File Ref.No.4794/GA - IV - J1/2012/CU

UNIVERSITY OF CALICUT

Abstract

General and Academic - B.Voc Programme in Nursery and Ornamental Fish Farming under modified B.Voc Regulations 2014 - Scheme and Syllabus - Approved - Implemented w.e.f 2018 Admissions - Orders issued.

G & A - IV - J

U.O.No. 1622/2019/Admn Dated, Calicut University.P.O, 02.02.2019

Read:-1. U.O.No. 7404/2018/Admn dated 19.06.2018
2. Item No.1 in the minutes of the B.Voc Regulations Committee held on 13.09.2018
3. Request from the Convenor, B.Voc Regulations Committee dated 06.10.2018
4. Remarks of the Chairman Board of Studies in Aquaculture dated 02.11.2018
5. Item No.III in the Minutes of Faculty of Science held on 05.12.2018
6. Item No.II.F in the Minutes of Academic Council held on 18.12.2018

ORDER

The modified B.Voc Regulations has been implemented vide paper read as (1) and vide paper read as (2) the B.Voc Regulations Commitee decided to place the syllabi of new B.Voc Programmes which are sanctioned by UGC, in various colleges under University of Calicut, before various Boards of Studies for approval.

The Convenor, B.Voc Regulations Committee vide paper read as (3), pointed out that UGC has directed to start the newly sanctioned programmes without delay and hence requested to initiate urgent steps to approve the syllabi of the newly sanctioned B.Voc Programmes at various colleges with a suggestion to submit the syllabi to the Chairmen of Boards of Studies concerned with a request to approve the syllabi in circulation with other Board members (as provided under CUFS 1976) and the same has been approved by Vice Chancellor. Consequently the syllabus of B.Voc Programme in Nursery and Ornamental Fish Farming was forwarded to the Chairman, Board of Studies in Aquaculture.

The Board of Studies in Aquaculture approved the syllabus for B.Voc Programme in Nursery and Ornamental Fish Farming vide paper read as (4). Vide paper read as (5), the Faculty of Science and vide paper read as (6), the Academic Council has approved the same. The Vice Chancellor has accorded sanction to implement the decision of the Academic Council.

Sanction has therefore been accorded for implementing the Scheme and Syllabus of B.Voc Programme in Nursery and Ornamental Fish Farming under modified B.Voc Regulations 2014, in the University. w.e.f 2018 admissions.

Orders are issued accordingly.(Syllabus is herewith appended)

Biju George K

Assistant Registrar

To

Principals of the Colleges offering BVoc Programme in Nursery and Ornamental Fish Farming

Copy to: PS TO VC/PA to R/PA TO CE/JCE VII/JCE I/GA I F/Library/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

B.Voc Programme in
NURSERY AND ORNAMENTAL FISH FARMING
(2018 Admn onwards)

B.VOC NURSERY AND ORNAMENTAL FISH FARMING

Sem No	Course No	Code	Paper	Credits	Marks		
					Internal	External	Total
1	1.1	GEC1EG01	English	4	20	80	100
	1.2	GEC1ML02 GEC1HD02	Malayalam Hindi	4	20	80	100
	1.3	GEC1GB03	General Botany	4	20	80	100
	1.4	SDC1BF01	Biology of Fishes	3	20	80	100
	1.5	SDC1NF02	Soil and Water Chemistry	3	20	80	100
	1.6	SDC1NF03(P)	Water and Soil Analysis	6	20	80	100
	1.7	SDC1NF04(P)	Ornamental Fish Farming - I	6	20	80	100
2	2.1	GEC2EG04	English	4	20	80	100
	2.2	GEC2ML05 GEC2HD05	Malayalam Hindi	4	20	80	100
	2.3	GEC2BF06	Ornamental Fish Culture	4	20	80	100
	2.4	SDC2NF05	Fish Biochemistry and Nutrition	3	20	80	100
	2.5	SDC2NF06	Plant Nursery	3	20	80	100
	2.6	SDC2NF07(P)	Plant Propagation	6	20	80	100
	2.7	SDC2NF08(Pr)	Mini Project	6	0	100	100
3	3.1	GEC3EG07	English	4	20	80	100
	3.2	GEC3BR08	Breeding and Rearing of Aquarium Fishes	4	20	80	100
	3.3	GEC3B009	Biofertilisers and Organic Farming	4	20	80	100
	3.4	SDC3NF09	Ornamental Fish Farming	3	20	80	100
	3.5	SDC3NF10	Floriculture	3	20	80	100
	3.6	SDC3NF11(P)	Ornamental Fish Farming - II	6	20	80	100
	3.7	SDC3NF12(P)	Floriculture	6	20	80	100
4	4.1	GEC4EG10	English	4	20	80	100
	4.2	GEC4FP11	Fish Pathology and Health Management	4	20	80	100
	4.3	GEC4ED12	Entrepreneurship Development	4	20	80	100
	4.4	SDC4NF13	Gardening and Landscaping	3	20	80	100
	4.5	SDC4NF14	Ornamental Fish Farming and Entrepreneurship Development	3	20	80	100
	4.6	SDC4NF15(P)	Gardening and Landscaping	6	20	80	100
	4.7	SDC4NF16(Pr)	Mini Project	6	0	100	100
5	5.1	GEC5HR13	Human Resourse Management	4	20	80	100
	5.2	GEC5PP14	Psychology and Personal Growth	4	20	80	100
	5.3	GEC5LS15	Life Skill Development	4	20	80	100
	5.4	GEC5AD16	Advertising	4	20	80	100
	5.5	SDC5NF17	Handling of cut flowers and dry flowers	3	20	80	100
	5.6	SDC5NF18(P)	Ornamental Fish farming -III	6	20	80	100
	5.7	SDC5NF19(P)	Handling of cut flowers and dry flowers	5	20	80	100
6	6.1	SDC6NF20(Pr)	Internship & Project(900 hrs)	30	0	100	100
						Total	**3600**

B.Voc NURSERY AND ORNAMENTAL FISH FARMING

NSQF/NSDC: QP/NOS

SEMESTER	QP/NOS	QP CODE	ALIGNED TO
I	Soil & Water Testing Lab Analyst	AGR/Q8103	NCO-2015/NIL
II	Aquaculture Technician	AGR/Q4903	NCO-2015/NIL
III	Florist	AGR/Q0703	NCO-2015/NIL
IV	Interior Landscaper	AGR/Q0806	NCO-2015/2162
V	Ornamental Fish Technician	AGR/Q4910	NCO-2015/NIL
VI	Gardener cum Nursery Raiser	AGR/Q0809	NCO-2015/6113.9900

Semester I

Semester I

GEC1IC03- GENERAL BOTANY

Course No: 1.3
Course Code: GEC1GB03
Course Name: General Botany
Credits: 4
Hours: 60
Taken From: BOT5D01

Module -1: Living World
Living and Non Living: Plants and Animals; Classification of plants-Eichler‟s system – general characters of each group with one example. An introduction to the Life cycle of plants.

Module - 2: Morphology of Angiosperms
Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non essential parts, symmetry. Pollination, seed dispersal of fruits and seeds.

Module - 3: Anatomy
Definition, general structure, Cell division- mitosis and meiosis, significance,cell cycle. Tissues: simple , compound; structure and functions; Structure and functions of root, stem and leaves. Monocot and Dicot stem- general features; Secondary thickening. Annual rings, heart wood and sap wood.

Module- 4: Plant physiology
General account on methods of absorption of water and nutrients; Osmosis, Diffusion, Imbibition. Transport of water and nutrients; transpiration and its significance. Mineral nutrients: macro and micro; deficiency symptoms Symbiotic nitrogen fixation and its significance. Photosynthesis- Light and
Dark reactions-brief description, Respiration and Growth Hormones.

Module - 5: Genetics
Heredity, variation; Mendelian experiments and principles. Exceptions of Mendelism – Structure and significance of DNA; Mutation. DNA: as the Genetic Material; Blood groupism in man; Sex determination in man.

Module - 6: Plant Biotechnology
Tissue culture - Principle and procedure; Transgenic plants: Scope and applications, BT Cotton, BT Brinjal, Golden Rice; Bioreactors and their significance.

