : 2 **Credit: 1**

1. Estimation of dissolved ammonia in water samples
2. Estimation of alkalinity in water samples.
3. Analysis of freshwater plankton
4. Decapsulation technique and hatching of artemia cysts
5. Feed formulation exercise – preparation of compound feed Demonstration
6. Identification of cultivable food fishes
7. Identification of aquatic weeds, predatory fishes and insects.
8. Study of fish parasites and diseases.
9. Visit to aquaculture farm – drawing the layout of ponds, dikes and sluices

Books for Reference

1. Methods in Hydrobiology Manual, *Centre for Advanced Studies in Marine Biology*, Published by Annamalai University, Parangipettai, Chidambaram.
2. Felix, N., Ahilan, B. and S. Athithan. 2004. *Fish Nutrition and Feed Technology Manual.* Fisheries College and Research Institute, Tamilnadu Verteinary & Animal Science University, Thoothukudi.
3. FAO Fisheries Technical Paper. No.361; *Manual on the Production and Use of Live food for Aquaculture.* Laboratory of Aquaculture and Artemia Reference Centre, University of Ghent, Belgium.

SEMESTER - IV			
Elective - I B	**Ornamental Fish Culture**		
Code : 19PZOE41	**Hrs / Week : 4**	**Hrs / Sem : 60**	**Credits : 4**

Vision

Impart basic understanding for operating an ornamental fish farm and improve the quality of fisheries education, research and extension activities. Instill competence and confidence among the students for self employment.

Mission

Generate technically skilled man power to work in ornamental fish farms

Augment ornamental fisheries trade and export earnings

Course Outcome:

CO.No	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	explain the construction, fabrication and accessories required for setting up an aquarium tank	2,3	Un
CO - 2	apply the knowledge and skills in aquarium management	1	Ap
CO - 3	evaluate the types and culture of live feed organisms and formulate the artificial feed	3	Ev
CO - 4	describe the factor related with taxonomy and biology of ornamental fish	3	An
CO - 5	choose the commercially important fresh water and marine ornamental fishes and their transport	8	Ev, Cr
CO - 6	analyse the different varieties of ornamental fish	2,3	An
CO - 7	acquire confidence to become an entrepreneur in ornamental fish culture	3	Un
CO - 8	develop entrepreneurial skills and make aware of National and International export earnings	2,7	Cr

SEMESTER - IV			
Elective - I B	Ornamental Fish Culture		
Code : 19PZOE41	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Unit I Construction of fish tanks

Design and Construction of fish tanks - setting up of tanks - accessories for aquarium tanks - hood, light source, hand net, suction tube, scrapper tool, aerator, gravels, filters and ornamental objects - aquarium plants and its importance.

Unit II Aquarium maintenance

Maintenance of water quality - temperature, water hardness, ammonia, pH, O_2, CO_2. Control of snail and algal growth. Diseases - protozoan - fungal - bacterial and nutritional diseases - diagnosis and treatment.

Unit III Nutritional requirements of ornamental fishes

Different types of feed - artificial and live feed - culture of live feed organisms - infusorians - zooplankton - rotifers - copepods - cladocerans - spirulina - brine shrimp - chironomous - tubifex. Artificial feed - principles of feed formulation - preparation of artificial feed - balanced diets.

Unit IV Popular ornamental fishes

Taxonomy and biology of egg layers - siamese fighting fish, gourami, gold fish, koi, rosy barb, neon tetra, zebra cichlid and angel fish. Live bearers - molly, guppy, sword tail and platy. Breeding and spawning of egg layers and live bearers .

Unit V Marine ornamental organisms

Commercially important marine ornamental fishes - butterfly fish, parrot fish, clown fish, marine angel fish. Transport of ornamental fishes - use of sedatives.

