

A.G.&S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE
VUYYURU-521165, KRISHNA Dt., A.P.

An Autonomous College in the Jurisdiction of Krishna University, Machilipatnam
Accredited by NAAC with “A” Grade ISO9001-2015 Certified Institution

2021-2022

B.SC.AQUACULTURE(Industrial Fisheries)

EVEN SEMESTER



DEPARTMENT OF ZOOLOGY

MINUTES OF BOARD OF STUDIES

B.SC.AQUACULTURE

01-04-2022

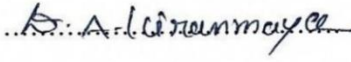
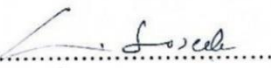
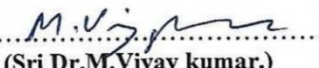
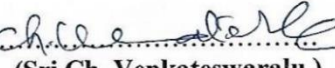
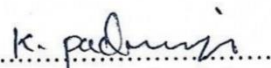




Minutes of the meeting of Board of studies in Zoology for the Autonomous courses of AG & SG Siddhartha Degree College of Arts & Science, Vuyyuru, held at 2:30 pm on 01.04,2022 in the Department of Zoology.

Smt.D.A. Kiranmayee. ...

Presiding

Members Present:

- 1)  Chair person Head, Department of Zoology,
(Smt. D.A.Kiranmayee.) A.G&S.G.S Degree College of
Vuyyuru-521165.
- 2)  University Nominee Bio Sciences & Bio technology
(Smt. Dr.L.Suseela.) Krishna University
Machilipatnam.
- 3)  Academic Council Head,Department of Zoology,
(Sri Dr.M.Viyay kumar.) Nominee SRR & CVR Govt. Degree College,
Vijayawada.
- 4)  Academic Council Head, Department of Zoology,
(Sri Ch. Venkateswaralu.) Nomine P.B. Siddhartha College,
Vijayawada.
- 5)  Member Lecturer in Zoology,
(Smt. K. Padmaja.) A.G&S.G.S Degree College
Vuyyuru-521165.
- 6)  Industrialist Asst. Project Manager,
(B. Appala Naidu.) RGCA
Manikonda.
- 7)  Student Represent P.hd –Research Scholar,
(Ch.Chiranjeevi) Dept.of Botany & Microbiology,
Acharya Nagarjuna University,
Guntur.

Agenda for B.O.S Meeting.

1. To recommend the syllabi (Theory & Practical), Model question paper for II Semester of I B.Sc (A.B.C) for the academic year 2021-2022.
2. To recommend the syllabi (Theory & Practical), Model question paper for IV Semester of II B.Sc (A.B.C) for the academic year 2021-2022.
3. To discuss to the syllabus of Elective & Clusters in VI semester for the academic year 2021-2022.
4. To recommend the Model question paper for VI Semester of III B.Sc (A.B.C) for the academic year 2021-2022.
5. To recommend Model question paper and Blue print of II, IV & VI semester of I, II, III B.Sc (A.B.C.) for the academic year 2021-2022.
6. To recommend the teaching and evaluation methods to be followed under Autonomous status.
7. Any other matter.

D. A. Chinnayee

Chairman.

RESOLUTIONS

1. It is resolved to continue the same syllabi (Theory & Practical), model question paper of II Semester of I B.Sc. (A.B.C) under Choice Based Credit System (CBCS) for the academic Year 2021 – 2022.
2. It is resolved to follow the changed syllabi (Theory & Practical), model question paper of IV Semester of II B.Sc. (A.B.C) under Choice Based Credit System (CBCS) for the academic Year 2021 – 2022.
3. It is resolved to follow Elective (Ornamental Fishery) and Cluster I. Fish Processing Technology, Cluster-II . Fishery Microbiology and Fishery by- Products & Cluster- III. Quality Control in Processing plants in VI Semester from the Academic year 2021-2022
4. It is resolved to follow the suggested model question paper for VI Semester of III B.Sc. (A.B.C) under Choice Based Credit System (CBCS) for the academic Year 2021 – 2022.
5. It is resolved to follow the Model question paper and Blue print as suggested for II & IV semester of I, II B.Sc (A.B.C.) for the academic year 2021-2022.
6. It is resolved to continue the following teaching & evaluation methods for the Academic year 2021-22.
7. Any other matter.

Teaching methods:

Besides the conventional methods of teaching, we use modern technology i.e. Using of OHP and LCD projector to display on U boards etc; for better understanding of concepts.

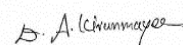
Evaluation of a student is done by the following procedure:

Internal Assessment Examination:

- Out of maximum 100 marks in each paper for II & III B.Sc(A.B.C) 30 marks shall be allocated for internal assessment.
- Out of these 30 marks, 20 marks are allocated for announced tests (i.e . IA-1& IA-2). Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks are allocated on the basis of candidate's percentage of attendance and remaining 5 marks are allocated for the assignment for I,II& III B.Sc (A.B.C).
- Out of maximum 100 marks in each paper for I B.Sc(A.B.C) 25 marks shall be allocated for internal assessment.
- Out of these 25 marks, 15 marks are allocated for announced tests (i.e . IA-1& IA-2). Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks are allocated on the basis of candidate's percentage of attendance / assignment for II, semester.
- There is no pass minimum for internal assessment for I, II, III B.Sc

Semester – End Examination:

- The maximum mark for I (ABC) semester – End examination shall be 75 marks and duration of the examination shall be 3 hours.
- The maximum mark for IV, VI (A.B.C) semester – End examination shall be 70 marks and duration of the examination shall be 3 hours. Even though the candidate is absent for two IA exams/ obtain Zero marks the external marks are considered (if the candidate gets 40/70) and the result shall be declared as “PASS”.
- Semester – End examination shall be conducted in theory papers at the end of every semester, while in practical papers, these examinations are conducted at the end of II, IV & VI semester for I, II & III B.Sc, (A.B.C).



Chairman

ADUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165, KRISHNA Dt., A.P. (AUTONOMOUS).

NAAC reaccredited at 'A' level
Autonomous –ISO 9001-2015 Certified

Title of the Paper: BIOLOGY OF FIN FISH & SHELL FISH.

Semester: - II

Course Code	AQTT21A	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	25
No. of Lecture Hours/ Week	4	Semester End Exam Marks	75
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2019-20	Year of Offering 2019-20	Year of Revision –	Percentage of Revision:

AIM

- To know the biology of fin fish and shell fish.

OBJECTIVES

- To study the systematics of cultivable finfish and shellfish.
- To understand feeding habit and growth patterns of cultured species.
- To study the factors responsible for longevity of fishes.
- To study the reproductive biology of finfish and shell fish.
- To study the developmental aspects of cultivable finfish and shell fish.
- To study the role of hormones in the growth of finfish and shell fish.

PREREQUISITE

- Knowledge of fisheries management acquired in Intermediate.

