

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE  
(AUTONOMOUS)  
NAAC A GRADE**

**KAKINADA**



**XXI-BOARD OF STUDIES**

**AQUACULTURE TECHNOLOGY  
DEPARTMENT OF ZOOLOGY**

**2020-21**

**(CHOICE BASED CREDIT SYSTEM)**

**P.R.GOV'T.COLLEGE (AUTONOMOUS) KAKINADA.  
2020 -21 XXI BOARD OF STUDIES MEETING.**

**THROUGH ONLINE GOOGLE MEET FROM 10:00 AM TO 11:42**

**P.R.GOV.T.COLLEGE (AUTONOMOUS) KAKINADA.  
2020-21, XXI BOARD OF STUDIES MEETING. Dt 22.06.2020  
DEPARTMENT OF ZOOLOGY**

The members present have discussed the syllabi and model question papers (Theory and Practical) related to I to VI semesters in Zoology and made the following Resolutions.

**Resolution I:** Resolved to Continue CBCS System as instructed by Commissioner of Collegiate Education( CCE ), Amaravathi.

**Resolution II:** Resolved to implement of 60% external and 40% internal marks for both theory and practicals from the academic year 2020-2021 for III and IV semesters along with I and II semesters.

**Resolution III:** Resolved to split 40 marks of theory internal as 20 marks for mid exams and 20 marks for co-curricular activities (seminar/assignment/quiz/group discussion).

**Resolution IV:** Resolved to conduct practical examination also at the end of III and IV semesters along with I and II semesters

**Resolution V:** Resolved to follow AdikaviNanayya University B.Sc Aquaculture UG syllabus for V and VI semesters along with III & IV semesters and B.Voc (professional) syllabus for I&II semesters from 2020-2021 onwards

**Resolution VI:** Resolved to follow the same syllabus and exam pattern for the II & III students (2020-2021)

**Resolution VII:** Resolved to induct apprenticeship programme for final year students in v semester by compressing the syllabus for 2 ½ semesters

**Resolution VIII:** Resolved to continue an elective paper – ornamental fishery in the VI th semester along with cluster papers- (-1-fishery processing technology and -2 fishery micro biology and fishery byproducts and 3- quality control in processing plants,along with project for final yearstudents at the end of VI semester)

**Resolution IX:** Resolved to introduce Question Bank for all the semesters, Module wise- Essay & Short Answer Questions.

**Resolution X:** Resolved to continue the same paper setters and examiners for all the semesters.

**Resolution XII:** Resolved to include Blue Prints for model question papers for all semesters.

**Resolutuon XIII:** Resolved to approve the syllabus with internship programme in the V semester,subjected to the directions of the Commissioner ate of Collegiate Education, AP Vijaywada.

**ResolutionXI:** Resolved to Adapt the guidelines of Authorities with respect reducing approved curriculum to Minimum Course curriculum for all semisters due to Covid Lockdown

**ResolutionX :** Resolved to Adapt Extra Credits for **MOOCS, Arpit** like online courses, Certificate courses as per the Academic Council Decisions and also to adapt I year syllabus intotto as prescribed by the Higher officials

**Chairperson  
Board of Studies**

**P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA  
DEPARTMENT OF ZOOLOGY**

**XXI-BOARD OF STUDIES MEETING 2020-21  
CHOICE BASED CREDIT SYSTEM  
(WITH EFFECTIVE FROM 2018-19)**

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The XXI BOARD OF STUDIES Meeting was done through online and the following members participated and approved the Curriculum.

<b>Sl No</b>	<b>Name and affiliation</b>	<b>Designation</b>	<b>Signature</b>
01	Sri.B.Ahmad Ali Baba Lecturer in-charge Dept of Zoology P R College(Autonomous) KAKINADA.	Chairperson	
02	Dr.K.Ramaneswari Prof. in Zoology Dept. of Zoology AdikaviNannaya University RAJAHMAHENDRAVARM	Vice- Chancellor's Nominee	
03	Dr.M. VijayaSanthi Lecturer in Zoology IDEAL College KAKINADA	Subject Expert	
04	Dr.D.Padmavathi Senior Lecturer in Zoology M.S.N. Degree College KAKINADA	Subject Expert	
	Dr. A.Sreenivasulu Director V.S.Lakshmi Research Centre	Industrialist	

**DEPARTMENT STAFF**

6. Dr. N. Sreenivas Lecturer in Zoology P.R. Govt College (A) Kakinada.	Member
7. P. John Kiran Lecturer in Zoology P.R. Govt College (A) Kakinada.	Member
8. T. Venkateswara Rao Lecturer in Zoology (Contract) P.R. Govt College (A) Kakinada.	Member
9. Sk. Madina Saheb Lecturer in Zoology (Contract) P.R. Govt College (A) Kakinada	Member
10. P. Vijaya Chandrika Lecturer in Zoology (Guest) P.R. Govt College (A) Kakinada	Member
11. Y. Gouthami Lecturer in Zoology (Guest) P.R. Govt College (A) Kakinada	Member
12. V. Praveena Lecturer in Zoology (Guest) P.R. Govt College (A) Kakinada	Member
13. Bhuvan Teja Lecturer in Zoology (Guest) P.R. Govt College (A) Kakinada	Member
14. Padeep Lecturer in Zoology (Guest) P.R. Govt College (A) Kakinada	Member
15. Mallika Lecturer in Zoology (Guest) P.R. Govt College (A) Kakinada	Member

## LIST OF EXAMINERS

### DEPARTMENT OF ZOOLOGY

S.No	Name of the Examiners	Subject	Name of the College
01	Dr. K. BalaJagannadha Rao	Zoology	AMAL College, Anakapally
02	Dr. M. vijayasanthi	Zoology	Ideal college ,kakinada
03	B.VijayaBhaskara Rao	Zoology	AVN College, Vizag
04	Dr.M.Vijaya Kumar	Zoology	GDC (Men), Palakollu
05	Dr. P.Jaya	Zoology	GDC Chodavaram
06	K.Visweswara Rao	Zoology	C.R.R.College (Men) Eluru
07	P.Ramakrishna Prasad	Zoology	C.R.R.College (Men) Eluru
08	K.K.D.M.Lakshmi	Zoology	C.R.R.College (Womens) Eluru
09	Dr.K.Usha Rani	Zoology	D.N.R.College, Bhimavaram
10	Smt.D.Parvathi	Zoology	G.D.College, Ganapavaram
11	N.Suneetha	Zoology	GDC ,Nidadavolu
12	C.Vara Lakshmi	Zoology	M.R.College (W) Vizianagaram
13	M.Rajeswari	Zoology	M.R.College (W) Vizianagaram
14	B.Narayana Rao	Zoology	M.R.College (A) Vizianagaram
15	G.Mani	Zoology	M.R.College (A) Vizianagaram
16	R.Indira	Zoology	St.Theressa College, Eluru
17	V.SuryaKumari	Zoology	M.R.College (A) Vizianagaram
18	R.Prabakara Rao	Zoology	M.R.College, Peddapuram
19	Dr.V. Sandhya	Zoology	GDC, Ganapavaram
20	V.V.Padmavathi	Zoology	St.Theressa College, Eluru

