

Syllabus on Vocational Education and Training Course (VTC)

Paper Title	: Fish Farming -I							
CODE	: VTC: 240.2							
Number of Credits	: 4							
Semester	: III							
No. of Theory Hours Per Week	: One (1 hour)							
No. of Practical Hours per Week	:Three (3 Hours)							
Outline of the Paper:								
Type of Course	Units in the VTC	Hours	Credits	Total Marks	Distribution of Marks (as per OC-8)			
Fish Farming-I					In-Semester		End-Semester	
					Theory	Practical	Theory	Practical
	Unit-I Theory (25 Marks)	15			25			
	Unit-II to IV Theory (75 Marks)	90	4	100		15		60
Marks Distribution	: Internal Assessment: 40 : External Assessment: 60							
Course Objectives	<ol style="list-style-type: none"> 1. To introduce the learner to different types of freshwater fishes and the significance of Fisheries in the region of study 2. To study the Biological and Morphological features of 3. To provide the knowledge on the anatomy of the gut and its relevance to fish culture 4. To allow the learner to get exposed to the different diseases affecting the fishes 5. 							
Course Learning Outcome	At the end of the course students will able to: <ol style="list-style-type: none"> 1. describe the types and morphology of fish 2. explain the meristic and morphometric analysis of fishes and its significance 3. identify the possible diseases affecting the fish of the region 							
Unit I: (Theory) 15 Hours	<ul style="list-style-type: none"> • Introduction to Fish, Types of Fish, Small Indigenous Fish species, Air breathing Fishes, Snake heads etc. and Fisheries: Its importance, Types of fisheries. Present status of Fresh Water Fisheries in the World, India, North East and the state and Scope of Fisheries in the region. Morphology of some commonly available Fish, Meristic and Morphometric analysis of Fish and its significance, Importance of growth and age studies. Classification of fish based on food and feeding habits, Digestive system and process of digestion, Gut analysis and Gastrosomatic Index and its relevance. Diseases of fish with special reference to the diseases in the region and its management. Use of herbal medicine in fish disease management. 							

<p>UNIT-II: (Practical) 30 Hours</p>	<ul style="list-style-type: none"> 1. Handling of Microscope. 2. Collection and identification of indigenous fish from local water bodies and fish from market in the place of study and maintain a diagrammatic record in the lab manual with significant features of specimen collected. 3. Collection of data from relevant sources (Fisheries dept., Govt. websites etc. on the status of fisheries in the state and make a report on the data collected. 4. Visit to fish farms either locally or outside and take note of the production per year and problems faced by the fish farmers 5. Study of fish landing and preservation by visiting a local market
<p>UNIT-III: (Practical) 30 Hours</p>	<ul style="list-style-type: none"> 1. Preparation of alcohol grades and stains. 2. Permanent slide Preparation of scales (Cycloid and Ctenoid). 3. Study the age of fish from the lines of growth in scales/otoliths 4. Meristic analysis of fish available in the local markets and indigenously. 5. Morphometric analysis of fish available in the local markets and indigenously.
<p>UNIT-IV: (Practical) 30 Hours</p>	<ul style="list-style-type: none"> 1. Dissection of digestive system of a fish. 2. RLG value of gut content and analysis of gut content by qualitative and quantitative methods. 3. Study of diseases of fishes (protozoan, helminthic, bacterial, viral etc.) from permanent slides and museum specimens. 4. W/M preparation of fish parasites. 5. Preparation of bacterial smears and identification of strains.
<p>Suggested Readings</p>	<ol style="list-style-type: none"> 1. Ayyappan, S. J.K. Jena, A. Gopalakrishnan and A.K. Pandey, Indian Council of Agricultural Research. Handbook of fisheries and aquaculture, 1st edition, 2006. Publisher Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, 2006. 2. Biswas, K.P. Prevention and control of fish and Prawn diseases. 3. Khanna.S.S. An introduction to fishes. 4. Lagler.K.G. Ichthyology 5. Manuals from state Govt on the status of Fish and Fisheries of Meghalaya 6. Mishra, B.K. P. Swain, P.K. Sahoo, B.K. Das, N. Sarangi. Disease management in FW Pisciculture 7. Moyle, P.B. and Cech, J.J. Fishes – An Introduction to Ichthyology Norman, J.R. A History of Fishes. 8. Ricker, W.E. 1984. Methods for assessment of fish production in freshwaters. Blackwell Publications. 9. Roberts R.J. Fish Pathology 10. Srivastava, C.B.L., 1985. Textbook of Fishery Science and Indian Fisheries. Kutub Mahal Publications, Allahabad Yadav, B.N. Fish and Fisheries. Daya