COURSE OUTCOMES

By the end of the course students will be able to

CO 1	Classify the finfish and shellfish, analyse the cultivable species of fin fish and shellfish of commercial importance, describe their salient features and appreciate the diversity and uniqueness of different groups.
CO 2	Comprehend the relationship between food and growth, age and growth, hormones and growth in cultivable fin and shell fish.
CO 3	Gain knowledge and compare the feeding habits, mouth parts and digestive systems and analyze gut contents.
CO 4	Develop the skill of identifying the gut contents, gonadal maturity and fecundity and comprehend the concept of breeding behaviour, embryonic and larval development of cultivable aquatic fin and shell fish.
CO 5	Acquaint with the significance of unique mechanisms and behavioural patterns like sense organs, electric organs, buoyancy, moulting and metamorphosis exhibited by finfish and shell fish.

Syllabus :

Unit	Learning Units	Lecture Hours
I	<p>1.0. Introduction Classification of Finfish and Shell fish Classification of fishes up to the level of Class. Classification of crustaceans up to the level of Class Finfish and Shell fish of Commercial Importance Cultivable fin fish Cultivable shell fish Sense organs of fishes and crustaceans</p>	11
II	<p>2.1. Food, Feeding and Growth Natural fish food Feeding habits, feeding intensity, stimuli for feeding, utilization of food Gut content analysis. Structural modifications in relation to feeding habits. Forage ratio and food selectivity index 2.2. Age and Growth Principles of Age and growth determination Growth regulation Growth rate measurement – scale method, otolith method, skeletal parts as age indicators Genetic, biotic & ecological factors in determining the longevity of fishes Length frequency method, age composition, age-length keys, absolute and specific growth, back calculation of length and growth, annual survival rate, asymptomatic length, fitting of growth curve . Length-weight relationship Condition factor/Ponderal index, relative condition factor</p>	17
III	<p>3.0. Reproductive Biology Breeding in Fishes .Breeding habits & breeding grounds Breeding in natural environment and in artificial ponds, courtship Reproductive cycles Induced breeding in fishes Breeding in shrimp Breeding in pearl oyster</p>	9
IV	<p>4.0. Development Ovo-viviparity, oviparity, viviparity in fishes Parental care in fishes, nest building and brooding Embryonic and larval development of fishes Embryonic and larval development of shrimp 4.. Embryonic and larval development of crabs Environmental factors affecting reproduction and development of cultivable aquatic fin & shellfish</p>	12
V	<p>5.0. Hormones & Growth Endocrine system in fishes Neurosecretory cells, androgenic gland, ovary, Y-organ, chromatophores, Pericardial glands and cuticle. Molting, molting stages, metamorphosis in crustacean shellfish</p>	11

PRESCRIBED BOOK(S):

1. Bone Q et al., 1995. Biology of fishes, Blackie academ
2. ic &professional,LONDON
3. Saxena AB 1996. Life of Crustaceans.Anmol Publications Pvt. Ltd., New Delhi

REFERENCES:

- 1.Tandon K.K&Johal M.S 1996.Age and Growth in Indian Fresh Water Fishes.Narendra Publishing
2. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
3. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology andManagement.
4. Barrington FJW 1971. Invertebrates: Structure andFunction. ELBS
5. Parker F &Haswell 1992. The text book of Zoology, Vol I.Invertebrates

CO-CURRICULAR ACTIVITIES

1. Collection of cultivable finfish and shellfish
2. Animal album-making on cultivable finfish and shellfish
3. Preparation of models of digestive system of herbivorous, omnivorous and carnivorous fishes.
4. Preparation of charts on sense organs of fish and crustaceans
5. Growth rate measurement of different fishes using various methods.
6. Collection of data and finding the length –weight relationship in fishes.
7. Preparation of charts on reproductive cycles in fishes.
8. Preparation of models on fish nests.

**A.G& S.G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU – 521165, KRISHNA
Dt.,A.P. (AUTONOMOUS)
SEMESTER-II**

(Model Question paper)

w.e.f. 2019 – 2020

Paper Title: **BIOLOGY OF FIN FISH & SHELL FISH.**

Paper Code: AQT21

Time: 3 hrs

Max.Marks:75

Note: Draw neat labelled Diagrams wherever necessary.

SECTION-A

Answer any **Five** of the following Questions. **5X5= 25M**

1. Evaluate the significance of Exotic fishes in culture.CO1, L4
2. Explain the structure and function of Sense organs in fishes. CO5, L2
3. Explain the different fish feeding habits. –CO2, L5
4. Describe Condition factor and Relative condition factor.–CO2, L2
5. Describe breeding process in Pearl oyster.– CO4, L2
6. Explain Ovo-viviparity in Fishes. CO4, L2
7. Explain the Embryonic and larval Development in Crabs.CO2, L5
8. Write a short note on Neurosecretary cells. – CO3, L1

SECTION-B

Answer **all** the Questions.**5X10=50M**

9. Classify the Crustaceans up to the level of subclass. CO1, L2
(Or)
Give an account of Buoyancy in fishes .– CO5, L2
10. Explain different factors that determine the longevity of fishes. – CO2, L4
(Or)
Describe the different methods of estimating age and growth of fish. – CO2, L4
11. Describe the process of Induced breeding in Fishes. CO2, L2
(Or)
Explain the breeding technique in shrimp. CO2, L2
12. Explain the role of Environmental factors on reproduction and development of finfish. CO2, L2
(Or)
Write an essay on Embryonic and larval development in shrimp. CO2, L2
13. Describe the structure of Pituitary gland and explain the functions of its hormones. CO2, L2
(Or)
Describe the process of Moulting in Crustaceans.CO2, L2

AQUACULTURE
PRACTICAL -II

Semester- II

Max. Marks: 50

Title Of The Paper:-Biology Of Fin Fish & Shell Fish

NO OF HOURS: 30

CREDITS: 02

LEARNING OUTCOMES:

By the end of the course students will be able to

- Differentiate between the feeding habits of different fish and shell fish basing on their mouth parts and alimentary canal and identify the various appendages of shellfish.
- Understand the length – weight relationship and analyse the gut contents of fish and shrimp.
- Identify the eggs and larval stages of different cultured species of fish and shell fish and confirm the maturity and fecundity in fish and shell fish.
- Gain knowledge in nest building and brooding in fishes.
- Maintain a neat, labeled record of identified museum specimens and exhibit the hidden creative talent.

1. Study of mouth parts in herbivorous omnivorous and carnivorous fishes
2. Comparative study of digestive system of herbivorous and carnivorous fishes
3. Length-weight relationship of fishes
4. Gut content analysis in fishes and shrimp
5. Mouth parts and appendages of cultivable prawns, shrimps and other crustaceans
6. Study of eggs of fishes, shrimps, prawns and other crustaceans
7. Study of gonadal maturity and fecundity in fishes and shellfish
8. Observation of crustacean larvae
9. Study of nest building and brooding of fishes
10. Biostatistics – Mean, Mode, Median, Standard Deviation, Correlation and t-test

REFERENCES

1. Bone Q et al., 1995. Biology of fishes, Blackie academic & professional, LONDON
2. Saxena AB 1996. Life of Crustaceans. Anmol Publications Pvt.Ltd., New Delhi
3. Tandon K.K & Johal M.S 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing
4. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
5. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology
6. **Thomas PC, Rath SC & Mohapatra KD.** 2003. Breeding and Seed Production of Finfish and Shellfish. Daya Publ.

