Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Fishery Science

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

(W.e.f. Academic Year 2018-19)

SYLLABUS FOR

B.Sc. II (Fishery Science)

Year 2018-19

RAJARSHI SHAHU MAHAVIDYALAYA,(AUTONOMOUS), LATUR.
SEMESTER PATTERN CURRICULUM UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
Faculty of Science B.Sc. S.Y.
SUBJECT: Fishery Science
w.e.f.- 2018-19

Semester	Course		Paper No. and Title	Total period /week	Marks		Credits
					Internal	Extern	
SEM-III	CCF-V	A	Aquaculture-V	45 3/week	20	3	2
		B	Fish Biology Harvest Technology-VI	45 3/week	20	3	2
	CCFP -III	A	Lab Course-III	45 3/week	20	3	2
	CCFP -IV	B	Lab Course-IV	45 3/week	20	3	2
	SECF-I		Meteorology and Geography	3/Week	20	3	2
SEM-IV	CCF-VI	A	Culture, Breeding of Ornamental Fishes and Aquarium Keeping-VII	45 3/week	20	3	2
		B	Fish Nutrition and Feed Technology -VIII	45 3/week	20	3	2
	CCFP-V	A	Lab Course-V	45 3/week	20	3	2
	CCFP-VI	B	Lab Course-VI	45 3/week	20	3	2
	SECF-II		Finfish Breeding and Hatchery Management	3/Week	20	3	2

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
Semester Pattern Curriculum under Choice Based Credit System (CBCS)
Faculty of Science B.Sc. S.Y. SEM-III
Sub: Fishery Science
Paper: Aquaculture
Course Code: CCF-V (A)

Marks: 50 Lect.: 45 Credits: 2

Learning Objective:

- Enable students to understand Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions, and can be contrasted with commercial fishing.
- Enable students to understand Successful aquaculture takes into consideration the biology of the aquatic species such as feeding, water flow and temperature needs, and disease prevention and design like water source and water quality study, pond and tank containment systems, water filtration and aeration.
- Enable students to understand Common products of aquaculture are catfish, tilapia, trout, crawfish, oysters, shrimp, and salmon, and tropical fish for aquariums.
- Enable students to understand Aquaculture basics and history of aquaculture.
- Enable students to understand wide range of aspects such as Systems of aquaculture, aquaculture in different types of water bodies, Pond management, study of Monoculture, polyculture and integrated culture systems, Water and soil quality in relation to fish production and estimation of productivity.

Course outcome:

- It emphasizes the importance of site selection for aqua farm.
- It gives an idea about important points to be remember before prepare aqua farm project.
- It describe about the important points to be considered to select a suitable site for aqua farm. Different stages of site selection, how these factors influences in reducing cost of construction, trouble free culture, easy maintenance for ponds and other related structures.
- How the accessibility of the site condition, physical feature of the land and water source influences in reducing the cost of construction.
- Site condition, topography and other factors influences in preparing layout of fish farm, planning and designing of the ponds.
- It also briefly describe about classification of ponds based on various factors like construction and source of water and their merits and demerits.

UNIT: I

Importance, objective and scope of aquaculture

- Introduction to types of aquaculture:
- Culture based on type of water – Freshwater aquaculture, brackish water aquaculture and Mari culture.

- Culture based on economic or commercial consideration – Extensive, Intensive and Semi-intensive culture.
    c) Culture based on types of designs of culture – pond culture, pen culture, cage culture, raceway culture, fish culture in paddy fields.
- Culture based on species - Monoculture and Polyculture, monosex culture (Tilapia)
- Culture based on climatic condition – Cold water fish culture and warm water fish culture.

UNIT: II

Intensive Fish farming

- Selection of site- a) Topography b) Soil type c) Water supply
- Construction of fish farm –

a) Layout, design and construction of different types of ponds:
b) Hatching pits ii) Nursery pond iii) Rearing Pond iv) Stocking pond
c) Physical, Chemical and Biological factors affecting fish culture.
d) Objectives of fish culture.
e) Qualities of cultivable species of fishes.
f) Types of cultivable fishes, qualities of major carps.
g) Breeding habits of cultivable fishes with special reference to Indian
h) Major Carps.

UNIT: III

Management of fish pond in fish culture

- Pre stocking management:

a) Drying the pond,
b) Eradication of aquatic weeds
c) Eradication of predatory fishes, weed fishes, aquatic insects.
d) Liming the pond,
e) Pond fertilization

- Stocking of fish seed
- Supplementary feeding
- Harvesting the fish.

UNIT: IV

- **Composite Fish Farming** :

a) Principle of composite fish farming.
Objective of composite fish farming.
b) Composite fish farming in India.
c) Stocking density.

