PITHAPUR RAJAH'SGOVERNMENT COLLEGE (AUTONOMOUS) NAAC "A" GRADE

KAKINADA

XXII–BOARD OF STUDIES

AQUACULTURE TECHNOLOGY

DEPARTMENT OF

Zoology and Aquaculture

2021-22

(CHOICE BASED CREDIT SYSTEM)

P.R.GOVT.COLLEGE (AUTONOMOUS) KAKINADA.
2021 -22 XXII BOARD OF STUDIES MEETING.

P.R.GOVT.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 for the II and III year students and to introduce new syllabus framed by APSCHE Aquaculture Technology under CBCS 2020-21Market oriented course for the FIRST YEAR STUDENTS from 2020-2021 batch onwards.

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 Dept. of Zoology

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

XXI-BOARD OF STUDIES MEETING 2020-21
CHOICE BASED CREDIT SYSTEM (WITH EFFECTIVE FROM2018-19)

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

Sl No	Name and affiliation	Designation	Signature
01	B.Chakravarthi Lecturer in-charge Dept of zoology P.R.Govt College (A) Kakinada.	Lecture in-charge	
02	Dr.K. Ramesh Babu Prof. in Zoology Dept. of Zoology Andhra University Visakhapatnam	Vice-Chancellor's Nominee	
03	Dr. K. Ramaneswai Prof. in Zoology Adikavi Nannayya University Rajamahendravaram	Subject Expert	
04	Dr.P.John Kiran Assistant Professor in Zoology GDC, Perumallapuram	Subject Expert	
05	K.Narasimha Murthy	Industrial Nominee	

DEPARTMENTAL STAFF	MEMBER
1. B.Chakravarthi Lecturer in-Charge Dept.of Zoology P.R.Govt College (A) Kakinada	Member& Lecture in-Charge
2. Dr. N. Srinivas Lecturer in zoology P.R.Govt College (A) Kakinada	Member
3. B.Ahmad Ali Baba Lecturer in zoology P.R.Govt College (A) Kakinada	Member
4. Dr.P. Kiran Kumar Lecturer in Zoology P.G Co-ordinator P.R.Govt College (A) Kakinada	Member& P.G Co-ordinator
5. B. Elia Lecturer in Zoology P.R.Govt College (A) Kakinada	Member
6. SK. Madina Saheb Lecturer in Zoology (Contract) P.R.Govt College (A) Kakinada	Member
7. P.Vijaya Chandrika Lecturer in Zoology (Guest) P.R.Govt College (A) Kakinada	Member
8. B.Devi Lecturer in Zoology (Guest) P.R.Govt College (A) Kakinada	Member
9. Y.Gowthami Lecturer in Zoology (Guest) P.R.Govt College (A) Kakinada	Member
10. I.Santhi Grace Lecturer in Zoology (Guest)	Member

P.R.Govt College (A)
Kakinada

11. G. Bhuvan Teja — Member
    Lecturer in Zoology(Guest)
    P.R.Govt College (A)
    Kakinada

12. K.Anusha — Member
    Lecturer in Zoology(Guest)
    P.R.Govt College (A)
    Kakinada

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS) KAKINADA
DEPARTMENT OF ZOOLOGY AND AQUACULTURE

LIST OF EXAMINERS

S.No	Name of the Examiners	Subject	Name of the College
01	Prof. G. Mani	Zoology	GDC (M), Srikakulam
02	D. K. Rama Rao	Zoology	VSK College , Vizag
03	Dr. R. Ramachandra Rao	Zoology	GDC, Rajam
04	K. Sujatha	Zoology	GDC (W),Srikakulam
05	N. Suneetha	Zoology	SRR&CVR GDC (A)
06	M. Vijaya Kumar	Zoology	SRR&CVR GDC (A)
07	Dr. G Vijaya Prathap	Zoology	GDC ,Yalamanchala
08	A. Arjuna apparao	Zoology	GDC ,Yalamanchala
09	Dr. Samuel Devid Raj	Zoology	Dr. VSK GDC (A)
10	Dr. R. Praveen Dathu	Zoology	GDC ,Thiruvuru
11	Dr. V. Sandhya	Zoology	GDC,kaikaluru
12	Dr.Y.PoliNaidu	Zoology	GDC,Srikakulam
13	Dr.P.JohnKiran	Zoology	GDC Perumallapuram
14	Dr.P Jaya	Zoology	Dr. V. S. K(A) Vizag
15	Dr. P. R Vani	Zoology	Dr.V.S.K(A)Vizag
16	Smt. M. Vasantha Lakshmi	Zoology	ASD Women's(A) Kakinada
17	Dr. G. Sithamma	Zoology	Dr. KV R (W),Karnool
18	M.Himasridevi	Zoology	SKRCollege(W),Rajahmandry
19	Dr.P.S.C.H.PDeepikaRani	Zoology	SKRCollege(W),Rajahmandri
20	M.Kasma	Zoology	SKRCollege(W),Rajahmandri