Books for Reference

1. Jameson. J.D. and R. Santhanam, 1996. Manual of Ornamental Fishes and Farming Technologies – Fisheries College and Research Institute TANUVAS, Tuticorin.
2. Santhanakumar. R. and A.M. Selvaraj. 2007. Manual of Freshwater Ornamental Fish Culture, Department of Fisheries Extension, Fisheries College and Research Institute, TANUVAS, Tuticorin .
3. Venkataramani V.K. and N. Jeyakumar. 2004. Biodiversity and Stock Assessment of Marine Ornamental Fishes. Department of Fisheries Biology and Capture Fisheries, Fisheries College and Research Institute, TANUVAS, Tuticorin
4. Tharadevi, C.S. and K. V. Jayashree. 2009. Home Aquarium. Saras Publications, Nagercoil.
5. Santhanam R., Sukumaran N.and P. Natarajan 1990. A Manual of Fresh Water Aquculture. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
6. Gupta, S. K. and P. C. Gupta. 2006. General and Applied Ichthyology 1st Edn. Chand and Company Ltd, New Delhi.
7. Dholakia, A.D. 2009. Ornamental Fish Culture and Aquarium Management. Daya publishing House, Tri Nagar, Delhi.
8. Amita Saxena. 2003. Aquarium Management. Daya Publishing House, Tri Nagar, Delhi.

SEMESTER – III			
Core X	**Aquaculture Practices and Farm Management**		
Course Code: 21PZOC32	**Hrs/Week:6**	**Hrs/Semester:90**	**Credits:4**

Objectives

- To develop a comprehensive knowledge and transferable professional skills for career in aquaculture industry
- To acquaint with technical and general knowledge for competent fisheries management

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO's addressed	CL
CO-1	design aquaculture systems	1	Cr
CO-2	develop practical skills for management of culture ponds	3	Ap
CO-3	apply techniques involved in breeding and culture of various organisms	1,2	Ap
CO-4	demonstrate competency in live feed culture and feed formulation	2,3	Un, Ev
CO-5	evaluate and manage aquaculture diseases, health and safety issues in aquaculture ventures	1,6	Un, Ev
CO-6	discuss important factors for performing a sustainable aquaculture	1,3	Un, Ap
CO-7	compare the principles of genetic improvement of fish stock	1	Un
CO-8	analyse aquaculture economics and marketing strategies	1,3	An, Ap

SEMESTER – III			
Core X	**Aquaculture Practices and Farm Management**		
Course Code: 21PZOC32	**Hrs/ Week:6**	**Hrs/Semester:90**	**Credits:4**

Unit I **Aquaculture Basics and Management**

Scope of aquaculture, Fishery resources of India and Tamil Nadu. Selection of site, construction of fish farm, soil chemistry, construction of different types of fish ponds. Management of culture ponds - fertilization, water quality management, predators and weed management.

Unit II **Seed Production and Culture Techniques**

Carp culture : Carp: Brooders care and management seed collection from natural sources, bundh breeding, hypophysation, fish seed transport, hatching and rearing techniques. Culture of edible oyster, pearl oyster and sea weed.

Unit III **Nutrition and Health Management**

Culture of fish feed organisms: diatoms, cladocerans, rotifers, artemia. Artificial feed formulation and management. Bacterial (gillrot & Furunculosis) viral (EUS White spot disease, Erythrocytic necrosis) fungal diseases (Saprolegniasis & Branchiomycosis) Nutritional deficiency diseases, ectoparasites, endoparasites, principles of fish health management, fish vaccines.

Unit IV **Integrated Aquaculture Management**

Water pollution, its effect on fisheries and methods of its abatement. Sewage – fed fish culture - sewage treatment. Integrated fish farming - animal husbandry cum fish culture, paddy cum fish culture, fish culture in cages and pens. Culture of air breathing fishes.

Unit V **Aquaculture Biotechnology and Economics**

Genetic improvement of stock - hybridization, polyploidy, production of monosex, sterile fish, transgenic fish, gynogenesis, androgenesis. Aquaculture economics, fish marketing, involvement of government organizations in marketing. Role of CMFRI, NIOT, CIBA & NABARD.