Chakraborty C & Sadhu AK. 2000. Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn. Daya Publ. House

AQUACULTURE
BIOLOGY OF FIN FISH AND SHELL FISH
MODEL QUESTION PAPER
EXTERNAL PARTICAL PAPER- II

SEMESTER-II

Time: 3 Hours

COURSE CODE: AQT P21

Max. Marks: 40M

1. Identify and draw labeled diagram of digestive system of Labeorohita.
Compare it with that of a carnivorous fish. CO1, L2 &L3 **10M**
Or
Identify and draw labeled diagram of digestive system of Channapunctatus.
Compare it with that of a herbivore fish. CO1, L2 &L3
Identification: 1M
Diagram: 2M
Labelling: 3M
Comparison: 4M
2. Identify and draw labeled diagram of abdominal appendages of Macrobrachiummalcolmsonii. CO1, L3 **10M**
Or
Identify and draw labelled diagram of thoracic appendages of Scylla serrata.CO1, L3
Identification: 2M
Diagram: 4M
Labelling: 4M
3. Identify and comment on CO1, CO3 & CO4, L3 & L1 **4x2½ =10M**
A. Mouth parts of fish/prawn/crab
B. Egg mass of fish/prawn/shrimp/crab
C. Crustacean larvae
D. Types of fish nests
Identification: 1M
Diagram: ½M
Notes: 1M
4. Record Book CO5, L3 **5M**
5.VIVA CO5, L5 **5M**

INTERNAL PRACTICAL- II

Max.marks: 10M.

1. Attendance ----- 05M.
2. Assignment ----- 05M.

Total ----- 10 M.

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Title of the Paper: **FISH NUTRITION & FEED TECHNOLOGY**

Semester: - IV

Course Code	<i>AQU-401</i>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-2022	Year of Offering 2021-2022	Year of Revision –	Percentage of Revision:

Learning Objectives:

- 1 To know the nutritional requirements of fish and shell fish at different stages of their life.
- 2 To understand the different types of feeds, and feed additives used in the preparation of fish and shell fish feeds.
- 3 To improve the knowledge on feed manufacture and feed storage.
- 4 To gain knowledge on feeding and feed evaluation methods.
- 5 To gain knowledge on feed manufacture and storage -
- 6 To know the nutritional pathology and remedial methods of cultivable fish and shrimp.
- 7 To improve the technical knowledge feed quality and nutritional value analysis.

Course outcomes:

CO 1	Understand Nutritional requirements of cultivable fishes and factors affecting energy partitioning and feeding.
CO 2	Know different types of feed and FCR and different types of feeders
CO 3	Gain Knowledge of Feed manufacture and storage methods of feeds
CO 4	Understand the value of Feed additives and Non-Nutrient ingredients
CO 5	To create awareness of different nutritional deficiency and importance of natural and supplementary feeds and balanced diet.

Syllabus
Course Details

Unit	Learning Units	Lecture Hours
I	<p>Nutritional requirements of cultivable fish and shellfish Classification of nutrients; Nutritional requirements (energy, proteins, carbohydrates, lipids, fiber, micronutrients) of different stages of cultivable fish and shellfish. Essential amino acids and fatty acids, protein to energy ratio, nutrient interactions and protein sparing effect Dietary sources of energy, effect of ration on growth, determination of feeding rate, check tray, factors affecting energy partitioning and feeding Importance of natural and supplementary feeds, balanced diet.</p>	10
II	<p>Types of feeds and Feed additives Live foods: Fish food organisms – Bacterioplankton, phytoplankton, zooplankton and their role in larval nutrition. Artificial feeds: Supplementary feed stuffs; Non-conventional feed ingredients; Forms of processed feeds - wet feeds, moist feeds, dry feeds, mashes, pelleted feeds - floating and sinking pellets; advantages of pelletization Water stability feeds, farm made aqua feeds, micro-coated feeds, micro-encapsulated feeds and micro-bound diets Feed additives: Binders, antioxidants, probiotics, enzymes, pigments, growth promoters, feed stimulants; use of preservatives.</p>	10
III	<p>Feed formulation, manufacture & storage Feed ingredients: selection, nutrient composition and nutrient availability. Feed formulation and manufacturing – extrusion processing and steam pelleting - grinding, mixing and drying, pelletization, and packing Microbial, insect and rodent damage of feed, chemical spoilage during storage period and feed storage methods.</p>	15
IV	<p>Feeding methods Feeding devices and methods: Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding & tray feeding Feeding schedules: Frequency of feeding, feeding rates and ration size Feed evaluation: feed conversion ratio, feed conversion efficiency and protein efficiency ratio.</p>	15
V	<p>Nutritional pathology of fish and shrimp Protein (Essential amino acid) and Lipid (Essential fatty acid) deficiency disorders; Fatty liver disease in fishes Vitamin and mineral deficiency disorders Anti-nutrients and aflatoxins.</p>	10

**A.G& S.G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU – 521165, KRISHNA
Dt.,A.P. (AUTONOMOUS)
SEMESTER-IV**

Model Question paper

w.e.f. 2021 – 2022

Paper Title: Fish Nutrition & Feed Technology

Paper Code: AQU-401

Time: 3 hrs

Max.Marks:70

Section -A

I. Answer any FOUR of the following

Draw labeled diagram wherever necessary

4x5=20M

1. Lipids
2. Checktray
3. Feed conversion efficiency
4. probiotics
5. Extrusion processing
6. Feed storage methods
7. Bag feeding
8. Aflatoxins

Section -B

Answer any FIVE of the following

5x5=50 M

Draw labeled diagrams wherever necessary

9. Explain essential amino acids required for cultivable fish
10. Describe various carbohydrates and micronutrients required for different stages of cultivable fish
11. Explain various feeds
12. Describe different feeding methods.
13. Explain nutrient composition and nutrient availability of feed ingredients..
14. Describe Enzymes and growth promoters
15. Explain Protein and Vitamin deficiency symptoms.
16. Describe the importance of natural and supplementary feeds.

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(AUTONOMOUS)**

SEMESTER-IV

Guide lines to the paper setter

w.e.f. 2021 – 2022.

Paper Title:Fish Nutrition & Feed Technology .

Paper Code: AQU-401

Time: 3 hrs

Max.Marks:70

Note: 1. Answer **any four** questions out of eight in Part-A. Each question carries five marks. 4 X 5= 20M.

2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks. 5 X 10= 50M.

	PART	Unit – I	Unit – II	Unit – III	Unit – IV	Unit – V
5 Marks Questions	A	2	2	2	1	1
10 Marks Questions	B	2	2	1	1	2
Weightage		30	30	20	15	25

Note: 1. please provide the scheme of valuation for the paper.

2. Question paper should be both in English and Telugu media.

ZOOLOGY PRACTICAL SYLLABUS

PAPERS – IV

w.e.f. 2021 – 2022.