Lecturer in charge-PG Dept of Zoology

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS) KAKINADA
DEPARTMENT OF ZOOLOGY AND AQUACULTURE

LIST OF QUESTION PAPER SETTERS

DEPARTMENT OF ZOOLOGY

S.N	Name of the Examiners	Subject	Name of the College
01	Dr.Samuel Devid Raj	Zoology	V.S.K. College(A) , Vizag
02	Dr.P.R Vani	Zoology	V.S.K. College(A) , Vizag
03	Dr.Y. Poli Naidu	Zoology	GDC, Srikakulam
04	Dr. P. John Kiran	Zoology	GDC, Perumallapuram
05	Smt. M. Vasantha Lakshmi	Zoology	A.S.D Women's College (A)
06	Dr. P Jaya	Zoology	Dr. VSK College(A), Vizag.
07	Dr. G. Mani	Zoology	GDC (M) Srikakulam
08	D. K. Rama Rao	Zoology	Dr. VSK (A) Vizag
09	P.S.C.H.P Deepika Rani	Zoology	SKRCollege(W),Rajahmandri
10	Dr. G Vijaya Prathap	Zoology	GDC,Yalamanchala
11	A. Arjun Apparao	Zoology	GDC,Yalamanchala
12	Dr. Praveen Dathu	Zoology	GDC,Thiruvuru
13	Dr. V Sandhya	Zoology	GDC,kaikaluru
14	Dr.G.Sithamma	Zoology	GDC,Thiruvuru

Lecturer in charge-PG Dept of Zoology

P R GOVERNMENT COLLEGE (A),
KAKINADA DEPARTMENT OF ZOOLOGY

Compressed syllabus for the embedded courses 2021-22 (Aquaculture Technology)

Aquaculture Technology Programme

S.No	CORE SUBJECTS			Marks	Credits
	Semester	Paper	Title		
1	I Semister APSCHE Syllabus	I	BASIC PRINCIPLES OF AQUACULTURE	100	03
			Practical I	50	02
2	II Semister APSCHE Syllabus	II	BIOLOGY OF FIN FISH & SHELL FISH	100	03
			Practical II	50	02
	OLD PATTERN				
3	**III Semester**	III	Fish nutrition & feed technology + 1	100	03
			Practical III	50	02
4		IV	Fish Health Management	100	03
			Practical IV	50	02
5	**IV Semester**	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	**V Semester**		Apprenticeship (as per the directions of CCE)		
8	**VI semester**	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
DEPARTMENT OF ZOOLOGY & AQUACULTURE

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

AQUACULTURE TECHNOLOGY MARKET ORIENTED COURSE SYLLABUS

SEMESTER - I – PAPER-1

BASIC PRINCIPLES OF AQUACULTURE

Course Outcomes: By the completion of the course the graduate should able to –

CO1: Describe the concept of blue revolution and different aqua culture systems
CO2: Explain the pond ecosystem
CO3: Describe the different types of fish ponds
CO4: Explain the steps of pond preparation
CO5: Describe the pond management practices

Learning objectives

1. To understand the concept of blue revolution and different aqua culture systems .
2. To understand the pond ecosystem .
3. To understand the different types of fish ponds.
4. To understand steps of pond preparation.
5. To understand the pond management practices

P .R.GOVERNMENT COLLEGE (A) KAKINADA
DEPARTMENT OF ZOOLOGY & AQUACULTURE

AQUACULTURE TECHNOLOGY COURSE SYLLABUS

SEMESTER - I – PAPER-I

BASIC PRINCIPLES OF AQUACULTURE

UNIT-I: INTRODUCTION

1-1 Concept of Blue Revolution - History and definition of Aquaculture
1.2 Scope of Aquaculture at global Level, India and Andhra Pradesh
1.3 Different Aquaculture systems – Pond, Cage, Pen, Running water, Extensive, Intensive and & Semi-Intensive Systems and their significance.
1.4 Monoculture, Polyculture and Monosex culture systems

UNIT-II: POND ECOSYSTEM

2.1 General Concepts of Ecology, Carrying Capacity and Food Chains
2.2 Lotic and lentic systems, streams and springs
2.3 Nutrient Cycles in Culture Ponds – Phosphorus, Carbon and Nitrogen
Importance of Plankton and Benthos in culture ponds, and algal blooms
2.4 Concepts of Productivity

UNIT-III: TYPES OF FISH PONDS and CONSTRUCTION

3.1 Functional classification of ponds - head pond, hatchery, nursery ponds rearing, production, stocking and quarantine ponds
3.2 Fish Hatchery design
3.3 Important factors in the construction of an ideal fish pond – site selection, nature of the soil, water resources, topography. Lay out and arrangements

UNIT- IV: POND PREPARATION AND MANAGEMENT

4.1 Pond preparation for stocking, Need of fertilizer and manure application in culture ponds
4.2 Physico-chemical conditions of soil and water optimum for culture –temperature, depth, turbidity, light, water and shore currents, PH, DOD, CO_2 and nutrients; measures to increase oxygen and reduce ammonia & hydrogen sulphide in culture ponds; correction of PH
4.3 Eradication of predators and weed control – weed plants in culture ponds,
aquatic weeds, weed fish, toxins used for weed control and control of predators

P.R.GOVERNMENT COLLEGE (A),
KAKINADA I B.Sc., (Fisheries),
SEMESTER-I

TITLE: BASIC PRINCIPLES OF AQUACULTURE
(WITH EFFECTIVE FROM 2020-2021)
MODEL QUESTION PAPER

Time: 2 ½ hrs. **Max Marks: 60**

SECTION –I

Answer any SIX of the following **6x5 = 30Marks**

(Draw labelled diagrams wherever necessary)

1. Scope of aquaculture at global level
2. Extensive farming
3. Lotic and lentic systems
4. Concepts of productivity
5. Site selection
6. Nursery ponds
7. Aquatic weeds and their control
8. Eradication of predators and weed control