Module - 7 Environmental Science
Ecosystem: Structure - Abiotic and Biotic Factors, Ecosystem:, Types of plant interactions; Mutualism, Commensalism, Predation, Symbiosis, Parasitism,Competition. Biodiversity, Conservation, *In situ* and *Ex situ* methods,National Parks, Sanctuaries, IUCN, Threat Categories, Red list. Green House Effect, Ozone depletion, Deforestation and Reforestation, Alternative energy resources, Sustainable development and Utilization of resources.

Semester 1
SDC1NF01–BIOLOGY OF FISHES

Course No: 1.4
Course Code: SDC1NF01
Course Name: BIOLOGY OF FISHES
Credits: 3
Hours: 45
Taken From: AQ1B01

Module 1: General Characteristics of Fishes
General characters of fishes, adaptations for swimming, body forms, fins. Structure and function of skin and mucous layer. Different types of scales and its modifications. Colouration in fishes. Bioluminescence in fishes. Form and appendages of prawn. Sense organs in fishes – organs of smell, taste buds, lateral line system. Ampullae of lorenzini etc. Specialized organs in fishes – electric organs and toxins in fishes. Sense organs in crustaceans and molluscs- statocyts.

Module 2: Food and Growth
Feed and feeding habits – herbivores, carnivores and omnivores. Feeding adaptations methods employed in the study of gut content analysis volumetric, gravimetric etc.. Age and growth – Techniques used in the study – use of scales and otoliths, length frequency analysis. Equations used for deriving growth rates.

Module 3: Reproduction and Migration
Reproduction – ovary and testes, structure, development of primary and secondary sexual characteristics. Sexual dimorphism in fishes and crustaceans. Maturation and spawning in fishes, factors affecting maturation and spawning. Fecundity, condition factor, size at first maturity. Oviparous, viviparaous and ovoviviparous fishes. Parental care and breeding migration in fishes and crustaceans. Biological clocks-diurnal, lunar, circadian and tidal rhythms. Migration in fishes –anadromous and catadromous, homing, instinct and orientation.

Module 4: Digestion, Respiration and Circulation
Digestive system – General morphological feature of digestive system in fishes, Digestive system and process of digestion in prawn and mussel. Respiratory system – general description, aquatic respiration, respiratory gases, gaseous exchange, oxygen transport. Adaptations for air breathing in fishes. Respiration in crustaceans and molluscs Cardiovascular system – General features of heart and blood circulation, circulatory system and oxygen transport in fishes crustaceans and molluscs.

Module 5: Endocrinology and Excretion
Endocrine organs in fishes. Hormones and their role in control of reproduction in fishes. Endocrine system in crustacean and molluscs. Role of hormones in reproduction and moulting in crustacean. Excretion and osmoregulation. Nitrogenous excretion freshwater and marine fishes. Water and salt balance.

Module 6: Taxonomy
Principles of zoological classifications, binomial nomenclature of commercially important fishes, crustaceans and molluscs.

Suggested reading
Core reading
1. Moyle,P.B. and Cech,J.J. Fishes – An Introduction to Ichthyology
2. Norman,J.R. A History of Fishes.
3. Bagenal. Methods of Fish Production in Freshwaters

4. Nicholski, G.V. Ecology of Fishes.
5. Lagler. Ichthyology.
6. Matty. Fish Physiology.
7. Francis Day. Fishes of India.
8. Munro,I.S.R. The Marine and Freshwater Fishes of Ceylon.
9. CMFRI. The Commercial Molluscs of India.

Supplementary Reading

1. Purchon,R.D. The Biology of Mollusca.
2. Dorothy E Bliss. The Biology of Crustacea.
3. Nelson,J.S. Fishes of the World
4. Berg,L.S. Classification of Fish Both Recent and Fossil.

Advanced Reading

1. Wootton,R.J. Fish Ecology.
2. FAO Identification Sheets for Fishery Purposes.

SDC1NF02–SOIL AND WATER CHEMISTRY

Course No: 1.5
Course Code: SDC1NF02
Course Name: SOIL AND WATER CHEMISTRY
Credits: 3
Hours: 45

Analytical Chemistry: principles, applications and types. Classical methods of analytical chemistry, volumetry and gravimetry. Solutions: Standard solutions, titration, indicators, dilute solutions, units of concentration: standard curve; nomograph.

Chemistry of water: the water molecule, properties of pure water, fresh water and sea water. Composition of waters: surface water, ground water and sea water. Dissolved gasses: Factors affecting natural waters. Acid, base, salts: Hydrogen ions, modern concept of pH and buffer. Water analysis: collection and preservation of water samples. Measurement of temperature. transparency, turbidity, determination of pH, electrical conductivity, salinity, chlorinity, total solids (TDS, TSS, TVS, TVDS), dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, Calcium, Magnesium, Inorganic Nitrogen (Ammonium and Nitrate) and phosphorus. Water quality criteria/ requirements for Aquaculture.

Soil Chemistry: origin and nature of soils. Physical properties of soil; soil colour. texture, structure, pore size, bulk density, water holding capacity. Soil types and their distribution. Soil chemistry: soil colloids, cation exchange, organic carbon, Carbon - Nitrogen ratio, soil fertility. Soil reaction: acidity, alkalinity, conductivity, redox - potential. Submersed soils: wet lands, peat soils, fluxes between mud and water, methane and hydrogen sulphide formation. Saline soils, Alkali soils, acid sulphate soils, iron pyrites, soil reclamation. Soil analysis: collection and preparation of soil samples. Determination of soil texture, water holding capacity, pH, conductivity, organiccarbon, nitrogen, phosphorus, lime requirement. Soil and water amendments: lime manures, fertilizers, micronutrients, zeolites, alum, gypsum. Environmental ameliorative: chlorination, deodorizers, bacterial formulation. Soil quality criteria/ requirements for aquaculture. Determination of Zinc, Copper, Iron, Manganese- DTPA method (Atomic Absorption Spectroscopy), Determination of cation exchange capacity- Ammonium Saturation & Sodium Saturation method

SDC1NF03 (P) –WATER AND SOIL ANALYSIS

Course No: 1.6
Course Code: SDC1NF03 (P)
Course Name: WATER AND SOIL ANALYSIS
Credits: 6
Hours: 90
Taken From:

1. Determination of salinity by refractometer
2. Determination of water pH
3. Determination of alkalinity
4. Determination of hardness of water
5. Determination of dissolved oxygen
6. Estimation of primary productivity
7. Determination of organic carbon in pond soil
8. Determination of nitrite / nitrate - demonstration
9. Determination of phosphate in pond water - demonstration
10. Determination of soil pH
11. Calculation of lime requirement
12. Grain size analysis of soil
13. Testing of potential acid sulphate soil
14. Determination of Secchi disc transparency of water
15. Determination of EC of water
16. Determination of total dissolved solids
17. Determination of total suspended solids
18. Determination Carbonates & Bicarbonates
19. Determination of Calcium & Magnesium- EDTA Titrimetric Method
20. Determination of Sodium on Flame Photometer
21. Determination of Potassium, phosphorus, Nitrogen, Boron, Chloride
22. Determination of Sulphate on Spectrophotometer
23. Determination of soil texture- International Pipette method (mechanical analysis)
24. Determination of soil moisture percentage (water holding capacity)
25. Determination of bulk density- Weighing bottle method, Clod Method, Core Method
26. Determination of hydraulic conductivity of soil- Constant head method, Falling head method
27. Determination of soil moisture content- Gravimetric method, Infrared moisture meter method
28. Determination of EC
29. Determination of Organic Carbon-Walkley & Black Method, UV spectrophotometer method
30. Determination of Calcium Carbonate ($CaCO_3$) free lime- Acid neutralization & Schrotus Apparatus method
31. Determination of Nitrogen-Alkaline Permanganate method, Kjeldahl Method
32. Determination of Phosphorus- Olsen's method
33. Determination of Potassium in soil on Flame Photometer
34. Determination of Sodium in soil on Flame Photometer
35. Determination of Calcium & Magnesium- EDTA Titrimetric method
36. Determination of Boron- Hot water method, Dilute Hydrochloric acid method
37. Determination of Sulphur- Precipitation method, Turbidimetric method

SDC1NF03 (P) –ORNAMENTAL FISH FARMING - I

Course No: 1.7
Course Code: SDC1NF04 (P)
Course Name: ORNAMENTAL FISH FARMING –I
Credits: 6
Hours: 90