Books for Reference

1. Dubey. S.K. and Band and Ghosh. *Fish Biotechnology*. New Delhi: Wisdom Press. 2012.
2. Amita Saxena. *Fisheries Economics*. New Delhi: Daya Publishing House. 2011.
3. Schonder. S.L. *Hypophysation in Indian Major Carps*. Agra: Sathish Book Enterprises 1980.

4. Pandian. I.D. Abhinandan Kumar and Rajbhushan Prasad. *Aquaculture and Biotechnology*. New Delhi: A.K. Publ. 2009.
5. Agnihotri. S.B. *Aquaculture Management and Technology*. New Delhi: Swastik Publication. 2013
6. Felix. S. *Marine and Aquaculture Biotechnology*. Jodhpur, India: Agrobios. 2010.
7. Santhanam. R., Ramanathan, N. and G. Jegathesan. *Coastal Aquaculture in India.* Delhi: CBS Publishers 1st edn. 1990.
8. Shagufta. *Fish Health and Diseases*. New Delhi: APH Publishing Corpoartion. 2012.
9. Yougesh Kumar and Rajeev Tyagi. *Aquaculture Fisheries Biotechnology and Genetics*. Delhi: Mangalam Publishers & Distributors. 2013.
10. Chandra Sekar. Y.S. *Fish Nutrition in Aquaculture*. Delhi: Swasthik Publishers & Distributers. 2012.
11. Rajendra Kumar Rath. *Freshwater Aquaculture*. Jodhpur: Scientific Publishers. 2011.
12. Singh. V.B. *Fish Farming.* New Delhi: ALP Books. 2010.

PRACTICALS

Course Code : 21PZOCR5

Hrs/ Week: 2 **Credit: 1**

1. Estimation of dissolved ammonia in water samples
2. Estimation of alkalinity in water samples.
3. Analysis of fresh water plankton
4. Decapsulation technique and hatching of artemia cysts
5. Feed formulation exercise – preparation of compound feed - Demonstration
6. Identification of cultivable food fishes
7. Identification of aquatic weeds, predatory fishes and insects.
8. Induced breeding in fishes
9. Study of fish parasites and diseases.
10. Visit to aquaculture farm

Books for Reference

1. Methods in Hydrobiology Manual. *Centre for Advanced Studies in Marine Biology*, Published by Annamalai University, Parangipettai, Chidambaram. 2011.

2. Felix, N., Ahilan, B. and S. Athithan. *Fish Nutrition and Feed Technology Manual.* Thoothukudi: Fisheries College and Research Institute Tamilnadu Verteinary & Animal Science University. 2004.

3. FAO Fisheries Technical Paper. No. 361; *Manual on the Production and Use of Live food for Aquaculture.* Laboratory of Aquaculture and Artemia Reference Centre, University of Ghent, Belgium. 1996.

SEMESTER IV			
Core XV	**Commercial Zoology**		
Course Code: 21PZOC43	**Hrs/ Week: 5**	**Hrs/ Sem: 75**	**Credits: 4**

Objectives

- To facilitate self-employment and entrepreneurship in Apiculture and Sericulture.
- To motivate the students to take up careers related to agro-based, rural oriented cottage industry through imparting knowledge in apiary management, mulberry cultivation and silkworm rearing.

Course Outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the behaviour of bees, prevent swarming and manage bee colonies	3	Un
CO-2	identify, choose suitable bees and maintain bee hive successfully	2	Ev
CO-3	inspect bee colony, identify diseases of bees, recognize their enemies and take necessary control measures	4	An, Ap
CO-4	apply their knowledge to implement the procedure to extract honey and other bee products	5	Ap
CO-5	demonstrate an understanding of mulberry cultivation, silkworm rearing and silk reeling	1	Un
CO-6	identify diseases, pests of mulberry, silkworm and adopt control measures	4	Ap, Cr
CO-7	utilize their knowledge in harvesting, marketing cocoons and reeling operations	5	Ap
CO-8	develop practical proficiency in apiculture and sericulture from the lab work as well as visit to the apiary and the sericulture unit.	6	Ap

Unit I **Beekeeping Technology**

Apiculture as a cottage industry - choice of species in apiculture- Indian bee, European bee. Beekeeping equipments - Langstroth hive and Newton's hive- appliances used in apiaries. Swarming – prevention and control. Queen rearing and introduction. Artificial feeding.

