P.R. GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF ZOOLOGY
Bachelor of Vocational Course (Commercial Aquaculture)

SYLLABUS AND NAME OF THE PAPERS
NSDC, NSQF & ASCI - LEVELS OF ASSESSMENT (4, 5.6 & 7)

S.No	CORE SUBJECTS		NON-CORE SUBJECTS	NSQF & NSDC Levels of Assessment (UGC)
1.	**First Year**	**First Semester**		
	Core I	Biology of fishes	Zoology	4 (Certificate)
	Core II	Principles and Aquatic Ecology	Chemistry	
	Core III	Fresh water Aquaculture	General English	
			Introduction to computer	
		Second Semester		
	Core IV	Brackishwater Aquaculture & Mariculture	Zoology	5 (Diploma)
	Core V	Hatchery Management and Aquatic organisms	Chemistry	
	Core VI	Fishing Methods	General English	
			Introduction to computer	
2.	**Second Year**	**Third Semester**		
	Core VII	Inland waters and Marine fisheries	Zoology	6 (Advanced Diploma)
	Core VIII	Bio-Statistics and Computer Application	Chemistry	
	Core IX	Bio-chemical and Aquaculture Nutrition	General English	
		Fourth Semester		
	Core X	Genetics and Aquaculture Biotechnology	Zoology	
	Core XI	Pathology in Aquaculture	Chemistry	
	Core XII	Ornamental Fisheries	General English	
3.	**Third Year**	**Fifth Semester**		
	Core XIII	Fish Microbiology and By-Products	Zoology	7 (B.Voc, Degreee)
	Core XIV	Fish Processing Technology and Quality Control	Chemistry	
		Project Work	-	
		Sixth Semester		
	Core XV	Aquaculture Engineering	Zoology	
	Core XVI	Fisheries Economics and Marketing	Chemistry	
		Project Work	-	

P.R. Govt. College (A), Kakinada
DEPARTMENT OF ZOOLOGY
Bachelor of Vocational Course (Commercial Aquaculture)
Semester-I
Core-I TITLE: BIOLOGY OF FISHES
Hours 4 Credits 4
Syllabus

OBJECTIVES:	**LEARNING OUTCOMES**
➢ To introduce the learner to general morphology and taxonomy of fin & Shell fishes. ➢ To study the Biological, Morphological and physiological characteristics of find & shell fishes ➢ To provide the knowledge on the taxonomic characteristics of the fin & Shell fishes	➢ By the end of the course the student will be equipped with the knowledge of taxonomy, morphology & physiology of fin & Shell fishes. ➢ Knowledge on the basic taxonomic tools for the identification of fin & shell fishes will be learnt by the student.

Module 1: General Characteristics and Taxonomy of Fishes (15 Hrs.)

1.1. General characters and Classification of fishes.
1.2. Sense organs in fishes (Neuromast organs) – lateral line system. Ampullae of Lorenzini.
1.3. Specialized organs in fishes – electric organs, Sound producing organs, Poison glands in fishes and Bioluminescence in fishes.
1.4. Air Bladder and Weberian Apparatus-Location of air bladder, Functions of air bladder, Location and Functions of weberian apparatus.

Module 2: Food and Feeding - Growth (10 Hrs.)

2.1. Food and feeding habits – structural adaptations, classification based on food and feeding habits.
2.2. Types of fishes on the basis of the manner of capture and ingestion, Gastrosomatic index.
2.3. Scales in fishes-Placoid, Ganoid. Cycloid and Ctenoid

Module 3: Digestion, Respiration and Circulation (15 Hrs.)

3.1. Digestive system – General morphological feature of digestive system in fishes, Digestive system and process of digestion.
3.2. Respiratory system – Types of gills, Structure of gill, mechanism of gill respiration.
3.3. Cardiovascular system – General features of heart and physiology of circulation, circulation.

Module 4: Reproduction, Excretion, Migration & Endocrine glands in fishes (10Hrs.)

4.1. Reproduction – ovary and testes, structure, development of primary and secondary sexual & Sexual dimorphism in fishes. Hormonal regulation of fish reproduction.
4.2. Excretion and osmoregulation-freshwater and marine fishes.
4.4. Parental care in fishes, Migration in fishes –anadromous and catadromous.
4.5. Endocrine organs in fishes-Pituitary gland, thyroid gland, adrenal gland, Urohypophysis,pancreatic islets and pineal ogans.

Internal Evaluation

- Assignments
- Seminars
- Quiz
- Field Trips

Suggested reading

Core reading

1. Moyle,P.B. and Cech,J.J. Fishes – An Introduction to Ichthyology Norman,J.R. A History of Fishes.
2. Bagenal. Methods of Fish Production in Freshwaters Nicholski, G.V. Ecology of Fishes.
3. Lagler. Ichthyology.
4. Matty. Fish Physiology.
5. Francis Day. Fishes of India.
6. Munro,I.S.R. The Marine and Freshwater Fishes of Ceylon.
7. CMFRI. The Commercial Molluscs of India.

Supplementary Reading

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

Advanced Reading

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

Other Reference Books:

1. Marshall & Williams. Textbook of Zoology. Vol.I.
2. Parker and Hasswell. Textbook of zoology, Vertebrates. Vol.II.
3. Barnes. General Zoology
4. Day, F. The fishes of India.
5. S.S. Khanna. An introduction to fishes.
6. K.G. Lagler. Ichthyology.
7. Rath,A.K. Freshwater Aquaculture,
8. Santhanam, et.al. a Manual of Freshwater Aquaculture
9. Pillay,T.V.R. Aquaculture – Principles and Practices
10. Jhingran,V.G. Fish and Fisheries of India
11. Jhingran,V.G and Sehgal,K.L. Coldwater Fisheries of India.
12. Bardach, Rhyther and McLarney. Aquaculture
13. Huet, M. Textbook of Aquaculture.
14. Rogen, Pallin and Shehadeh. Integrated Agriculture and Aquafarming Farming system.
15. Boyd,C.E. Qater Quality in Warmwater Fish Ponds
16. Moyle,P.B. and Cech,J.J. Fishes – An Introduction to Ichthyology

P.R.GOVERNMENT COLLEGE (A), KAKINADA
Ist B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-I,
CORE-I TITLE: BIOLOGY OF FISHES

BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	01	01	03
MODULE-III	02	02	03
MODULE-IV	02	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
Ist B.Voc., COMMERCIAL AQUACULTRE SEMESTER-I, 2014-15
MODEL QUESTION PAPER

Time: 3 hrs. **TITLE: BIOLOGY OF FISHES, CORE-I** **Marks: 70**

PART – 1

Note: Answer any <u>THREE</u> questions choosing at least one question from each section

10 x 3 = 30

<u>SECTION- A</u>

1. Write an essay on General characters of Fishes.
2. Describe various sense organs in Fishes.
3. Give an account on anatomical characters of Fish.