**Lecturer in charge- Dept of Zoology**

***LIST OF QUESTION PAPER SETTERS***

**DEPARTMENT OF ZOOLOGY**

<b>S.N</b>	<b>Name of the Examiners</b>	<b>Subject</b>	<b>Name of the College</b>
01	Dr.K.V.C.S.Appa Rao	Zoology	Y.N.College, Narasapuram
02	Y.V.K.Durgaprasad	Zoology	V.S.K. College , Vizag
03	Dr.k.Narasimhamurthy	Zoology	Pydah fisheries polytechnic college Patavala
04	Dr.K.Usha Rani	Zoology	D.N .R. College, Bhimavaram
05	Mrs, R.KrishnaBharathi	Zoology	S.K.V.T.College, Rajahmundry.
06	A.VenkatapathiRaju	Zoology	S.K.B.R.College, Amalapuram.
07	Dr. Rama Murthy	Zoology	B.V.K.College, Vizag.
08	K.Sathi Reddy	Zoology	Bullayya College, Vizag.
09	K. Chakravarthy	Zoology	DRG Govt. Degree College, Tp.gudem
10	Y.Polinaidu	Zoology	C.R.R.College (A) Eluru
11	K.V.S. Reddy	Zoology	A.N.R. College, Gudivada
12	Dr.V.SuryaKumari	Zoology	M.R.College, Vijayanagaram
13	Dr. K.S.R.Prasada Rao	Zoology	S.N.K.P.&Dr.K.S.Raju College Penugonda
14	Smt.M.Vasanthalakshmi	Zoology	D.R.G.Govt Degree College, Tp.gudem.
15	Dr. P.Jaya	Zoology	GDC Chodavaram
16	Dr.M.Vijaya Kumar	Zoology	GDC (Men), Palakollu
17	N.Suneetha	Zoology	GDC ,Nidadavolu

**Lecturer in charge-Dept of Zoology**

**P R GOVERNMENT COLLEGE (A), KAKINADA**  
**DEPARTMENT OF ZOOLOGY**  
 Compressed syllabus for the embedded courses 2020-202120 (Aquaculture Technology)

## Aquaculture Technology Programme

S.No	CORE SUBJECTS			Marks	Credits
	Semester	Paper	Title		
3	<b>III Semester</b>	III	Fish nutrition & feed technology + 1	100	03
			Practical III	50	02
4		IV	Fish Health Management	100	03
			Practical IV	50	02
5	<b>IV Semester</b>	V	Fresh water & brackish water aquaculture	100	03
			Practical V	50	02
6		VI	Fisheries Extension, economics and marketing	100	03
			Practical VI	50	02
7	<b>V Semester</b>		<b>Apprenticeship</b> (as per the directions of CCE)		
8	<b>VI semester</b>	Elective	Ornamental Fishery	100	03
			Practical VII	50	02
9		Cluster 1A	Fishery Processing technology	100	03
			Practical VIII	50	02
10		Cluster 1B	Fishery microbiology and fishery byproducts	100	03
			Practical IX	50	02
11		Cluster 1C	Quality control in processing plants	100	03
			Project	50	02

**P .R.GOVERNMENT COLLEGE (A), KAKINADA  
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**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2018-2019 onwards)**

**SEMESTER III – PAPER-III**

**TITLE - FISH NUTRITION & FEED TECHNOLOGY**

**UNIT-I: NUTRITIONAL REQUIREMENTS OF CULTIVABLE FISH**

- 1-1 Requirements for energy, proteins, carbohydrates, lipids, fiber, micronutrients for different stages of cultivable fish and prawns
- 1-2 Essential amino acids and fatty acids, protein to energy ratio, nutrient interactions and protein sparing effect
- 1-3 Dietary sources of energy, effect of ration on growth, determination of feeding rate, check tray
- 1-4 Factors affecting energy partitioning and feeding

**UNIT-II: FORMS OF FEEDS & FEEDING METHODS**

- 2-1 Feed conversion efficiency, feed conversion ratio and protein efficiency ratio
- 2-2 Wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets, advantages of pelletization
- 2-3 Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding & tray feeding
- 2-4 Frequency of feeding

**UNIT-III: FEED MANUFACTURE & STORAGE**

- 3-1 Feed ingredients and their selection, nutrient composition and nutrient availability of feed ingredients
- 3-2 Feed formulation – extrusion processing and steam pelleting, grinding, mixing and drying, pelletization, and packing
- 3-3 Water stability of feeds, farm made aqua feeds, micro-coated feeds, micro-encapsulated feeds and micro-bound diets
- 3-4 Microbial, insect and rodent damage of feed, chemical spoilage during storage period and proper storage methods

**UNIT-IV: FEED ADDITIVES & NON-NUTRIENT INGREDIENTS**

- 4-1 Binders, anti-oxidants, probiotics
- 4-2 Feed attractants and feed stimulants
- 4-3 Enzymes, hormones, growth promoters and pigments
- 4-4 Anti-metabolites, aflatoxins and fiber

**UNIT-V: NUTRITIONAL DEFICIENCY IN CULTIVABLE FISH**

- 5-1 Protein deficiency, vitamin and mineral deficiency symptoms
- 5-2 Nutritional pathology and anti-nutrients
- 5-3 Importance of natural and supplementary feeds, balanced diet

**PRESCRIBED BOOK(S):**

1. HALVER JE 1989. Fish nutrition. Academic press, San diego
2. Lovell rt 1998. Nutrition and feeding of fishes, Chapman & Hall, New York



**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)****SEMESTER III – PAPER-1III****TITLE - FISH NUTRITION & FEED TECHNOLOGY  
PRACTICAL SYLLABUS****PRACTICALS: (Any 8 as per the local Industry needs and Requirement)**

1. Estimation of protein content in aquaculture feeds
2. Estimation of carbohydrate content in aquaculture feeds
3. Estimation of lipid content in aquaculture feeds
4. Estimation of ash in aquaculture feed
5. Study of water stability of pellet feeds
6. Feed formulation and preparation in the lab
7. Study of binders used in aquaculture feeds
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

**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**  
**SEMESTER III – PAPER-III**  
**TITLE - FISH NUTRITION & FEED TECHNOLOGY**  
**PRACTICAL MODEL PAPER**