Unit II **Management of Bees & Honey Bee Products**

Diseases of bees - brood diseases, diseases of adult bees - nosema and septicemia, enemies and pests - greater wax moth, lesser wax moth, ants, wasps, mites - control measures. Extraction and uses of honey - bee wax - bee venom, pollen, propolis, royal jelly – Agmark index.

Unit III **Silkworm Rearing**

Mulberry silkworm development – silkworm rearing – rearing house – rearing appliances rearing operations. Shelf rearing – floor rearing – shoot rearing. Silkworm diseases – bacterial flacherie, muscardine, grasserie. Pest - Indian uzifly - symptoms and control measures.

Unit IV **Cocoon Mounting and Reeling**

Mounting - cocoons – harvesting and marketing of cocoon. Grading of silk and cost benefit ratio. Silk reeling – reeling operations, reeling appliances – cottage basin – filature units - by-products.

Unit V **Economics of Sericulture**

Sericulture industry – present status – prospects in India; Role of Governmental organizations and NGOs in the development of Sericulture industry – Schemes for Sericulture development – NABAARD, MSME, MUDRA.

Books for Reference

1. Krishnaswami S. *Improved Method of Rearing Young Age Silkworms*. Bangalore: Central Silk Board, 1990.
2. Hisao Aruga. *Principles of Sericulture*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd. 1990.

3. Acharya J. *Sericulture and Development*. New Delhi: Indian Publishers Distributers Kamak Nagar, 1993.
4. Pierre Jean – Prost. *Apiculture*. New Delhi: Oxford & IBH Publishing Co. Pvt. LTD, 1994.
5. Raja Instus E. *Economics of Bee Keeping Industry*. Jaipur and New Delhi: Rawat Publications, 1994.
6. Mishra R.C. *Perspectives in Indian Apiculture*. Agro Botanica, 4E 176 J.N. Vyas Nagar, Bikaner, H.S. Offset Printers, Daryagunj, New Delhi: 1997-98.
7. Arthur G. and Carter J. *Beekeeping: A Guide to the Better Understanding of Bees, their Diseases and the Chemistry of Beekeeping*. New Delhi: Biotech books, 2004.
8. Everett Franklin Phillips. *Bee Keeping*. Jodhpur: Agrobios (India), Agro House, Chopasani Road, 2010.
9. Ganga G. and Sulochana Chetty J. *An Introduction to Sericulture*. New Delhi: Oxford & IBH Publishing Co Pvt. Ltd, 2019.

PRACTICALS

Course Code: 21PZOCR8

Hrs / Week : 2 **Credit: 1**

1. Identification of bee species and castes.
2. Mounting of mouth parts and legs of worker bee.
3. Adulteration in honey
4. Beekeeping equipments - Newton's hive, hive tool, smoker, uncapping knife, pollen box, honey extractor.
5. Identification of diseases and enemies of honey bees.
6. Development of silkworm.
7. Mounting of silk gland.
8. Rearing house and appliances.
9. Silkworm diseases and pests.

10. Filling forms for entrepreneurs

11. Visit to an apiary or sericulture unit.

Books for Reference

1. Tammanna N. Sonwalker. 1993. *Hand Book of Silk Technology*. Wiley Eastern Ltd. Chennai.
2. Alka Prakash. 2001. *Laboratory Manual of Entomology*. New Age International (P) Ltd, 4835/ 24, Ansari Road, Daryaganj, New Delhi – 110002.