	<p>Publishing House</p> <p>Web Resources</p> <p>FAO http://www.fao.org/fishery/topic/4340/en Fish farming</p> <p>http://www.fishfarming.com/ ICAR</p> <p>http://www.icar.org.in/indiafishvoice/intro.htm CIFA</p> <p>http://www.cifa.in/tech.htm</p>
Requirements	<ul style="list-style-type: none"> • Aquaculture Systems: Install necessary aquaculture systems such as tanks, ponds, recirculating aquaculture systems (RAS), and raceways for practical training. • Aquaculture Equipment: Procure essential equipment like aerators, pumps, filters, feeding systems, and water quality monitoring devices. • Fish Stock: Obtain various species of fish for practical farming exercises, ensuring a diversity that includes both freshwater and marine species. • Any other item as required
Qualified Instructors	<p>Instructors with experience in Fish Farming</p> <p>Certifications or relevant qualifications in Fish Farming</p>

Paper Title	: Fish Farming-II							
CODE	: VTC: 260.2							
Number of Credits	: 4							
Semester	: IV							
No. of Theory Hours Per Week	: One (1 hour)							
No. of Practical Hours per Week	: Three (3 Hours)							
Outline of the Paper:								
Type of Course	Units in the VTC	Hours	Credits	Total Marks	Distribution of Marks (as per OC-8)			
Fish Farming-II					In-Semester		End-Semester	
	Theory	Practical	Theory	Practical				
	Unit-I Theory (25 Marks)	15	4	100	25			
Unit-II to IV Theory (75 Marks)	90				15		60	
Marks Distribution	: Internal Assessment: 40 : External Assessment: 60							
Course Objectives	<ol style="list-style-type: none"> 1. To make the learner have the expertise in identifying the sex determination in fishes and then to introduce the techniques of breeding in fishes. 2. To develop the different types of ponds required in fish farming. 3. To capacitate the learner on the water quality parameters analysis important for Fisheries. 							
Course Learning Outcome	After completion of the course students are able to: <ol style="list-style-type: none"> 1. identify the knowledge of hypophysation techniques for Induced breeding 2. explain the concept of pond management for fisheries 3. test different water bodies on physicochemical and biological parameters useful to fish farming 							
Unit I: (Theory) 15 Hours	<ul style="list-style-type: none"> • Reproductive organs of fishes, Morphological Differentiating features of Males and Female fishes, Breeding Cycles, Gonado-Somatic index, maturation of Gonads. Induced Breeding by Hypophysation technique. Selecting of Broods, Collection, Transportation and Rearing of brood fish. Wet and Dry Bundh methods for Induced breeding of Carps. Pond management: Hatchery, Nursery, Rearing and Stocking Pond construction. Application of lime and Fertilizers in the different units, weeds in the pond and their control. Physicochemical and biological Characteristics of Pond: Significance of physical parameters in fish farming. Chemical parameters and biological parameters for fish rearing. Biological Oxygen Demand (BOD) and primary productivity in water and their relevance to fish cultivation. 							
UNIT-II: (Practical) 30 Hours	<ul style="list-style-type: none"> • 1. Dissection of both male and female reproductive 							