SECTION –II

Answer Any THREE of the following each question carries 10 marks 3x10=30 Marks

(Draw diagrams wherever necessary)

9. Write an essay on Concept of blue revolution
10. Write an essay on General concepts of Ecology
11. Write an essay on Construction of an ideal fish pond
12. Write an essay on Physico-chemical conditions of soil and water in pond

BLUE PRINT

MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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

- **ESSAYS**

1. 1.Concept of blue revolution
2. 2. Scope of aqua culture at global level
3. Different aqua culture systems
4. Poly culture
5. General concepts of ecology
6. Nutrient cycles in culture ponds
7. Concepts of productivity
8. Classification of ponds
9. Construction of an ideal pond
10. Fish hatchery design
11. Pond preparation for stocking
12. Physico chemical conditions of soil and water optimum for culture
13. .Eradication of predators and weed control
14. Measures to increase oxygen and reduce ammonia and hydrogen sulphide in culture ponds

SHORTS

15. Difination of aquaculture
16. Aqua culture in AP state
17. Extensive ,Intensive,semi intensive
18. Poly culture and monosex culture
19. Pond cage and pen culture
20. Carrying capacity and food chain
21. Lentic systems
22. Carbon and nitrogen cycles
23. Algal blooms and culture ponds
24. Importance of planktons and bethos
25. Classification of ponds
26. Nursery ponds rareing
27. Site selection and water resources
28. Quarantine pons
29. Need of fertilizer and manure applications
30. PH,BOD,COD
31. Aquatic weeds
32. Toxins used for weed control
33. Control of predators
34. Weed plants and culture ponds

SEMESTER - I – PAPER-1
BASIC PRINCIPLES OF AQUACULTURE

PRACTICALS: (Any 8 of the following)

1. Estimation of Carbonates, Bicarbonates in water samples
2. Estimation of Chlorides in water samples
3. Estimation of dissolved oxygen
4. Estimation of ammonia in water
5. Field visit to nursery, rearing and stocking ponds of aqua farms or hatchery
6. Field visit to Study of algal blooms and their control
7. Collection & identification of zooplankton and phytoplankton (6 each)
8. Study of aeration devices
9. Determination of soil nitrogen and phosphorus
10. Collection and study of aquatic weeds (Any Five)

PRESCRIBED BOOK(S):

1. Jhingran VG 1998. Fish and Fisheries of India. Hindusthan Publishing Corporation, New Delhi
2. Pillay TVR, 1996. Aquaculture Principles and Practices, Fishing News Books Ltd., London

REFERENCES:

1. Pillay TVR & M.A.Dill, 1979. Advances in Aquaculture. Fishing News Books Ltd., London
2. Stickney RR 1979. Principles of Warm Water Aquaculture. John Wiley & Sons Inc. 1981
3. Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsivier Scientific Publishing Company.
4. Bose AN et.al., 1991. Costal Aquaculture Engineering. Oxford & IBH Publishing Company Pvt.Ltd.

SEMESTER - I – PAPER-I

BASIC PRINCIPLES OF AQUACULTURE

PRACTICAL MODEL QUESTION PAPER

MaxMarks50 **Time2hrs**

I.	Estimate carbonate levels in given water samples.	10marks
II.	Identification of given spotters a) Zooplankton b) Phytoplankton c) Aquatic weeds d) Aeration device	20marks
III.	Record	05marks
IV.	Field Notebook	05marks
V.	Internal Assessment	10marks
Total		**50marks**

P.R.GOVERNMENT COLLEGE (A), KAKINADA I B.Sc., (Fisheries),

SEMESTER – II PAPER-II

BIOLOGY OF FIN FISH & SHELL FISH

Course Outcomes: By the completion of the course the graduate should able to –

CO1: Describe the general characters and classification of cultivable fishes

CO2: Explain the food, feeding and growth of fish

CO3: Describe the reproductive biology of fishes

CO4: Explain the parental care and development of fishes

CO5: Describe the parental care and development of fishes

Learning objectives

1. To understand the general characters and classification of cultivable fishes .

2. To understand the food, feeding and growth of fish.

3. To understand the reproductive biology of fishes.

4. To understand the parental care and development of fishes.

5. To understand the parental care and development of fishes

SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH

UNIT-I: GENERAL CHARACTERS & CLASSIFICATION OF CULTIVABLE FIN & SHELL FISH

1.1 General Characters and classification of fishes, crustaceans and molluscs up to the level of Class
1.2Fish, Crustaceans and Molluscs of commercial importance
1.3. Buoyancy in fishes- swim bladder and mechanism of gas secretion

UNIT-II: FOOD, FEEDING AND GROWTH

2.1. Natural fish food, feeding habits, gut content analysis, structural modifications in relation to feeding habits, forage ratio and food selectivity index
2.2 Principles of Age and growth determination; Growth rate measurement – scale method, otolith method, skeletal parts as age indicators
2.3 Genetic, biotic & ecological factors in determining the longevity of fishes, length- frequency method, age composition, age-length keys, absolute and specific growth, annual survival rate, Length-weight relationship, condition factor/Ponderal index, relative condition factor

UNIT-III: REPRODUCTIVE BIOLOGY

3.1 Breeding in fishes, breeding places, breeding habits & places, courtship and reproductive cycles
3.2 Induced breeding in fishes
3.3 Breeding in shrimp, pearl oyster, pila, and cephalopods
3.4 Parental care in fishes, ovo-viviparity, oviparity, viviparity, nest building and brooding, Embryonic and larval development of fishes and Shrimp.