Period: 24

Max.Marks:50

Credits: 2

Paper Title: Fish Nutrition & Feed Technology

Paper Code: AQU-401P

PRACTICALS: (Any 8 as per the local Industry needs and Requirement)

1. Estimation of protein content in aquaculturefeeds
2. Estimation of carbohydrate content in aquaculturefeeds
3. Estimation of lipid content in aquaculturefeeds
4. Estimation of ash in aquaculturefeed
5. Study of water stability of pelletfeeds
6. Feed formulation and preparation in the lab
7. Study of binders used in aquaculturefeeds
8. Study of feed packing materials
9. Study of physical and chemical change during storage
10. Study on physical characteristics of floating and sinking feeds
11. Visit to a aqua-feed production unit
12. Visit to a farm for studying feeding practices

A. G.& S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYURU-521165

EXTERNAL PRACTICAL- IV

MODEL QUESTION PAPER –IV
2hrs/week)

Code: AQU-401P

Time: 3 hrs.

Max.marks: 25m.

I.Estimation of carbohydrate content in aquaculture feeds	7M.
II. Estimation of ash in aquaculture feed	5M.
III.Study of feed packing materials	5M
IV.Study of physical and chemical change during storage	5M
V. Viva.	3M
TOTAL: -----	25M.

Guide lines for the practical Examiners

- I:Estimation of carbohydrate content in aquaculture feeds (5marks notes & Result 2 mark .)
- II :Estimation of ash in aquaculture feed(5 marks notes)
- III :Study of feed packing materials (5 marks notes)
- IV. Study of physical and chemical change during storage (5 marks notes)

A. G.& S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYURU-521165

INTERNAL PRACTICAL- IV

w.e.f. 2021-2022.

(2 hrs/week).

Practical –IV

MODEL QUESTION PAPER -IV

Max.marks:25M.

Time: 3hrs.

Code: AQU-401P.

3. Attendance	-----	05M.	
4. Record	-----	10M.	
5. Field trip	-----	05M	
6. Assignment	-----	05M.	Total ----- 25M.

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Title of the Paper: **FISH HEALTH MANGEMENT**

Semester: - IV

Course Code	<i>AQU-402</i>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2021-2022	Year of Revision –	Percentage of Revision:

Learning Objectives:

1. To understand the Principles of disease diagnosis and fish healthmanagement.
2. To know the prophylactic and therapeutic methods to control thediseases.
3. T understand the defense mechanism and immune system in fish andshrimp.
4. To gain detailed knowledge on the disease symptoms, causative agent, preventive measures and treatment for microbial, parasitic, nutritional and environmental disorders in fish andshrimp.
5. To understand the diagnosis tools that are followed in field of aquaculture and vaccine production for fishimmunization.
6. To know the significance of Quarantine, Biosecurity and SPF seed in the health management of fish andshrimp.

Course outcomes:

CO1: Provide students with knowledge about fish diseases and pathological aspects of diseases.

CO2: Learn about Fungal, Viral and Bacterial diseases of finfish.

CO3: Learn about major shrimp viral, bacterial and protozoan diseases and prevention and therapy methods.

CO4: Gain knowledge of Nutritional deficiency related diseases and antibiotic and chemotherapeutics.

CO5: Understand and learn the importance of diagnostic tools in identification of diseases andapplication and development of vaccines. To know about production of disease freeseeds andgood feed management

Syllabus
Course Details

Unit	Learning Units	Lecture Hours
I	<p>Introduction Principles of disease diagnosis and fish health management. Prophylaxis, Hygiene and Therapy of fish diseases. Defence mechanism in finfish and shellfish – specific and non-specific immunosystem. Role of stress and host defence mechanism in disease development - Host, pathogen and environment interaction.</p>	10
II	<p>Fish Diseases Clinical symptoms, pathology, prevention and therapy of Viral diseases: Viral Haemorrhagic septicemia, Infectious Hematopoietic Necrosis (IHN). Bacterial diseases: Epizootic ulcerative syndrome, Infectious abdominal dropsy, Bacterial gill disease, Columnaris disease, Tail and finrot. Fungal diseases: Saprolegniasis and Branchiomycosis. Protozoan diseases: Ichthyophthiriasis, Myxoboliasis/ Whirling disease, Enterococcidiasis. Helminthic and Crustacean parasitic diseases: Gyrodactylosis and Dactylogyrosis; Argulosis and Lernaeiasis.</p>	10
III	<p>Shrimp Diseases Clinical symptoms, pathology, prevention and therapy of Viral diseases: White spot syndrome, Monodon Baculovirus, Infectious hypodermal and haematopoietic necrosis virus, Hepato Pancreatic parvo like virus, Yellow head baculovirus, Taura Syndrome. Bacterial diseases: Vibriosis, white gut disease, loose shell syndrome, Acute Hepato-pancreatic Necrosis Disease (Early Mortality Syndrome, EMS) Fungal diseases: Hepatopancreatic microsporidiosis (HPM) by <i>Enterocytozoon hepatopenaei</i> (EHP), <i>Lagenidium</i> and <i>Fusarium</i> disease. Protozoan diseases: ectocommensal protozoa – <i>Zoothamnium</i> and <i>Acineta</i>.</p>	15
IV	<p>Nutritional and Environmental disorders Clinical symptoms, pathology, prevention and therapy of Fish: Protein (Essential amino acid) and Lipid (Essential fatty acid) deficiency disorders; Vitamin and mineral deficiency disorders; Fatty liver disease; Gas bubble disease, Asphyxiation. Shrimp: Soft shell syndrome, Blue disease/Pigment deficiency syndrome, Red disease, Cramp tail syndrome, Black gill disease, Muscle necrosis, Black death disease. Role of gut probiotics in health management of fish and shrimp. Bioremediation of soil and water as a strategy for health management in ponds.</p>	15
V	<p>Fish Health Management Diagnostic tools – immune detection- DNA/RNA technique – molecular diagnosis of viral diseases. Principles and methods of vaccine production and fish immunization. Quarantine and health certification in aquaculture. Significance of Biosecurity and Specific pathogen free seed (SPF) in health management.</p>	10

Semester –IV

w.e.f. 2021-2022

Model question paper

Title of the paper: Fish health management.

Code – AQU-402

Time: 3hrs.

Max.marks: 70

Section – A

4 x 5= 20.

Answer any **four** questions. Each question carries **five** marks. Draw neat labeled diagrams wherever necessary.

1. Necrosis.
2. Atrophy
3. Lagenidium diseases
- 4 Bacterial kidney disease.
5. Monodon Bacculovirus
6. Yellow head bacculovirus
7. Lipid liver degeneration
- 8, Zero water exchange.

Section – B

5 x 10 =50.

Answer any **five** questions. Each question carries **Ten** marks. Draw neat labeled diagrams wherever necessary.

9. Write an essay on any two nutritional Requirements for cultivable fish?
10. Explain the changes in cell metabolism?
11. Explain about Bacterial diseases of shell fish?
12. Explain about channel cat fish viral disease prevention and therapy?
13. Describe the Protozoan diseases??
14. Write an essay on genetically and environmentally induced diseases?
15. Explain about application and development of vaccines?
16. Methods and regulations for transplants?

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Semester - IV

Guide lines to the Paper Setter.

Title of the paper: Fish health management

Code – AQU-402

Time: 3hrs.

Max. Marks: 70.