Identification of common ornamental fishes and plants.
Carry out dismantling and stripping of windmill
Identify type's aquarium tanks
Carry out service and repairs to bores, windmills, motors, pumps aerators, blowers, air compressors and aquarium tanks according to manufacturer specifications
Condition and acclimatize each component of the reef system like sand, rocks, before introducing fish
Set up the complete aquarium structure with air inlets, lighting, filtration
Maintain the reef system in a sustainable condition
Monitor the reef system for any undesirable growth, parasites or any substance that may threaten the balance of the reef system
Test the pH, ammonia and nitrite levels, and salinity, regularly
Report complex faults and repairs and refer for remedial action
Reassemble bore and windmill components and test them for operation according to manufacturer specifications
Clean work site, tools and equipment and store them according to enterprise requirements
Collect, treat and dispose or recycle waste from service and repair activities
Document relevant information according to industry and enterprise requirements
Collect, assess and take basic tools /equipment and spare parts to site
Fabricate frame tank, all side glass, plexi-glass tank, glass with ply woods, glass with FRB, Eternit tank/glass with RCC
Design the construction of public fresh water and marine aquaria and oceanarium.
Installation of re-circulatory systems
Carry out repair and maintenance of aquarium tanks
Conditioning and packing of ornamental fishes.
Preparation of feed.

Semester II

GEC2OF06 – ORNAMENTAL FISH CULTURE

Course No: 2.3
Course Code: GEC2OF06
Course Name: ORNAMENTAL FISH CULTURE
Credits: 4
Hours: 60
Taken From: AQ5D01

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

Module 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.

Module 3: Commercial Production of Freshwater 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.

Module 4: Marine Ornamental Fishes
Marine ornamental fishes – verities 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. Other ornamental organisms – anemones, worms, lobsters, shrimps, octopus, starfish.

Module 5: Aquarium Management
Setting up of aquarium. Marine Aquarium setting up and reef aquariums. Maintenance of water quality. Common disease of aquarium fishes, their diagnosis and treatment. Handling, care & transportation of fish. Temperature acclimation, oxygen packing. .

Module 6: Marketing of Aquarium Fishes
Marketing of aquarium fishes. Whole-sale markets of aquarium fish. Design of retail outlet. Export of ornamental fishes, procedures for export. Training and promotion schemes for the entrepreneurs involved in ornamental fish breeding and marketing by governmental agencies.

Suggested reading

Core reading

1. Biswas. S.P., J.N.Das, U.K.Sarkar and Lakra W.S. 2007Ornamental fishes of North East India : An Atlas : NBFGR
2. Marine Aquarium keeping : The Sciences, Animals and Art John Wiley & Sons, New York
3. Ramachandran.A, Breeding, Farming and Management of fishes (CUSAT, School of Industrial Fisheries)
4. Madhusoodanakurup etal – Ornamental Fish -Breeding, Farming and Trade. (CUSAT, School of Industrial Fisheries)

Supplementary Reading :

1. Murthi.V.S. 2002 Marine ornamental Fishes of Lakshadweep CMFRI, Special publication 72

Advanced Reading

1. Butting.B., Holthus, P.S. Dalding,S. 2003, Marine Aquarium Industry and conservation.
2. Oliver, K 2003. World trade in ornamental species
3. Marine Ornamental species; collection,… and Conservation
4. Fish Disease and Disorders, CAB international, Oxford.

SDC2NF05 – FISH BIOCHEMISTRY AND NUTRITION

Course No: 2.4
Course Code: SDC2NF05
Course Name: FISH BIOCHEMISTRY AND NUTRITION
Credits: 3
Hours: 45
Taken From: AQ6B24 (E01)

Module 1: Biochemistry of Fishes
Proteins - Structure of fish muscle, muscle proteins, non-protein nitrogenous compounds. Carbohydrates, important mono and disaccharides. Lipids- types of lipids. Flavor active components of fish and shell fishes. Nucleic acids, purines, pyrimidines. Energy requirements of fish and shellfish, factors affecting energy requirement, protein to energy ratio

Module 2: Nutritional Requirements of Fish
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. Feeds and feed additives, pigments, immunostimuants, non-nutritional feed additives - chemoattractants, feeding stimulants, growth promoters, preservatives.

Module 3: Feed ingredients& quality
Different feed ingredients- animal, plant, microbial origin, SCP, silages, fermented products, anti-nutritional factors in feed ingredients, compounded feeds, pellets crumbles and microencapsulated feed. Feed ingredients- fish meal, fish silage. Storage, quality standards, proximate composition & chemical evaluation. Digestibility studies, methods, protein digestibility,

Module 4: Feed & Feed Manufacturing
Different forms of feed-fodders, mash, pellets, floating and sinking feeds, Feed formulation - methods, square method. Feed manufacturing processes, Extrusion , Pelletization , Different size and grades of fish / shrimp feeds - starter, grower and finisher feeds. Storage and transportation of feeds. Quality problems-toxins, pests, rancidity, quality standards.

Module 5: Feed Management& Biological Quality
Practical feeding in grow-outs of fishes & shrimps. Feed ration, feed quantity estimation, feeding frequency, demand feeders, automatic feeders, feed dispensers. Farm made feeds, factory made fish & shrimp feeds in India . Data keeping. Feed conversion efficiency, protein conversion ratio, feed conversion ratio, net protein utilization, leaching, water stability. Nutritional diseases.

Module 6: Live Feeds
Different live feeds and their nutritional value. Manipulation of pond for natural feed production. Candidate species of phytoplankton and zooplankton for fish and shell fish culture - diatoms, micro algae, nano planktons, artemia, daphnia and brachionus. Enrichment of live feed. Micro-bound feed, micro encapsulated feed. Weaning of fish and prawn larvae.

Suggested reading
Core reading
1. Brown E.E Fish Farming Handbook
2. Milne P.H. Fish and shell fish farming in coastal waters
3. CMFRImanual on research methods for fish and shellfish nutrition
4. Borgstorm,G. Fish as Food
5. Heen,E and Kreuzer,R. Fish in Nutrition

6. Shepherd,J and Brommage,W. Intensive Fish Farming Techniques
7. Hepher,B. and Pruginin,Y. Commercial Fish Farming
Supplementary Reading
1. Halver J.E. Fish Nutrition
2. Hepher Nutrition of pond fishes
Advanced Reading
1) Muir,J.F. and Donald,R. Recent Advances in Aquaculture

SDC2NF06 – PLANT NURSERY

Course No: 2.5
Course Code: SDC2NF06
Course Name: PLANT NURSERY
Credits: 3
Hours: 45
Taken From:

Importance of plant propagation. Sexual and asexual methods– advantages and disadvantages. Propagation through seeds – seed formation, maturation, dormancy, treatments for breaking dormancy, germination, viability. Vegetative propagation – cuttings, layering , budding and grafting – different methods. Other plant parts used for propagation – bulbs, tubers, runners, stolons etc., Polyembryonic and apomictis seedlings. Progeny orchards – establishment, maintenance and utilization. Factors affecting rooting – physiological, anatomical, external factors. Root stock production, use of rootstocks for imparting high yield, quality and for tackling specific problems like tree size control , resistance / tolerance to pests, disease, salinity. Rootstock-scion relations. Use of growth regulators in plant propagation. Plant growing structures for propagation – design, construction and maintenance. Care and handling of nursery plants. Rapid production of uniform and good quality planting materials. Plant protection in nurseries – control of pests and diseases. Tissue culture technique – advantages and disadvantages.

Fundamental principles and practices to be followed in nursery management. Factors to be considered in the establishment of commercial nurseries in plantation crops, spices and medicinal plants – Green houses, store houses and nursery structures. Techniques of propagation of the above crops. Application of tissue culture in the propagation of these crops. Special treatments for improving germination and rooting. Advances in nursery techniques. Application of mist in the propagation of plantation crops, spices and medicinal plants. Importance of polythene in the nursery. Packing, storage and transport of nursery plants. Hardening of the nursery plants. Productions of disease free nursery stock and protection of nursery plants from pests and diseases. Export of nursery plants and seed materials of plantation crops, spices and medicinal plants.