<b>MaxMarks50</b>	<b>Time2hrs</b>
I. Estimate Protein content in aquaculture feeds. Write procedure	10marks
II. Estimate the Ash content in aquaculture feed. Write procedure	10marks
III. Different Feed formulation identification using charts	05marks
IV. Record	05marks
V. Field Notebook	05marks
VI. Internal assessment	15marks
<b>Total</b>	<b>50marks</b>

## **AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

### **SEMESTER III– PAPER-IV FISH HEALTH MANGEMENT**

#### **UNIT I: PATHOLOGY AND PARASITOLOGY**

- 1-1 Introduction to fish diseases –Definition and categories of diseases – Disease and environment
- 1-2 Disturbance in cell structure – changes in cell metabolism, progressive and retrogressive tissue changes, types of degeneration, infiltration, necrosis, cell death and causes
- 1-3 Atrophy, hypertrophy, neoplasms, inflammation, healing and repair

#### **UNIT II: DISEASES OF FIN FISH**

- 2-1 Fungal diseases (both of shell and finfish) – Saprolegniosis, brachiomyxosis, ichthyophthirius diseases – Lagenidium diseases – Fusarium disease, prevention and therapy
- 2-2 Viral diseases – Emerging viral diseases in fish, haemorrhagic septicemia, spring viremia of carps, infectious hematopoietic necrosis in trout, infectious pancreatic necrosis in salmonids, swim-bladder inflammation in cyprinids, channel cat fish viral disease, prevention and therapy
- 2-3 Bacterial diseases – Emerging bacterial diseases, aeromonas, pseudomonas and vibrio infections, columnaris, furunculosis, epizootic ulcerative syndrome, infectious abdominal dropsy, bacterial gill disease, enteric red mouth, bacterial kidney disease.

#### **UNIT III: DISEASES OF SHELL FISH**

- 3-1 Major shrimp viral diseases – Baculovirus penaei, Monodon Baculovirus, Baculovirus midgut necrosis, Infectious hypodermal and haematopoietic necrosis virus, Hepatopancreatic parvo like virus, Yellow head baculovirus, white spot baculovirus.
- 3-2 Bacterial diseases of shell fish – aeromonas, pseudomonas and vibrio infections, luminous bacterial disease, filamentous bacterial disease. Prevention and therapy
- 3-3 Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis. Prevention and therapy

#### **UNIT IV: NUTRITIONAL DISEASES & FISH HEALTH MANAGEMENT**

- 4-1 Nutritional pathology – lipid liver degeneration, Vitamin and mineral deficiency diseases. Aflatoxin and dinoflagellates.
- 4-2 Antibiotic and chemotherapeutics. Nutritional cataract. Genetically and environmentally induced diseases.
- 4-3 Diagnostic tools – immune detection- DNA/RNA techniques, General preventive methods and prophylaxis. Application and development of vaccines, Quarantine methods, Zero water exchange, Use of Probiotics in Aquaculture.

#### **Suggested Reading:**

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 husbandry and medicine. Pergamon Press. Oxford
4. Shankar KM & Mohan CV. 2002. Fish and Shellfish Health Management. UNESCO Publ. Sindermann CJ. 1990
4. Walker P & Subasinghe RP. (Eds.). 2005 Principal Diseases of Marine Fish and

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**II B.Sc., (Fisheries), SEMESTER-III**  
**TITLE: FISH HEALTH MANGEMENT**  
 (WITH EFFECTIVE FROM 2020-2021)  
**COURSE CODE:**  
**MODEL QUESTION PAPER**  
**Time: 2 ½ hrs. Max Marks: 60**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section.**

**3x10 = 30M**

**SECTION- A**

- Define disease? Explain the about the categories of Fishdiseases.
- Write an essay on Bacterial diseases in Carps.
- Write an account of Viral diseases in shrimp and prophylaxis methods.

**SECTION- B**

- Write an essay on the Bacterial diseases in shrimps and preventive methods.
- Describe the nutritional diseases in the fishes.
- Explain about the Use of probiotics in Aquaculture.

**Part – II**

Answer any Six question

**6x5=30M**

- Cell metabolism
- Atrophy and hypertrophy
- Lagenidium diseases
- CCVD
- Ichthyophthiriasis
- Whirling diseases in shrimp
- Preventive methods of prawn protozoan diseases
- Vaccines
- Vitamic C
- Quarantine methods

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**BLUE PRINT**

<b>MODULE NO.</b>	<b>ESSAY QUESTIONS 10 MARKS</b>	<b>SHORT ANSWER QUESTIONS 5 MARKS</b>	<b>MARKS ALLOTTED TO THE UNIT</b>
MODULE – I	01	02	20
MODULE – II	01	02	20
MODULE – III	02	03	35
MODULE – IV	02	03	35
Total no.of Questions	06 Of which 3 to be answered	10 Of which 6 to be answered	110 marks including choice Of which 60 marks to be answered

**Note: The question paper setters are requested to kindly adhere to the format given in the above table.**

## QUESTION BANK

### 10 marks

1. Define disease? Explain the about the categories of Fishdiseases.
2. What is Cell? Explain the types of degenerations of cell.
3. Write an essay on Bacterial diseases in Carps.
4. Explain about the Fungal diseases in Fishes.
5. Describe the viral diseases in Fishes.
6. Write an account of Viral diseases in shrimp and prophylaxis methods.
7. Write an essay on the Bacterial diseases in shrimps and preventive methods.
8. Explain the different types of protozoan diseases in shrimp.
9. Explain about the best preventive methods shrimp diseases management.
10. Describe the nutritional diseases in the fishes.
11. Explain about the Use of probiotics in Aquaculture.
12. Describe the environmentally induced diseases and management practices.

### 5 Marks

1. Cell metabolism
2. Atrophy and hypertrophy
3. Necrosis
4. Cell death
5. Lagenidium diseases
6. CCVD
7. Fusarium
8. Brachiomyxosis
9. Ichthyophthiriasis
10. Whirling diseases in shrimp
11. WSSV
12. Costiasis
13. YHV
14. MBV
15. Preventive methods of prawn protozoan diseases
16. Vaccines
17. Vitamin C
18. Quarantine methods
19. DNA/RNA technique
20. Zero water exchange
21. Aflatoxins
22. Disease causing dinoflagellates

**SEMESTER III– PAPER-IV  
FISH HEALTH MANGEMENT**

**PRACTICALS:**

1. Enumeration of Bacteria by TPC Method
2. Enumeration of total Coliforms
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, hepatopancreas, lymphoid organ, muscles and nerves of prawn and shrimp
6. Collection, processing and analysis of data for epidemiological investigations of viral diseases
7. Bacterial pathogens – isolation, culture and characterization
8. Identification of parasites in fishes: Protozoan, Helminths, 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 shellfish
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