1. Answer any **four** questions out of eight in Section – A. Each question carries five marks. $4 \times 5 = 20M$.

2. Answer any **five** questions out of eight in Section – B. Each question carries Ten marks. $5 \times 10 = 50M$.

	Section	UNIT-I	UNIT-II	UNIT-III	UNIT-IV	UNIT-V
5 Marks Questions	A	2	2	2	1	1
10 Marks Questions	B	1	2	2	1	2
Weightage		20	30	30	15	25

Note: 1. please provide the scheme of valuation for the paper.

2. Question paper should be in English medium.

w.e.f. 2021-2022
MAX.MARKS : 50.
(2hrs/week)

Code : AQU- 402P

PRACTICAL SYLLABUS

1. Enumeration of Bacteria by TPC Method
2. Enumeration of total Coli forms
3. Observation of gross pathology and external lesions of fish and prawn with reference to the common diseases in aquaculture
4. Examination of pathological changes in gills and gut lumen, lymphoid organ, muscles and nerves of fish
5. Examination of pathological changes in gut lumen, hepatopneacas, lymphoid organ, muscles and nerves of prawn and shrimp
6. Collection, processing and analysis of data for epidemiological investigations of viraldiseases
7. Bacterial pathogens – isolation, culture and characterization
8. Identification of parasites in fishes: Protozoan, Helmiths, Crustaceans
9. Antibigrams – preparation and evaluation
10. Molecular and immunological techniques; Biochemical tests; PCR; ELISA; Agglutination test; Challenge tests; Purification of virus for development of vaccines (Demonstration at institutes/labs)
11. Estimation of dose, calculation of concentration, methods of administration of various chemotherapeutics to fish and shell fish
12. Estimation of antibiotics used in aquaculture practices
13. Estimation of probiotics used in aquaculture
14. Field visit to farm for health monitoring and disease diagnosis

PRESCRIBED BOOK(S):

1. Shaperclaus W. 1991 Fish Diseases- Vol.I & II. Oxonian Press Pvt.ltd
2. Roberts RJ 1989. Fish pathology. Bailliere Tindall, New York
3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandray and medicine. Pergamon Press. Oxford

REFERENCES:

1. Shankar KM & Mohan CV. 2002. Fish and Shellfish Health Management. UNESCO Publ. Sindermann CJ. 1990
2. Walker P & Subasinghe RP. (Eds.). 2005 Principal Diseases of Marine Fish and Shellfish. Vols. I, II. 2nd Ed. Academic Press
3. DNA Based Molecular Diagnostic Techniques: Research Needs for Standardization and Validation of the Detection of Aquatic Animal Pathogens and Diseases. FAO Publ. Wedmeyer G, Meyer FP & Smith L. 1999.
4. Bullock G et.al., 1972 Bacterial diseases of fishes. TFH publications, New Jersey
5. Post G 1987. Text book of Fish Health. TFH publications, New Jersey
6. Johnson SK 1995. Handbook of shrimp diseases. Texas A & M University, Texas

EXTERNAL PRACTICAL-IV

MODEL QUESTION PAPER –IV

(2hrs/week)
Code: AQU-402P

Time: 3 hrs.

Max.marks: 25m.

I.Estimation of antibiotics used in aquaculture practices	5M.
II. Biochemical tests	5M.
II.	5M
IV. Identify, draw labeled diagram & write notes on A, B, C, D E	5X2=10M

TOTAL: ----- 25M.

Guide lines for the practical Examiners

I: Estimation of carbohydrate content in aquaculture feeds (4 marks notes & Result 1 mark.)

II: Biochemical tests. (5 marks notes)

III: ELISA (5 marks notes)

IV. ½ Mark for identification, ½ Mark for labeled diagram & 1 Mark for notes for each question.

4 specimens / slides / models.

INTERNAL PRACTICAL-IV

w.e.f. 2021-2022.
(2 hrs/week).

Code: AQU-402P.

MODEL QUESTION PAPER -IV

Max.marks:25M.

Time: 3hrs.

1. Attendance	-----	05M.
2. Record	-----	10M.
3. Field trip	-----	10M
	Total -----	25M.

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(AUTONOMOUS).**

NAAC reaccredited at 'A' level
Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Ornamental fishery**

Semester: - VI

Course Code	<i>AQU-601C</i>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2021-2022	Year of Revision –	Percentage of Revision:

Objective of the course: The students understand Ornamental fishery.

Course outcomes:

Learning Objectives:

- This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students
- The course objectives are to provide the students with an introductory knowledge of live bearers.
- The students will be required to identify common Marine Ornamental species available in and around their region using Ocean area.
- To gain detailed knowledge on the disease symptoms, causative agent, preventive measures and treatment in fish and shrimp.
- To understand the students will be required - Commercial production of aquarium fish and plants

COURSE OUTCOMES

At the end of the course, students will be able to:

CO1. Describe and identify the characters of commercially important ornamental fishes

CO2. Explain the procedure for transportation fish and feed preparation

CO3. Identify the diagnosing procedure for ornamental fish diseases

CO 4. Construct aquarium and analyse water quality parameters

CO5. Access the role of Mass production of aquarium plants

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	UNIT- I: Introduction Aquarium and ornamental fishes – introduction Present status of Aquarium trade in the world and India Aquarium accessories – aerators, filters, lighters and heaters Water quality needs and different kinds of feeds.	10
II	UNIT-II: Fresh water ornamental fishes Live bearers, gold fish, koi, gourami, barbs and tetras, angel fish and cichlid fish Brood stock development, breeding, larval rearing and grow out. Larval feeds and feeding	10
III	UNIT-III: Marine ornamental fishes Varieties and habitat of marine ornamental fishes Major marine ornamental fish resources of India Collection and transportation of live fish, use of anaesthetics Breeding of marine ornamental fish. Other aquarium animals – sea anemones, lobsters, worms, shrimps, octopus and starfish	15
IV	UNIT-IV: Aquarium management Setting up fresh water, marine and reef aquariums. Water quality management for different types of aquariums. Common diseases of aquarium fish, diagnosis and treatment. Temperature acclimatization and oxygen packing for aquarium fish.	15
V	UNIT-V: Commercial production of aquarium fish and plants Commercial production units of ornamental fish- requirements and design. Commercial production of goldfish, live bearers, gouramies, barbs, angels and tetras. Mass production of aquarium plants. Retail marketing and export of ornamental fish.	10

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Semester –VI
Time: 3hrs

(Model question paper)

w.e.f. 2021-2022

Title of the paper: **Ornamental fishery**

Code – AQU-601C

Max.marks: 70

Section – A

Answer any **four** questions. Each question carries **five** marks. **4 x 5= 20.**

Draw neat labeled diagrams wherever necessary.

1. Aerators
2. Larval rearing
3. Gold fish
4. Use of anaesthetics
5. Lobsters
6. Diagnosis and Treatment of aquarium fish
7. Gouramies,
8. Retail marketing

Section – B

Answer any **five** questions. Each question carries **Ten** marks. **5 x 10 =50**

Draw neat labeled diagrams wherever necessary.

9. Describe the Present status of Aquarium trade in the world and India?
10. Write an essay on angel fish and cichlid fish?
11. Explain larval feeds and feeding?
12. Describe the Collection and transportation of live fish?
13. Explain Breeding of marine ornamental fish?
14. Water quality management for different types of aquariums?
15. Describe the Common diseases of aquarium fish?
16. Mass production of aquarium plants?