SDC2NF07 (P) – PLANT PROPAGATION

Course No: 2.6
Course Code: SDC2NF07 (P)
Course Name: PLANT PROPAGATION
Credits: 6
Hours: 90
Taken From:

Media for Propagation of Plants in Nursery beds and mist chambers
Preparation of Nursery beds and sowing of Seeds
Preparation and Application of plant growth regulator solutions for seed germination and vegetative propagation
Use of Mist chamber for propagation and hardening of plants
Seed treatments for breaking seed dormancy and inducing vigorous seedling growth
Preparation of different types of cuttings
Practicing different types of layering
Practicing different types of Grafting
Practicing different types of Budding
Maintenance of Nursery Records
To demonstrate application of nutrients and plant protection measures in fruit nursery
Application of plant protection chemicals in the nursery
Uprooting/Digging, Labeling and Packing of nursery plants
Online Nursery Plant Trading
Exporting and Importing of Nursery plants, bulbs, roots, cut flowers, ornamental foliage

Semester III

GEC3BO09 – BREEDING AND REARING OF AQUARIUM FISHES

Course No: 3.2
Course Code: GEC3BO09
Course Name: BREEDING AND REARING OF AQUARIUM FISHES
Credits: 4
Hours: 60
Taken From: AQ5B12

Module 1: Introduction

Introduction to aquarium, ornamental fishes and aquarium accessories. World aquarium trade and present status. Design and construction of public fresh water and marine aquaria. Aerators and filters. Water quality requirements. Temperature control. Biofilters in aquarium.

Module 2: Aquarium Management

Setting up of aquarium – under gravel filter, pebbles, plants, drift wood, ornamental objects and selection of fishes. Cleaning the aquarium; maintenance of water quality. Control of snail and algal growth. Handling, care and transportation of fish. Temperature acclimation, oxygen packing. Indigenous ornamental fishes of Kerala.

Module 3: Freshwater Ornamental Fishes

Species of ornamental fishes; their taxonomy and biology- Live bearers, Gold fish and koi, Gourami, Barbs and Tetras, angel fish, cichlids. Maturation, secondary sexual characters, breeding habits, spawning, parental care, fertilization and development of eggs. Hatching, larval rearing and their health. Freshwater plants – their taxonomy and morphology, multiplication of aquarium plants – different methods.

Module 4: Commercial Production of Freshwater 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.

Module 5: 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. Reef aquarium and live rocks. Other ornamental organisms – anemones, worms, lobsters, shrimps, octopus, starfish.

Module 6: Nutrition and Disease
Nutritional requirements of aquarium fishes. Different kinds of feeds. Culture of fish food organisms; Preparation of dry feeds; feeding methods. Use of pigments for colour enhancement. Larval feeds and feeding. Provision of nutrients and optimum environmental conditions for their growth. Identification of common parasites infecting ornamental fishes. Study of bacterial, viral, fungal diseases of ornamental fishes and their control and prophylaxis.

Suggested reading

Core reading

1. Biswas. S.P., J.N.Das, U.K.Sarkar and Lakra W.S. 2007 Ornamental fishes of North East India : An Atlas : NBFGR
2. Marine Aquarium keeping : The Sciences, Animals and Art. John Wiley & Sons, New York
3. Ramachandran.A, Breeding, Farming and Management of Fishes, CUSAT
4. Madhusoodanakurup etal – Ornamental Fish - Breeding, Farming and Trade CUSAT.
5. Jhingran,V.G. Fish and Fisheries of India.
6. Bijukumar,A. Rearing of Aquarium Fishes.
7 Rath,A.K. Freshwater Aquaculture,
8 Santhanam, et.al. a Manual of Freshwater Aquaculture

Supplementary Reading :

1. Murthi.V.S. 2002 Marine ornamental Fishes of Lakshadweep CMFRI, Special publication 72

Advanced Reading

1. Butting.B., Holthus, P.S. Dalding,S. 2003, Marine Aquarium Industry and conservation.
2. Oliver, K 2003. World trade in ornamental species
3. Marine Ornamental species; collection and preservation.
4. Fish Disease and Disorders, CAB international, Oxford

GEC3BO09 – BIOFERTILISERS AND ORGANIC FARMING

Course No: 3.3
Course Code: GEC3BO09
Course Name: BIOFERTILISERS AND ORGANIC FARMING
Credits: 4
Hours: 60
Taken From: PLA5D03

MODULE – I

Biofertilizers - introduction , history, definition , importance of biofertilizers, ecofarming chemical fertilizers – health and the environment.

MODULE- II

Cyanobacteria as biofertilizers. Isolation of cyanobacteria, culturing of cyanobacteria, identification, characterization and selection of cyanobacteria, inoculum preparation – small scale and large scale. Factors affecting cyanobacterial growth. Azolla as biofertilizer and other uses. Morphology and life cycle of Azolla and Anabaena azollae. Nitrogen fixation by Azolla. Growth rate and Nitrogen input. Factors affecting the growth of Azolla. Decomposition of Azolla and mobilization of its nitrogen. Methods of Azolla utilization Control of insects and diseases

MODULE – III

1. Rhizobium: Isolation of Rhizobium from nodules, classification, identification, plant tests, maintenance of culture, cultivation and mass production, quality control, methods of inoculation.
2. Azotobacter: Isolation of Azotobacter by soil dilution plating method, identification and classification, maintenance and cultivation, crop response.
3. Azospirillum: Isolation of Azospirillum from rice root, identification and classification Maintenance and cultivation crop response.

4. Isolation of phosphate-solubilizing microorganisms: Pseudomonas, Bacillus - quantitative measurement of phosphate solubilization in culture-medium, agronomic aspects.
5. Mycorrhiza: Isolation and identification of ectomycorrhizal fungi; inoculation technique for ectomycorrhizal fungi; isolation and identification of VAM fungal spores; inoculum production of VAM Fungi; field response.

MODULE – IV

Organic Farming: introduction and history. Methods of organic farming- Biological/natural pest and weed control, Composting, Cover cropping, Crop rotation, Diversity on the farm, Do-nothing farming, Effective Microorganism (EM), Green manuring and green leaf manuring, Indigenous seeds, Intercropping, Integration of systems, Living fences, Microbial biofertilisers, Mulching, Multicropping, Multipurpose trees, Permaculture, Polyculture, Reduced tillage, Soil and water conservation,

Specialised organic farming techniques, Vermi-composting.

Integrated Pest management; biological pest control; non-chemical pesticide formulations like kerosene emulsion, tobacco decoction, neem kernel suspension, and pheromone traps.

REFERENCES

1. Kanniyan.S.1990. Biofertilizer Technology for Rice. TNAU , Coimbatore
2. Lumpkin T.A and D.L. Plucknett, 1980. Azolla; Botany, Physiology and use as a green manure. Econ. Bot. 34:111-153.
3. Balasundaran, V.R, and Subha Rao , N.S. 1977. A review of development of rhizobial inoculants for soybeans in India. Fertilizer News. 22 : 42-46.
4. Subha Rao, N.S. 1993, Biofertilizers in agriculture and forestry. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Elkan, H.H.1984. Taxonomy and metabolism of Rhizobium and its genetic relationship in biological nitrogen fixation, Ed. M. Alexander. Plenum Press, New York.
6. Date , R.A. 1976. Principles of Rhizobium strain selection. In symbiotic nitrogen fixation in plants. Ed. P.S. Nutman. Cambridge University Press. Cambridge.
7. Brown, M. 1962. Population of Azotobacter in the rhizosphere and effect of artificial inoculation. Plant and soil. 17 :15.
8. Lehri, L.K and C.L. Mehrotra. 1972 . Effect of Azotobacter inoculation on the yield of vegetable crops . Indian J. Agriculture Research. 9 : 210 -204.
9. Terrand, J.J, Kreig, N.R and J. Dobereiner. 1978. A taxonomic study of Spirillum lipoferum group, with description of a new genus Azospirillum gen. nov. and two species. Azospirillum braseilliense sp. nov., Can. J. Microbial., 24: 967 -980.
10. Trappe, J.M.1962. Fungus associates of ectotrophic mycorrhizae. Bot. Rev. 28: 538-606.