**II B.Sc., (Fisheries), SEMESTER-III  
PRACTICAL MODEL PAPER**

**Max marks: 50**

**Time : 2Hrs**

- |   |                |
|---|----------------|
| 1. Dissect and display the external lesions of fish/prawn. Draw a neat labelled diagram | 10M            |
| 2. Identification of spotters   | 4X5=20M        |
| A)  |                |
| B).   |                |
| C).   |                |
| D)  |                |
| E).   |                |
| 3. Record   | 05M            |
| 4. Continuous Internal Assessment   | 15M            |
| <br>Total   | <br><b>50M</b> |



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**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**SEMESTER IV – PAPER-V**

**TITLE - FRESH WATER & BRACKISHWATER AQUACULTURE**

**UNIT-1: INTRODUCTION TO FRESHWATER AQUACULTURE**

- 1-1.1 Status, scope and prospects of fresh water aquaculture in the world, India and AP
- 1-1.2 Different fresh water aquaculture systems

**UNIT-II: CARP CULTURE**

- 2-1 Major cultivable Indian carps – Labeo, Catla and Cirrhinus & Minor carps
- 2-2 Exotic fish species introduced to India – Tilapia, Pangassius and Clarius sp.
- 2-3 Composite fish culture system of Indian and exotic carps
- 2-4 Impact of exotic fish, Compatibility of Indian and exotic carps and competition among them

**UNIT-III: CULTURE OF AIR-BREATHING AND COLD WATER FISH**

- 3-1 Recent developments in the culture of clarius, anabas, murrels,
- 3-2 Advantages and constraints in the culture of air-breathing and cold water fishes- seed resources, feeding, management and production
- 3-3 Special systems of Aquaculture- brief study of culture in running water, re-circulatory systems, cages and pens, sewage-fed fish culture

**UNIT-IV: CULTURE OF PRAWN**

- 4-1 Fresh water prawns of India - commercial value
- 4-2 *Macrobrachium rosenbergii* and *M. Malcomsonii* – biology, seed production, pond preparation, stocking, management of nursery and grow-out ponds, feeding, morphotypes and harvesting

**UNIT-V: CULTURE OF BRACKISHWATER SPECIES**

- 5-1 Culture of *P. mondon* – Hatchery technology and Culture practices including feed and disease management
- 5-2 Culture of *L. vannamei* – hatchery technology and culture practices including feed and disease management.
- 5-3 Mixed culture of fish and prawns

**PRESCRIBED BOOK(S):**

1. Jhingran VG 1998. Fish and Fisheries of India. Hindusthan Publishing Corporation, New Delhi
2. Sena de Silva, Trevor A and Anderson 1995. Fish nutrition in aquaculture. Chapman & Hall,
3. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.
4. Barrington FJW 1971. Invertebrates: Structure and Function. ELBS
5. Parker F & Haswell 1992. The text book of Zoology, Vol II. Invertebrates

**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**SEMESTER IV – PAPER-IV**

**TITLE - FRESH WATER & BRACKISHWATER AQUACULTURE**

**PRACTICALS SYLLABUS**

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

1. Identification of important cultivable carps
2. Identification of important cultivable air-breathing fishes
3. Identification of important cultivable fresh water prawns
4. Identification of different life history stages of fish
5. Identification of different life history stages of fresh water prawn
6. Collection and study of weed fish
7. Identification of commercially viable crabs – *Scylla cerrata*, *Portunus pelagicus*, *P. sanguinolentus*, *Neptunus pelagicus*, *N. Sanguinolentus*
8. Identification of lobsters – *Panulirus polyphagus*, *P. ornatus*, *P. homarus*, *P. sewelli*, *P. penicillatus*
9. Identification of oysters of nutritional significance – *Crossostrea madrasensis*, *C. gryphoides*, *C. cucullata*, *C. rivularis*, *Picnodonta*
10. Identification of mussels and clams
11. Identification of developmental stages of oysters
12. Field visit to aqua farm and study of different components like dykes etc.

**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**TITLE - FRESH WATER & BRACKISHWATER AQUACULTURE**

**SEMESTER IV – PAPER-IV**

**PRACTICALS MODEL PAPER**

**Max Marks 50**

**Time 2hrs**

- |  |                |
|--|----------------|
| I. Identify the following specimens and write a short notes on their commercial importance | 6x5=30M        |
| a. Carp  |                |
| b. Freshwater prawn  |                |
| c. Stages of prawn   |                |
| d. Crab  |                |
| e. Oysters   |                |
| f. Mussel/clam   |                |
| II. Record   | 05marks        |
| III. Internal assessment   | 15marks        |
| <b>Total</b>   | <b>50marks</b> |

**P .R.GOVERNMENT COLLEGE (A), KAKINADA  
CHOICE BASED CREDIT SYSTEM**

**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**SEMESTER IV – PAPER-VI  
FISHERIES EXTENSION, ECONOMICS & MARKETING**

**UNIT – 1 INTRODUCTION**

- 1-1 Meaning and scope of economics with reference to fisheries
- 1-2 Basic concepts of economics – goods, services, wants and utility, demand and supply, value price, market demand and individual demand, elasticity of demand, law of diminishing marginal utility
- 1-3 Theory of production, production function in fisheries
- 1-4 Various factors influencing the fishery product's price

**UNIT – II FISHERIES MARKETING**

- 2-1 Basic marketing functions, consumer behaviour and demand, fishery market survey and test marketing product
- 2-2 Fish marketing – prices and price determination of fishes
- 2-3 Marketing institutions- primary (producer fishermen, fishermen cooperatives, and fisheries corporations) and secondary (merchant/agent/speculative middlemen)
- 2-4 Methods of economic analysis of business organizations
- 2-5 Preparation of project and project appraisal

**UNIT-III FISHERIES ECONOMICS**

- 3-1 Aquaculture economics- application of economics principles to aquaculture operations
- 3-2 Various inputs and production function. Assumptions of production function in aquaculture analysis, least cost combination of inputs, laws of variable proportions
- 3-3 Cost and earnings of aquaculture systems – carp culture, shrimp farming systems, hatcheries, Cost and earnings of fishing units and freezing plants
- 3-4 Socio-economic conditions of fishermen in Andhra Pradesh, Role of Matsyafed and NABARD in uplifting fishermen's conditions, fishermen cooperatives
- 3-5 Contribution of fisheries to the national economy

**UNIT-IV FISHERIES EXTENSION & TRANSFER OF TECHNOLOGY**

- 4-1 Fisheries extension – scope and objectives, principles and features of fisheries extension Education; Fisheries extension methods and rural development
- 4-2 Adoption and diffusion of innovations; ICAR programs – salient features of ORP, NDS, LLP, IRDP, ITDA, KVK, FFDA, FCS, FTI, TRYSEM
- 4-3 Training – meaning, training vs. education and teaching
- 4-4 DAATT centres and their role in TOT programs, video conferencing, education of farmers through print and electronic media