SEMESTER IV			
Core Elective	**A. Ornamental Fish Culture**		
Course Code: 21PZOE41	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To impart basic understanding for operating an ornamental fish farm and improve the quality of fisheries education, research and extension activities.

- To generate technically skilled manpower to work in ornamental fish farms, augment ornamental fisheries trade, export earnings and self employment.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	explain the construction, fabrication and accessories required for setting up an aquarium tank	1	Un
CO-2	apply the knowledge and skills in aquarium management	2	Ap
CO-3	evaluate the types and culture of live feed organisms and formulate the artificial feed	3	Ev
CO-4	demonstrate the mastery related with taxonomy and biology of ornamental fish	3	Ap
CO-5	identify the commercially important fresh water and marine ornamental fishes and their transport	8	Ap
CO-6	analyse the different breeding techniques employed for varieties of ornamental fish	2,3	An
CO-7	acquire competencies to become an entrepreneur in ornamental fish culture	3	Un
CO-8	develop entrepreneurial skills and make aware of National and International export process and income generation	2,7	Cr

Unit I Construction of Fishtanks

Design and Construction of fish tanks – setting up of tanks - accessories for aquarium - hood, light source, hand net, suction tube, scrapper tool, aerator, heater, gravels, filters and aquarium decor –aquarium plants and its importance.

Unit II Aquarium and Fish Health Management

Maintenance of water quality - temperature, water hardness, ammonia, pH, O_2, CO_2. Control of snail and algal growth. Fish diseases - protozoan, fungal, bacterial and parasitic diseases - symptoms, diagnosis, therapy and prevention.

Unit III Fish Nutrition

Different types of feed - artificial and live feed - culture of live feed organisms - infusorians - zooplankton - rotifers - copepods - cladocerans - spirulina - brine shrimp - chironomous - tubifex. Artificial feed: ingredients of feed formulation – Pearson square method of feed formulation - steps in the preparation of artificial feed – nutritional deficiency diseases.

Unit IV Biology and Breeding

Taxonomy and biology of egg layers - siamese fighting fish, gold fish, koi, rosy barb, neontetra, zebra cichlid and angel fish. Live bearers - molly, guppy, sword tail and platy. Breeding and spawning of egg layers and livebearers – parental care in ornamental fishes.

Unit V Marine ornamental Fishes and Transport

Commercially important marine ornamental fishes - butterfly fish, parrot fish, clown fish, marine angel fish. Transport of ornamental fishes – oxygen packing - use of sedatives - marketing strategies.

Books for Reference

1. Jameson. J.D. and R. Santhanam. *Manual of Ornamental Fishes and Farming Technologies* – Tuticorin: Fisheries College and Research Institute TANUVAS. 1996
2. Santhanakumar. R. and A.M. Selvaraj. *Manual of Fresh water Ornamental Fish Culture*, Tuticorin: Department of Fisheries Extension, Fisheries College and Research Institute, TANUVAS. 2007
3. Venkataramani V.K. and N. Jeyakumar. *Biodiversity and Stock Assessment of Marine Ornamental Fishes*. Tuticorin: Department of Fisheries Biology and Capture Fisheries,

Fisheries College and Research Institute, TANUVAS. 2004

4. Tharadevi, C.S. and K.V. Jayashree. *Home Aquarium*. Nagercoil: Saras Publications. 2009
5. Santhanam R., Sukumaran N. and P. Natarajan. *A Manual of Freshwater Aquculture*. NewDelhi: Oxford and IBH Publishing Co. Pvt. Ltd. 1990
6. Gupta, S.K. and P.C. Gupta. General and Applied Ichthyology. New Delhi: Chand and Company Ltd, 1st Edn. 2006
7. Dholakia, A.D. *Ornamental Fish Culture and Aquarium Management*. Delhi: Daya Publishing House, Trinagar. 2009.