- Integrated Fish Farming

a) Duck cum fish farming.
b) Poultry cum fish farming
c) Pig cum fish farming.
d) Paddy cum fish farming
e) Cattle cum fish farming

Reference Books

1. Hilmar Kristjonsonn (Ed.) Vol 1 (1962), Vol 2 (1964) Vol. 3 (1971)
2. Modern Fishing Gears of the World 3. Fishing News Books Ltd. England.
3. Jhingran and Srivastava (1983) Fisheries Development in India. Concept Publishing Co. New Delhi, 606p
4. Jan-Olof- Traung (Ed.) Vol 1 (1955), Vol 2 (1966) Vol. 3 (1967).
5. Fishing Boats of the World. Fishing News Books Ltd. England.
6. Subbarao, Mechanization of marine fisherman.
7. Srivastava, Impact of mechanization on small fishermen.
8. Text book of Fish Biology and Fisheries - By S. S. Khanna and H. R
9. Singh(2003 Ed.), Narendra Publishing House, Delhi – 110006
10. Encyclopedia of Fishes and Fisheries of India – By A. K. Pandey and G. S. Sandhu, Vol I to IV, Amol Publications, New Delhi.
11. A text book of Fishery Science and Indian Fisheries – By C.B.L.Srivastava (Kitab Mahal)
12. An Introduction to Fishes – S. S. Khanna, Central Book Depot, Allahabad.

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
Semester Pattern Curriculum under Choice Based Credit System (CBCS)
Faculty of Science B.Sc. S.Y. SEM-III
Sub: Fishery Science
Paper: Fish Biology and Harvest Technology
Course Code: CCF-V (B)

Marks – 50 Hours 45 Credits – 2

Learning Objectives

- Enable students to understand in identification, external and internal morphology, tagging, reproduction, and aging of fishes.
- Enable students to understand Maturity and Spawning in fishes.
- Enable students to understand Methods of fishing and fishing gear
- Enable students to understand different Fishing Crafts

Course outcome:

At the end of this course, students should be able to

- Students enable to understand Sexual maturity stages and breeding seasons of Indian major carps and exotic carps
- Students enable to understand of gamete maturation and release of eggs and sperms
- Students enable to understand Methods of fishing and fishing gear along with the operation of fishing gear
- Have a greater understanding of external and internal morphology
- Have greater insight into how growth is regulated in fishes.

UNIT I

- Growth Studies:
- Length – weight relationship
- Ponderal Index
- Age and Growth Studies in Fishes:
- Methods of age and growth determination – Tagging, Marking, Scale method, otolith, radio carbon uptake method, RNA – DNA ratio method,
- Length frequency method.
- Factors affecting growth rate in fishes.
- Significance of age and growth studies.

UNIT II

- Maturity and Spawning in fishes:
- Sexual dimorphism in fishes.
- Seasonal changes ion testes (Morphological and Histological)
- Seasonal changes in ovary (Morphological and Histological)
- Study of oogenesis and spermatogenesis in fishes.
- Determination of spawning periodicity by ova diameter method.
- Study of Gonado somatic index.

- Fecundity in fishes – Methods of estimation of fecundity:
- Volumetric ii) Gravimetric iii) Von Bayers Method

UNIT III

- Methods of fishing and fishing gear
- Introduction
- ii) Fishing without gear
- iii) Wounding gear
- iv) Line fishing
- v) Fishing baited springs, fish screens, fish traps.
- vi) Traditional and Modern fishing gears :
- dip net, cast net, triangular net purse net, drag net gill net, bag net, rampani
- net, trawls, tuna line fishing.
- vii) Fishing gear material,
- viii) Fabrication of nets.
- viii) Preservation of gears
- ix) Recent development in fishing gears of India.

UNIT IV:

- Fishing Crafts:
- Indigenous fishing crafts-
- Sea fishing crafts- i) Catameron ii) Masula boat iii) Dugout canoes
    - iv) Out trigger canoes v) Plank built canoes
- Built up boats
- Mechanization of Indian fishing crafts.
- Selection of boat construction material.
- Electronics in fishing industry – i) Echo sounder ii) Sonar iii) Electro fishing

Reference Books

1. Jan-Olof- Traung (Ed.) Vol 1 (1955), Vol 2 (1966) Vol. 3 (1967).Fishing Boats of the World. Fishing News Books Ltd. England.
2. Subbarao, Mechanization of marine fisherman. Srivastava, Impact of mechanization on small fishermen
3. Hilmar Kristjonsonn (Ed.) Vol 1 (1962), Vol 2 (1964) Vol. 3 (1971) Modern Fishing Gears of the World 3. Fishing News Books Ltd. England.
4. Text book of Fish Biology and Fisheries - By S. S. Khanna and H. R. Singh(2003 Ed.), Narendra Publishing House, Delhi – 110006
5. FISHES BY Mary chandy