SDC3NF09 – ORNAMENTAL FISH FARMING

Course No: 3.4
Course Code: SDC3NF09
Course Name: ORNAMENTAL FISH FARMING
Credits: 3
Hours: 45
Taken From:

INTRODUCTION

Fresh water: temperature, oxygen, carbon dioxide, pH, hardness, food chain, peat, calcium, measuring GH, relationship between GH and CH, modifying the hardness of water, turbidity, nitrogenous products and nitrogen cycle, Bacteria in the nitrogen cycle, The toxicity of nitrogenous compounds, level of nitrites, other dissolved solids, Origin and quality of fresh water used in aquariums, Optimum characteristics of fresh water suitable for aquariums, water usable in aquariums

Sea water: temperature, salinity, density, pH, Variations in pH in a marine aquarium, nitrogen cycle, other dissolved substances, calcium in sea water, turbidity, where and when to collect natural sea water, Advantages and disadvantages of natural sea water and reconstituted sea water, The reconstitution of artificial sea water, Making sea water in an aquarium, before putting it into operation, Artificial salts, Making sea water for storage and back-up, Adjusting the density

Different types of aquarium: temperature aquariums, tropical aquariums, special purpose aquariums

BASICS OF FISH KEEPING
Anatomy and Physiology, A Brief Overview of the Ornamental Fish Industry and Hobby, Stress in Fish , Water Quality
Environment and Husbandry: Ponds and Aquaria

ORNAMENTAL FISH
Anatomy and biology, Feeding, Reproduction ,Health , Nomenclature and distribution of aquarium fish

INVERTEBRATES
Freshwater invertebrates, Marine invertebrates

Freshwater Ornamental Fishes
Species of ornamental fishes; their taxonomy and biology- Live bearers, Gold fish and koi, Gourami, Barbs and Tetras, angel fish, cichlids.
Maturation, secondary sexual characters, breeding habits, spawning, parental care, fertilization and development of eggs.
Hatching, larval rearing and their health.
Freshwater plants – their taxonomy and morphology, multiplication of aquarium plants – different methods.

Marine Ornamental Fishes & Disease
Marine ornamental fishes – varieties and their habitat.
Major marine ornamental fish resources of India. Method of collection of live fish.
Breeding of marine ornamental fishes (clown fishes and Damsel fishes). Reef aquarium and live rocks.
Other ornamental organisms – anemones, worms, lobsters, shrimps, octopus, starfish.
Common parasites infecting ornamental fishes. Bacterial, viral, fungal diseases of ornamental fishes and their control and prophylaxis.

FISH HEALTH

Biosecurity and Ornamental Fish, Nutrition in Fish , Parasites of Fish, Viral Pathogens of Fish, Bacterial Diseases of Fish, Fungal Diseases in Fish, Zoonotic Diseases of Fish

FISH MEDICINE

Transport and Hospitalization of the Fish Patient, History , Physical Examination of Fish , Anesthesia, Analgesia, and Euthanasia , Nonlethal Diagnostic Techniques , Surgery and Wound Management in Fish, Necropsy of Fish , Neoplasia in Fish , Specifi c Syndromes and Diseases

PLANTS

Origin and variety of plants, Algae problems, Caring for plants

Reference:

1. The complete aquarium guide, Konemann Verlagsgesellschaft mbH, ISBN 3-8290-1736-7
2. Fundamentals of Ornamental Fish Health, Helen E. Roberts, DVM, John Wiley & Sons
3. Biswas. S.P., J.N.Das, U.K.Sarkar and Lakra W.S. 2007 Ornamental fishes of North East India An Atlas : NBFGR
4. Marine Aquarium keeping : The Sciences, Animals and Art. John Wiley & Sons, New York
5. Ramachandran.A, Breeding, Farming and Management of Fishes, CUSAT
6. Madhusoodanakurup etal – Ornamental Fish - Breeding, Farming and Trade CUSAT.
7. Jhingran,V.G. Fish and Fisheries of India.
8. Bijukumar,A. Rearing of Aquarium Fishes.
9. Rath,A.K. Freshwater Aquaculture,
10. Santhanam, et.al. a Manual of Freshwater Aquaculture.
11. Murthi.V.S. 2002 Marine ornamental Fishes of Lakshadweep CMFRI, Special publication
12. Butting.B., Holthus, P.S. Dalding,S. 2003, Marine Aquarium Industry and conservation.
13. Oliver, K 2003. World trade in ornamental species
14. Marine Ornamental species; collection,……. and Conservation
15. Fish Disease and Disorders, CAB international, Oxford.
16. Bardach, et. Al. Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms. John Wiley & Sons, NY, 1972.
17. Stickney, R.R. Principles of Water Aquaculture. John Wiley & Sons, NY, 1979.
18. Chondar, C.L. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, 1980.
19. Jhingran, V.G. Fish and fisheries of India. Hindustan Publ. Corporation (India), 1982.
20. Santhanam, R. et. Al. A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
21. Pilley, T.V.R. Aquaculture – Principles and Practices. Fishing News (Books) Ltd., London, 1990.
22. Pandey, A.C. Air Breathing Fishes. Reliance Publishing House, New Delhi, 1990.

SDC3NF10 – FLORICULTURE

Course No: 3.5
Course Code: SDC3NF10
Course Name: FLORICULTURE
Credits: 3
Hours: 45
Taken From:

Status and prospects of commercial cultivation of flowers. Varieties, planting systems, spacing, manuring, irrigiation, pruning, mulching, plant protection, harvesting, postharvest handling and marketing of major traditional and cut flowers - jasmine, crossandra, marigold, celosia, gomphrena, lotus, tuberose, gladiolous, heliconia etc. Protected cultivation of rose, gerbera, chrysanthemum etc. - general concepts and practices.
Commercial cultivation of orchids and anthurium. Status and prospects of Kerala. Classification and varieties, planting material production, methods of planting, media components and managements, shade regulation, irrigation, nutrition, plant protection, stage and method of harvest, postharvest handling and marketing. Economics of cultivation.
Pot plant and cut foliage production - species and varieties, propagation, media, shade and water requirement, nutrition, pruning, plant protection, harvesting, postharvest handling and marketing.

SDC3NF11 (P) – ORNAMENTAL FISH FARMING - II

Course No: 3.6
Course Code: SDC3NF11 (P)
Course Name: ORNAMENTAL FISH FARMING - II
Credits: 6
Hours: 90
Taken From:

Identify the appropriate environmental requirement for ornamental fish
Monitor water quality on a regular basis
Identify potential diseases and their prophylaxis
Identify the sexual dimorphism and life history traits
Identify feeding behavior of the various species of fish
Undertake brood stock development
Use appropriate method for breeding the ornamental fish
Use suitable substrates depending on the fish used
Use proper live feeds and formulations of feeds
Provide required aeration and maintain optimum water quality parameters
Observe and monitor the breeding process
Rear the juvenile fish to the marketable size
Determine health parameters to judge the condition of organisms in culture system
Determine how to regulate the feed and fertilizer inputs for achieving desired production
Determine the correct dose of medicines / disinfectants to cure diseases
Separate the diseased fish from the healthy fish and put them in a hospital tank, in case of a disease outbreak
Diagnose the problem/disease and treat appropriately
Monitor the condition of fish in the hospital tank for signs of improvement

Undertake necessary biosecurity protocols for disease prevention
Carry out nutritional prophylactics before harvesting
Use appropriate tools and equipment for harvesting
Reduce the level of water in the water body before harvesting
Condition the fish before packing
Starve the fish for 24 hours before packing
Use appropriate packing material for transport based on the number and size of the fish

Morphological Study of ornamental fishes
Indigenous ornamental fishes of Kerala
Identification of common live bearer ornamental fishes: - Guppy, Molly, Platy, Sword Tail etc
Identification of common Egg layer ornamental fishes: - Angel, Neon tetra etc
Identification of common Egg layer ornamental fishes: Discus and Siamese fighter
Identification of common Egg layer ornamental fishes: Gold fish, Koi Carp,etc
Identification of common Egg layer ornamental fishes: Danio- Zebra, and Flower Horn.
Identification of aquarium plants
Setting up of breeding tank for live bearers, barbs, goldfish, tetras, chiclids, gouramis, fighters and catfishes.
Identification of ornamental fish diseases and prophylactic measures.
Aquarium plants and their propagation methods

SDC3NF12 (P) – FLORICULTURE

Course No: 3.7
Course Code: SDC3NF12 (P)
Course Name: FLORICULTURE
Credits: 6
Hours: 90
Taken From:

Selection of varieties, cultural practices and propagation of orchids.
Selection of varieties, cultural practices and propagation of anthurium.
Post harvest handling techniques in orchids and anthurium.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in rose.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in chrysanthemum and carnation.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in tuberose.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in gladiolus.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in heliconia and alpinia.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in gerbera.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in jasmine.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in crossandra.
Selection of varieties, cultural practices and propagation and post harvest handling techniques in marigold.
Seed production in annual flower crops
Seed production in annual flower crops
Selection of varieties, cultural practices and propagation of important cut foliage.
Harvesting and post harvest handling techniques in important cut foliage.