SEMESTER-VI

Time: 3 hrs

Guide lines to the paper setter

Paper Title: -Ornamental fishery.

Paper Code: AQU-601C

Max.Marks:70

Note: 1. Answer **any four** questions out of eight in Part-A. Each question carries five marks. 4X 5 = 20M.

2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks.
5 X 10 = 50M.

	PAR T	Unit –I	Unit – II	Unit-III	Unit – IV	Unit – V
5 Marks Questions	A	1	2	2	1	2
10 Marks Questions	B	1	2	2	2	1
Weightage		15	30	30	25	20

- Note:**
1. Please provide the scheme of valuation for the paper.
 2. Question paper should be both in English and Telugu media.

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AQUACULTURE

PRACTICAL - VI

w.e.f. 2021-2022

Code: AQU- 601P

MAX.MARKS : 50.

(2hrs/week)

PRACTICAL SYLLABUS

PRACTICALS:

1. Study of aerators – types and structures
2. Water circulation methods in aquarium and filtration
3. Collection and identification of aquarium plants
4. Identification of common marine aquarium fishes
5. Identification of common fresh water aquarium fishes
6. Breeding of egg layers
7. Breeding of live bearers
8. Evaluation of significance of aquaria for commercial and domestic use.

PRESCRIBED BOOK(S):

1. Dick Mills 1998. Aquarium fishes, Dorling Kindersly Ltd, London
2. Van Ramshort JD 1978. The complete aquarium encyclopedia, Elsevier

REFERENCES:

1. Jameson JD and Santhanam R 1996. Manual of ornamental fishes and farming technologies, Fisheries College and research institute, Tuticorn
2. Stephen Spotte 1993. Marine aquarium keeping. John wiley and sons, USA

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Practical - VI

w.e.f. 2021 – 2022

Paper Code: AQU-601P

Max. Marks: 25

Model Question Paper (External)

-
1. Identify, draw labeled diagram & write notes on marine aquarium fishes. 4x2=8M
A , B, C & D
 2. Identify, draw labeled diagram & write notes on fresh water aquarium fishes. 4x2=8M
A , B, C & D
 3. Collection and identification of aquarium plants 5M
 4. Breeding of egg layers / Breeding of live bearers 4M
- Total-----25m

Guide lines for the practical Examiners

1. ½ Mark for identification, ½ Mark for labeled diagram & 1 Mark for notes for each question.
(4 specimens / slides / models.)
2. ½ Mark for identification, ½ Mark for labeled diagram & 1 Mark for notes for each question.
(4 specimens / slides / models.)
3. Collection and identification of aquarium plants submit field note book (5 marks).
4. Labeled diagrams 1 mark & 3 marks for notes (4marks)

**A. G.& S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYURU
INTERNAL PRACTICAL- III**

(Practical -III)

w.e.f. 2021-2022.

Code: AQU-601P.

MODEL QUESTION PAPER -III

Max.marks:25M.

Time: 3hrs.

1. Attendance ----- 05M.
2. Record -----10M.
3. Field note book. ----- 05M
4. Assignment ----- 05M.

Total ----- 25M.

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(AUTONOMOUS).**

NAAC reaccredited at 'A' level
Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Fish Processing Technology**

Semester: - VI (CI-1)

Course Code	<i>AQU-602C</i>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2021-2022	Year of Revision –	Percentage of Revision:

Learning Objective of the course:

- The students understand Fish Processing Technology
- Advanced treatment of the concepts – involved in the production, processing and acceptance of Fish processing Products derived from fish- Fish waste utilization

Course Outcomes:

CO1: After completing this course students can able to, deliver the different unit operations and its equipments involved in fish processing fishing resources.

CO2: Develop value added products from fish. Able to know about quality control of fish processing

CO3: Know about different methods of processing of fish Able to acquire a confident to get placement in any fish processing industry.

CO4: Students grow in understanding of Packing, Cold Storage and Export of Fishery Products.

CO5: Export of fishery products from India - major countries

Syllabus
Course Details

Unit	Learning Units	Lecture Hours
I	UNIT- I: : Introduction: Principles of fish preservation. Importance of hygiene and sanitation in fish handling. Quality of water and ice in fish handling and processing. Preparation of ice. Different types of ice used in the seafood industry and their merits. Preservation by refrigerated seawater and chilled sea water	10
II	UNIT-II:Freezing and Canning: Fundamental principles involved in chilling and freezing of fish and fishery products. Various freezing methods. Freezing of shrimps and fishes. Changes during the cold storage of fish and fishery products. Principles involved in canning of fish. Different types of containers. Different stages of canning of Tuna. Retortable pouch processing.	10
III	UNIT-III: Drying, Smoking and Freeze-drying: Principles of smoking, drying and salting of fish, factors affecting drying. Traditional drying / curing methods. Different types of drying. Drying of fish and prawns. Packing and storage of dried products. Spoilage of dried products. Preventive measures. Standards for dry fish products. Cold smoking. Principles of freeze drying. Accelerated freeze drying and packing of freeze dried products. Modern methods of preservation by irradiation and modified atmospheric storage.	15
IV	UNIT-IV: Packing, Cold Storage and Export of Fishery Products: Functions of packing. Different types of packing materials and its quality evaluation. Packing requirements for frozen and cured products. Statutory requirements for packing. Labeling requirements. Different types of cold storages. Insulated and refrigerated vehicles.	15
V	UNIT-V: Export of fishery products from India - major countries, important products, export documents and procedures. Prospects and constraints in export including tariff and non- tariff barriers, marine insurance, export incentives, registered exporters	10

Semester –VI
w.e.f. 2021-2022
Time: 3hrs

Model question paper

Title of the paper: Fish Processing Technology
max.marks: 70

Code – AQU-602P

Section – A

Answer any **four** questions. Each question carries **five** marks. $4 \times 5 = 20$.

Draw neat labeled diagrams wherever necessary.

1. Preparation of ice
2. Canning
3. Various freezing methods
4. Drying and salting of fish
5. Spoilage of dried products
6. Functions of packing
7. Labeling requirements.
8. Registered exporters

Section – B

Answer any **five** questions. Each question carries **Ten** marks. $5 \times 10 = 50$

Draw neat labeled diagrams wherever necessary.

9. Describe the Principles of fish preservation?
10. Changes during the cold storage of fish and fishery products.?
11. Describe the Different stages of canning of Tuna?
12. Explain Different types of drying?.
13. Modern methods of preservation by irradiation and modified atmospheric storage?
14. Describe the Different types of packing materials and its quality evaluation?
15. Packing requirements for frozen and cured products?.
16. Explain about export documents and procedures?

SEMESTER-VI

Time: 3 hrs

Guide lines to the paper setter

Paper Title: -Fish Processing Technology

Paper Code: AQU-602C

Max.Marks:70

Note: 1. Answer **any four** questions out of eight in Part-A. Each question carries five marks.4X 5 = 20M.

2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks.5 X 10 = 50M.

	ART	Unit –I	Unit – II	Unit-III	Unit – IV	Unit – V
5 Marks Questions	A	1	2	2	2	1
10 Marks Questions	B	1	2	2	2	1
Weightage		15	30	30	30	15

- Note:**
1. please provide the scheme of valuation for the paper.
 2. Question paper should be both in English and Telugu media.