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
Semester Pattern Curriculum under Choice Based Credit System (CBCS)
Faculty of Science B.Sc. S.Y. SEM-III
Sub: Fishery Science
Course Code: CCFP-III (A)

Marks – 50 Hours 45 Credits – 2

Learning Objective

- Enable students to understand Aquaculture Successful aquaculture takes into consideration the biology of the aquatic species such as feeding, water flow and temperature needs, and disease prevention and design like water source and water quality study, pond and tank containment systems, water filtration and aeration.
- Enable students to understand Identification, Classification, and description of special feature of Fresh Water Fishes ,Indigenous and exotic carps, brackish water fishes
- Enable students to understand Classification, and description of Phytoplankton and zooplankton

Course outcome:

- It emphasizes the importance of site selection for aqua farm Lay out design and construction of different types of ponds.
- It describe about the important points to be considered to select a suitable site for aqua farm. Different stages of site selection, how these factors influences in reducing cost of construction, trouble free culture, easy maintenance for ponds and other related structures..
- Site condition, topography and other factors influences in preparing layout of fish farm, planning and designing of the ponds.
- The students will understand to Estimate of carbon dioxide in water sample .
- The students will understand to Estimate chloride in water sample
- The students will understand to operate water analysis kit.
- The students will understand to different fish diseases and treatments in actual field.

Practicals:

1 - Identification, Classification, and description of special features of Fresh Water Fishes
2. Identification, Classification, and description of special features brackish Water Fishes
3. Identification, Classification, and description of special feature of Indigenous and exotic carps
4. Identification, Classification, and description of special feature of Phytoplankton
5. Identification, Classification, and description of special feature of Zooplanktone.
6. Lay out design and construction of different types of ponds.
7. Study of aquatic weeds and plants.
8. Estimation of dissolved oxygen in water sample
9. Estimation of carbon dioxide in water sample
10. Estimation of chloride in water sample

11. **Estimation of pH, salinity, Nitrate etc by water analysis kit.**
12. Identification of fishing crafts and gears
13. Study of fish diseases
14. Visit to fish breeding farm

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
Semester Pattern Curriculum Under Choice Based Credit System (CBCS)
Faculty of Science B.Sc. S.Y. SEM-III
Sub: Fishery Science
Course Code: CCFP-IV (B)

Marks – 50 Hours 45 Credits – 2

Objectives

1. Enable students to understand in identification of sexual dimorphism in fishes.they can differentiate male and female
2. Enable students to understand Maturity and Spawning in fishes so that they can breed fishes according to season.
3. Enable students to understand Methods of histological slides preparation.
4. Enable students to understand Length weight relationship study in locally available fishes.

Course outcome:

At the end of this course, students should be able to

- Students enable to understand sexual dimorphism
- Students enable to understand Sexual maturity stages and breeding seasons of Indian major carps and exotic carps.
- Students enable to understand of gamete maturation and release of eggs and sperms
- Students enable to understand Methods of fishing and fishing gear along with the operation of fishing gear
- Have a greater understanding of Preparation of permanent histological slides.
- Students enable to understand structure and building of Crafts – Catamaran, Masula boat, Dugout canoes.
- Students enable to understand Determination of fish age by scale method

Practicals:

1. Identification and sexual dimorphism in fishes (any 5)
2. Study of maturity stages in teleosts (any locally available fishes) – Morphological and histological studies.
3. Preparation of permanent histological slides of Testis and Ovary of any locally available fish.
4. Assessment of fecundity of any two locally available fish.\
5. Assessment of spawning season by ova diameter measurement in any locally available fish.
6. Length weight relationship study in locally available fishes. (any 5)
7. Determination of fish age by scale method.
8. 8. Study of Fishing Gears- Wounding gears, fish traps, Line fishing, Nets- Cast net, Drag net, Gill net.
9. Study of Crafts – Catamaran, Masula boat, Dugout canoes

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
Semester Pattern Curriculum Under Choice Based Credit System (CBCS)
Faculty of Science B.Sc. S.Y. SEM-III
Sub: Fishery Science
Skill enhancement Course
Meteorology and Geography
Course Code: SECF-I