<u>SECTION- B</u>

4. Explain the General morphological features of Digestive system and process of digestion.
5. Describe the process of Respiration and Respiratory gases exchange in Fish.
6. Write an essay on endocrine organs in Fish.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Types of scales in Fish
8. Types of Fish based on food
9. Bioluminescence in Fishes
10. Electric organs
11. Migration in Fishes
12. Maturation and Spawning in Fish
13. Structure of Gill

Part – III

Answer any **TEN** Questions **10x2=20**

14. Buoyancy
15. Swim bladder
16. Ampullae of Lorenzini
17. Fecundity
18. Biological clocks
19. Accessory respiratory organs
20. Pseudobranch
21. Gill Rakers
22. Plankton feeders
23. Column feeders
24. Chromotophores
25. Adrenal gland

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P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-I,
Core-II:TITLE: PRINCIPLES AND METHODS IN AQUACULTURE
Syllabus
Hours 4 Credits 4

OBJECTIVES	LEARNING OUTCOMES
➢ To study the aquatic environment their components. ➢ To study the pond ecosystem ➢ To study the cultivable fresh water fishes	➢ By the end of the course the student will be equipped with the aquatic ecosystem ➢ Knowledge on the pond ecosystem will be learnt by the student. ➢ Knowledge on the cultivable fishes will be learnt by the student.

Module 1 Introduction (10 Hrs.)

1.1. History, definition, scope and significance of aquaculture, Blue Revolution, concepts of Blue Revolution.
1.2. Different aquaculture systems, classification of Aquaculture.
1.3. Based on organisms and based on levels of management intensity of culture systems

Module 2: Pond Ecology (15 Hrs)

2.1. General concepts of ecology-Ecological factors, productivity of culture pond, carrying capacity, food chain and food web.
2.2. Nutrient cycles (Biogeochemical cycles) – Nitrogen, Phosphorous and Carbon.
2.4. Significance and important groups of phytoplankton, zooplankton and benthos in culture ponds.
2.5. Management of water and soil quality parameters.

Module 3: Types of ponds & Cultivable Freshwater fishes (15 Hrs)

3.1. Type of ponds – nursery, rearing and stocking.
3.2. Design and construction of fish farms
3.3. Criteria for the selection of species.
3.4. Cultivable freshwater fishes- carps, airbreathing fishes, tilapia, freshwater prawn.

Module 4: Brackishwater culture and mariculture (15 Hrs)

4.1. Brackishwater resources and fishes of commercial importance – Milk fish, mullet, seabass, shrimps, crabs.
4.2. Major brackish water culture systems in India.
4.3. Different organisms in Mariculture –Edible oyster, pearl oyster and sea weeds.

Internal Evalution

- Assignments
- Seminars
- Quiz
- Field Trips

Suggested reading

Core reading

1. Rath,A.K. Freshwater Aquaculture,
2. Santhanam, et.al. a Manual of Freshwater Aquaculture
3. Pillay,T.V.R. Aquaculture – Principles and Practices
4. Jhingran,V.G. Fish and Fisheries of India
5. Jhingran,V.G and Sehgal,K.L. Coldwater Fisheries of India.
6. Bardach, Rhyther and McLarney. Aquaculture
7. Huet, M. Textbook of Aquaculture.
8. Rogen, Pallin and Shehadeh. Integrated Agriculture and Aquafarming Farming system.
9. Boyd,C.E. Qater Quality in Warmwater Fish Ponds
10. Moyle,P.B. and Cech,J.J. Fishes – An Introduction to Ichthyology

Supplementary Reading

1. Shepherd,J and Bromage, N. Intensive Fish Farming
2. Pillay,T.V.R. Advances in Aquaculture
3. Beveridge. Cage Culture

Advanced Reading

Stickney,R.R. Principles of Warmwater Aquaculture

Web resources

FAO http://www.fao.org/fishery/topic/4340/en
NACA http://www.enaca.org/
VUAT http://www.vuatkerala.org/static/eng/advisory/fisheries/index.htm
Aquaculture/Pond Dynamics http://pdacrsp.oregonstate.edu/pubs/
Wikipedia http://en.wikipedia.org/wiki/Aquaculture
Fish farming http://www.fishfarming.com/
ICAR http://www.icar.org.in/indiafishvoice/intro.html
CIFA http://www.cifa.in/tech.htm
Aquaculture articles: http://aquafind.com/articles/aquaculture.php
Aquaculture Artices http://www.aquarticles.com/

Other Reference Books:

1. Friedrich, H.: Marine Biology
2. Raymont, J.E.C.: Plankton and productivity in the Oceans, Volume 1.
3. Balakrishna Nair. N. and D.M. Thampy: A text book of Marine ecology
4. Broecker, W.S.: Chemical Oceanography
5. Sverdrup, H.V., M.W., Johnson and R.H. Fleming.: The Oceans - Their physics, chemistry and general biology. Prentice-Hall Inc. 1942.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
Ist B.Voc., (COMMERCIA AQUACULTURE), SEMESTER-I,
CORE-II, : PRINCIPLES AND METHODS IN AQUACULTURE

BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	02	03
MODULE-III	02	02	03
MODULE-IV	01	01	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
Ist B.Voc., COMMERCIAL AQUACULTRE SEMESTER-I, 2014-15
MODEL QUESTION PAPER
TITLE: CORE-II : PRINCIPAL AND METHODS IN AQUACULTURE,

Time: 3 hrs. **Marks: 70**

PART – 1

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

10 x 3 = 30

SECTION- A

1. Describe the culture systems used for Aquaculture practices.
2. Describe various concepts of Pond Ecology.
3. Explain Nitrogen Cycle.

SECTION- B

4. Give an account of the criteria for the selection of a species for culture.
5. Write an essay on factors influencing Fish farm management.
6. Write an essay any four commercially important Brackish water Fishes.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Role of Nutrients in Fish Pond
8. Algal Blooms in Carp culture
9. Biology of Common Carp
10. Criteria for selection of site
11. Common cultivated Brackish water and Shell Fish in India
12. Integrated Fish Farm
13. Significance of Plankton

Part – III

Answer any **TEN** Questions **10x2=20**

14. Blue Revolution
15. Primary Productivity
16. Food Web
17. Pelagic Zone
18. Brood Stocks
19. Tilapia
20. *Penaeus monodon*
21. Sea Weeds
22. Liming
23. Oysters
24. Intensive culture
25. Eutrophic Pond

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)

Semester-I, Core-III Freshwater Aquaculture

Syllabus

Hours 4 **Credits 4**

OBJECTIVES	LEARNING OUT COME
➢ To give an introduction to Fresh water aquaculture practices.	➢ At the end of the course student can able to gain the knowledge on the fresh water aquaculture practices.
➢ To develop the basic knowledge of Fin fish and shellfish culture systems.	➢ Knowledge on the culture systems be learnt by the student.

