

MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
B.VOC IN VALUE ADDED AQUACULTURE (CBCS)
(With effective from the academic year 2016-17 onwards)

Sem.	Subjects	Subject Title	Hrs./Week	Credits	Marks				
					Maximum			Passing Minimum	
					Int.	Ext.	Total	Ext.	Total
I		General Component							
	GC-1	Introduction to Aquaculture	6	6	25	75	100	30	40
	GC -2	Communicative English	6	6	25	75	100	30	40
			12	12					
		Skill Component							
	SKC-1	Harvest and Post harvest Technology:Paper-1	6	6	25	75	100	30	40
	SKC-2	Practical covering SKC-1	8	8	25	75	100	30	40
	SKC-3	Industrial Visit/record Submission	4	4	25	75	100	30	40
			18	18					
		Total	30	30					
II		General Component							
	GC-3	Biology of Fin Fishes	6	6	25	75	100	30	40
	GC-4	Life Skills	6	6	25	75	100	30	40
			12	12					
		Skill Component							
	SKC-4	Harvest and Post harvest Technology:Paper-2	6	6	25	75	100	30	40
	SKC-5	Practical covering SKC-4	8	8	25	75	100	30	40
	SKC-6	Project work on skill component	4	4	25	75	100	30	40
			18	18					
		Total	30	30					
III		General Component							
	GC-5	Freshwater Aquaculture	6	6	25	75	100	30	40
	GC-6	Aquaculture Nutrition	6	6	25	75	100	30	40
			12	12					
		Skill Component							
	SKC-7	Aquaculture farm Design and Management	5	5	25	75	100	30	40
	SKC-8	Aquaculture Disease management	5	5	25	75	100	30	40
	SKC-9	Practical Covering SKC-7 & 8	8	8	25	75	100	30	40
			18	18					
		Total	30	30					

IV	General Component								
	GC-7	Aquaculture Biotechnology	6	6	25	75	100	30	40
	GC-8	Ornamental Fish culture	6	6	25	75	100	30	40
			12	12					
	Skill Component								
	SKC-10	Marine hydrocolloids	4	4	25	75	100	30	40
	SKC-11	Practical Covering SKC-10	8	8	25	75	100	30	40
	SKC-12	Project work on SKC	6	6	25	75	100	30	40
			18	18					
		Total	30	30					
V	General Component								
	GC-9	Fishery Resources	4	4	25	75	100	30	40
	GC-10	Environmental Studies	4	4					
	GC-10	Mariculture	4	4	25	75	100	30	40
			12	12					
	Skill Component								
	SKC-13	Hatchery technologies in aquatic organisms	6	6	25	75	100	30	40
	SKC-14	Disease Diagnosis in Aquaculture	6	6	25	75	100	30	40
	SKC-15	Practical Covering SKC-13 &14	6	6	25	75	100	30	40
			18	18					
	Total	30	30						
VI	General Component								
	GC-11	Fisheries Economics and Extension	6	6	25	75	100	30	40
	GC-12	Bio-entrepreneurship	6	6	25	75	100	30	40
			12	12					
	Skill Component								
	SKC-16	Value Added Products	5	5	25	75	100	30	40
	SKC-17	Practical covering SKC-16	5	5	25	75	100	30	40
	SKC-18	Project Work on SKC	8	8	25	75	100	30	40
			18	18					
	Total	30	30						

Note: GC= General Components 72 credits; SKC-Skill Component :108 credits

B. Voc. Value Added Aquaculture

SEMESTER III

Freshwater aquaculture [GC-5]

Unit - 1 : Freshwater Fish Culture: Various freshwater organisms used for aquaculture in India. Culture of carps; Nursery rearing and stocking ponds – composite fish culture, Preparation of ponds– different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting. Culture of air breathing fishes.

Unit – 2 : Culture of Prawns, Molluscs and Frog: Cultivable species of freshwater prawns and their biology – culture of *Macrobrachium rosenbergii*. Important freshwater molluscs. Freshwater pearl culture.

Unit – 3 : Sewage fed fish culture : Sewage fed fish culture, sewage treatment,– Sewage cum fish culture in India. Fish in relation to public health – Larvivores fishes and mosquito eradication using fishes.

Unit – 4 : Integrated Farming : Recent development in integrated farming – Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and Pig cum fish culture. Organic aquafarming. Fish culture in cages and pens. Running water fish culture.

Unit – 5 : Freshwater Aquaculture Systems : Fish culture in cages and pens, race way, indoor tanks, canals, silo culture, Aquaponics. Monoculture, polyculture, composite fish culture.