Marks – 50 Hours 45 Credits – 2

Learning Objectives

- This course contains two parts- Meteorology and Geography. Meteorology is the science that deals with the study of the atmosphere. Geography studies earth as the home of man. It attempts to find out the relationship between man and his environment.
- This course is important to understand meteorological and geographical aspects of the earth that influence on all most all activities of the human being. This course imparts overall knowledge about meteorology and geography which is applicable in fisheries activities.
- As fisheries is concerned, knowledge of meteorology and geography is essential for fish/shrimp farming activities as well as capture fisheries.
- This course imparts information on weather and climate, clouds, winds, longitude, latitude, thunderstorms, cyclones, south-west and northeast monsoon which are helpful in fisheries activities .
- This course gives information on precipitation, spatial and temporal variations in atmospheric temperature, pressure and humidity, physical features of the earth, factors influencing the distribution and activities of man etc.
- These information would be helpful in fish/shrimp farming activities such as pond construction and assessment of suitability of pond.
- Every year, life and property are lost due to climate-related hazards such as tropical cyclones, rough seas, lighting etc. This course gives adequate awareness about all these climate- related natural disasters.
- This course also deals with action of nature upon man and reaction or action of man upon nature. So that the students will get precise information about greenhouse gases, greenhouse effect, global warming and their influence on fisheries. From this course, students also get information on weather forecasting and effects of weather and climate changes on fisheries.

UNIT 1:

1. Introduction to Meteorology

Definition of Meteorology; divisions of Meteorology- Aeronomy, Biometeorology. Structure of atmosphere– troposphere, stratosphere, mesosphere, thermosphere and exosphere. Composition of atmosphere- water vapor, gases and aerosols.

2. Weather and Climate

Weather and climate- definition and concept; weather and climate elements; weather factors; climate control.

3. Process of heat transmission

Process of heat transmission- conduction, convection, advection and radiation. Irregular heating of atmosphere; atmospheric stability; thermals.

4 :Disposal of insolation

Insolation- its characteristics; albedo; terrestrial radiation; Green house effect- influence on humans; Green house gases. Global warming.

UNIT II:

5 : Air temperature

Air temperature- dependence on insolation and back radiation; isotherms;latitudinal variation; vertical temperature profile; inversion layer; diurnal and seasonal fluctuations; horizontal distribution of temperature; temperature measuring instruments- minimum-maximum thermometer, Six's thermometer, thermograph.

6 :Humidity and water vapour

Role and causes of water vapour in the atmosphere; humidity and their gradients; evaporation; relationship between temperature and humidity; humidity measuring instruments-psychrometer, hair hygrometer, hygrograph.

7: Condensation

Condensation nuclei- wettable aerosols; forms of condensation-fog, dew, frost and clouds; process of condensation-Bergeron process, rimming, aggregation; conditions for condensation-saturation point; orographic ascent.

8: Precipitation

Precipitation-different forms- drizzle, rain, shower, hail, sleet and snow.Measurement of precipitation- ordinary rain gauge, self recording rain gauge.Rainfall in India and Karnataka.

9: Atmospheric Pressure

Definition; isobars; pressure gradient; pressure units; laws of Gases; vertical, horizontal and periodic variations. Pressure measuring instruments- aneroid barometer, Fortin's barometer, and barograph.

UNIT III:

10: Clouds
Clouds- their formation; classification- low, medium and high clouds; ceiling; influence of clouds on climate; identification of clouds-cumiliforms, stratiforms, cirriforms.
11: Thunderstorms
Convective cells; life cycle of a thunderstorm- cumulus stage, mature stage and dissipating stage. Weather associated with a thunderstorm-lightning, thunder, heavy rain.
12: Wind
Wind motion-its characteristics, isotachs, factors affecting wind motion, pressure gradient wind; geostrophic wind. Coriolis force.

UNIT-IV:

13 : Planetary Wind Systems
Planetary pressure belts and wind systems- Intertropical Convergence Zone (ITCZ), subtropical highs, polar high, polar front. Northeast trades, southeast trades, midlatitude westerlies, polar easterlies. Secondary winds-synoptic scale system, meso and macro scale system. Monsoon winds- Southwest and Northeast monsoon winds.
14: Tropical cyclones
Meaning of low and high; vertical structure of storm centre; storm divisions; hurricane-influence on humans. Sea, swell and surge; hurricane warning.
15: Weather forecasting
Forecasting process; forecasting from local indications- radiosonde, hydrogen-filled balloons, and weather rockets. Organisational set up and function of the World Meteorological Organisation (WMO) and India Meteorological Department (IMD). Role of satellite in weather forecasting. Synoptic weather charts-colours, symbols for synoptic analysis. Predictability.
16: Introduction to Geography
Definition, subdivisions of geography-Physical geography, Human geography. Model of globe- distribution of land and oceans. Shape and size of the earth; structure of the earth-crust, mantle and core. Concepts of latitude, longitude and great circles.International data line; equator and prime meridian.