Module 1: Freshwater Fish Culture (10 Hrs)

1.1. Various freshwater organisms used for aquaculture in India.
1.2. Management of carp culture ponds- Nursery rearing and stocking ponds –Preparation of ponds– different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting.
1.3. Culture of air breathing fishes- Channa, Heteropneustes, Clarius, Anabas.

Module 2: Culture of Prawns and Molluscs (10 Hrs)

2.1. Cultivable species of freshwater prawns and their biology.
2.2. Essentials of prawn Hatchery; Culture management techniques of Nursery and Grow-out ponds
2.2. Freshwater pearl culture – Present status of freshwater pearl culture and production in India.

Module 3 Reservoir fisheries & Integrated Farming (10 Hrs)

4.1. Major reservoirs in India, measures for increasing production from reservoirs in India
4.2. Recent development in integrated farming – Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and Pig cum fish culture.
4.3. Organic aqua farming.
4.4. Fish culture in cages and pens.

Module 4: Aquaculture for stable environment (10 Hrs)

3.1. Sewage fed fish culture, sewage treatment,– Sewage cum fish culture in India.
3.2. Fish in relation to public health – Larvivores fishes and mosquito eradication using fishes.

Internal Evalution

- Assignments
- Seminars
- Quiz
- Field Trips

Suggested reading

Core reading

1. Jhingran, V.G. Fish and fisheries of India. Hindustan Publ. Corporation (India), 1982.
2. Santhanam, R. et. Al. A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
3. Pilley, T.V.R. Aquaculture – Principles and Practices. Fishing News (Books) Ltd., London, 1990.
4. Pandey, A.C. Air Breathing Fishes. Reliance Publishing House, New Delhi, 1990.

Supplementary Reading

1. Welch, P.S. Limnology. McGrawHill, NY, 1952.
2. Hutchinson, G.E. A Treatise on Limnology, Vols. I & II. John Wiley & Sons, 1957.
3. Ruttner, F. Fundamentals of Limnology. Translated by D.G. Frey and F.E.Fry. University of Toronto Press, 1968.
4. Wetzel, R.G. Limnology. W.B. Saunders Co., 1975.
5. Reid, G.K. & R.D. wood. Ecology of inland waters and Estuaries. Van Nostrand Company, 1976.

Other Reference Books:

1. Cole, C.A. Textbook of Limnology. The C.V. Mosby Co., 1983.
2. Bardach, et. Al. Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms. John Wiley & Sons, NY, 1972.
3. Stickney, R.R. Principles of Water Aquaculture. John Wiley & Sons, NY, 1979.
4. Chondar, C.L. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, 1980.
5. Janardhana Rao, K. & S.D. Tripathi. A Manual of Giant Freshwater Prawn Hatchery. CIFA, Kausalyaganga, Orissa, India, 1993.
6. Iso Matsui. Theory and Practice of Eel Culture. American Publishing Co. Pvt. Ltd., 1980.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
Ist B.Voc., (COMMERCIA AQUACULTURE), SEMESTER-I,
CORE-III Freshwater Aquaculture

BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	02	02	03
MODULE-II	01	02	03
MODULE-III	02	02	03
MODULE-IV	01	01	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
Ist B.Voc., COMMERCIAL AQUACULTRE SEMESTER-I, 2014-15
MODEL QUESTION PAPER

Time: 3 hrs. **TITLE: FRESH WATER AQUACULTURE, CORE-III** **Marks: 70**

PART – 1

Note: Answer any <u>THREE</u> questions choosing at least one question from each section

10 x 3 = 30

<u>SECTION- A</u>

1. Give an account of the management of Nursery Ponds in Carp culture.
2. Write an essay on Biology of Common Carp and breeding techniques in India.
3. Write about the essentials for the establishment of Prawn Hatchery.

<u>SECTION- B</u>

4. What is Sewage, describe its water quality and different methods of treatment of Sewage.
5. Write an essay on major Reservoirs of Fishery resources in India.
6. Give an account on Integrated Fish farming.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Morphology of *Channa* species
8. Supplementary Feed in Carp culture
9. Fresh water pearl culture
10. Cage culture
11. Pen culture
12. Larvivorous Fishes
13. Organic aqua farming

Part – III

Answer any **TEN** Questions **10x2=20**

14. Eutrophication
15. BOD
16. Algal Blooms
17. DO
18. Zooplankton
19. Polyculture
20. Shrimps
21. Cat Fishes
22. Raft culture
23. Race way culture
24. Oligotrophic
25. Supplementary Feed

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-II, Core-IV Brackishwater Aquaculture and Mari culture
Syllabus
Hours 4 Credits 4

OBJECTIVES:	LEARNING OUT COME
➢ To provide basic biology of the species used for brackish water aquaculture and mariculture. ➢ To give an introduction to brackish water aquaculture practices. ➢ To provide a basic idea about various Mari culture practices.	➢ Knowledge on the biology and biological cycle of the brackish water & marine cultivable species will be learnt. ➢ .Knowledge on the brackish water culture practices will be learnt by the student. ➢ Knowledge on the Mari culture will be learnt by the student.

Objectives:

Module 1: Introduction **15 Hours**

1.1. Introduction, history, development and present status of brackishwater farming in India.
1.2. Brackishwater as a medium for aquaculture, ecological factors – abiotic and biotic factors.
1.3. Selection of site, general planning and design of brackish water farms.

Module 2: Brackishwater Finfish Culture **15 Hours**

2.1. Selection of cultivable species in brackish water systems, their biology and culture practices – monoculture and polyculture of – *Chanos chanos, Mugil cephalus, Lates calcarifer.*
2.2. Nursery, rearing and grow out in ponds, cages and pens.

Module 3: Crustacean Culture **15 Hours**

3.1. Species of shrimps cultured in brackishwater and their biology – *Penaeus monodon, Penaeus indicus, Litopenaeus vannamei*.
3.2. Extensive, semi-intensive and intensive shrimp farming practices.
3.3. Crab culture (*Scylla serrata*, *Scylla occeanica* and *Charybdis* sp.): Pond design, management of crab farm, fattening process of crab, economics-cage culture and pen culture

Module 4: Mariculture **15 Hours**

4.1. Ecological subdivisions of the sea. Selection of site and selection of materials for sea farming.
4.2. Different designs of open sea farming structures – construction of cages – bioengineering problems and solutions – scope of open sea farming in India.
4.3. Present status and recent developments in mariculture.