Integrated pest and disease management practices in cut flowers and foliage.
Value addition in cut flowers and loose flowers, hands on training in preparation of garlands, bouquet, flower arrangements etc.
Production techniques of dry flowers
Production of pot plants
Hi-tech cultivation of commercial flowers.

Semester IV

GEC4FP11– FISH PATHOLOGY AND HEALTH MANAGEMENT

Course No: 4.2
Course Code: GEC4FP11
Course Name: FISH PATHOLOGY AND HEALTH MANAGEMENT
Credits: 4
Hours: 60
Taken From: AQ6B19

Module 1: Protozoan Diseases
Introduction to fish diseases – pathology and parasitology – Definition and categories of diseases – Disease and environment. Protozoan diseases (finfish) –Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis. Shrimp diseases –Microsporidiosis, Gregaria disease, ecto-comensal protozoan.
Module 2. Bacterial Diseases
Bacterial disease (finfish) – furunculosis, columnaris, bacterial gill disease, gill rot, Entero redmouts, Edwardsiellosis, vibriosis, tail and fin rot, EUS. Shrimp disease –brown spot, black gill, filamentous bacterial disease, luminous vibriosis.
Module 4: Fungal and Viral Diseases
Fungal diseases (finfish) – Saprolegniosis, brachiomycosis, ichthyophorus diseases – Lagenidium diseases – Fusarium disease. Viral diseases (finfish) – IPN, IHN, Viral Hemorrhagic Septicemia, Spring Viremia of carps – Major CCVD, Carp lymphocytes – Major shrimp viral diseases – *Bacculovirus penaeii*, Monodon Bacculovirus, Bacculoviral midgut necrosis, IHHNV, Hepatopancreatic parvo like virus, Yellow head bacculovirus, white spot bacculovirus.
Module 5: Nutritional deficiency and Immunology
Nutritional pathology – lipid liver degeneration , deficiency diseases due to vitamin A,D,E,K, B-Complex, C, pantothenic acid, folic acid, biotin, choline, minerals. Aflatoxin and dinoflagellates. Antibiotic and chemotherapentants. Nutritional cataract. Genetically and environmentally induced diseases. Immunology, defence mechanism in fish and shell fish, Application and development of vaccines, Diagnostic tools – microscopy, immune detection DNA/RNA techniques.
Module 6: Health Management
General preventive methods and prophylaxis against the occurrence of diseases. Good pond management practices- Eco-friendly and sustainable aquaculture. Quarantine. Methods of pathological examination of fish and infectious diseases. Production of disease-free seeds. Evaluation criteria of healthy seeds. Good Feed management for healthy organisms. Zero water exchange. Probiotics in health management.

Suggested reading
Core reading
1. R. Ramachandran Nair Encyclopedia of fish disease –
2. K.P. Biswas Prevention and control of fish and Prawn diseases –
3. B.K. Mishra, P. Swain, P.K.Sahoo, B.K.Das, N.Sarangi. Disease management in FW Pisicultue –
4 Wheaton,F.W. Aquacultural Engineering
5 Bose et al. Coastal Aquacultural Engineering
Supplementary Reading
1. Sinderman C.J. Principle diseases of Marine fish and shell fish
2. Schaperclaus Fish Diseass.
Advanced Reading
1. Roberts R.J.Fish Pathology..
2. Post, G. Text Book of Fish Health.

GEC4ED12– ENTRENEURSHIP DEVELOPMENT

Course No: 4.3
Course Code: GEC4ED12
Course Name: ENTRENEURSHIP DEVELOPMENT
Credits: 4
Hours: 60
Taken From: CA4A14

Module I
Entrepreneur and Fundamentals of Entrepreneurship: Entrepreneurial competencies – Factors affecting entrepreneurial growth – Role of entrepreneur in economic development - Challenges of women entrepreneurs.
Module II
Micro, Small and Medium Enterprises: Legal Framework – Licenses – Role of promotional institutions with special reference to KINFRA , KITCO , MSME & DICs – Concessions - Incentives and subsidies.
Module III
Project Management: Feasibility and Viability Analysis – Technical – Financial – Network – Appraisal and evaluation - Project Report preparation.
Module IV
Identification of Business Opportunities in the Context of Kerala: Rate of ED Clubs – Industrial Policies – Skill development for entrepreneurs – Business Incubation: Meaning - Setting up of Business Incubation Centres.
References:
1. S.S. Kanka , Entrepreneurial Development , Sultan Chand.
2. Prasanna Chandra , Project Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill.
3. Vasantha Desai , Dynamics of Entrepreneurial Development, Himalaya.
4. C.B. Gupta & N.P. Sreenivasan , Entrepreneurial Development , Sultan Chand.
5. Nirmal K Gupta , Small Industry –Challenges and Perspectives, Anmol Publications.
6. Vasantha Desai , Small scale Industries and Entrepreneurship, Himalaya.

SDC4NF13 – GARDENING AND LANDSCAPING

Course No: 4.4
Course Code: SDC4NF13
Course Name: GARDENING AND LANDSCAPING
Credits: 3
Hours: 45
Taken From:

Introduction to landscaping and gardening - components of landscapes and gardens -description and functional uses. Garden enclosures - roads and paths - surfacing materials - enrichment items and uses - establishment and maintenance. History of gardening – gardening trends in India - types of gardens -. Characteristics and components of English gardens - Mughal, Japanese, Persian, French and Italian gardens - Styles in gardening. Principles of landscaping – designing and preparation of landscape and garden plans – considerations for different situations – application of the outdoor room concept. Lawns - types of lawn grasses - methods of establishing lawns - land preparation – planting – mowing – rolling - application of manures and fertilizers – irrigation - weed control and plant protection – rejuvenation of

lawns. Annuals and herbaceous perennials – their use in gardens – selection - colour schemes - planting designs - season and methods of planting - Cultural practices. Shrubs and trees - types – uses of shrubs in gardens - trees for landscapes - avenue planting - group planting and specimen planting – selection – planting – pruning - maintenance and rejuvenation of shrubs and trees. Climbers and Creepers – Cacti and succulents - Ferns and palms - definition and classification - special requirements - functional uses – planting - aftercare and cultural practices. Specialized gardening techniques - rock gardening - water gardening – Bonsai - Roof gardens - terrace garden - sunken garden etc. – their special requirements - establishment and maintenance. Indoor gardening – function - selection and types of indoor plants - environmental requirements - containers and media - methods of growing - special care for indoor plants – types of indoor display – vertical garden - tray garden - terrarium etc.

Suggested Readings

Bland, J. and Davidson, W. 2004. *Houseplant – Survival Manual*. Quantum Books Ltd., London.
Bose,T.K., Maiti, R.G., Dhua,R.S and Das,P.1999.Eds-Floriculture and Landscaping- Naya Prakash,206,Bidhan Sarani,Calcutta
Carpenter, P.L., Walker, T.D. and Lanphear,F.O. 1975. *Plants in theLandscape*. W.H.Freeman and Co., San Franciso
Chadha, K.L. and Choudhury, B. 1992. *Ornamental Horticulture in India.* ICAR,New Delhi
Das, S.N. 2007. Handbook of Ornamental Horticulture. Agrotech Publishing Academy, Udaipur -313 002.
Desai, B.L.1979. *Planning and planting Designs of Home Gardens*. Indian Council of Agricultural Research, New Delhi
Joiner, J.N.1981. *Foliage Plant Production*. Prentice Hall Inc.London
Nambisan, K.M.P. 1991.*Design elements of Landscape Gardening*. Oxford and IBH publishers Pvt. Ltd., Calcutta
Swarup, V. 1996. *Indoor Gardening*. ICAR, New Delhi.