Practicals:

Practical 1: Study of observatory

Practical 2: study of air temperature measuring instruments

Practical 3: Study of Pressure Measuring Instruments

Practical 4: Study of humidity measuring instruments

Practical 5: Study of wind measuring instruments

Practical 6: Rain measuring instruments

Practical 7: Study of sunshine hours measuring instrument

Practical 8: Annual variation of temperature at different places.

Practical 9: Identification of clouds

Practical 10: Weather map symbols

Practical 11: Map Projections

Practical 12: Graphical representation of the structure of the atmosphere

Practical 13: Diagrammatical representation of thunderstorm cells

Practical 14: Diagrammatical representation of pressure and wind systems

Practical 15: Diagrammatic representation of shape and size of the earth

Practical 16: Diagrammatic representation of structure of the earth

Practical 17: Indian monsoons-Southwest and Northeast

Practical 18: Diagrammatic representation of latitude and longitude

Reference Books:

1. Miller A. 1983. Elements of Meteorology. Charles & Merrill Books.
2. Pettersen Sverre. 1958. Introduction to Meteorology. McGraw Hill Book company.
3. Miller Albert. 1966. Meteorology. Charles & Merrill Books.
4. Byers Robert Horace. 1959. General Meteorology. McGraw Hill Book Company.
5. Pettersen Sverre. 1956. Weather Analysis and Forecasting. McGraw Hill Book Company.
6. Chlorey, Barry, R.G. 1968. Atmosphere, Weather and Climate. Methuen Company.
7. Menon P.A. 1991. A Weather. National Book Trust.
8. Menon P.A. 1993. Ways of the Weather. National Book Trust.
9. Schneider Stephen H. 1996. Encyclopedia of climate and Weather (Part I & II). Oxford University Press.
10. Roger G. Barry, Richard J. Chorley. 2009. Atmosphere, Weather and Climate. Paperback (Routledge).
11. Fredrick Lutgens, Edward Tarbuck, Dennis Tasa. 2009. An Introduction to Meteorology (11th Edition). Pearson.
12. Howard A. Bridgman, John E. Oliver. 2006. The Global Climate System. Hardback.
13. Mark Moldwin. 2008. An Introduction to Space Weather. Paperback.

14. Lake Philip. 1974. Physical Geography. MacMillan Co. of India.
15. Dasagupta, A. V. Kapoor. 1971. Principlesof Geography. D.V.K. Murthy Publish.
16. Strahler A.N. 1975. Physical Geography. John Wiley.
17. Nag Prithvish. 1997. Geography and Environment. Concept Publishing Company.
18. Singh R. L. 1990. India - A Regional Geography. National Geographical Society.
19. Narmadeshwar Prasad. 1999. UPSC Complete Guide to Geography. Jawahar Publications.
20. Aijazuddin Ahmad. 2009. Geography of the South Asian Subcontinent : A Critical approach - Eastern Book Corporation.
21. Afzal Sharieff et. al. 2007. Encyclopedia of World Geography (25 Vol.). Eastern Book Corporation.
22. A.M. Bagulia. 2006. Indian Geography. Eastern Book Corporation.

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
Semester Pattern Curriculum under Choice Based Credit System (CBCS)
Faculty of Science B.Sc. S.Y. SEM-III
Sub: Fishery Science
Paper: Culture & Breeding of Ornamental Fishes and Aquarium Keeping
Course Code: CCF-VI (A)

Marks: 50 Lect.: 45 Credits: 2

Objectives

- Enable students to understand Aquarium Setting
- To give students knowledge about various techniques of ornamental fish breeding, rearing and its marketing to make them self sustainable after graduation.
- To teach techniques of construction of glass aquarium and its maintenance
- Enable students to understand Hybridization of ornamental fishes

Course outcome:

- Student enables to set aquarium
- Student enables to manage the home as well as commercial aquariums
- Students will learn to hand different aquarium equipment
- Students will learn Decorations of aquarium
- Students will learn Breeding of Aquarium Fishes

UNIT –I

1 Aquarium Setting
Introduction and history of aquarium
How to set up an aquarium
Choosing a spot for your aquarium
Choosing an aquarium
Acrylic or Glass Aquarium
Putting the aquarium in place
Choosing equipment
Lighting
Heating
Filtration
- Mechanical filtration
- Chemical filtration
- Biological filtration
- Other types of filtration
-Air Pumps
Decorations

Plants
Setting up the aquarium
Water chemistry
Conditioning water
Cycling
Adding Fish
Stress in aquarium
Water problems and their solutions
Tropical fish aquarium problems
Vacation care for your fish
Safety
2 – Aquarium Plants
Choosing plants for your aquarium
Factors that affect plant growth
Water
Lighting
Substrate
Nutrients
Suitable plants for beginners
Caring for plants
Propagating plants.