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Internal Evalution

- Assignments
- Seminars
- Quiz
- Field Trips

Suggested reading

Core reading

1. Pillay T.V.R - Aquaculture – Principles and practices
2. Chen, L.C. – Aquaculture in Taiwan
3. Milne P H. – Fish and Shell fish farming in coastal waters
4. Ivenson E.S. – Farming the edge of the sea
5. Bandach, Rhyster V McLarney – Aquaculture
6. Jhingwa V.A – Fish and Fisheries of India
7. Kurian,C.V and Sebastian V.O. – Prawn and Prawn fisheries of India

Supplementary Reading

1. Pillay TVR – Advances in Aquaculture
2. Pillay TVR – Coastal Aquaculture in the Indo-Pacific

Advanced Reading

1. Heut M. – Text book of fish culture
2. Sheperd and Bromage N. – Intensive Fish Farming

Other references:

1. Welch, P.S. Limnology. McGrawHill, NY, 1952.
2. Hutchinson, G.E. A Treatise on Limnology, Vols. I & II. John Wiley & Sons, 1957.
3. Ruttner, F. Fundamentals of Limnology. Translated by D.G. Frey and F.E.Fry. University of Toronto Press, 1968.
4. Wetzel, R.G. Limnology. W.B. Saunders Co., 1975.
5. Reid, G.K. & R.D. wood. Ecology of inland waters and Estuaries. Van Nostrand Company, 1976.
5. Cole, C.A. Textbook of Limnology. The C.V. Mosby Co., 1983.
6. Friedrich, H.: Marine Biology
7. Raymont, J.E.C.: Plankton and productivity in the Oceans, Volume 1.
8. Balakrishna Nair. N. and D.M. Thampy: A text book of Marine ecology
9. Broecker, W.S.: Chemical Oceanography
10. Sverdrup, H.V., M.W., Johnson and R.H. Fleming.: The Oceans – Their physics, chemistry and general biology. Prentice-Hall Inc. 1942.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
Ist B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-II,
CORE-IV Brackishwater Aquaculture and Mari culture

BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	01	03
MODULE-III	02	02	03
MODULE-IV	01	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
Ist B.Voc., COMMERCIAL AQUACULTRE SEMESTER-II, 2014-15
MODEL QUESTION PAPER
TITLE: CORE-IV : BRACKISH WATER AQUACULTUE AND MARICULTURE,
Time: 3 hrs. Marks: 70

PART – 1

Note: Answer any <u>THREE</u> questions choosing at least one question from each section

<u>SECTION- A</u> **3 x 10 = 30**

1. Describe the general planning and design of brackishwater farms.
2. Explain the Biology and culture systems of *Lates calcarifer.*
3. Write an essay on shrimp farming culture practices.

<u>SECTION- B</u>

4. Explain the pond design, management of crab farm and culture practices.
5. Explain the ecological subdivisions of the sea.
6. Write an essay on recent developments in mariculture.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Brackishwater farming
8. Ecological factors
9. *Mugil cephalus*
10. Biology of *Litopenaeus vannamei*
11. Semi-intensive culture
12. Crab fattening
13. Open sea farming

Part – III

Answer any **TEN** Questions **10x2=20**

14. Backishwater
15. Abiotic
16. Primary poducers
17. Cage culture
18. Grow-out pond
19. *Mullet*
20. Nauplius
21. Zoea larvae
22. *Chanos chanos*
23. Benthic zone
24. Mariculture
25. Profundal zone

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-II,

Core-V Hatchery Technology in Aquatic organisms

Syllabus
Hours 4 Credits 4

OBJECTIVES:	LEARNING OUT COME
➢ To understand the current methodology and various techniques of commercial seed production. ➢ To develop basic knowledge on the spawning, larval rearing and feeding of the commercially important species. ➢ Hatchery management stratigies..	➢ Knowledge on the biology and biological cycle of the brackish water & marine cultivable species will be learnt. ➢ .Knowledge on the brackish water culture practices will be learnt by the student. ➢ Knowledge on the Mari culture will be learnt by the student.

Module 1: Carp Hatchery 15 Hours

1.1. Hatchery management-seed production of carps.
1.2. Hypophysation of Indian major carps and exotic carps, history of hypophysation. Pituitary gland. Collection and preservation of gland. Other ovulating agents.
1.3. Brood stock management, sexing, dosage for injection, mechanism of ovulation.

Module 2: Carp Production System and Seed production of other Fishes 15 Hours

2.1. Transport of fish seed and brood fishes. Causes of mortality during transport, techniques of transport, open and closed systems, methods of transportation, use of anaesthetics.
2.2. Carp seed resources in major rivers India.
2.3. Bundh breeding, types of bundh breeding techniques. Problems of bundh breeding.

Module 3: Seed Production of Crustaceans and Molluscs 15 Hours

3.1. Seed production and nursery rearing of *Penaeus indicus, Penaeus monodon* and *Macrobrachium rosenbergii.*
3.2. Hatchery operations of pearl oysters, crabs, lobster.

Module 4: Hatchery Management and Design of shrimp hatcheries 15 Hours

4.1. Site selection
4.2. Operation and management of maturation section.
4.3. Operation and management of larval section.
4.4. Operation and management of post larval section
4.5. Live feed culture system,Mechanical and biological filters.

Internal Evalution

- Assignments
- Seminars
- Quiz
- Field Trips

Suggested Reading

Core reading

1. Chodar SL Hypophysation in Indian Major Carps
2. CMFRI Spl. Bul. Hatchery Operation of Penaied Shrimps
3. Venkataraman GS The Cultivation of Algae
4. MPEDA Sea Fishes
5. CMFRI sp Bul Artificial Reefs and Sea Farming Techniques

Supplementary Reading

1. Jhingran VG Fish and Fisheries of India
2. Raymond EG Plankton and Productivity of Oceans
3. Boney AD Phytoplankton

Advanced Reading

1. Pillay, TVR and Kutty MN, Principles and Practices of Aquaculture
2. Harvey BJ and Hoar WS, Principle and Practice of Induced Fish Breeding
3. Woyanarovich E and Horrath L., The Artificial Propagation of Warm, Water Fishes- Manual for Extension.

Other Reference Books:

1. Pillay, T.V.R. & M.A. Dill. Advances in Aquaculture. Fishing News (Books) Ltd., England, 1979.
2. Stickney, R.R. Principles of Warm water Aquaculture. John Wiley & Sons Inc.,1979.
3. Hepher, B. & Y. Prugim. Commercial Fish Farming. John Wiley & Sons Inc.,1981.
4. Boyd, C.E. Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing Company, 1982.
5. Jhingran, V.G. Fish and Fisheries of India. Hindustan Publishing Corporation India, 1982
6. Turcker, C.S. (ed.). Channel Catfish Culture. Elsevier, 1985.
7. Bose, A.N. et. Al. Coastal Aquaculture Engineering. Oxford & IBH Publishing Company Pvt. Ltd., 1991.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
Ist B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-II,
CORE-V HATCHERY TECHNOLOGY IN AQUATIC ORGNISMS,
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	02	01	03
MODULE-II	01	02	03
MODULE-III	01	02	03
MODULE-IV	02	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
Ist B.Voc., COMMERCIAL AQUACULTRE SEMESTER-II, 2014-15
MODEL QUESTION PAPER
TITLE: HATCHERY TECHNOLOGY IN AQUATIC ORGNISMS, CORE-V

Time: 3 hrs. **Marks: 70**

PART – 1

Note: Answer any <u>THREE</u> questions choosing at least one question from each section **3 x 10 = 30**

<u>SECTION- A</u>

1. Give an account of Hypophysation technique in Indian major carps.
2. Explain the brood stock management in Indian major carps.
3. What is the Bundh breeding? Explain the types of bundh breeding and their problems.