**PRACTICAL:**

Project work/on-job training at industry

**PRESCRIBED BOOK(S):**

1. Adivi Reddy sv 1997. An introduction to extension education. Oxford & IBHCo.Pvt. Ltd. NewDelhi
2. Jayaraman R 1996. Fisheries Economics. Tamilnadu Veterinary and AnimalScience University.Tuticorn
3. Subba Rao N 1986. Economics of Fisheries. Daya publishing house,Delhi

**REFERENCES:**

1. Dewwett KK and Varma JD 1993. Elementary economic theory. S.chand, NewDelhi
2. Korakandy R 1996. Economics of Fisheries Mangement. Daya Publishing House,Delhi
3. Tripathi SD 1992. Aquaculture Economics. Asian Fisheries Society,Mangalore.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**III B.Sc., (Fisheries), SEMESTER-V**  
**TITLE: FISHERIES EXTENSION, ECONOMICS & MARKETING**  
 (WITH EFFECTIVE FROM 2020-2021)  
**COURSE CODE:**  
**MODEL QUESTION PAPER**  
**Time: 2 ½ hrs. Max Marks: 60**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section.**

**Draw the diagrams wherever necessary**

**3x10 =30M**

**SECTION- A**

1. Explain about the scope of fisheries economics in India.
2. Explain the methods of economic analysis of fishery marketing.
3. How to preparation of project and their appraisals.

**SECTION- B**

4. Explain the Role of NABARD in fisherman cooperatives.
5. Write an account on the economic principles to Aquaculture.
6. Give an account on the ICAR programs.

**Part – II**

Answer any **Six** question

**6x5=30M**

7. Goods and services
8. Law of diminishing
9. Types of economics
10. Market functions
11. Price determination
12. NABARD
13. Fishermen cooperative
14. Fisheries rural development
15. DAAT Centres
16. ORP and NDS

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**BLUE PRINT**

<b>MODULE NO.</b>	<b>ESSAY QUESTIONS 10 MARKS</b>	<b>SHORT ANSWER QUESTIONS 5 MARKS</b>	<b>MARKS ALLOTTED TO THE UNIT</b>
MODULE – I	01	03	25
MODULE – II	02	02	30
MODULE – III	02	02	30
MODULE – IV	01	03	25
Total no.of Questions	06 Of which 3 to be answered	10 Of which 6 to be answered	110 marks including choice Of which 60 marks to be answered

**Note: The question paper setters are requested to kindly adhere to the format given in the above table.**

## Question Bank

10 Marks

1. Explain about the scope of fisheries economics in India.
2. Describe the various factors influencing the fishery products.
3. Explain the basic marketing functions and demand.
4. Give an account on the price determination of fishes.
5. Explain the methods of economic analysis of fishery marketing.
6. How to preparation of project and their appraisals.
7. Explain the Role of NABARD in fisherman cooperatives.
8. Write an account on the economic principles to Aquaculture.
9. Explain the various cost and earning of Aquaculture systems.
10. Explain about the various inputs and production functions.
11. Give an account on the ICAR programs.
12. Describe the fisheries extensions, objectives and their scope.

5 Marks

1. Goods and services
2. Law of diminishing
3. Types of economics
4. Microeconomics
5. Macroeconomics
6. Market functions
7. Price determination
8. Economic analysis
9. Project appraisal
10. Primary producer fishermen
11. Aquaculture economics
12. Aquaculture economic principles
13. Role of Matsyafed
14. NABARD
15. Fishermen cooperative
16. Fisheries National economy
17. Fisheries Extension
18. Fisheries rural development
19. DAATTCentres
20. ORP and NDS
21. FFDA and TRYSEM
22. LLP and IRDP
23. Fisheries Transfer of Technology

**P .R.GOVERNMENT COLLEGE (A), KAKINADA  
CHOICE BASED CREDIT SYSTEM**

**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**SEMESTER VI – ELECTIVE PAPER  
ORNAMENTAL FISHERY**

**UNIT I: INTRODUCTION AND FRESH WATER ORNAMENTAL FISHES**

- 1-1 Aquarium and ornamental fishes – introduction; Present status of Aquarium trade in the world and India
- 1-2 Aquarium accessories – aerators, filters, lighters and heaters; Water quality needs and different kinds of feeds
- 1-3 Live bearers, gold fish, koi, gourami, barbs and tetras, angel fish and cichlid fish
- 1-4 Brood stock development, breeding, larval rearing and growout
- 1-5 Larval feeds and feeding

**UNIT II: MARINE ORNAMENTAL FISHES**

- 2-1 Varieties and habitat of marine ornamental fishes
- 2-2 major marine ornamental fish resources of India
- 2-3 Collection and transportation of live fish, use of anaesthetics
- 2-4 Breeding of marine ornamental fish
- 2-5 Other aquarium animals – sea anemones, lobsters, worms, shrimps, octopus and starfish

**UNIT III: AQUARIUM MANAGEMENT**

- 3-1 Setting up fresh water, marine and reef aquariums
- 3-2 Water quality management for different types of aquariums
- 3-3 Common diseases of aquarium fish, diagnosis and treatment
- 3-4 Temperature acclimatization and oxygen packing for aquarium fish

**UNIT IV: COMMERCIAL PRODUCTION OF AQUARIUM FISH AND PLANTS**

- 4-1 Commercial production units of ornamental fish- requirements and design
- 4-2 Commercial production of goldfish, live bearers, gouramies, barbs, angels and tetras
- 4-3 Mass production of aquarium plants
- 4-4 Retail marketing and export of ornamental fish



**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 livebearers
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 encyclopaedia, Elsevier

**REFERENCES:**

1. Jameson JD and Santhanan 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

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**III B.Sc., (Fisheries), SEMESTER-VI**  
**TITLE: ORNAMENTALFISHERY**  
 (WITH EFFECTIVE FROM 2020-2021)  
**COURSE CODE:**  
**MODEL QUESTION PAPER**  
**Time: 2 ½ hrs. Max Marks: 60**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section. Draw diagrams where ever necessary.**

**SECTION-A**

1. Write an essay on Present status of Aquarium trade in the world and India.
2. Describe the Freshwater brood stock development and their grow out technology.
3. Explain about the major marine ornamental fish resources of India.

**SECTION-B**

4. Describe the transportation of marine ornamental live fish and which techniques were used.
5. Describe the different types of aquarium plants.
6. Define Aquarium? Explain about setting up Aquarium.