UNIT – IV: DEVELOPMENT, HORMONES AND GROWTH

4.1 Environmental factors affecting reproduction and development of cultivable aquatic fin & shell fish
4.2 Endocrine system in fishes - Neurosecretary cells, androgenic gland, ovary,
4.3 Y-organ, chromatophores, pericardial glands and cuticle.
4.4 Molting, molting stages, metamorphosis in crustacean shell fish

Paper II - BIOLOGY OF FIN FISH & SHELL FISH
MODEL QUESTION PAPER

Time: 2 ½ hrs. **Max Marks: 60**

SECTION –I

Answer any SIX of the following 6x5 = 30 Marks
(Draw labelled diagrams wherever necessary)

1. Commercial importance of mollucs
2. Buoyancy in fishes
3. Gut content analysis
4. Length frequency method
5. Breeding habits in fishes
6. Ovo-viviparity, oviparity and viviparity
7. Y- organ and Chromatophores
8. Molting and molting stages

SECTION –II

Answer any THREE the questions each question carries 10 marks 3x10=30 Marks
(Draw diagrams wherever necessary)

9. Write an essay on General characters of fish
10. Write an essay on Principles of age determination and growth
11. Write an essay on Induced breeding in fishes
12. Write an essay on Endrocrine system in fishes

BLUE PRINT

MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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

QUESTION BANK

ESSAYS

1.Classification fishes and shell fish
2.General characters of shell fish
3.Commercial importance of shell fish
4.Buoyacy in fishes
5.Natural fish feed and feeding habits
6.Structure and modifications in relation to feeding
7.Age and growth determination
8.Length frequency method
9.Length weight relationship
10.Ecological factors in longevity of fishes
11.Breeding in fishes
12.Breeding places and breeding habits
13.Reproductive cycles
14.Parental care in fishes
15.Endocrine system in fishes
16.Reproduction and development of cultivable fish and shell fish
17.Metamorposiss in crustaceans
18.Molting and molting stages
19.Environmental factors effective reproduction.
20.Chromatophores and pericardial glands .

SHOTS

1.General characters of shell fish
2.Commercial importance of fish
3. Classification shell fish
4.Mechonism of gas secretion
5.Gut content analysis
6.Structural modifications in fishes
7.Growth rate measurement
8.Scale method and otolith method as age indicators
9.Age composition and age length keys
10.Anual survival rate
11.Length frequency method
12.Breeding in fishes
13.Breeding places and breeding habits
14. Reproductive cycles
15.Breeding in shrimp /perl oyster
16.ovo – viviparity , voviparity and oviparity
17.next building brooding
18.Y – Organ and chromatophores
19.Moulting and stages
20.Neuro secretory cells androgenic gland and ovary

SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH

PRACTICALS:

1. Study of mouth parts in herbivorous 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
6. Study of eggs of fishes, shrimps, prawns
7. Study of oyster eggs
8. Embryonic and larval development of fish
9. Observation of crustacean larvae
10. Study of nest building and brooding of fishes

PRESCRIBED BOOK(S):

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

REFERENCES:

1. Tandon KK & Johal MS 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing House, New Delhi.
2. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
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, VolI. Invertebrates (eds. Marshal AJ & Williams). ELBS & Mc Millan & Co.

SEMESTER – II PAPER-II
BIOLOGY OF FIN FISH & SHELL FISH

PRACTICAL MODAL PAPER

I.	Gut content analysis in fishes	10marks
II.	Identification of spotters	5X4 = 20marks
	A Crustacean of larva	
	B. Study of eggs (Oyster)	
	C. Study of eggs (fish)	
	D. Appendages of shrimp	
III.	Record	5marks
IV.	Internal assessment	15marks

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

AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2018-2019 onwards) SEMESTER III – PAPER-1II

TITLE - FISH NUTRITION & FEED TECHNOLOGY

UNIT-I: NUTRITIONAL REQUIREMENTS OF CULTIVABLE FISH

1-1 Requirements for energy, proteins, carbohydrates, lipids, fiber, micronutrientsfor different stages of cultivable fish andprawns

1-2 Essential aminoacids and fatty acids, protein t0 energy ratio, nutrient interactionsand protein sparingeffect

1-3 Dietary sources of energy, effect of ration on growth, determination of feedingrate, check tray

1-4 Factors affecting energy partitioning andfeeding

UNIT-II: FORMS OF FEEDS & FEEDING METHODS

2-1 Fed conversion efficiency, feed conversion ratio and protein efficiencyratio

2-2 Wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets, advantages ofpelletization

2-3 Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding & tray feeding

2-4 Frequency offeeding

UNIT-III: FEED MANUFACTURE & STORAGE

3-1 Feed ingredients and their selection, nutrient composition and nutrient availability offeed ingredients

3-2 Feed formulation – extrusion processing and steam pelleting, grinding, mixing and drying, pelletization, andpacking

3-3 Water stability of feeds, farm made aqua feeds, micro-coated feeds, micro-encapsulated feeds and micro-bounddiets

3-4 Microbial, insect and rodent damage of feed, chemical spoilage during storage period and proper storagemethods

UNIT-IV: FEED ADDITIVES & NON-NUTRIENT INGREDIENTS

4-1 Binders, anti-oxidants,probiotics

4-2 Feed attractants and feedstimulants

4-3 Enzymes, hormones, growth promoters and pigments

4-4 Anti-metabolites, afflatoxins andfiber

PRESCRIBED BOOK(S):

1. HALVER JE 1989. Fish nutrition. Academic press, San diego

2. Lovell rt 1998. Nutrition and feeding of fishes, Chapmann& Hall, NewYork

3. Sena de silva, trevor a anderson 1995. Fish nutrition in aquaculture**.** Chapmann&Hall,

4. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology andManagement.