SDC4NF14 – ORNAMENTAL FISH FARMINGAND ENTREPRENEURSHIP DEVELOPMENT

Course No: 4.5
Course Code: SDC4NF14
Course Name: ORNAMENTAL FISH FARMINGAND ENTREPRENEURSHIP DEVELOPMENT
Credits: 3
Hours: 45
Taken From:

Ornamental fishes

Criteria of selection of suitable fish species for aquarium
External morphology of important fresh water aquarium fishes (egg layers and live bearers)
External morphology of important marine aquarium fishes
Other ornamental organisms (Sea anemone, lobsters, and star fish)

Introduction to ornamental fish farming

Scope and importance of ornamental fish farming
Global and National status of ornamental fish farming
Important indigenous ornamental fishes – Rosy barb, Dwarf gourami Zebra fish, Glass fish
Important exotic ornamental fishes – Gold fish, Pearl gourami, Angel fish, Sword tail

Engineering Aspects of aquarium construction

Construction of fresh water aquarium

Introduction to aquarium accessories – Aerator, Filter, Thermostat
Settings up of aquarium
General account of public aquarium

Ornamental Fish Breeding
Brood stock maintenance
Breeding techniques of ornamental fishes
Nursery rearing of ornamental fishes
Transportation of ornamental fishes

Ornamental Fish Farm Management
Construction of commercial ornamental fish farm
Feeding and maintenance of stock
Common ornamental fish diseases and their management: Argulus, White spot, Fin rot, Mouth fungus

Entrepreneurship Development
World trade of ornamental fish and export potential.
Starting an aquarium shop – a business opportunity
Small scale ornamental fish farming business
Training and promotion schemes for the entrepreneurs involved in ornamental fish farming

Reference:

1.Zaidi, S.G.S (2002) Ornamental fish culture
2. Mahapatra, B.K., Dutta S., Pailan, G.H.(2015) Ornamental Fish Breeding, Culture and Trade
3. Ahilan, B., Felix, N., Santham, R., (2008) A text book of Aquariculture
4. Dholakia A.D. (2010)Ornamental Fish culture and Aquarium Management

SDC4NF15 (P) – GARDENING AND LANDSCAPING

Course No: 4.6
Course Code: SDC4NF15 (P)
Course Name: GARDENING AND LANDSCAPING
Credits: 6
Hours: 90
Taken From:

Preparation of landscape plan, identification of plants.
Use of software in landscape designing, computer aided landscape designs.
Planting of lawn
Rolling and mowing of lawn - use of different types of lawn mowers.
Planting of trees and shrubs, preparation of flower beds.
Pruning of shrubs, hedges and trees.
Application of manures and fertilizers to garden plants.
Practice in different methods of irrigation in landscapes.
Practice in application of plant protection chemicals, use of different types of sprayers.
Selection and establishment of enclosures and paving.
Layout of roads, paths and walks
Preparation of rock garden
Preparation of water garden
Designing indoor garden
Preparation of miniature garden and vertical garden.
Preparation of terrarium.

Semester V

GEC5HR13 – HUMAN RESOURCE MANAGEMENT

Course No: 5.1
Course Code: GEC5HR13
Course Name: HUMAN RESOURCE MANAGEMENT
Credits: 4
Hours: 60
Taken From: BC5B09

Module I

Introduction to Human Resource Management : Concept – Scope – Importance – Objectives and functions of Human Resource Management – Personnel Management Vs Human Resource Management - Human resource planning, Recruitment and Selection : Man power planning – Concept and objectives – Process of manpower planning – Methods of manpower planning – Conventional Vs Strategic planning – Recruitment :Meaning – Sources of recruitment – Modern trends in recruitment - Selection : Meaning and importance – Steps in selection procedure – Interviews – Types of interview – Test – Types of test – Induction – Job changes – Transfer – Promotion – Demotion – Separation.

Module II

Human Resource Development: Training – Concept – Need for training – Objectives – Approaches – Methods of training – Training environment – Areas of training – Training evaluation – Executive development – Process and techniques .

Module III

Performance Appraisal and Career Planning : Need and importance – Objectives – Process – Methods and problems of performance appraisal – Concept of career planning – Features – Methods – Uses – Career development .

Module IV

Compensation Management: Compensation planning – Objectives – Wage systems – Factors influencing wage system – Components of employee remuneration – Basic wage – Dearness Allowance – Bonus – Fringe benefits and incentives

Module V

Grievance redressal : Meaning and causes of grievances – Procedure of grievance handling – Absenteeism – Discipline – Essentials of good discipline system.

References:

1. Bernardin. John H, Human Resource Management. Tata McGraw Hill. New Delhi.
2. Arthur M, Career Theory Handbook, Prentice Hall Inc. Englewood Cliff.

3. Belkaoui, A.R. and Belkaoui J.M, Human Resource Valuation: A Guide to Strategies and Techniques, Quarum Books, Greenwood, 1995.
4. Dale, B, Total Quality and Human Resources: An Executive Guide. Blackwell, Oxford.
5. Greenhaus, J.H.. Career Management, Dryden, New York.
6. Mabey, C and Salama, G., Strategic Human Resource Management. Blackwell. Oxford.
7. Aswathappa, K., Human Resource Management
8. Subba Rao, Human Resources Management.

9. Michael Porter. HRM and Human Relations
10. Garry Dessler & Biju Varkkey, Human Resource Management, Pearson, 2012.
11. Amstrong'sHand book of Human Resource Management, Kogan Page, 2012.

GEC5PP14 – PSYCHOLOGY AND PERSONAL GROWTH

Course No: 5.2
Course Code: GEC5PP14
Course Name: PSYCHOLOGY AND PERSONAL GROWTH
Credits: 4
Hours: 60
Taken From:CPY5DO1

Psychology: - The subject matter and scope-Branches of Psychology and its application in personal and social life - Brief out line of transactional analysis and Positive Psychology.
2. **Concept of Happiness: -** Basic nature of emotional development. Positive and negative emotional state. Control of emotional states. Happiness – causes and effect of happiness application in day to day life. Hope and Optimistic Behaviour - General concepts.
3. **Positive Self**: - Self esteem-determinants-self efficacy-Development of social and personal self-Barriers in self development. Conflicts and frustration management-coping processes - resolutions and positive approach in self development.
4. **Positive Social Relations**: - Person and social attitudes - Family and relationships-role of emotional intelligence in activating social life. Social well - being and personal growth.
5. **Methods for Personal Growth**. Meditation as a tool for personal growth - Yoga techniques for enhancing personal effectiveness and positive emotional and social life.

Book for Study
Carr, Alan (2011) *Positive Psychology* (2nd Edn), New York: Routledge Taylor and Francis Group.

Reference:
1. Fadiman, James and Frager, Robert (2002) *Personality and Personal Growth* (5th Edn) Prentice Hall

GEC5LS15 – LIFE SKILL DEVELOPMENT

Course No: 5.3
Course Code: GEC5LS15
Course Name: LIFE SKILL DEVELOPMENT
Credits: 4
Hours: 60
Taken From: SO4B06

Module 1: Introduction to Life skills
Definition – communication and action skills: verbal and vocal communication skills- body language - Mind skills, rules skill, self talk skills, explanation skills, expectation skills, time management skills, self awareness
Module 2: Presentation Skills
Planning, structuring and delivering a presentation-Effective use of language and audio visual aid - Managing Performance Anxiety, Relaxation techniques, Interviews and Group Discussions
Module 3: Relationship Skills
Introduction- Skills for Listening and Understanding, Skills for choosing and starting relationship, Skills for anger management, Coping with emotions and stress, Leadership skills.
Module 4: Critical Thinking Skills
Critical Thinking, Creative Thinking-Stages, Strategies to improve creativity, Decision Making, Problem Solving- Steps, Strategies, Factors Affecting. Activities: Make a Plan for Critical Thinking; Demonstrate Conflict Management.