**Part – II**

Answer any Six question

**6x5=30M**

7. Livebearers
8. Freshwater ornamental fishes
9. Collection of marine ornamental fishes
10. Breeding of marine ornamental fishes
11. Gouramies
12. Aquarium plants
13. Retail marketing of ornamental fishes
14. Marine other ornamental animals
15. Acclimatization
16. Reef Aquarium

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**BLUE PRINT**

<b>MODULE NO.</b>	<b>ESSAY QUESTIONS 10 MARKS</b>	<b>SHORT ANSWER QUESTIONS 5 MARKS</b>	<b>MARKS ALLOTTED TO THE UNIT</b>
MODULE – I	02	02	30
MODULE – II	02	02	30
MODULE – III	01	03	25
MODULE – IV	01	03	25
Total no.of Questions	06 Of which 3 to be answered	10 Of which 6 to be answered	110 marks including choice Of which 60 marks to be answered

**Note: The question paper setters are requested to kindly adhere to the format given in the above table.**

## Question Bank

### ORNAMENTAL FISHERY

10 Marks

4. Write an essay on Present status of Aquarium trade in the world and India.
5. Describe the Freshwater brood stock development and their grow out technology.
6. Explain about the larval food and feeding in Freshwater ornamental fishes.
7. Give an account on the Aquarium accessories.
8. Explain about the major marine ornamental fish resources of India.
9. Describe the transportation of marine ornamental live fish and which techniques were used.
10. Explain the different types of marine ornamental fishes.
11. Describe the common diseases of Aquarium fishes and diagnosis methods.
12. Define Aquarium? Explain about setting up Aquarium.
13. Explain about the water quality management in Aquarium.
14. Explain about the export of ornamental fishes.
15. Describe the different types of aquarium plants.

5 Marks

1. Livebearers
2. Freshwater ornamental fishes
3. Aquarium feeds
4. Angelfish
5. Brood stock development
6. Collection of marine ornamental fishes
7. Breeding of marine ornamental fishes
8. Marine other ornamental animals
9. Acclimatization
10. Reef Aquarium
11. Fungal diseases of Aquarium fishes
12. Bacterial diseases of Aquarium fishes
13. Production of goldfish
14. Gouramies
15. Aquarium plants
16. Retail marketing of ornamental fishes

**SEMESTER-VI  
PRACTICAL MODEL PAPER**

**Max marks: 50  
Time : 2Hrs**

- |   |     |            |
|---|-----|------------|
| 1. Dissect and display the fish. Draw a neatlabelleddiagram | 10M |            |
| 2. Identificationofspotters                                 |     | 4X5=20M    |
| A)  |     |            |
| B).   |     |            |
| C).   |     |            |
| D)  |     |            |
| E).   |     |            |
| 3. Record   |     | 05M        |
| 4. ContinuousInternalAssessment                             |     | 15M        |
| Total   |     | <b>50M</b> |

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**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**SEMESTER VI – CLUSTER ELECTIVE I A  
FISH PROCESSING TECHNOLOGY**

**Unit 1: Introduction:**

- 1-1 Principles of fish preservation. Importance of hygiene and sanitation in fish handling.
- 1-2 Quality of water and ice in fish handling and processing. Preparation of ice.
- 1-3 Different types of ice used in the seafood industry and their merits.
- 1-4 Preservation by refrigerated seawater and chilled sea water

**Unit 2: Freezing and Canning:**

- 2-1 Fundamental principles involved in chilling and freezing of fish and fishery products.
- 2-2 Various freezing methods. Freezing of shrimps and fishes.
- 2-3 Changes during the cold storage of fish and fishery products. Principles involved in canning of fish.
- 2-4 Different types of containers. Different stages of canning of Tuna. Retortable pouch processing.

**Unit 3: Drying, Smoking and Freeze-drying:**

- 3-1 Principles of smoking, drying and salting of fish, factors affecting drying. Traditional drying / curing methods. Different types of drying.
- 3-2 Drying of fish and prawns. Packing and storage of dried products. Spoilage of dried products.
- 3-3 Preventive measures. Standards for dry fish products. Cold smoking. Principles of freeze drying.
- 3-4 Accelerated freeze drying and packing of freeze dried products. Modern methods of preservation by irradiation and modified atmospheric storage.

**Unit 4: Packing, Cold Storage and Export of Fishery Products:**

- 4-1 Functions of packing. Different types of packing materials and its quality evaluation.
- 4-2 Packing requirements for frozen and cured products. Statutory requirements for packing. Labeling requirements.
- 4-3 Different types of cold storages. Insulated and refrigerated vehicles.
- 4-4 Export of fishery products from India - major countries, important products, export documents and procedures.
- 4-5 Prospects and constraints in export including tariff and non- tariff barriers, marine insurance, export incentives, registered exporters

**Text books:**

1. K.Gopakumar, Fish Processing Technology, ICAR, NewDelhi
2. T.K. Govindan, Fish Processing Technology Oxfor& IBH PublicationCo.
3. K.K. Balachandran Fish Canning – Principles &Practices.
4. Borgstrom,G. Fish asFood.
5. K.K. Balachandran, Postharvest Technology in Fish and Fishery Products. 6.Moorjani,M.V. Fish Processing inIndia.
7. Connell,J.J. Advances in Fishery science andTechnology.
8. CIFT. Manual of Quality Control in Fish and Fishery Products. 9. Gopakumar,K.Fish PackagingTechnology

**Reference Books:**

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

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**III B.Sc., (Fisheries), SEMESTER-VI**  
**TITLE: FISH PROCESSING TECHNOLOGY**  
 (WITH EFFECTIVE FROM 2020-2021)  
**COURSE CODE:**  
**MODEL QUESTION PAPER**  
**Time: 2 ½ hrs. Max Marks: 60**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section. Draw diagrams where ever necessary**

**SECTION-A**

1. Give an account on Principles of fish preservation methods.
2. Describe the various freezing methods.
3. Explain the Modified Atmospheric Storage methods for preservation.

**SECTION-B**

4. Explain the different types of drying methods.
5. Write an essay on export of fishery products from India.
6. Explain about the constraints in export including tariff and non-tariff barriers.