Suggested Readings:

1. S.H. Singh and A.K. Ahmad, 2011. Freshwater Aquaculture, Daya Publishing House, New Delhi.
2. N. Romoanowski, 2006. Sustainable Freshwater Aquacultures: The complete guide from backyard to investor, University of New Southwales Press.
3. R.K. Rath, 2000. Freshwater Aquaculture, Laurier Books Ltd.
4. Ahilan, B. Textbook of freshwater Aquaculture, Daya Publishing House, New Delhi.
5. J.E. Bardach and J.H. Rhyther, 2013. Aquaculture: The Farming and Husbandary of Freshwater and Marine organisms, John Wiley & Sons.

Aquaculture Nutrition [GC-6]

Unit – 1 : Nutritional Requirements of Fishes : Protein and amino acid requirement, carbohydrate and lipid requirement, Essential fatty acids, Non protein nitrogen sources. Vitamin and mineral requirements, vitamin C for fish and shell fishes.

Unit – 2 : Larval nutrition: Larval stages, nutritional requirements of fish and shellfish larvae, quality requirements of larval feeds (particle size, digestibility), natural food and its importance in aquaculture, nutritional quality of commonly used fish food organisms, bioenrichment, biofilm / periphyton and its uses.

Unit – 3 : Feed ingredients and Feed additives: Different feed ingredients- animal, plant, microbial origin, SCP, silages, fermented products. Anti-nutritional factors. Storage, quality standards, proximate composition & chemical evaluation. Digestibility studies and methods. Feeds and feed additives, pigments, immunostimulants, non-nutritional feed additives - chemoattractants, feeding stimulants, growth promoters, preservatives.

Unit – 4 : Types of Feed & Feed Manufacturing : Different types of feeds : Simple feed, compound feed, crumbles, micro-encapsulated feed. Types of compound feeds : Mash / meal, wet feeds, dry feeds. Feed Formulation - Square method. Feed manufacturing processes: Different size and grades of fish / shrimp feeds - starter, grower and finisher feeds. Micro-bound feed, micro encapsulated feed. Storage and transportation of feeds. Quality problems- toxins, pests, rancidity.

Unit – 5 : Feed Management: Practical feeding in grow-outs of fishes & shrimps. Feed ration, feed quantity estimation, feeding frequency. Check trays, demand feeders, automatic feeders, feed dispensers. Farm made feeds, factory made fish & shrimp feeds in India. Record keeping.

Suggested Readings:

1. Daniel. L. Merrifield and E. Ringo, 2014, Aquaculture Nutrition, Wiley- Blackwell.
2. Tom Lovell, 1998. Nutrition and Feeding of Fish, 2nd Edition, Kluwer Academic Publishers.
3. D. Allen Davis, 2015. Feed and Feeding Practices in Aquaculture, Woodhead Publishing.
4. J. Guillaume, S. Kaushik, P. Bergot and J. Watson, 2008. Nutrition and Feeding of fish and crustaceans, Springer Parxis publications.

Aquaculture Farm Design and Management [SKC-7]

Unit - 1: Soil and water resources of fish farm, component of fish farm – Design and construction – Water regulating devices – Fertilisation of Pond – Improvement of pond bottom – Control of aquatic weeds.

Unit – 2: Water quality Management : Important water quality parameters – Maintenance of water quality – Types of Aerators and Aeration system.

Unit – 3 : Natural seed resource – Seed production and seed grounds – Methods of collection of seed for culture practices – Quantifying and acclimatization of seeds – Hatchery production of seed – Components of hatchery – Nursery management.

Unit – 4 : Traditional, extensive, semi-intensive and intensive culture practices in India and other countries – Advantages and disadvantages of extensive, intensive and semi-intensive culture system – Culture of shrimps, carp, milk fish and sea bass.

Unit – 5 : Design of freshwater and brackish water farms – Project formulation and layout – Different components of aqua farm peripheral dikes, secondary dikes, feeder canals, shine gate and monks – Design of shrimp hatcheries – Means of increasing production from aquaculture ponds.

Suggested Readings:

1. Pillay, T.V.R. 1993. Aquaculture: Principles and Practices, Fishing News Books, Blackwell Scientific Publications.
2. Upadhyay, A. S. 1995. A Hand Book on Design, Construction and Equipments in Coastal Aquaculture (Shrimp Farming). Daya Publishing House, New Delhi.
3. Lucas, J.S. 2012. Aquaculture: Farming Aquatic animals and plants, Wiley – Blackwell.
4. Christenson, K. 2015, Aquaponics: Aquaculture – An introduction to aquaculture for small farmers, 3rd Edition (Aquaponics, hydroponics, permaculture, fish farming, aquaponics system, ecosystem,
5. Huguenin, J.E. and J. Colt, 2014, Design and Operating guide for aquaculture seawater system, Elsevier.