Chapter 3 - Aquarium Fishes
Choosing Fishes for aquarium
Taxonomy
Size, shape, colour adaptability

UNIT –II

4 - Aquarium Maintenance
Daily routine
Checking the fish
Checking the water
Checking the Filter
Feeding the fish
Weekly Routine
Monthly Routine
The “Old Aquarium” Syndrome
Filtration
5 - Food and its Types
Feeding Fish
Flavor and taste
Sound

Smell
Color and Buoyancy of food
Understanding feeding and digestion in fish
Protein
Fatty acids
Fat-soluble carotenoid
Carbohydrates
Vitamins and minerals
Live foods
Cultivation of some common live food
Feeding Fry
Feeding Habits

UNIT –III

6 – Breeding of Aquarium Fishes
Spawning Methods
Egg Scatterers
Egg Depositors
Mouth Brooders
Nest Builders
Livebearers

7. Equipment management while breeding fish
Choosing the parents
Conditioning the parents
Tips for effective breeding
Raising Fry
Failure in Reproduction
8 – Diseases
Buying healthy fish
Prevent diseases
Quarantine Aquarium
Columnaris
Gill Disease
Ick
Dropsy
Fin-rot
Fungal Infections
Hole in the Head
Pop-Eye
Cloudy Eye
Fish Lice

Nematode Worms
Water Quality Induced Diseases
Treating Fish

UNIT –IV (10Hours)

9-Hybridization of ornamental fishes

Hybrid gold fish variety comet, celestial, telescope eye, lion head, fan tail.
10-Genetic manipulation and transgenic ornamental fishes
Types of transgenic fish
Methods of making transgenic fish.
Genes of interest
Merits and demerits of transgenic fish

Books and References Recommended for Paper-VII

1. Hawlins, A.D. (Ed). Aquarium Systems. Academic Press.
2. Hunnam, P. Ward Lock, Living Aquarium.
3. Ratjak, K. and Zukal, R., Aquarium Fishes and Plants.
4. Spotte and John Wiley, S., Seawater Aquariums.
5. Straughan, R.P.L. and Thomas Yoseloff. Salt water Aquarium in the Home.
6. Dick Mills, 1987. Illustrated Guide to Aquarium Fishes. Published by Galley and Price, an imprint of W.H. Smith and Sons Limited, England.
7. Stephen Spotte. Marine Aquarium Keeping. A Wiley-Interscience Publication.
8. Dick Mills and Gwynne Vevere. Tropical Aquarium Fishes. Published by Salamander Books Limited. London.
9. Carcacson, R.H. A field guide to the Coral Reef Fishes of the Indian and West Pacific Oceans.
10. Vincent B. Hargreaves. The Tropical Marine Aquarium. Mc-Graw-Hill Book Company. New York.
11. Guy N. Smith. Profitable Fish Keeping.
12. Maurice Melzak. Marine Aquarium Manual. B.T. Balsford Ltd., London.
13. Ornamental aquarium fishes of India- 1999- K.L.Tekrival and A.A. Rao.- TFH United Kingdom.
14. Marine Ornamental species (collection, culture and conservation) – J.C.Cato and C.L.Brown. – Blackwell Science

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)
LATUR.
Course Structure
B.Sc. S.Y. (Semester IV)
Subject: FISHERY SCIENCE
Paper VIII: Fish Nutrition and Feed Technology
Course Code: CCF-8

Marks: 50 Lect.: 45 Credits: 2

Objectives

1. The course deals with different aspects of fish nutrition and feed technology. The fish requires different types of nutrients for its growth, health and maintenance. The various nutrients required by fish and shellfish include proteins, lipids, carbohydrates, vitamins and minerals. Crustacean nutritional requirements, feed formulation and feeding strategy.
2. Basic concept of feed formulation and different feed processing techniques The course also deals with the fish feed formulation and manufacturing of various forms of feeds and their description and use have been presented. Different feed additives like binders, antioxidants
3. The importance of carbohydrate in aqua feed and the relationship of dietary Carbohydrate for protein sparing.

Course outcome:

- The course deals with different aspects of fish nutrition and feed technology. The fish requires different types of nutrients for its growth, health and maintenance. The various nutrients required by fish and shellfish include proteins, lipids, carbohydrates, vitamins and minerals.
- The course also deals with the nutritional requirement of cultivable fish and shellfish. The nutritional requirement of fish is dependent on the various factors like type of fish species /size/age/metabolic state etc. and an overview of nutritional requirements by different fish and shellfish species are presented.
- The course also deals with the fish feed formulation and manufacturing of various forms of feeds and their description and use have been presented.
- Different feed additives like binders, antioxidants, enzymes, pigments, growth promoters and feed stimulants have been dealt.
- An account on feed storage, use of preservatives and antioxidants gives an insight into importance of preserving nutrient value of feeds during storage. The details on feed evaluation in terms of food conversion ratio (FCR), feed efficiency ratio (FER), protein efficiency ratio (PER), net protein utilization and biological value are also presented.