**Part – II**

Answer any Six question

**6x5=30M**

7. Principles of fish preservation
8. Preparation of Ice
9. Types of ice used in the seafood industry
10. Freezing methods
11. Canning
12. Labeling requirements.
13. Fisheries export products
14. Marine insurance
15. Standards for dry fish products
16. Types of cold storage

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**BLUE PRINT**

<b>MODULE NO.</b>	<b>ESSAY QUESTIONS 10 MARKS</b>	<b>SHORT ANSWER QUESTIONS 5 MARKS</b>	<b>MARKS ALLOTTED TO THE UNIT</b>
MODULE – I	01	03	25
MODULE – II	01	02	20
MODULE – III	02	02	30
MODULE – IV	02	03	35
Total no.of Questions	06 Of which 3 to be answered	10 Of which 6 to be answered	110 marks including choice Of which 60 marks to be answered

**Note:** The question paper setters are requested to kindly adhere to the format given in the above table.

## Question Bank

10 Marks

1. Give an account on Principles of fish preservation methods.
2. How to Preservation by refrigerated seawater and chilled seawater.
3. Explain about the fundamental principles involved in chilling and freezing of fish and fishery products.
4. Describe the various freezing methods.
5. Give an account on the accelerated freeze drying and packing dried products.
6. Explain the Modified Atmospheric Storage methods for preservation.
7. Explain the different types of drying methods.
8. Give an account on the spoilage of dried products.
9. Describe the different types of packing materials and its quality measurements.
10. Explain about the different types of cold storages.
11. Write an essay on export of fishery products from India.
12. Explain about the constraints in export including tariff and non-tariff barriers.

5 Marks

1. Principles of fish preservation
2. Preparation of ice
3. Types of ice used in the seafood industry
4. Chilled seawater
5. Refrigerated seawater
6. Freezing methods
7. Canning
8. Retortable pouch processing.
9. Types of fish drying
10. Smoking of Fish
11. Traditional drying methods
12. Spoilage of dried fish products
13. Standards for dry fish products
14. Types of cold storage
15. Types of packing materials
16. Frozen and cured products
17. Statutory requirements for packing.
18. Labeling requirements.
19. Fisheries export products
20. Marine insurance

**P .R.GOVERNMENT COLLEGE (A), KAKINADA  
CHOICE BASED CREDIT SYSTEM**

**AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards)**

**SEMESTER VI – CLUSTER ELECTIVE IB  
FISHERY MICROBIOLOGY AND FISHERY BYPRODUCTS**

**Unit 1: Introduction:**

1-1 History and development of microbiology –Different members of the microbial community – General characteristics of bacteria, fungi, viruses, algae and protozoans.

1-2 Ultrastructure of prokaryotic cell – structure and function of bacterial cell wall, plasma membrane, capsule, flagella and endospore. Structure of fungi and yeast cell.

1-3 Ultrastructure of virus – classification of viruses, Life cycle bacteriophages – lytic and lysogenic cycle.

**Unit 2: Aquatic Microbiology:**

2-1 Microflora of aquatic environment, Different culture techniques.

2-2 Nutrition and growth of bacteria – different types of media for isolation of bacteria and fungi. Isolation, enumeration, preservation and maintenance of cultures.

2-3 Routine tests for identification of bacteria – morphological, cultural biochemical and serological. Basics of mycological and virological techniques.

**Unit 3: Fish Microbiology:**

3-1 Perishability of seafood – Fish as an excellent medium for growth of microorganisms.

3-2 Spoilage microflora of fish and shellfish.

3-3 Intrinsic and extrinsic factors affecting spoilage.

**Unit 4: Fishery By-Products and Value Added Products**

4-1 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 carragenan.

4-2 Advantages of value addition. Fish mince and Surimi. Analog and fabricated products. Preparation of coated fishery products.

4-3 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.

**Text Books:**

1. Pelzar, Reid & Chan – Microbiology
2. Prescott, Harley & Klein –Microbiology
3. Adeloger, 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 Pangborn, 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

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**III B.Sc., (Fisheries), SEMESTER-VI**  
**TITLE: FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**  
 (WITH EFFECTIVE FROM 2020-2021)  
**COURSE CODE:**  
**MODEL QUESTION PAPER**

**Time: 2 ½ hrs. Max Marks: 60**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section. Draw diagrams wherever necessary. **3x10 =30M****

**SECTION- A**

1. Explain about the Ultrastructure of prokaryotic cell.
2. Explain the microflora of aquatic environment.
3. Give an account on different types of media preparation for bacterial culture.

**SECTION- B**

4. Give an account on the preparation of coated fishery products.
5. How to spoilage fish? Explain the spoilage of microflora of fish and shellfish.
6. Explain about the Fishery By-products.

**Part – II**

Answer any **Six** question

**6x5=30M**

7. General characters of Algae
8. Prokaryotics
9. Ultra structure of virus
10. Aquatic environment
11. Identification of Bacteria
12. By-Products
13. Advantages of value addition
14. Pearlessence
15. Fish liveroil
16. Fish fillets

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**BLUE PRINT**

<b>MODULE NO.</b>	<b>ESSAY QUESTIONS 10 MARKS</b>	<b>SHORT ANSWER QUESTIONS 5 MARKS</b>	<b>MARKS ALLOTTED TO THE UNIT</b>
MODULE – I	01	03	25
MODULE – II	02	02	30
MODULE – III	02	02	30
MODULE – IV	01	03	25
Total no.of Questions	06 Of which 3 to be answered	10 Of which 6 to be answered	110 marks including choice Of which 60 marks to be answered

**Note: The question paper setters are requested to kindly adhere to the format given in the above table.**

## Question Bank

### 10 marks

1. Explain about the Ultrastructure of prokaryotic cell.
2. Define microbes? Explain about the different types of microbes.
3. Explain the microflora of aquatic environment.
4. Give an account on different types of media preparation for bacterial culture.
5. How to explain the basics of mycological and virological techniques.
6. Explain about the different types of culture techniques in microbiology.
7. Describe the Fish as an excellent medium for growth of microorganisms.
8. How to spoilage fish? Explain the spoilage of microflora of fish and shellfish.
9. Explain about the Fishery By-products.
10. Describe the fishery value added products.
11. Explain the fish mince and surimi products.
12. Give an account on the preparation of coated fishery products.

### 5 Marks

1. General characters of Algae
2. Prokaryotics
3. Ultra structure of virus
4. Life cycle of bacteriophages
5. Structure of fungi
6. Aquatic environment
7. Identification of Bacteria
8. Perishability of seafood
9. Intrinsic factors
10. Extrinsic factors
11. By-Products
12. Advantages of value addition
13. Seaweed products
14. Chitin and chitosan
15. Pearlessence
16. Fish liver oil
17. Fish fillets

**P .R.GOVERNMENT COLLEGE (A), KAKINADA  
CHOICE BASED CREDIT SYSTEM**

**QUALITY CONTROL IN PROCESSING PLANTS (Effective from 2020-2021 onwards)  
SEMESTER VI - CLUSTER IC**

**Unit I:**

- 1-1 Quality management, total quality concept and application in fishtrade.
- 1-2 Quality assessment of fish and fishery products - physical, chemical, organoleptic and microbiological.
- 1-3 Quality standards. Quality Assurance. Inspection and quality assurance:
- 1-4 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.