<u>SECTION- B</u>

4. Give an account on shrimp seed production.
5. Describe the shrimp hatchery management.
6. Explain the quarantine and disease management in hatcheries.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Seed production of carps
8. Closed carp seed transportation
9. Techniques of transportation of seed
10. Transport of breeders
11. Seed production of molluscs
12. Quarantine management
13. Mechanical filters

Part – III

Answer any **TEN** Questions **10x2=20**

14. Synthetic hormones
15. Exotic carp
16. Pituitary gland
17. Mortality
18. Anaesthetics
19. Breeding grounds
20. Live feed
21. Pearls oysters
22. Clams
23. Berried female
24. Quarantine
25. Biological filters

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)

Semester-II,Core-VI Fishing Methods

Syllabus
Hours 4 Credits 4

OBJECTIVES:	LEARNING OUT COME
➢ To develop basic knowledge about various crafts ➢ To understand operation of various fishing gears ➢ To create awareness about fish finding devices.	➢ Student will learn the knowledge on the crafts. ➢ Mechanism involved in the operation of the fishing gear will be learnt by the student. ➢ Tools for the identification of fishery resources will be learnt by the student.

Objectives:

Module 1: Inland Fishing Crafts and Gears (15Hrs)

1.1. Introduction, Different types of fishing crafts and gears in India; Crafts-Rafts, Boats; Gears-Trap net, Hand net, Drag net, fixed net and miscellaneous types.

1.2. Boat building materials - wood, steel, FRP, ferro-cement, aluminum etc.

Module 2: Marine Fishing Crafts and Gears (15Hrs)

2.1. Introduction, Crafts-crafts of the east coast and west coast. Gears-Fixed nets, Trawl nets, shore seines, drift nets, cast nets, trap nets, dip nets (scoop nets), long line and hoocks.

2.2. Factors affecting the design of fishing gears and fish catching methods. Fishing accessories.

2.3. Introduction to netting materials - natural and synthetic fishing gear materials. Yarn numbering systems.

Module 3: Active Fishing Gears: Passive and Traditional Fishing Gears (15 Hrs)

3.1.

3.2. Destructive and Prohibited fishing practices, fishing methods like electrical fishing, poisoning and use of dynamites.

Module 4: Fish Finding Devices and Conservation. (15Hrs)

4.1. Introductory information on echo-sounder, sonar, net sonde, global positioning systems, remote sensing.

4.2. Potential fishing zones (EEZ) Turtle Exclusion Devices (TED) - By-catch Reduction Devices (BRD).

Internal Evalution

- Assignments
- Seminars
- Quiz
- Field Trips

Suggested reading

Core reading

1.Boopendranath, M.R., Meenakumari, B., Joseph, J., Sankar, T.V., Pravin,P., and Edwin, L. (Eds.) 2002, Riverine and ReservoirFisheries of India, Society of Fisheries Technologists (India), Cochin.

2. Brandt. A. v. (1984) Fish catching methods of the world. Fishing News Books Ltd., London: 432 p.

3. George V.C. (1971) An account of the inland fishing gears and methods of India. Spl. Bull.No.1.CIFT

4. Hameed, M.S. and Boopendranath, M.R. (2000) Modern Fishing Gear Technology, Daya Publishing House, Delhi:186 p.

5.Klust, G. (1982) Netting materials for fishing gear, FAO Fishing Manual, Fishing News Books (Ltd)., Farnham, 192p.

6.Sainsbury, J.C. (1986) Commercial fishing methods- An introduction to vessels and gear. Fishing News Books, Oxford: 208pp

7.Sreekrishna, Y. and Shenoy L. (2001) Fishing gear and craft technology, Indian Council of Agricultural Research, New Delhi.

Supplementary & advanced reading

1. Gulland, J.A.1974, Guidelines for Fishery Management, IOFC Dev. 74-36 FAO Rome

2. FAO (1997) Fisheries management. FAO Technical Guidelines for Responsible Fisheries. No. 4. Fishery Resources Division and Fishery Policy and Planning Division, FAO. Rome: 82p.

3. FAO (1995) Code of Conduct for Responsible Fisheries, FAO, Rome: 41 p.

4. FAO (1997) Inland fisheries. FAO Technical Guidelines for Responsible Fisheries. No. 6 Fisheries Department, FAO, Rome: 36 p.

Other Reference Books:

1. Jhingran, V.G. 1993. Fish and fisheries of India. Hindustan Publishing Corporation (India), New Delhi.
2. Ricker, W.E. 1984. Methods for assessment of fish production in freshwaters. Blackwell Publications.
3. Srivastava, C.B.L., 1985. Textbook of Fishery Science and Indian Fisheries. Kutub Mahal Publications, Allahabad.
4. S.S. Khanna. An introduction to fishes
5. Kurian, C.V. and Sebastian, V.O. 1986. Prawns and prawn fishery of India. Hindustan Publishing Corporation (India), New Delhi.
6. Yadav, B.N. Fish and Fisheries. Daya Publishing House.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
Ist B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-II,
CORE-VI, FISHING METHODS,
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	01	03
MODULE-II	02	02	03
MODULE-III	02	02	03
MODULE- IV	01	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
I[st] B.Voc., COMMERCIAL AQUACULTRE SEMESTER-II, 2014-15
MODEL QUESTION PAPER

Time: 3 hrs. **TITLE: FISHING METHODS, CORE-VI** **Marks: 70**

PART – 1

Note: Answer any <u>THREE</u> questions choosing at least one question from each section **3 x 10 = 30**

<u>SECTION- A</u>

1. Give an account of the different types of fishing crafts in India? Explain the traditional methods.
2. What is netting material? Explain the natural and synthetic fishing gear materials.
3. Explain the factors affecting the design of fishing gears and methods.