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AQUACULTURE
PRACTICAL -VIII

w.e.f. 2021-2022.
MAX.MARKS : 50.
(2hrs/week)

Code :AQU- 602P

PRACTICAL SYLLABUS

Practical I Title: Fish Processing Technology and Quality Control

Experiments:

1. Determination of moisture content in fish and fishery products
2. General description –freezing
3. Processing shrimp
4. Filleting of fish
5. Drying of fish
6. Organoleptic analysis of fish
7. Preparation of fishery by products
8. Preparation of shark fin rays fish maws, chitin, fish wafer
9. Fish pickling
10. Value added fishery products, fish curry, cutlets fish finger.
11. Preparation of surimi

Filed visit:

1. Visit to sea food pre-processing plants
2. Visit to fish processing plants

Text books:

1. K.Gopakumar, Fish Processing Technology, ICAR, New Delhi
2. T.K. Govindan, Fish Processing Technology Oxfor & IBH Publication Co.
3. K.K. Balachandran Fish Canning – Principles & Practices.
4. Borgstrom,G. Fish as Food.
5. K.K. Balachandran, Postharvest Technology in Fish and Fishery Products. 6. Moorjani,M.V. Fish Processing in India.
7. Connell,J.J. Advances in Fishery science and Technology.
8. CIFT. Manual of Quality Control in Fish and Fishery Products. 9. Gopakumar,K. Fish Packaging Technology

Reference Books:

1. A.M.Martin, Fisheries – Processing Chapman & Hall, Madras 2. Ed.G.M.Hall – Fish Processing Technology Chopra & Hall. Madras.

Practical - VI

w.e.f. 2021 – 2022

Paper Code: AQU-602P

Max. Marks: 25

Model Question Paper (External)

1. General description –freezing.	5 m
2. Processing shrimp.	5 m
3. Drying of fish	5m
4. Preparation of fishery by products.	5m
5. Fish pickling	5m

Total-----25m

Guide lines for the practical Examiners

1. General description-5m
2. Processing shrimp notes-5m
3. Drying of fish. 5m
4. Preparation of fishery by products notes.5m
5. Fish pickling notes.5m

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INTERNAL PRACTICAL

w.e.f. 2021-2022.
(2 hrs/week).

Code: AQU-602P.

MODEL QUESTION PAPER

Max.marks:25M.

Time: 3hrs.

1. Attendance	-----	05M.
2. Record	-----	10M.
3. Field note book.	-----	10M

Total ----- 25M.

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Title of the Paper: **Fishery Microbiology and Fishery by-products**

Semester: - VI (C1-2)

Course Code	AQU-603C	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2021-2022	Year of Revision –	Percentage of Revision:

Objective of the course: The students understand Fishery Microbiology and Fishery by-products.

Course outcomes

CO1: The ecosystem and taxonomy of microbes will be understood by the students along with prokaryotic and eukaryotic divisions

CO2: Hands on techniques on handling the microscopes in the class and instrumentation lab will be elaborate study of microbial organisms advanced techniques for easy and speedy identification will be known

CO3: Screening, isolation and enumeration of microbes using different media and application of advanced techniques for easy and speedy identification will be known

CO4: Students will be able to discuss Fishery By - products.

CO5: The practical knowledge of Value Added Products will be achieved by the students .

Syllabus
Course Details

Unit	Learning Units	Lecture Hours
I	<p>UNIT- I: Introduction: History and development of microbiology –Different members of the microbial community – General characteristics of bacteria, fungi, viruses, algae and protozoan's. Ultra structure of prokaryotic cell – structure and function of bacterial cell wall, plasma membrane, capsule, flagella and endospore. Structure of fungi and yeast cell. Ultra structure of virus – classification of viruses, Life cycle bacteriophages - lytic and lysogenic cycle.</p>	10
II	<p>UNIT-II: Aquatic Microbiology: Microflora of aquatic environment, Different culture techniques. Nutrition and growth of bacteria – different types of media for isolation of bacteria and fungi. Isolation, enumeration, preservation and maintenance of cultures. Routine tests for identification of bacteria – morphological, cultural biochemical and serological. Basics of mycological and virology techniques</p>	15
III	<p>UNIT-III: Fish Microbiology: Perish ability of seafood – Fish as an excellent medium for growth of microorganisms. Spoilage microflora of fish and shellfish. Intrinsic and extrinsic factors affecting spoilage.</p>	10
IV	<p>UNIT-IV:Fishery By-Products: Fish meal, fish protein concentrate, shark fin rays, fish maws, isinglass, fish liver oil, fish body oil, fish hydrolysates, chitin, chitosan, glucosamine hydrochloride, squalene, pearl essence, ambergris, gelatin, beche-de-mer, fish silage, fish ensilage and seaweed products like agar, alginic acid and carrageen.</p>	15
V	<p>UNIT-V: Value Added Products. Value addition in sea food. Different types of value added products from fish and shell fishes – status of value addition in Indian seafood sector. Advantages of value addition. Fish mince and Surimi. Analog and fabricated products. Preparation of coated fishery products. Different types of batter and breading and its applications. Preparation of products viz. fish / prawn pickle, fish wafers, prawn chutney powder, fish soup powder, fish protein hydrolysate, fish stacks, fillets, fish curry, mussel products, marinated products.</p>	10

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Semester –VI

w.e.f. 2021-2022

Time: 3hrs

Model question paper

Title of the paper: Fishery Microbiology and Fishery by-products

Code – AQU-603C

Max.marks: 70

Section – A

Answer any **four** questions. Each question carries **five** marks. **4 x 5= 20.**

Draw neat labeled diagrams wherever necessary.

1. General characteristics of bacteria
2. Plasma membrane
3. Isolation
4. Spoilage microflora of fish
5. Carrageen
6. Isinglass
7. Advantages of value addition.
8. Mussel products

Section – B

Answer any **five** questions. Each question carries **Ten** marks. **5 x 10 =50**

Draw neat labeled diagrams wherever necessary.

9. Describe the Ultra structure of prokaryotic cell?
10. Life cycle of bacteriophages?
11. Different types of media for isolation of bacteria and fungi?
12. Write an essay on preservation and maintenance of cultures.?
13. Intrinsic and extrinsic factors affecting spoilage?
14. Describe the Fishery By-Products?
15. Explain about Value addition in sea food.
16. Different types of batter and breading and its applications?

SEMESTER-VI

Time: 3 hrs

Guide lines to the paper setter

Paper Title:-Fishery Microbiology and Fishery by-products.

Paper Code: AQU-603C

Max.Marks:70

Note:

1. Answer **any four** questions out of eight in Part-A. Each question carries five marks. $4 \times 5 = 20M$.
2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks. $5 \times 10 = 50M$.

	PART	Unit –I	Unit – II	Unit-III	Unit – IV	Unit – V
5 Marks Questions	A	2	2	1	2	1
10 Marks Questions	B	2	2	1	1	2
Weightage		30	30	15	20	25

- Note:**
1. Please provide the scheme of valuation for the paper.
 2. Question paper should be both in English and Telugu media.