5. Jhingran VG 1998. Fish and Fisheries of India. Hindusthan Publishing Corporation, NewDelhi

AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards) SEMESTER III – PAPER-III

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 aquaculturefeeds
3. Estimation of lipid content in aquaculture feeds
4. Estimation of ash in aquaculturefeed
5. Study of water stability of pelletfeeds
6. Feed formulation and preparation in thelab
7. Study of binders used in aquaculturefeeds
8. Study of feed packingmaterials
9. Study of physical and chemical change duringstorage
10. Study on physical characteristics of floating and sinkingfeeds
11. Visit to a aqua-feed productionunit
12. Visit to a farm for studying feedingpractices

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

MaxMarks50 **Time2hrs**

I	Estimate Protein content in aquaculture feeds.Writeprocedure	10marks
Estimate the Ash content in aquaculture feed.Writeprocedure		10marks
VI.	Different Feed formulation identificationusingcharts	05marks
VII.	Record	05marks
VIII.	FieldNotebook	05marks
IX.	Internalassessment	15marks
Total		**50marks**

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 andretrogressive tissue changes, types of degeneration, infiltration, necrosis, cell death andcauses

1-3 Atrophy, hypertrophy, neoplasms, inflammation, healing andrepair

UNIT II: DISEASES OF FIN FISH

2-1 Fungal diseases (both of shell and finfish) – Saprolegniosis, brachiomycosis, ichthyophorus diseases – Lagenidium diseases – Fusarium disease, prevention andtherapy

2-2 Viral diseases – Emerging viral diseases in fish, haemorrhagicscepticemia,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 Baterial diseases – Emerging bacterial diseases, aermonas, pseudomonas and vibrio infections, columnaris, furunculosis, epizootic ulcerative syndrome, infectiousabdominal dropsy, bacterial gill disease, enteric red mouth, bacterial kidneydisease.

UNIT III: DISEASES OF SHELL FISH

3-1 Major shrimp viral diseases – Bacculoviruspenaeii, MonodonBacculovirus, Bacculoviralmidgut necrosis, Infectious hypodermal and haematopoietic necrosisvirus, Hepatopancreaticparvo like virus, Yellow head bacculovirus, white spotbacculovirus.

3-2 Bacterial diseases of shell fish – aeromonas, pseudomonas and vibrio infections, luminous bacterial disease, filamentous bacterial disease. Prevention andtherapy

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 anddinoflagellates.

4-2 Antibiotic and chemotherapeutics. Nutritional cataract. Genetically and environmentally induceddiseases.

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 inAquaculture.

Suggested Reading:

1. Shaperclaus W. 1991 Fish Diseases- Vol.I& II. Oxonian PressPvt.ltd
2. Roberts RJ 1989. Fish pathology. BailliereTindall, NewYork
3. Lydia Brown 1993. Aquaculture for veterinarians- fish husbandray 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 Shellfish. Vols. I, II. 2nd Ed. AcademicPress

P.R.GOVERNMENT COLLEGE (A),

II B.Sc., (Fisheries), SEMESTER-III

TITLE: FISH HEALTH MANGEMENT

(WITH EFFECTIVE FROM 2020-2021)

MODEL QUESTION PAPER

Time: 2 ½ hrs. **Max Marks: 60**

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 inCarps.
- Write an account of Viral diseases in shrimp and prophylaxismethods.

SECTION- B

- Write an essay on the Bacterial diseases in shrimps and preventivemethods.
- Describe the nutritional diseases in thefishes.
- Explain about the Use of probiotics inAquaculture.

Part – II

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

- Cellmetabolism
- Atrophy andhypertrophy
- Lagenidiumdiseases
- CCVD
- Ichthyophthiriasis
- Whirling diseases inshrimp
- Preventive methods of prawn protozoandiseases
- Vaccines
- VitamicC
- Quarantinemethods

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BLUE PRINT

MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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 ofcell.
3. Write an essay on Bacterial diseases inCarps.
4. Explain about the Fungal diseases inFishes.
5. Describe the vial diseases inFishes.
6. Write an account of Viral diseases in shrimp and prophylaxismethods.
7. Write an essay on the Bacterial diseases in shrimps and preventivemethods.
8. Explain the different types of proteozoan diseases inshimp.
9. Explain about the best preventive methods shrimp diseasesmanagement.
10. Describe the nutritional diseases in thefishes.
11. Explain about the Use of probiotics inAquaculture.
12. Describe the environmentally induced diseases and managementpractices.