<u>SECTION- B</u>

4. Describe the modern fishing gears.
5. Explain the design and operation of different types of fishing gears.
6. What is the conservation? Explain the potential fishery zones.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Mechanized boat
8. Fishing accessories
9. Modern fishing gears
10. Traditional fishing gears
11. Prohibited fishing practices
12. Electrical fishing
13. Remote sensing

Part – III

Answer any **TEN** Questions **10x2=20**

14. Purse seiners
15. FRP
16. RCC
17. Do l net
18. Dip net
19. Cast net
20. Dynamites
21. Echo-sounder
22. EEZ
23. Net sonde
24. TED
25. Hoocks

PRACTICALS PAPER I
Title: Identification of Cultivable Fishes and Aquatic Weeds
Hours 3, credits 3

I. Morphometric and meristimatic characters of fish.

II. Identification of cultivable fishes

A. Fresh water fishes
   1. *Catla catla*
   2. *Labeo rohita*
   3. *Cirrhinus mrigala*
   4. *Clarias batrachus*
   5. *Heteropneutes fossilis*

B. Brackish water fishes/Estuarine fishes
   1. *Chanos chanos*
   2. *Etroplus surantensis*
   3. *Mugil cephalus*
   4. *Megalopa cyprinoides*
   5. *Eleutheronema tetradachylum*

C. Marine water fishes
   1. *Lates calcarifer*
   2. *Scomberomorus guttatus*
   3. *Scomberomorus commerson*
   4. *Rachycentron canadom*
   5. *Stromateus argnteus*

D. Exotic fishes
   1. *Tilapia mossambica*
   2. *Hypopthalmicthys molitrix*
   3. *Ctenopharyngodon idella*
   4. *Cypinus carpio*

E. Migratory fishes
   1. *Hilsa ilisha*
   2. *Anguilla anguilla*

III. Dissections
   1. Mounting of scales in fishes
   2. Digestive system of fish
   3. Gut content analysis of fish

IV. Identification of Aquatic weeds

A. Floating weeds	B. Emergent weeds	C. Submerged weeds	D. Marginal weeds
1. Pistia	1. Typha	1. Vallisneria	1. Marsilia
2. Lemna	2. Nymphaea	2. Hydrilla	2. Ipomoea
3. Eichhornia		3. Utricularia	3. Jussiaea
4. Azolla			

PRACTICAL MODEL PAPER I
Title: Identification of Cultivable Fishes and Aquatic Weeds
Hours 3, credits 3

Examinations at the end of the II Semester.

Internal:

Examinations at the end of the II Semester.

Internal:30 Marks, Time 1 Hour

External: 70 Marks Time 3 Hours

1. Major Dissection	10 Marks
Dissection Display } 10 Marks	
Diagram & Labeling 5 Marks	
2.. Identification Cultivable fishes	10 Marks.
(Morphometric and meristimatic)	
3. Spotters 6x 5 Marks	30 Marks
3. Record	10 Marks
Total	70 Marks

PRACTICAL PAPER II
Title: Identification of plankton, crustaceans, soil and water parameters
Hours 3, credits 3

I. Identification of phytoplanktons
A. Diatoms
    1. *Coscinodiscus* sp.
    2. *Chaetoceros* sp.
    3. *Biddulphia* sp.
    4. *Skeletonema* sp.
    5. *Leptocylindrus* sp.
    6. *Pleurosigma* sp.
    7. *Thalassionema* sp.
    8. *Thalassiothix* sp.
    9. *Asterionella* sp.
    10. *Amphora* sp.
B. Dinoflagellates
    1. *Ceratium* sp.
    2. *Protoperidinium* sp.
    3. *Dinophysis* sp.
C. Blue Green Algae (BGA)
    1. *Trichodesmium* sp.
    2. *Spirulena* sp.
    3. *Nostoc* sp.
    4. *Anabena* sp.
II. Identification of zooplankton
    1. Copepods
    2. Amphipods
    3. Luciferans
    4. Ephasids
    5. Mysids
    6. Zoea larvae
    7. Megalopa larvae
    8. Pteropods
    9. Ostracoda
    10. Cladocerans
III. Biology and Identification of fresh water prawns (Scampi)
    1. *Macobrachium rosenbergii*
    2. *M. malcolmsonii*
IV. Biology and Identification of shrimps (Marine/Brackish water)
    1. *Penaeus monodon*
    2. *P. indicus*
    3. *Litopenaeus vennamei*
V. Biology and Identification of crabs
    1. *Scylla serrata*
    2. *S. oceanica*
    3. *S. caribdis*

VI. Dissections

A. Mounting of the prawn appendages
B. Digestive system of prawn
C. Nervous system of prawn
D. Eye stalk ablation in Prawn

PRACTICAL MODEL PAPER II
Title: Identification of Cultivable Fishes and Aquatic Weeds
Hours 3, credits 3

Examinations at the end of the II Semester.

Internal:

Examinations at the end of the II Semester.

Internal:30 Marks, Time 1 Hour

External: 70 Marks Time 3 Hours

1. Major Dissection	10 Marks
Dissection Display } 10 Marks	
Diagram & Labeling 5 Marks	
3. Spotter 6 x5	30 Marks
4. Identification of Phytoplankton	10 Marks
5. Identification of Zooplankton	10Marks
3. Record	10 Marks
Total	70 Marks

PRACTICAL PAPER III
SKILL COMPONENT AND BENCH WORK

1. Training – OJT (On Job Training) in the collaborative institute or linkage organisation (Or)Internshipin in the collaborative institute or linkage organization
   Total 30Hours 3 Credits

2. Project/ Seminar 2 Credits

3. Field visits 1 Credit

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-III, Core-VII Inland and marine Fisheries
Syllabus

Hours 4 **Credits 4**

OBJECTIVES:	LEARNING OUT COME
➢ To study the Riverine, Reservoir and Estuarine fisheries. ➢ To understand pelagic fishery resources and demersal resources	➢ Student learns the knowledge on the inland fishery resources ➢ Student learns the knowledge on the pelagic and demersal fishery resources

Module 1: Riverine and Estuarine Fisheries (10 Hrs.)

1.1. Riverine fisheries – Major river systems in India, important characteristic features of Rivers
1.2. Estuarine fisheries- definition, Ecological characteristics of estuary, Biota of estuary, classification and categories of estuaries- capture fisheries- resident and migrant species.
1.3. Fishing methods, recent statistics of catches.

Module 2: Reservoir and Lakesterine Fisheries (10 Hrs.)

2.1. Reservoir fisheries- Major reservoirs in India- important characteristic features of reservoirs.
2.2. Lakesterine fisheries- definition, Types of lakes based on circulation, nutrients and surface temperature.
2.3. Fishing methods, recent statistics of catches.

Module 3: Marine Fisheries- Pelagic Resources (15 Hrs.)

3.1. Marine fishery resources in India- important fishing zones including Wadge bank, maritime states.
3.2. Major pelagic resource groups– sardines, mackerel, anchovies, ribbon fishes, tuna, seer fishes.
3.3. Methods of fishing - Recent catch statistics of pelagic fisheries.

Module 4: Marine Fisheries- Demersal Resources & Deep Sea Resources (15 Hrs.)

4.1. Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources.
4.2. Methods of fishing, recent catch statistics. Fishery of mud banks.
4.3. Major deep sea resources - fishes, shrimps, lobsters – status of deep sea fishing in India. Fishing regulations.