AQUACULTURE
PRACTICAL -VI

w.e.f. 2021-2022.
MAX.MARKS : 50.
(2hrs/week)

Code :AQU- 603P

PRACTICAL SYLLABUS

Practical II Title: Fishery Microbiology and Quality Control

Experiments/Activities

1. Sterilization technique- dry heating, autoclaving
2. Media preparation
3. Isolation and maintenance of bacteria from fishes and water.
4. Gram staining of bacteria
- 5.Enumeration of bacteria by TPC method
6. Enumeration of total coli forms.
7. Evaluation of fish / fishery products for organoleptic, chemical and microbial quality

Collection:

1. Collection of fishery by-products.

Text Books:

1. Pelzar, Reid & Chan – Microbiology
2. Prescott, Harley & Klein – Microbiology
3. Adelogerg, Ingra & Wheates – Introduction to Microbial World
4. Windsor and Barlow. Introduction to Fishery Byproducts.
5. CIFT. Proceedings on Summer Institute on Non-traditional Diversified Fish Products &Byproducts.
6. Anon. Productivity in Aquatic Bodies.
7. Chincheste,C.O. and Graham,H.D. Microbial Safety of Fishery Products.
8. Amerine,M.A. and Pangborm,R.M. Principles of Sensory Evaluation of Foods.
9. Connell,J.J. Control of Fish Quality
10. Bigh,E.G. Seafood Science and Technology
11. Gopakumar.K Tropical Fishery Products

Reference Books

1. Kreuzer,R. Fishery Products.
2. Borgstrom,G .Fish as Food
3. Suzuki,T. Fish and Krill Protein: Processing Technology

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521165, KRISHNA Dt., A.P. (AUTONOMOUS)

Practical – VI

Paper Code: AQU-603P

Max. Marks: 25 Model Question Paper (External)

1. Write notes on autoclaving. 5M
2. Write notes on Media preparation any two. 2x2¹/₂=5M
3. Gram staining of bacteria 5M
4. Enumeration of bacteria by TPC method 5M
5. Enumeration of total coli forms. 5M

Total-----25m

**A. G.& S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE,
VUYYURU-521165**

INTERNAL PRACTICAL- VI

(2 hrs/week).

. Code: AQU-603P.

MODEL QUESTION PAPER

Max.marks:25M.

Time: 3hrs

- | | |
|---------------------|------------|
| 1. Attendance | ----- 05M. |
| 2. Record | -----10M. |
| 3. Field note book. | ----- 10M |

Total ----- 25M.

**DUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS SIDDHARTHA
DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165, KRISHNA Dt., A.P.
(AUTONOMOUS).**

NAAC reaccredited at 'A' level
Autonomous –ISO 9001-2015 Certified

Title of the Paper: **Quality Control in Processing Plants**

Course Code	<i>AQU-604C</i>	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-2022	Year of Offering 2021-2022	Year of Revision –	Percentage of Revision:

Objective of the course: The students understand Quality control in processing plants.

Course outcomes:

CO1: Explain the application of fish quality and quality standards.

CO2: To understand the different types of water treatments

CO3: Examine the chemical and microbiological quality of fish and fish products.

CO4: To gain the knowledge on different types of processing plants.

CO5: Review of legislative approaches for the management of food safety

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	UNIT- I: Quality management, total quality concept and application in fish trade. Quality assessment of fish and fishery products - physical, chemical, organoleptic and microbiological. Quality standards. Quality Assurance. Inspection and quality assurance.	10
II	UNIT-II: Fish inspection in India, process; water quality in fishery industry, product quality, water analysis, treatments, chlorination, ozonisation, UV radiation, reverse osmosis, techniques to remove pesticides and heavy metals.	10
III	UNIT-III Sensory evaluation of fish and fish products, basic aspects, different methods of evaluation, taste panel selection & constitution, statistical analysis. Quality problem in fishery products: good manufacturing practices. HACCP and ISO 9000 series of quality assurance system, validation and audit. national and international standards, EU regulation for fish export trade,	15
IV	UNIT-IV: IDP and SAT formations in certification of export worthiness of fish processing units, regulations for fishing vessels pre-processing and processing plants, EU regulations. Factory sanitation and hygiene: National and international requirements, SSOP.	10
V	UNIT-V: Hazards in sea foods: Sea food toxins, biogenic amines, heavy metals and industrial pollutants. Infection and immunity, Microbial food poisoning, bacteria of public health significance in fish /fishery products / environments - Salmonella, Clostridia, Staphylococcus, E. coli, Streptococcus, Vibrio, Aeromonas, Listeria, Yersinia, Bacillus. Laboratory techniques for detection and identification of food poisoning bacteria. Mycotoxins in cured fish, bacterial associated with fish disease.	15

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Krishna Dt. A.P. (Autonomous)**

**Semester –VI
Time: 3hrs**

w.e.f. 2021-2022

Model question paper

Title of the paper:Quality Control in Processing Plants

Code – AQU-604C

Max.marks: 70

Section – A

Answer any **four** questions. Each question carries **five** marks. **4 x 5= 20.**

Draw neat labeled diagrams wherever necessary.

1. Quality standards
2. UV radiation
3. Chlorination,
- 4.Different methods of evaluation
5. Validation and audit
- 6.SSOP
- 7.Mycotoxins in cured fish.
8. Salmonella.

Section – B

Answer any **five** questions. Each question carries **Ten** marks. **5 x 10 =50**

Draw neat labeled diagrams wherever necessary.

9. Describe the total quality concept and application in fish trade?
10. Write an essay on Quality Assurance?
11. Discuss about the techniques to remove pesticides and heavy metals.?
12. Write an essay on Hazard Analysis Critical Control Point (HACCP)?.
13. Explain about good manufacturing practices.?
14. Describe the Factory sanitation and hygiene?
15. Explain about the Microbial food poisoning?
16. Laboratory techniques for detection and identification of food poisoning bacteria?

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SEMESTER-VI

Time: 3 hrs

Guide lines to the paper setter

Paper Title:- Quality Control in Processing Plants

Paper Code: AQU-604C

Max.Marks:70

1. Answer **any four** questions out of eight in Part-A. Each question carries five marks. 4X 5 = 20M
2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks. 5 X 10 =50M

	PAR T	Unit –I	Unit – II	Unit-III	Unit – IV	Unit – V
5 Marks Questions	A	1	2	2	1	2
10 Marks Questions	B	2	1	2	1	2
Weightage		25	20	30	15	30

- Note:**
1. Please provide the scheme of valuation for the paper.
 2. Question paper should be both in English and Telugu media.

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AQUACULTURE

PRACTICAL - X

w.e.f. 2021-2022

Code :AQU- 604P

MAX.MARKS : 50.

(2hrs/week)

PRACTICAL SYLLABUS
Practical III – PROJECT WORK

Reference Books

1. Ellis Harward. 18 Felix S, Riji John K, Prince Jeyaseelan MJ & Sundararaj V. 2001
Bacterial Fish Pathogens (Diseases in Farm and Wild)
2. Fish Disease Diagnosis and Health Management. Fisheries College and Research
Institute, T.N. Veterinary and Animal Sciences University. Thoothukkudi. Inglis V,
Roberts RJ & Bromage NR. 1993