5 Marks

1. Cell metabolism
2. Atrophy andhypertrophy
3. Necosis
4. Celldeath
5. Lagenidiumdiseases
6. CCVD
7. Fusarium
8. Brachiomycosis
9. Ichthyophthiriasis
10. Whirling diseases inshrimp
11. WSSV
12. Costiasis
13. YHV
14. MBV
15. Preventive methods of prawn protozoandiseases
16. Vaccines
17. VitamicC
18. Quarantinemethods
19. DNA/RNAtechnic
20. Zero waterExchange
21. Aflotoxins
22. Disease causingdinoflagellates

PRACTICALS
SEMESTER III– PAPER-IV
FISH HEALTH MANGEMENT

1. Enumeration of Bacteria by TPCMethod
2. Enumeration of totalColiforms
3. Observation of gross pathology and external lesions of fish and prawn with reference to the common diseases inaquaculture
4. Examination of pathological changes in gills and gut lumen, lymphoid organ,muscles and nerves offish
5. Examination of pathological changes in gut lumen, hepatopncreas, lymphoidorgan, muscles and nerves of prawn andshrimp
6. Collection, processing and analysis of data for epedemeiological investigations ofviral diseases
7. Bacterial pathogens – isolation, culture andcharacterization
8. Identification of parasites in fishes: Protozoan, Helmiths,Crustaceans
9. Antibiograms – preparation andevaluation
10. Molecular and immunological techniques; Biochemical tests; PCR; ELISA; Agglutination test; Challenge tests; Purification of virus for development ofvaccines (Demonstration atinstitutes/labs)
11. Estimation of dose, calculation of concentration, methods of administration ofvarious chemotherapeutics to fish and shellfish
12. Estimation of antibiotics used in aquaculturepractices
13. Estimation of probiotics used inaquaculture
14. Field visit to farm for health monitoring and diseasediagnosis

SEMESTER-III PRACTICAL MODEL PAPER

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

1. Dissect and display the external lesions of fish/prawn. Draw a neat labelled diagram10M
2. Identificationofspotters 4X5=20M
   - A)
   - B)
   - C)
   - D)
   - E)
3. Record 05M
4. ContinuousInternalAssessment 15M

Total **50M**

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

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 andproduction

3-3 Special systems of Aquaculture- brief study of culture in running water, re-circulatory systems, cages and pens, sewage-fed fishculture

UNIT-IV: CULTURE OF PRAWN

4-1 Fresh water prawns of India - commercial value

4-2 *Macrobrachiumrosenbergii*and *M. Malcomsonii*– biology, seed production, pond preparation, stocking, management of nursery and grow-out ponds, feeding, morphotypes andharvesting

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 andprawns

PRESCRIBED BOOK(S):

1. Jhingran VG 1998. Fish and Fisheries of India. Hindusthan Publishing Corporation, New Delhi 2.Sena de silva, trevor a anderson 1995. Fish nutrition in aquaculture**.** Chapmann& Hall,

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, VolI.Invertebrates

AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards) SEMESTER IV – PAPER-1V

TITLE - FRESH WATER & BRACKISHWATER AQUACULTURE

PRACTICALS SYLLABUS

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

1. Identification of important cultivablecarps
2. Identification of important cultivable air-breathingfishes
3. Identification of important cultivable fresh waterprawns
4. Identification of different life history stages offish
5. Identification of different life history stages of fresh waterprawn
6. Collection and study of weedfish
7. Identification of commercially viable crabs – Scylla cerrata, Portunuspelagicus,P.sanguinolentus, Neptunuspelagicus, N.Sanguinolentus
8. Identification of lobsters – Panuliruspolyphagus, P.ornatus, P.homarus, P.sewelli,*P.penicillatus*
9. Identification of oysters of nutritional significance – Crossostreamadrasensis, C.gryphoides,C. cucullata, C.rivularis ,Picnodanta
10. Identification of mussels andclams
11. Identification of developmental stages ofoysters
12. Field visit to aqua farm and study of different components like dykesetc.

AQUACULTURE TECHNOLOGY COURSE SYLLABUS (Effective from 2020-2021 onwards) TITLE - FRESH WATER & BRACKISHWATER AQUACULTURE

SEMESTER IV – PAPER-

1V PRACTICALS MODEL PAPER

MaxMarks50 **Time2hrs**

I. Identify the following specimens and write a short notes ontheir commercial 6x5=30M importance
   a. Carp
   b. Freshwaterprawn
   c. Stages ofprawn
   d. Crab
   e. Oyesters
   f. Mussel/clam

II. Record 05marks

III. Internalassessment 15marks

Total **50marks**

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 tofisheries
1-2 Basic concepts of economics – goods, services, wants and utility, demand andsupply, 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'sprice

UNIT – I1 FISHERIES MARKETING

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

UNIT-III FISHERIES ECONOMICS

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

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 ruraldevelopment
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 andteaching
4-4 DAATT centres and their role in tot programs, video conferencing, education offarmers through print and electronicmedia

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)
MODEL QUESTION PAPER

Time: 2 ½ hrs. **Max Marks: 60**

PART – 1

Note:Answer any <u>THREE</u> questions choosing at least one question from each section. Draw the diagrams whereevernecessary

3x10 =30M

<u>SECTION- A</u>

1. Explain about the scope of fisheries economics inIndia.
2. Explain the methods of economic analysis of fisherymarketing.
3. How to preparation of project and theirappraisals.

<u>SECTION- B</u>

4. Explain the Role of NABARD in fishermencooperatives.
5. Write an account on the economic principles toAquaculture.
6. Give an account on the ICARprograms.