Internal Evaluation

- Assignment
- Seminars
- Quiz
- Field visits

Suggested Reading:

Core reading

1. Jhingran, V.G. 1993. Fish and fisheries of India. Hindustan Publishing Corporation (India), New Delhi.
2. Ricker, W.E. 1984. Methods for assessment of fish production in freshwaters. Blackwell Publications.
3. Srivastava, C.B.L., 1985. Textbook of Fishery Science and Indian Fisheries. Kutub Mahal Publications, Allahabad.
4. S.S. Khanna. An introduction to fishes
5. Kurian, C.V. and Sebastian, V.O. 1986. Prawns and prawn fishery of India. Hindustan Publishing Corporation (India), New Delhi.
6. Yadav, B.N. Fish and Fisheries. Daya Publishing House

Supplementary Reading

1. S.S. Khanna. An introduction to fishes
2. Kurian, C.V. and Sebastian, V.O. 1986. Prawns and prawn fishery of India. Hindustan Publishing Corporation (India), New Delhi.
3. Yadav, B.N. Fish and Fisheries. Daya Publishing House

Advanced Reading

1. Blake, D.J.H. 2006. *The Songkhram River wetlands – a critical floodplain ecosystem of the lower Mekong Basin*. International River Symposium 06, Brisbane, Australia. pp. 1-25.
2. Boonkumjad, S. 2004. *Analysis on fisheries cooperation between Thailand and Union of Myanma*r. Technical paper No. 6/2004. Fisheries Foreign Affairs Division, Department of Fisheries. 66 pp. [in Thai]
3. Coates, D. 2002. *Inland capture fishery statistics in Southeast Asia: current status and information needs*. Asia-Pacific Fishery Commission, Bangkok, Thailand. RAP Publication No. 2002/11. 114 pp.
4. Pawaputanon Na Mahasarakarm O. 2007. *An Introduction to the Mekong fisheries of Thailand*. Mekong Development Series No. 5. Vientiane, Lao PDR, Fisheries Programme, Mekong River Commission. 49 pp.
5. Royal Irrigation Department 2004. *Data cited in* Country review paper on inland capture fisheries information – Thailand. FAO. FI:TCP/RAS/3013, Field Document 11, 31 pp.
6. SAS Institute Services. *JMP statistics andgraphic guide version 4*. 2000. SAS Institute Inc. United State of America. 613 pp.
7. Thummachua, S. 2004. *Cost and revenue analysis of Thai fishing vessels operating in Myanmar waters*. Technical paper No. 1/2004. Fisheries Foreign Affairs Division, Department of Fisheries. 17 pp. [in Thai]
8. Virapat C., Phimonbutra U. and Chantarawaratid C. 2000. *Fishery and fisheries management in Thai reservoirs: review and assessment*. Mekong River Commission. Vientiane. 42 pp.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II[nd] B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-III,
CORE-VII INLAND AND MARINE FISHERIES,
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	02	03
MODULE-III	02	01	03
MODULE-IV	01	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
II[nd] B.Voc., COMMERCIAL AQUACULTRE SEMESTER-III, 2015-16
MODEL QUESTION PAPER

Time: 3 hrs. TITLE: INLAND AND MARINE FISHERIES, CORE-VII Marks: 70

PART – 1

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

3 x 10 = 30

SECTION- A

1. Write essay on major riverine systems in India.
2. Define estuary? Write about the classification of estuaries?
3. Write about major pelagic resource groups.

SECTION- B

4. Describe the fishing methods? Write about recent catch statistics.
5. Write essay on fishing policies and problems.
6. Explain the estimation of fish landing.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Capture fisheries
8. Cold water fisheries
9. Migrant fisheries
10. Fishing zones
11. Mud banks
12. Deep resources
13. Deep sea fishing

Part – III

Answer any **TEN** Questions **10x2=20**

14. Inland fish
15. Cast net
16. Fishing gear
17. Reservoir
18. Migration
19. Anadromous
20. Pomfrets
21. cephalopods
22. Inshore
23. Lobsters
24. Conservation
25. Sancturies

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-III, Core-VIII BIO-STATISTICS AND COMPUTER APPLICATIONS
Syllabus

Hours4 **Credits 4**

OBJECTIVES:	LEARNING OUT COME
➢ To briefly introduce some important statistical techniques needed for understanding growth and population dynamics of fishes. ➢ To understand important computer aided packages used for present day fisheries and aquaculture.	➢ Student learns the knowledge on the methods used in the bio statistics ➢ Knowledge on the population dynamics and growth dynamics will be learnt, ➢ Knowledge on the basic computer skills will be learnt by the learner

Module 1: Basic Statistics & Measures of central tendency (10 Hrs)

1.1. Origin, growth, meaning, definition and use of statistics.
1.2. Methods of data collection. Biological data collection.
1.3. Sampling methods. Biological sampling.
1.4. Frequency distribution, tabulation and diagrammatic representation of data.
1.5. Arithmetic mean, median, mode, quartiles, geometric mean and harmonic mean.
1.6. Measures of dispersion and its application.

Module 2: Statistical Tests (10 Hrs)

3.1. Application and use of least square method. Application of probability.
3.2. Testing of hypothesis. Chi-square test, t test, f-test, Z- test.
3.4. Degrees of freedom, test of goodness of fit, test of independence. Analysis of Variance.

Module 3: Computer - History & Introduction (10 Hrs)

4.1. History of computing; Computer organization; Binary system; Hardware and software; Generation of computers; Computer programming; System flowcharts.
4.2. Microprocessors, Storage devices, Memory systems and ASCII Code; Input- Output devices; Disk Operating System; Booting; Formatting; Operating Systems.

Module 4: Introduction to Office applications & Web Development and programming (10 Hrs)

6.1. Office application software, Word Processing, Worksheet, presentation softwares, and data analysis. SQL.

6.2. Basics of web development using HTML. Introduction to the World Wide Web, Creation of email accounts and search for organized information.

Internal Evaluation

- Assignment
- Seminars
- Quiz
- Field visits

Reference Books:

1. Fundamentals of mathematical statistics – Gupta and Kapoor.
2. Fundamentals of Statistics – S.P. Gupta
3. Elementary Statistics – Yule and Kendall
4. Introduction to Biostatistics – Sokal & Rohlf
5. Fundamentals of Biostatistics – By Khan and Khanum

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II[nd] B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-III,
CORE-VIII BIO-STATISTICS AND COMPUTER APPLICATION,
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	02	03
MODULE- III	02	01	03
MODULE-IV	01	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
II[nd] B.Voc., COMMERCIAL AQUACULTRE SEMESTER-III, 2015-16
MODEL QUESTION PAPER
TITLE: BIO-STATISTICS AND COMPUTER APPLICATION, CORE-VIII

Time: 3 hrs **Marks: 70**

PART – 1

Note: Answer any THREE questions choosing at least one question from each section **3 x 10 = 30**

SECTION- A

1. Write essay on frequency distribution.
2. Measures of dispersion and its application their importance.
3. Describe the testing of hypothesis? Explain the Chi-square test.