Unit I

I) Composition of the Fish

a) Introduction
b) Why composition is important
c) Structure of fish muscle
d) The principal components of fish muscle
e) The minor components of fish muscle
f) Factors affecting the composition of fish
g) Fish for human consumption

II) Ingredients for Fish Feed Manufacturing

a) Introduction
b) Mill by-products
c) Oil Extractives
d) Animal by-products
e) Miscellaneous

Unit II

III) Anti-oxidants in compounded feeds

a) Introduction
b) Criteria for selecting feed Anti-oxidants
c) Commonly used feed Anti-oxidants
d) Functional effect of Anti-oxidants
e) Level of anti-oxidant usage in feed
f) Other effect on Anti-oxidant in feed

IV) Storage problems of Feedstuffs

a) Introduction
b) Insects
c) Micro-organisms
d) Deteriorative changes in stored feed stuffs
e) Storing feedstuffs

Unit III

V) Stability of micro-ingredients in fish feed

a) Introduction
b) Selection of Micro-ingredient sources
c) Stability of micro-ingredient

d) Diluents for premixes

VI) Fish Feed Formulation

a) Introduction
b) Balancing crude protein level
c) Steps in feed formulation
d) Best-buy techniques

Unit IV

VII) Material Flow in Feed Manufacturing

a) Introduction
b) Receiving
c) Processing
d) Packaging
e) Storage and distribution

VIII) Feed Milling Processes

a) Introduction
b) Grinding
c) Mixing
d) Pelleting

Reference Book

1. Verreth, J. Fish Larval Nutrition. Chapman and Hall, Publ.
2. Stephen Goddard, 1996. Feed Management in Intensive Aquaculture.
3. Farm-made Aquafeeds. FAO Fisheries Technical Paper 343.
4. Devadasan, K. (Ed.)1994. Nutrients and Bioactive substances in Aquatic Organisms.
5. Kalver John, E. 1972. Fish Nutrition. Academic Press, London.
6. Halver John E. and Tiews Klaus, 1979 Finfish Nutrition and Fish Feed Technology.

   Heenemann, Berlin.
7. Hepher Balfour 1988. Nutrition of Pond Fishes. Cambridge University Press.
8. Tyler Peter and Calow Peter, 1985. Fish Energetics. Croom Helin, London.
9. Winberg, 1960. Rate of Metabolism and Food Requirements in Fishes. Fisheries Research Board of Canada.

10. Shimeno Sadao, 1982. Studies on Carbohydrate Metabolism in Fish. Amerind Publishing Company, New Delhi.

11. Cowey, C.B. et al. (Eds.) 1985. Nutrition and Feeding in Fishes. Academic Press, London

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RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)
LATUR.
Course Structure
B.Sc. S.Y. (Semester IV)
Subject: FISHERY SCIENCE
PRACTICAL CCFP-5

Marks: 50 Lect.: 45 Credits: 2

Objectives

- Enable students to understand Identify classify and describe an aquarium fishes & hybrid aquarium fishes.
- To give students knowledge about various foods and its Types
- To teach techniques of construction of glass aquarium and its maintenance
- To give students knowledge about various techniques of ornamental fish breeding, rearing and its marketing to make them self sustainable after graduation.
- Enable students to understand Aquarium fish diseases

1. **Course outcome:**

    - Student enables Identify and describe the aquarium accessories with their use and maintains
    - Student enables to set aquarium
    - Student enables to manage the home as well as commercial aquariums
    - Students will learn Maintenance of an aquarium, Decorations of aquarium
    - Students will learn Breeding of Aquarium Fishes
    - Students will learn Cultivation of some common live food
    - Students will be self sustainable after graduation in the field of Aquarium keeping.

1. Identify and describe the aquarium accessories with their use and maintains. (any five).

1. Identify classify and describe an aquarium fishes (any five).
2. Identify and describe hybrid aquarium fishes.
3. Identify and describe food and its Types
4. Identify and describe an aquarium plants (any five).
5. Preparation of an aquarium tank of suitable size
6. Setting of aquarium.