	organs of fish. 2. Detection of male and Female brood fish by abdominal observation and measurement of Gonado-Somatic Index. 3. Dissection, Removal and Preservation of Pituitary Gland from Carp/Air Breathing Fish. 4. Complete technique of Induced breeding (Hypophysation) in Carps/Air Breeding Fishes. 5. In-vitro technique of post larval development of fish
UNIT-III: (Practical) 30 Hours	<ul style="list-style-type: none"> 1. Designing of fish farm by models (clay/acrylic/resin). 2. Identification of different weeds in water bodies and their characteristics. 3. Study of Different Physical parameters in water a. Temperature b. pH c. Turbidity d. Conductivity
UNIT-IV: (Practical) 30 Hours	<ul style="list-style-type: none"> 1. Estimation of free Carbon Dioxide and dissolved oxygen (Winkler method) in water. 2. Estimation of Total Hardness and Alkalinity of water 3. Qualitative and Quantitative (Shannon – Weiner and Sorensen’s Index) analysis of Planktons in water (comparison between at least two water bodies) 4. Analysis of BOD for two types of water (polluted water and clean water) 5. Estimation of Primary Productivity by Light and dark Bottle method
Suggested Readings	<ol style="list-style-type: none"> 1. Biswas K.P. A text book of fish, fisheries and technology 2. Boyd, C. E. and Tucker, C. S. 1992. Water Quality and Pond Soil Analyses for Aquaculture, Alabama Agricultural Experimental Station, Auburn University 3. Fernandes R. Microbiology Handbook: Fish and Seafood. Leatherhead Food Research Association; 2nd New edition edition 4. ICAR. latest edition. Hand Book of Fisheries and Aquaculture. ICAR. 5. Jayaram, K. C. (2002), The Freshwater Fishes in India – A Hand Book, Zoological Survey of India 6. Mishra, B.K. P. Swain, P.K. Sahoo, B.K. Das, N. Sarangi. Disease management in FW Pisciculture 7. Parihar, R P (2004). A Text Book of Fish Biology and Indian Fisheries. Central Publishing House. Allahabad 8. Pawar and Diganawala- General Microbiology – Vol. I and Vol. II 9. Pillay TVR & Kutty MN. 2005. Aquaculture- Principles and Practices. Blackwell. 10. Pillay TVR. 1990. Aquaculture: Principles and Practices. Fishing News Books, Cambridge University Press, Cambridge. 11. Sandhu, G. S. (2005). A Text Book of Fish and Fisheries, Daya Publishing House, New Delhi – 35 12. Sharma P.D.- Ecology And Environment. Rastogi Publications 13. Singh H.R. and Lakra W.S. Coldwater Aquaculture and

	<p>Fisheries. Narendra Publishing House</p> <p>14. Srivastava C.B.L. (2014). Fishery Science and Indian Fisheries.</p> <p>15. Yadav, B N (2002). Fish and Fisheries. 2nd Edition, Daya Publishing House, New Delhi – 35</p>
Requirements	<p>Infrastructure and Facilities</p> <ul style="list-style-type: none"> • Aquaculture Systems: Install necessary aquaculture systems such as tanks, ponds, recirculating aquaculture systems (RAS), and raceways for practical training. • Aquaculture Equipment: Procure essential equipment like aerators, pumps, filters, feeding systems, and water quality monitoring devices. • Fish Stock: Obtain various species of fish for practical farming exercises, ensuring a diversity that includes both freshwater and marine species. • Any other item as required
Qualified Instructors	<ul style="list-style-type: none"> • Instructors with experience in Fish Farming • Certifications or relevant qualifications in Fish Farming

Paper Title	: Fish Farming-III							
CODE	:VTC: 360.2							
Number of Credits	: 4							
Semester	:VI							
No. of Theory Hours Per Week	: One (1 hour)							
No. of Practical Hours per Week	: Three (3 Hours)							
Outline of the Paper:								
Type of Course	Units in the VTC	Hours	Credits	Total Marks	Distribution of Marks (as per OC-8)			
Fish Farming-III					In-Semester		End-Semester	
					Theory	Practical	Theory	Practical
	Unit-I Theory (25 Marks)	15			25			
	Unit-II to IV Theory (75 Marks)	90	4	100		15		60
Marks Distribution	: Internal Assessment: 40 : External Assessment: 60							
Course Objectives	<ol style="list-style-type: none"> 1. Knowledge of the different types of Integrated Fish Farming practices. 2. To learn about the different feeds and feeding for culture fisheries 3. A thorough knowledge of the mechanism of preservation and processing of fish. 4. To learn about the Bio Floc Fish farming. 							
Course Learning Outcome	<p>After completion of the course students are able to:</p> <ol style="list-style-type: none"> 1. The trainees would acquire knowledge on the process of Integrated Fish Farming and also feed and feeding to be applied in fisheries 2. At the end of the course the learner would have derived the knowledge of Biofloc technology for further study and practice. 3. The learner would derive the knowledge on fish preservation and processing. 							
Unit I: (Theory) 15 Hours	<ul style="list-style-type: none"> • Integrated Fish farming- Agro Based and Livestock based. Composite Fish culture and its benefits. Floating, semi-floating, sinking and stable feeds for aquaculture, Feed making methods. High energy feeds, Alternative protein sources for feeds, maturation diets to enhance breeding efficiency, Larval feeds. Nutritional requirements of cultivable fishes, feed formulation. Commonly used feed ingredients. Novel feed ingredients, estimation of quality of feed ingredients. Selection of ingredients, formulation of feeds, feed processing and making. Biofloc in fisheries and Fish Products. Nutritional value and advantages of Biofloc, Species suitable for Biofloc. Principles of fish preservation and processing. Processing of fish by 							