References:

1. Jones, R.N.(2007) *Life coaching skills-how to develop skilled clients*. New Delhi: Sage Publications.
2. Lewis, H.(2000) *Body Language- A guide to Professionals*. New Delhi: Response Books.
3. Kaul A. (2005). *The Effective Presentation- Talk your way to success*. New Delhi: Response Books.
4. Mishra, B.K.(2008). *Psychology- The Study of Human Behaviour*. New Delhi: Prentice Hall India Ltd.
5. Sherfield, R.M., Montgomery, R.J. &Moody, P.G.(2009). *Developing Soft Skills*. 4th ed New Delhi: Pearson Education
6. Shephard, K. (2005) *Presenting at Conferences, Seminars and Meetings*. New Delhi: Response Books.
7. Sanghi, S. (2007). *Towards a Personal Excellence-Psychometric Tests & Self Improving*
8. *Techniques for Managers*. New Delhi: Response Books.

GEC5AD16 – ADVERTISING

Course No: 5.4
Course Code: GEC5AD16
Course Name: ADVERTISING
Credits: 4
Hours: 60
Taken From: BMM4C08

Unit 1. Definition, Features, Evolution and Functions of Advertising; Kinds of Advertising; Agencies; Economic, Social and Ethical Issues of Advertising; Professional Organizations and Code of Ethics.
Unit 2. Media Planning – Market Analysis, Product Research, Media Reach and Frequency, Scheduling, Segmentation, Positioning, Media Mix and Support Media Planning. Ad Campaign.
Unit 3. Brand Awareness and Attitudes, Brand Identity, Brand Equity, Brand Image, Brand Loyalty and Rossiter Percy Model.
Unit 4. Types of Print Radio, TV and Web Ads; Outdoor Ads-Hoardings, Billboards, Posters, Digital Displays and Pop Ads; Basic Elements of Ads-Headlines/ Slogans, Copy, Illustrations/Pictures, Logo, Brand Names, Agency Signature. Advertising Skills; Principles, Concepts and Functions of Advertising; Types of Advertising; Advertising Media and Their Effects Out Door, Print; Radio, TV and Web; Elements of Advertisement – Copy, Slogans, Illustrations, Brand Names, Trade Names, Jingles; Designing of Ads

SDC5NF17 – HANDLING OF CUT FLOWERS AND DRY FLOWERS

Course No: 5.5
Course Code: SDC5NF17
Course Name: HANDLING OF CUT FLOWERS AND DRY FLOWERS
Credits: 3
Hours: 45
Taken From:

Factors affecting post harvest quality and vase life of cut flowers and foliage. Stage method and time of harvest. Postharvest handling - pre-cooling, pulsing, grading, bunching, packing and storage of important cut flowers. Types of packaging materials – methods of packaging for short term and long term transport and transit. Use of bud opening and holding solutions. Quality deterioration in the storage environment – sanitary procedures to be followed. Internal and global demand and consumption trends of cut flowers - standards – marketing systems in India and abroad – role of intermediaries – problems and prospects in production for export. Postharvest handling of cut foliage. Value addition in flowers - garlands, bouquet, flower arrangements. Extraction of oil and pigment, use in aromatherapy. Preparation of dry flowers, dry flower arrangements and marketing of dry flowers. Storage and care of dried products.

Suggested Readings

Bose, T.K. and Yadav, L.P. 1989 Ed. *Commercial Flowers*. Naya Prakash, Calcutta, India
Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. 1999 ed. *Floriculture and Landscaping* Naya Prakash, 206, Bidhan Sarani, Calcutta.
Hardenbug, R.E. Watadar. A.E and Wong C.Y. 1986. The *Commercial storage of Fruits. Vegetables, Florist and Nursery stock*. U.S. Department of Agriculture. New York.
Chadha, K.L., 2001 (ed). *Handbook of Horticulture*. ICAR, New Delhi.

Choudhary, M.L. and Prasad, K.V. 2003. *The value addition in Horticulture*. Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi. p. 100-104.
Larson, R.A. 1980. *Introduction to Floriculture* Academic Press, London
Laurie, A., Kiplinger, D.C. and Nelson, K.S. 1979. *Commercial Flower Forcing*. Mc- Graw Hill Book Company, New York.
Pal B.P. 1972. *The Rose in India*. Indian Council of Agricultural Research, New Delhi.
Prakahs, J. and Bhandary, K.R. *Floriculture Technology, Trades and Trends* 1994. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
Rajeevan, P.K. Singh, K.P. and Valsalakumari P.K. 2003 *ed*. *Bulbous Flowers.* Indian Society of Ornamental Horticulture Division of Floriculture & Landscaping, IARI, New Delhi.
Rajeevan, P.K., Sobhana, A., Bhaskar, J., Swapna, S and Bhattacharjee, S.K 2002. *Orchids*. Technical Bulletin. AICRP on Floriculture ,ICAR, New Delhi.
Rajeevan, P.K., Valsalakumari, P.K., Geetha, C.K., Leena Ravidas., Vinod Kumar and Bhattacharjee, S.K. 2002. Anthurium. Technical Bulletin. AICRP on Floriculture, ICAR, New Delhi
Randhawa, G.S. and Mukhopadhyay, A. 1986. *Floriculture in India*. Allied publishers, New Delhi
Sessler, G.J. 1978. *Orchids and how to grow them*. Prentice Hall, New Jersey
Steffek, E.F. 1972. Ed. *The world of the gladiolus*. The North American Gladiolus Council, Inc., Maryland
Yadav, I.S. and Choudhary, M.L. *ed*. 1997. *Progressive Floriculture*. The House of Sarpan (Media), Bangalore.

SDC5NF18 (P) – ORNAMENTAL FISH FARMING - III

Course No: 5.6
Course Code: SDC5NF18 (P)
Course Name: ORNAMENTAL FISH FARMING - III
Credits: 6
Hours: 90
Taken From:

Prepare ponds for ornamental fish broodstock management, breeding and rearing
Identification of feeding cycles, Proper feeding at time intervals, procurement of indigenous feed materials, feed formulation, preparation of farm made ornamental feed, live feed culture
Ornamental fish broodstock development, substrate selection depending on breeding pattern, fish breeding, aeration, maintenance of water quality health monitoring of species regularly, potential disease identification and prophylactic methods, determining dosage of medicines and disinfectants, quarantine protocols, biosecurity protocols, harvesting, packaging and conditioning for transportation
Prevention of species escape, identifying common preys and predators, restricted entry, protective clothing and gear, fencing biosecurity, quarantine arrangements

Breeding of ornamental fish with reference to live bearer species and egg laying species.
Breeding of Guppies, Mollies, Swardtail fish and Platy fish
Breeding of bubble nest builder- Gourami
Introduction to Breeding of Angel fish, Zebra fish and Neon tetra
Introduction hatchery management system for egg layers
Nursery management of egg layers

Special emphasis on Breeding of Gold fish.
Methods of isolation & culture of bacteria & fungi.
Identification methods for common bacterial & fungal pathogen of fish.
Examination of common fish parasite.
Control of snails in ornamental fish culture system
Disease of aquarium fishes (signs and causative agents and treatments)

SDC5NF19 (P) – HANDLING OF CUT FLOWERS AND DRY FLOWERS

Course No: 5.7
Course Code: SDC5NF19 (P)
Course Name: HANDLING OF CUT FLOWERS AND DRY FLOWERS
Credits: 6
Hours: 90
Taken From:

Practice in harvesting and post harvest handling operations of different cut flowers (rose, chrysanthemum, carnation, gerbera, anthurium, orchid, *Lilium*, *Alstroemeria*, heliconia, alpinia, tuberose, gladiolus etc.).
Precooling, and pulsing - preparation of pulsing solutions and studying their effect on extension of post harvest longevity of cut flowers .
Grading of important cut flowers.
Packing and storage of cut flowers.
Study of different methods of transport.
Preparation of bud opening and holding solutions and studying their effect on extension of post harvest longevity of cut flowers.
Practice in post harvest handling operations of different cut foliage.
Study of different channels of marketing of cut flowers and foliage.
Sanitary and quarantine measures for export.
Value addition, practice in preparation of garlands.
Practice in preparation of bouquet.
Tinting of fresh flowers.
Flower arrangement.
Practice in post harvest handling of cut foliage.
Dry flowers and plants - practicing different methods of drying.
Bleaching and dyeing, skeletonizing leaves, storage of dry flowers.
Preparation of natural dyes and observing their effect on dyeing dry flowers.
Preparation of value added products from dry flowers and foliage, flower arrangements, bouquets, wall hangings, greeting cards, *pot pourri* and other floral crafts.