**Unit 2:**

- 2-1 Sensory evaluation of fish and fish products, basic aspects, different methods of evaluation, taste panel selection & constitution,
- 2-1 Statistical analysis Quality problem in fishery products: good manufacturing practices.
- 2-3 HACCP and ISO 9000 series of quality assurance system, validation and audit. national and international standards, EU regulation for fish export trade,

**Unit 3:**

- 3-1 IDP and SAT formations in certification of export worthiness of fish processing units, regulations for fishing vessels pre-processing and processing plants, euregulations.
- 3-2 Factory sanitation and hygiene: National and international requirements, SSOP.

**Unit 4:**

- 4-1 Hazards in sea foods: Sea food toxins, biogenic amines, heavy metals and industrial pollutants.
- 4-2 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.
- 4-3 Laboratory techniques for detection and identification of food poisoning bacteria. Mycotoxins in cured fish, bacterial associated with fish disease.

**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.



## 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 byproducts
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

## SEMESTER-VI PRACTICAL MODEL PAPER

**Max marks: 50**

**Time : 2Hrs**

1. Determination of moisture content in fish and fishery products. Draw a neat labelled diagram 10M

2. Identification of spotters

4X5=20M

A)

B).

C).

D)

E).

3. Record

05M

4. Continuous Internal Assessment

15M

Total

**50M**

### Practical II

#### Title : Fishery Microbiology and Quality Control

Experiments/Activities 1. Sterilization technique- dry heating, autoclaving

2. Mediapreparation

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 coliforms.

7. Evaluation of fish/fishery products for organoleptic, chemical and microbial quality

Collection:

1. Collection of fishery by-products

### SEMESTER-VI PRACTICAL MODEL PAPER

**Max marks: 50**

**Time : 2Hrs**

1. Determination of Enumeration of bacteria by TPC method. Draw a neat labelled diagram 10M

2. Identification of spotters

4X5=20M

A)

B).

C).

D)

E).

3. Record

05M

4. Continuous Internal Assessment

15M

Total

**50M**

**Practical III –**

**PROJECT WORK**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**III B.Sc., (Fisheries), SEMESTER-VI**  
**TITLE: QUALITY CONTROL IN PROCESSING PLANTS**  
 (WITH EFFECTIVE FROM 2020-2021)  
**COURSE CODE:**  
**MODEL QUESTION PAPER**  
**Time: 2 ½ hrs. Max Marks: 60**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section. Draw diagrams wherever necessary** **3x10 =30M**

**SECTION- A**

1. Give an account on water quality in fishery industry.
2. Write an essay on quality management application in fish trade.
3. Explain about the sensory evaluation of fish and fish products.

**SECTION- B**

4. Give an account on SSOP.
5. Explain the infection and immunity processes of seafoods.
6. Give an account on Laboratory techniques for detection and identification of bacteria.

**Part – II**

Answer any Six question **6x5=30M**

7. Quality assurance
8. Quality standards
9. Quality assessment of fish products
10. UV radiation
11. Sensory evaluation
12. Aeromonas
13. Listeria
14. Bacillus
15. Industrial pollutants
16. Microbial food poisoning

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**BLUE PRINT**

<b>MODULE NO.</b>	<b>ESSAY QUESTIONS 10 MARKS</b>	<b>SHORT ANSWER QUESTIONS 5 MARKS</b>	<b>MARKS ALLOTTED TO THE UNIT</b>
MODULE – I	02	03	35
MODULE – II	01	02	20
MODULE – III	01	02	20
MODULE – IV	02	03	35
Total no.of Questions	06 Of which 3 to be answered	10 Of which 6 to be answered	110 marks including choice Of which 60 marks to be answered

**Note: The question paper setters are requested to kindly adhere to the format given in the above table.**

## Question Bank

### 10 Marks

1. Explain the Quality assessment of fish and fisheryproducts.
2. Give an account on water quality in fisheryindustry.
3. Write an essay on quality management application in fishtrade.
1. Explain the quality standards of fisheryproducts.
2. Explain the fish inspection inIndia.
3. Explain about the sensory evaluation of fish and fishproducts.
4. Describe the Statistical analysis Quality problem in fisheryproducts.
5. Describe the concept ofHACCP.
6. Explain about the IDP and SAT formations in certification forExport.
7. Give an account onSSOP.
8. Describe the hazards in seafoods.
9. Explain the infection and immunity processes of seafoods.
10. Give an account on Laboratory techniques for detection and identification ofbacteria.

### 5 Marks

1. Qualityassurance
2. Qualitystandards
3. Quality assessment of fishproducts
4. Chlorination
5. UVradiation
6. Sensoryevaluation
7. Different methods ofevaluation
8. HACCP
9. Validation andaudit
10. EUregulation
11. Fish exporttrade
12. IDP andSAT
13. SSOP
14. Sea foodtoxins
15. Industrialpollutants
16. Microbial foodpoisoning
17. Staphylococcus
18. E.coli
19. Aeromonas
20. Listeria
21. Bacillus

**DEPARTMENT OF ZOOLOGY  
BACHELOR OF VOCATIONAL COURSE  
(COMMERCIAL AQUACULTURE)  
LIST OF EXAMINERS**

<b>S.NO.</b>	<b>NAME OF THE EXAMINER</b>	<b>SUBJECT</b>	<b>NAME OF THE COLLEGE/INSTITUTION</b>
01.	R. Indira	Zoology	St. Theresa College, Eluru
02	K. Madhavi Rani	Zoology	St. Theresa College, Eluru
03.	Dr. Ramatheerdham	FDO	SIFT, Jaganaikpur, Kakinada
04	Dr. Chandra Sekhar Reddy	FDO	SIFT, Jaganaikpur, Kakinada
05	Murali Mohan	Senior Technical Officer	CIFE, Kakinda
06	Dr. P. Rami Reddy	Senior Technical Officer	CIFE, Kakinda
07	Dr. P.Jaya	Zoology	Dr. V.S.K. College (A), Visakhapatnam
08	Dr. K. Usharani	Zoology	D.N.R. College, Bheemavaram
09	Smt. M. Vasanthalakshmi	Zoology	D.R.G.Govt. Degree College, Tadepalligudam
10	Dr. K.S.R. Prakasa Rao	Zoology	S.N.K.P. & Dr. K.S. Raju Arts & Science College, Penugonda, W.G.
11	B. Vijayabhaskara Rao	Zoology	A.V.N. College, Visakhapatnam
12	V. Surya Kumari	Zoology	M.R. College (A), Vizianagaram

Lecturer in Incharge  
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**P.R. GOVT. COLLEGE (A)**  
**DEPT. OF ZOOLOGY**  
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**(COMMERCIAL AQUACULTURE)**  
**QUESTION PAPER SETTERS**

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