7. Maintenance of an aquarium.

8. Cultivation of some common live food

9. Aquarium fish diseases

    1. Columnaris
    2. Gill Disease
    3. Ick
    4. Dropsy
    5. Fin-rot
    6. Fungal Infections
    7. Hole in the Head
    8. Pop-Eye
    9. Cloudy Eye
    10. Fish Lice
    11. Nematode Worms
    12. Water Quality Induced Diseases

    Treating Fish

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)
LATUR.
Course Structure
B.Sc. S.Y. (Semester IV)
Subject: FISHERY SCIENCE
Lab course
PRACTICAL
Course Code: CCFP-6

Marks: 50 Lect.: 45 Credits: 2

Objectives

- The course deals with different aspects of fish nutrition and feed technology.
- Enable students to understand The importance of carbohydrate in aqua feed and the relationship of dietary Carbohydrate for protein sparing.
- Enable students to understand different milling machines their operation handling and use.
- Enable students to understand Packing and storage of feed stuffs
- Enable students to understand Estimation of carbohydrate/ vitamin from feed ingredients and feed.

Course outcome:

- At the end of this course, students should be able to
- Students enable to understand formulation and manufacturing of various forms of feeds and their description and use have been presented
- Students enable to understand Different feed additives like binders, antioxidants, enzymes, pigments, growth promoters and feed stimulants have been dealt.
- Students enable to Formulate fish feed for Herbivorous/Carnivorous fishes.
- Students enable to analyze proximate compounds of feed stuff.
- Students enable to identify locally available feed ingredients
- Students enable to formulate different fish diets.

1. Study of different milling machines (Any 2)
2. Study of locally available feed ingredients (Any 5)
3. Packing and storage of feed stuffs
4. Study of insects & microorganism affecting the feeds storage
5. Formulation of fish feed for Herbivorous/Carnivorous fishes
6. Estimation of crude protein from feed ingredients and feed.(Standard MAFF (1982) method for determining proteins in feedstuffs and feed ingredients.
7. Estimation of lipid from feed ingredients and feed.
8. Estimation of carbohydrate from feed ingredients and feed.
9. Estimation of vitamin from feed ingredients and feed.
10. 3. PROXIMATE ANALYSES

1. MOISTURE
2. CRUDE LIPIDS
3. CRUDE FIBRE
4. ASH
5. NITROGEN-FREE EXTRACT (NFE)

11. Collection and submission of locally available feed ingredients.
12. Submission of prepared fish feed.

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)
LATUR.
Course Structure
B.Sc. S.Y. (Semester IV)
W.e.f. 2020-21
Subject: FISHERY SCIENCE
SECF-II

Marks: 50 Lect.: 45 Credits: 2

Finfish Breeding and Hatchery Management

Unit I

1. Freshwater and marine fish seed resources and natural breeding of finfishes.
2. Riverine fish seed collection
3. Sexual maturity, breeding season and development of gonads
4. Methods of breeding carps in bundhs

UNIT II

1. Induced breeding of warm water finfishes and environmental factors affecting spawning
2. Fish pituitary gland
3. Synthetic hormones for induced breeding of fishes
4. Fish brood stock management and transportation of broodfish
5. Induced breeding of Indian major carps
6. Induced breeding of exotic carps (silver carp and grass carp)
7. Major carp egg and embryonic developmental stages
8. Causes of mortality of fish eggs and spawn and their treatment

Unit III

1. Different types of fish hatcheries – traditional double-walled hapa
2. Different types of fish hatcheries – Chinese type of carp hatchery
3. Different types of fish hatcheries – glass jar hatchery
4. Spawn rearing techniques – nursery pond
5. Spawn rearing techniques – rearing pond
6. Packing and transportation of fish seed and use of anaesthetics and disinfectants in fish breeding and transport.

Unit IV

1. Breeding of common carp (*Cyprinus carpio*)
2. Breeding of mahseers
3. Breeding of trouts
4. Breeding of tilapia
5. Breeding of catfishes
6. Breeding of grey-mullet, *Mugil cephalus*
7. Breeding of milk fish, *Chanos chanos*
8. Breeding of Asian sea bass, *Lates calcarifer*
9. Breeding of groupers
10. Breeding of indigenous carps /Multiple breeding of carps

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)
LATUR.
Course Structure
B.Sc. S.Y. (Semester IV)
W.e.f. 2020-21
Subject: FISHERY SCIENCE
SECF-II PRACTICAL

Marks: 50 Lect.: 45 Credits: 2

1. Collection and preservation of fish pituitary gland and preparation of pituitary extract for hypophysation

2. Calculation of fecundity of fishes

3. Brood stock maintenance and selection of brooders for injection

4. Double-walled hapa and glass jar hatchery

5. Chinese type of carp hatchery

6. Preparation and management of fish nursery

7. Maturity stages of carps

8. Indian major carp egg and embryonic development

9. Common carp egg and embryonic development

10. Identification of eggs, spawn, fry and fingerlings of different species

11. Fish seed and broodfish transportation

12. Use of anaesthetics, disinfectants and antibiotics in fish breeding

13. Water quality monitoring in fish hatcheries and nurseries

14. Breeding and larval rearing of major carps