Part – II

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

7. Goods andservices
8. Law ofdiminishing
9. Types ofeconomics
10. Marketfunctions
11. Pricedetermination
12. NABARD
13. Fishermen cooperative
14. Fisheries ruraldevelopment
15. DAATTCentres
16. ORP andNDS

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BLUE PRINT

MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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 inIndia.
2. Describe the various factors influencing the fisheryproducts.
3. Explain the basic marketing functions anddemand.
4. Give an account on the price determination offishes.
5. Explain the methods of economic analysis of fisherymarketing.
6. How to preparation of project and theirappraisals.
7. Explain the Role of NABARD in fishermencooperatives.
8. Write an account on the economic principles toAquaculture.
9. Explain the various cost and earning of Aquaculturesystems.
10. Explain about the various inputs and productionfunctions.
11. Give an account on the ICARprograms.
12. Describe the fisheries extensions, objectives and theirscope.

5 Marks

1. Goods andservices
2. Law ofdiminishing
3. Types ofeconomics
4. Microeconomics
5. Macroeconomics
6. Marketfunctions
7. Pricedetermination
8. Economicanalysis
9. Projectappraisal
10. Primary producerfishermen
11. Aquaculture economics
12. Aquaculture economicprinciples
13. Role ofMatsyafed
14. NABARD
15. Fishermen cooperative
16. Fisheries Nationaleconomy
17. FisheriesExtension
18. Fisheries ruraldevelopment
19. DAATTCentres
20. ORP andNDS
21. FFDA andTRYSEM
22. LLP andIRDP
23. Fisheries Transfer ofTechnology

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 anddifferent kinds offeeds

1-3 Live bearers, gold fish, koi, gourami, barbs abd tetras, angel fish and cichlidfish 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 reefaquariums

3-2 Water quality management for different types of aquariums 3-3 Common diseases of aquarium fish, diagnosis andtreatment

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 anddesign

4-2 Commercial production of goldfish, live bearers, gouramies, barbs, angels andtetras 4-3 Mass production of aquariumplants

4-4 Retail marketing and export of ornamental fish

PRACTICALS:

1. Study of aerators – types andstructures
2. Water circulation methods in aquarium andfiltration
3. Collection and identification of aquariumplants
4. Identification of common marine aquariumfishes
5. Identification of common fresh water aquariumfishes
6. Breeding of egglayers
7. Breeding of livebearers
8. Evaluation of significance of aquaria for commercial and domesticuse

PRESCRIBED BOOK(S):

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

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 FROM2020-2021)
COURSE CODE: MODEL QUESTION PAPER

Time: 2 ½ hrs. **Max Marks: 60**

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 andIndia.
2. Describe the Freshwater brood stock development and their grow outtechncology.
3. Explain about the major marine ornamental fish resources ofIndia.

SECTION- B

4. Describe the transportation of marine ornamental live fish and which techniques wereused.
5. Describe the different types of aquariumplants.
6. Define Aquarium? Explain about setting upAquaium.

Part – II

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

7. Livebearers
8. Freshwater ornamental fishes
9. Collection of marine ornamentalfishes
10. Breeding of marine ornamentalfishes
11. Gouramies
12. Aquariumplants
13. Retail marketing of ornamentalfishes
14. Marine other ornamentalanimals
15. Acclimatization
16. ReefAquarium

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MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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 andIndia.
5. Describe the Freshwater brood stock development and their grow outtechncology.
6. Explain about the larval food and feeding in Freshwater ornamentalfishes.
7. Give an account on the Aquariumaccessories.
8. Explain about the major marine ornamental fish resources ofIndia.
9. Describe the transportation of marine ornamental live fish and which techniques wereused.
10. Explain the different types of marine ornamentalfishes.
11. Describe the common diseases of Aquarium fishes and diagnosismethods.
12. Define Aquarium? Explain about setting upAquaium.
13. Explain about the water quality management inAquarium.
14. Explain about the export of ornamentalfishes.
15. Describe the different types of aquariumplants.

5 Marks

1. Livebearers
2. Freshwater ornamentalfishes
3. Aquariumfeeds
4. Angelfish
5. Brood stockdevelopment
6. Collection of marine ornamentalfishes
7. Breeding of marine ornamentalfishes
8. Marine other ornamentalanimals
9. Acclimatization
10. ReefAquarium
11. Fungal diseases of Aquariumfishes
12. Bacterial diseases of Aquariumfishes
13. Production of goldfish
14. Gouramies
15. Aquariumplants
16. Retail marketing of ornamentalfishes

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 **50M**

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

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 pouchprocessing.

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 ofdrying.

3-2 Drying of fish and prawns. Packing and storage of dried products. Spoilage of driedproducts. 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 qualityevaluation.

4-2 Packing requirements for frozen and cured products. Statutory requirements for packing. Labeling requirements.

4-3 Different types of cold storages. Insulated and refrigeratedvehicles.

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, registeredexporters

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**

PART – 1

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

SECTION- A

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

SECTION- B

4. Explain the different types of dyingmethods.
5. Write an essay on export of fishery products fromIndia.
6. Explain about the constraints in export including tariff and non-tariffbarriers.