Aquaculture Disease Management [SKC-8]

- Unit – 1 :** Significance and Development process of disease: Disease development process in fish and shell fish – Defense mechanism in finfish and shellfish – Specific and non-specific immune system – Role of stress and host defense mechanism in disease development.
- Unit – 2 :** Host pathogen and environment interaction: Viral, bacterial and fungal fish pathogens – their general biology and taxonomy – Detection and isolation techniques, symptoms, pathology – Diagnosis of known bacterial, viral and fungal diseases.
- Unit – 3 :** Infectious diseases: Morphology, biology and life cycle of parasites – Infectious diseases of cultured finfish and shellfish – Important disease epizootics of wild fish population – Zoonotic diseases – OIE listed and notifiable diseases – Diagnosis of parasitic diseases.
- Unit – 4 :** Non-infectious diseases: Nutritional deficiency diseases due to Environmental parameters and their effects of fish health – Diseases due to algal toxins – Disease of hatcheries and growout systems.
- Unit – 5 :** Disease management: Environment management – Chemotherapeutic agents, host management, prophylaxis –vaccines, adjuvants, immunostimulants and probiotics – Use and abuse of antibiotics and chemicals in health management – Fish health and quarantine systems – Seed certification, SPF and SPR stocks – Development and applications.

Suggested Readings:

1. Patrick, T.K. Woo, 2006. Fish Diseases and Disorders,
2. J.S.Lipton, 2009. Shrimp Disease Management, ANE Books.
3. Galina, J. 2011, Fish Diseases: Prevention and Control Strategies, Academic press.
4. Austin, B. And Austin, D.A. 2016, Bacterial fish pathogens: Disease of farmed and wild fish, Springer publications.
5. Martimore, S. And Motarjemi, Y, 2010. Food safety Management: A practical guide for Food industry, Academic press.

PRACTICAL COVERING [SKC 7 & 8]

1. Equipment used in soil and water analysis [pH Meter, Thermometer, Salinity refractometer, Secchi disc, Nansen water sampler, Plankton net, Petersen Grab]
2. Soil analysis: Determination of soil texture, temperature, pH, conductivity, salinity.
3. Water analysis: Determination of dissolved oxygen, turbidity, pH, total alkalinity and hardness, transparency and turbidity.
4. Estimation of primary productivity and chlorophyll.
5. Application of fertilizers and pond liming.
6. Design and operation of biological filters and aerators.
7. Identification and working of various equipments in farm and hatchery.
8. Design of farm structure: ponds and dykes, earthwork calculation.
9. Methods of fish sampling for disease diagnosis. Live and post mortem examination of diseased fish.
10. Collection and identification of fish parasites.
11. Morphological, biochemical and biological tests of bacteria and virus.
12. Sampling, preparation of media and culture of pathogenic bacteria.
13. Antibiotic sensitivity assay.
14. Histological techniques for disease diagnosis.
15. Agglutination test and Challenge tests.
16. PCR and ELISA (Demonstration)

B. Voc. Value Added Aquaculture

SEMESTER IV

Aquaculture Biotechnology [GC-7]

Unit – 1 : Feed Technology : Micro encapsulated feeds, micro coated feeds, micro-particulate feeds and bio-encapsulated feeds, mycotoxins and their effects on feeds.

Unit – 2 : Health Management: DNA and RNA vaccines, molecular diagnosis of viral diseases, PCR, Dot-blot, ribotyping of pathogenic microbes, RNAi, Biofilms and its impact on health management - Probiotics and prebiotics – Immunostimulants - Bioremediation of soil and water.

Unit – 3 : Algal Biotechnology: Microalgae - indoor and mass culture methods, biotechnological approaches for production of important microalgae, single cell protein from Spirulina, raceway system of micro algae culture, vitamins, minerals and omega3 fatty acids from micro algae, enrichment of micro algae with micronutrients.

Unit – 4 : Breeding and cryopreservation : Synthetic hormones for induced breeding- GnRH analogue structure and function. Definition and significance, cryopreservation of gamets and embryo, advantage and disadvantage of cryopreservation.

Unit – 5 : Transgenesis : Transgenic fishes, Methods of gene transfer in fishes, single gene traits, screening for transgenics, site of integration, applications, regulation of GMOs, IPR, Evaluation of GFP transgenics.

Suggested Readings:

1. Lakra WS, Abidi SAH, Mukherjee SC & Ayyappan S. 2004. Fisheries Biotechnology. Narendra Publ. House.
2. Nagabhushanam R, Diwan AD, Zahurnec BJ & Sarojini R. 2004. Biotechnology of Aquatic Animals. Science Publ.
3. Nair PR. 2008. Biotechnology and Genetics in Fisheries and Aquaculture. Dominant Publ. 106
4. Pandian TJ, Strüssmann CA & Marian MP. 2005. Fish Genetics and Aquaculture Biotechnology. Science Publ.
5. Reddy PVGK, Ayyappan S, Thampy DM & Gopalakrishna. 2005. Text Book of Fish Genetics and Biotechnology. ICAR.