	<p>traditional methods – salting, sun drying, smoking, marinading and fermentation. Drying and dehydration-theory, importance of water activity in relation to microbial growth. Fish aquarium. Use of Artificial Intelligence and ICT in fish farming.</p>
<p>UNIT-II: (Practical) 30 Hours</p>	<ul style="list-style-type: none"> • Development and maintenance of any agro-based or/and livestock-based fish farming. • . Development and maintenance of a pond for composite fish culture. • Visit to farm practicing Integrated Fish Farming and make a detailed report
<p>UNIT-III: (Practical) 30 Hours</p>	<ul style="list-style-type: none"> • Preparation of Inoculum • Preparation of Biofloc tanks for demonstration purposes • Preparation of salted fish, dried fish and smoked fish. • Quality assessment of salted, dried and smoked fish. • Preparation of fish pickles and preparation of fermented fish sauce and marinaded products.
<p>UNIT-IV: (Practical) 30 Hours</p>	<ul style="list-style-type: none"> • Identification of live feed. • Proximate composition analysis of feed ingredients and feeds. • Preparation of supplementary feeds with locally available ingredients. • Feed calculation and daily ration • Estimation of FCR.
<p>Suggested Readings</p>	<ol style="list-style-type: none"> 1. Ali SA. 2018. Nutritional feeding of fish and shrimps in India. MJP Publ. 2. Avnimelech Y. 2015. Biofloc Technology- a Practical Guidebook. 3rd edition. World Aquaculture Society 3. Balachandran KK. 2001. Post-harvest Technology of Fish and Fish Products. Daya Publ. House 4. Bardach EJ, Rhyther JH and Mc Larney WO. 1972. Aquaculture the Farming and Husbandry of Freshwater and Marine Organisms. John Wiley and Sons 5. Clucas IJ. 1981. Fish Handling, Preservation and Processing in the Tropics. Parts I, II. FAO 6. Ganguly S. 2014. Potential and recommended feed additives for sustainable aquaculture, livestock and poultry farming practices. Narendra Pub. 7. Gopakumar K. (Ed.). 2002. Text Book of Fish Processing Technology. ICAR 8. Santhanam, R. et. Al. A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987. 9. Strasbourg LK. 2013. Fish feeding in integrated fish farming. Random Exports

	<p>10. Syda Rao G, Imelda-Joseph, Philipose KK and Suresh Kumar M, 2013. Cage aquaculture in India. CMFRI Publ</p> <p>11. Wiley Blackwell. Ninawe AS and Khedkar GD. 2009. Nutrition in aquaculture. Narendra Publ</p> <p>12. Yoram Avnimelech. Biofloc technology Practical and Guide Book: Biofloc Fish Framing Full Training</p>
Requirements	<ul style="list-style-type: none"> • Aquaculture Systems: Install necessary aquaculture systems such as tanks, ponds, recirculating aquaculture systems (RAS), and raceways for practical training. • Aquaculture Equipment: Procure essential equipment like aerators, pumps, filters, feeding systems, and water quality monitoring devices. • Fish Stock: Obtain various species of fish for practical farming exercises, ensuring a diversity that includes both freshwater and marine species. • Any other item as required
Qualified Instructors	<ul style="list-style-type: none"> • Instructors with experience in Fish Farming • Certifications or relevant qualifications in Fish Farming