Part – II

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

7. Principles of fishpreservation
8. Preparation ofIce
9. Types of ice used in the seafoodindustry
10. Freezingmethods
11. Canning
12. Labelingrequirements.
13. Fisheries export products
14. Marineinsurance
15. Standards for dry fishproducts
16. Types of coldstorage

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MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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 freezingmethods.
5. Give an account on the accelerated freeze drying and packing driedproducts.
6. Explain the Modified Atmospheric Storage methods forpreservation.
7. Explain the different types of dyingmethods.
8. Give an account on the spoilage of driedproducts.
9. Describe the different types of packing materials and its qualitymeasurements.
10. Explain about the different types of coldstorages.
11. Write an essay on export of fishery products fromIndia.
12. Explain about the constraints in export including tariff and non-tariffbarriers.

5 Marks

1. Principles of fishpreservation
2. Preparation ofIce
3. Types of ice used in the seafoodindustry
4. Chilled seawater
5. Refrigeratedseawater
6. Freezingmethods
7. Canning
8. Retortable pouchprocessing.
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. Rozen and curedproducts
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 andprotozoans.

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

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

Unit 2: Aquatic Microbiology:

2-1 Microflora of aquatic environment, Different culturetechniques.

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

2-3 Routine tests for indentification of bacteria – morphological, cultural bioehemical and serological. Basics of mycological and virologialtechniques.

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 fisheryproducts.

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, marinatedproducts.

Text Books:

1. Pelzar, Reid & Chan – Microbiology
2. Prescolt, Harley & Klein –Microbiology
3. Adelogerg, Ingra &Wheates – Introduction to MicrobialWorld
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 AquaticBodies.
7. Chincheste,C.O. and Graham,H.D. Microbial Safety of FisheryProducts.
8. Amerine,M.A. and Pangborm,R.M. Principles of Sensory Evaluation ofFoods.
9. Connell,J.J. Control of FishQuality
10. Bigh,E.G. Seafood Science andTechnology
11. Gopakumar.K Tropical FisheryProducts

Reference Books

1. Kreuzer,R. FisheryProducts.
2. Borgstrom,G .Fish asFood
3. Suzuki,T. Fish and Krill Protein: ProcessingTechnology

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**

PART – 1

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

SECTION- A

1. Explain about the Ultrastructure of prokaryoticcell.
2. Explain the microflora of aquaticenvironment.
3. Give an account on different types of media preparation for bacteriaculture.

SECTION- B

4. Give an account on the preparation of coated fisheryproducts.
5. How to spoilage fish? Explain the spoilage of micoflora of fish andshellfish.
6. Explain about the FisheryBy-poducts.

Part – II

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

7. General characters ofAlgae
8. Prokaryotics
9. Ultra structure ofvirus
10. Aquaticenvironment
11. Identification of Bacteria
12. By-Products
13. Advantages of value addition
14. Pearlessence
15. Fish liveroil
16. Fishfillets

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MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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 prokaryoticcell.
2. Define microbes? Explain about the different types ofmicrobes.
3. Explain the microflora of aquaticenvironment.
4. Give an account on different types of media preparation for bacteriaculture.
5. How to explain the basics of mycological and virologicaltechniques.
6. Explain about the different types of culture techniques inmicrobiology.
7. Describe the Fish as an excellent medium for growth ofmicroorganisms.
8. How to spoilage fish? Explain the spoilage of micoflora of fish andshellfish.
9. Explain about the FisheryBy-poducts.
10. Describe the fishery value addedproducts.
11. Explain the fish mince and surimiproducts.
12. Give an account on the preparation of coated fisheryproducts.

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. Extrinsicfactors
11. By-Products
12. Advantages of valueaddition
13. Seaweedproducts
14. Chitin andchitosan
15. Pearlessence
16. Fish liveroil
17. Fishfillets

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

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

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 qualityassurance:
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 heavymetals.

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 industrialpollutants.
4-2 Infectionandimmunity,Microbialfoodpoisoning,bacteriaof 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 andWild)
2. Fish Disease Diagnosis and Health Management. Fisheries College andResearch 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 fisheryproducts
2. General description –freezing
3. Processingshrimp
4. Filleting offish
5. Drying offish
6. Organoloptic analysis offish
7. Preparation of fishery byproducts
8. Preparation of shark fin rays fish maws, chitin, fishwafer
9. Fishpickling
10. Value added fishery products, fish curry, cutlets fishfinger.
11. Preparation ofsurimi

Filed visit:

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

SEMESTER-VI PRACTICAL MODEL PAPER

Maxmarks:50 **Time :2Hrs**

1. Determination of moisture content in fish and fishery products. Draw a neat labelleddiagram10M

2. Identificationofspotters 4X5=20M

   A)

   B)

   C)

   D)

   E)

3. Record 05M

4. ContinuousInternalAssessment 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 andwater.
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 labelleddiagram10M

2. Identificationofspotters 4X5=20M

A)

B)

C)

D)

E)

3. Record 05M

4. ContinuousInternalAssessment 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**

PART – 1

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

SECTION- A

1. Give an account on water quality in fisheryindustry.
2. Write an essay on quality management application in fishtrade.
3. Explain about the sensory evaluation of fish and fishproducts.

SECTION- B

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

Part – II

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

7. Qualityassurance
8. Qualitystandards
9. Quality assessment of fishproducts
10. UVradiation
11. Sensoryevaluation
12. Aeromonas
13. Listeria
14. Bacillus
15. Industrialpollutants
16. Microbial foodpoisoning

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MODULE NO.	ESSAY QUESTIONS 10 MARKS	SHORT ANSWER QUESTIONS 5 MARKS	MARKS ALLOTED TO THE UNIT
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

THANK YOU