Ornamental fish culture [GC-8]

Unit – 1 : Introduction to Aquarium and ornamental fishes: World aquarium trade and present status. Accessories- Aerators, filters, lights, heaters. Water quality requirements. Different kinds of feeds. Culture of fish food organisms; preparation of dry feeds; feeding methods.

Unit – 2: Freshwater Ornamental Fishes: Different varieties of Ornamental fishes- Live bearers, Gold fish and koi, Gourami, Barbs and Tetras, angel fish and cichlids. Broodstock development, breeding, larval rearing and grow out. Larval feeds and feeding. Induced breeding.

Unit – 3 : Production of Ornamental Fishes: Requirements and design for the commercial production units of ornamental fishes. Commercial production of goldfish, live bearers, gouramies, barbs and tetras, angel fish. Mass production of aquarium plants. Natural ponds for the mass production of ornamental fishes. Marketing of aquarium fishes, retail outlets, export of ornamental fishes.

Unit – 4 : Marine Ornamental Fishes: Marine ornamental fishes – varieties and their habitat. Major marine ornamental fish resources of India. Method of collection and transportation of live fish. Use of anesthetics. Quarantine measures. Breeding of marine ornamental fishes.

Unit – 5 : Aquarium Management: Setting up of Fresh water, Marine and reef aquariums. Maintenance of water quality. Common diseases of aquarium fishes, their diagnosis and treatment. Handling, care & transportation of fish. Temperature acclimatisation, oxygen packing.

Suggested Readings:

1. R. Santhanam, 1987, A manual of freshwater aquaculture, Oxford, IBH
2. V.K.Dey, 1997, Hand book on aquafarming, ornamental fishes, MPEDA
3. Dholakia, A.D. 2009. Ornamental fish culture and Aquarium Management, Daya Publishing House,
4. Brain Andrews, 2011. Ornamental fish farming. The small, medium and large scale breeding and marketing of freshwater tropical fish and gold fish,
5. Ravi, K. And B.F. Phillips, 2011, Recent Advances and New species in Aquaculture, Wiley Interscience.

Marine Hydrocolloids – [SKC – 10]

Unit – 1: Introduction to Hydrocolloids: Sources of hydrocolloids: Seaweeds – Methods of seaweed cultivation. Properties of hydrocolloids: viscosity, gelling properties, surface activity and emulsifying property - Enzymatic hydrolysis of hydrocolloids.

Unit – 2: Alginates: Sources of alginate from seaweeds – Methods of extraction and yield – Chemical characterization - Structure – Molecular weight determination - Physico-Chemical properties.

Unit – 3: Carrageenan - Sources of carrageenan from seaweeds – Methods of extraction and yield – Chemical characterization - Structure – Molecular weight determination - Physico-Chemical properties.

Unit – 4: Agar - Sources of agar from seaweeds – Methods of extraction and yield – Chemical characterization - Structure – Molecular weight determination - Physico-Chemical properties.

Unit – 5: Applications of hydrocolloids: Food industry – Textile industry - Pharmaceutical industry –Drug delivery system – Aquaculture industry.

References:

1. Scheupr, P.J. 1984. Chemistry of Marine Natural Products, Chemical and Biological perspectives, Academic Press, New York.
2. Williams, P.A. and Phillips, G.O. 2000. Gums and Stabilizers for the Food Industry. Royal Society of Chemistry.
3. G.O. Phillips and P.A. Williams, 2009. Handbook of hydrocolloids, 2nd Edition, Woodhead Publishing, UK.
4. C.S. Hollingworth, 2010. Hydrocolloids: Characteristics, properties and structures, Food Science and Technology,
5. Dennis. J. McHugh, 2003. A guide to the seaweed industry, Food and Agriculture Organization of the United Nations, Rome.

PRACTICAL COVERING SKC-10 [SKC-11]

1. Methods of seaweed cultivation and harvesting technology.
2. Extraction of agar agar from seaweeds.
2. Extraction and quantification of carageenan from seaweeds.
3. Extraction and quantification of sodium alginate from seaweeds.
4. Immobilization of bacterial cells using sodium alginate.
5. Immobilization of bacterial cells using agar agar.
6. Analysis of gelling property of agar agar.
7. Analysis of gelling property of carageenan.
8. Analysis of gelling property of sodium alginate.

PROJECT WORK ON SKC [SKC 7, 8 & 10]

A mini project work related to skill component 7, 8 & 9 has to be undertaken by the students.