SECTION- B

4. Write essay on computer organisation.
5. Explain the office application software and other softwares.
6. Write essay on World Wide Web.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Biological data collection
8. Frequency distribution
9. Arithmetic mean
10. Probability
11. Disk Operating System
12. Word processing
13. Using HTML

Part – III

Answer any **TEN** Questions **10x2=20**

14. Statistics
15. Consumers
16. Tabulation
17. Median
18. Harmonic mean
19. Binomial and poisson
20. Hardware
21. Storage devices
22. SQL
23. Lobsters
24. WWW
25. HTML

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-III,
Core-IX AQUACULTURE NUTRITION
Syllabus

Hours 4 **Credits 4**

OBJECTIVES:	LEARNING OUT COME
➢ To provide a basic understanding about fish nutrition. ➢ Provide the knowledge on the Fish feeding physiology, nutritional requirements. ➢ Providing the basic knowledge on the feed composition, formulation of nutritionally balanced feed, production and use of live feed for optimal production.	➢ Student will learn the concept of the fish nutrition,. ➢ Knowledge on the physiology of fish feeding and nutritional requirements will be learnt by the students. ➢ Knowledge on the fish feed composition, formulation and balanced diet will be learned.

Module 1: Biochemical aspects, Feed ingredients & feed requirements of Fish (10 Hrs)

1.1. Protein and amino acid requirement, carbohydrate and lipid requirement, Essential fatty acids, Non protein nitrogen sources.
1.2. Vitamin and mineral requirements, vitamin C for fish and shell fishes.
1.3. Different feed ingredients- animal, plant, microbial origin, SCP, silages, fermented products.
1.4. Anti-nutritional factors. Compounded feeds, pellets, crumbles and microencapsulated feed. Storage, quality standards, proximate composition & chemical evaluation.

Module 2: Feed & Feed Manufacturing (10 Hrs)

2.1. Different forms of feed-fodders, mash, pellets, floating and sinking feeds. Feed formulation - methods, square method.
2.2. Feed manufacturing processes, Extrusion, Pelletization.
2.3. Quality control in Fish feed manufacturing-

Module 3: Feed Management & Feed Quality (10 Hrs)

3.1. Feed schedule in finfish and shellfish, Protein requirements of finfish and shellfish
3.2. Artificial feed formulations of different cultural species
3.3. Wet feed, dry feed and larval feeds; advantages and disadvantages in culture farms.
3.4. Feed energetics, feed conversion efficiency, protein efficiency ratio, feed conversion ratio, net protein utilization, leaching, water stability. Quality standards.

Module 4: Larval nutrition (10Hours)

4.1. Larval stages, nutritional requirements of fish and shellfish larvae, quality requirements of larval feeds (particle size, digestibility).
4.2. Natural food and its importance in aquaculture, nutritional quality of commonly used fish food organisms, bioenrichment, biofilm/periphyton and its uses.

Internal Evaluation

- Assignment
- Seminars
- Quiz
- Field visits

Suggested reading

Core reading

1. Brown E.E Fish Farming Handbook
2. Milne P.H. Fish and shell fish farming in coastal waters
3. CMFRI manual on research methods for fish and shellfish nutrition
4. Borgstorm,G. Fish as Food
5. Heen,E and Kreuzer,R. Fish in Nutrition
6. Shepherd,J and Brommage,W. Intensive Fish Farming Techniques
7. Hepher,B. and Pruginin,Y. Commercial Fish Farming

Supplementary Reading

1. Halver J.E. Fish Nutrition
2. Hepher Nutrition of pond fishes

Advanced Reading

1) Muir,J.F. and Donald,R. Recent Advances in Aquaculture

Other Reference Books :

1. Prosser & Brown. Comparative Physiology
2. Hoar. Comparative Physiology
3. Hoar & Randall. Fish Physiology
4. Lockwood. Physiology of Crustacea
5. Watermann. Physiology of Crustacea
6. Leninger. Principles of Biochemistry
7. Harper. Physiological Chemistry
8. Bell Patterson & Smith. Textbook of Physiology & Biochemistry
9. Wilson. Textbook of animal Physiology.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II[nd] B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-III,
CORE-IX, AQUACULTURE- NUTRITION
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	02	03
MODULE- III	02	02	03
MODULE-IV	01	01	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
II[nd] B.Voc., COMMERCIAL AQUACULTRE SEMESTER-III
MODEL QUESTION PAPER

Time: 3 hrs. **TITLE: AQUACULTURE- NUTRITION, CORE-IX**

Marks: 70

PART – 1

Note: Answer any THREE questions choosing at least one question from each section **3 x 10 = 30**

SECTION- A

1. Describe the essential fatty acids.
2. Write an essay on anti nutritional factors.
3. Write an essay storage and transportation of feeds.

SECTION- B

4. Describe the shrimp feeds in India.
5. Explain the feed conversion efficiency.
6. Write essay on natural food and its importance in aquaculture.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Non protein nitrogen
8. Preservatives
9. Fermented products
10. Feed formulation
11. Floating and sinking
12. Feed energetic
13. Larval nutrition

Part – III

Answer any **TEN** Questions **10x2=20**

14. Carbohydrate
15. Vitamin
16. SCP
17. Pellets
18. Square method
19. Rancidity
20. Check trays
21. Shrimp
22. FCR
23. Leaching
24. Bio enrichment
25. Periphyton

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-IV,
CORE-X GENETICS AND BIOTECHNOLOGY
Syllabus

Hours 4 **Credits 4**

OBJECTIVES:	LEARNING OUT COME
➢ To provide basic idea about the principles of genetics and depict the hereditary mechanism in cultured species. ➢ To acquaint with the state of the art techniques in biotechnology as applied to aquaculture industry. .	➢ Student will learn the concept of Medalian genetic principles ➢ Knowledge on heredity determination will be learnt. ➢ Principles of Biotechnology and its applications in the aquaculture will be learnt

Module 1: Basic Genetics (10Hrs)

1.1. Introduction- Genetics, Mendel's law of inheritance, interaction of gene.
1.2. Supplementary and complementary genes.
1.3. Principles of fish genetics. Cytogenetics, quantitative genetics, population genetics.

Module 2: Selection and Hybridisation (10 Hrs)

2.1. Genetic selection, mass selection, genotypic selection, family and sib selection, progeny testing and combined selection.
2.2. Principles of breeding- methods and selection, selective hybridisation, intra-specific and inter-specific hybridisation.
2.3. Hybrid vigor, inbreeding and cross breeding.

Module 3: Sex determination & Chromosome manipulation in fish and shell fishes(10 Hrs)

3.1. Practical application of genetics in aquaculture. Genetics of sex determination in fish.
3.2. Gonochorism, Hermaphroditism, Protandry, Protogyni, Environmental Influence of Sex Determination.
3.3. Polyploidy, gynogenesis and androgenesis. Monosex production, super male and super female fish production techniques.

Module 4: Aquaculture Biotechnology & Marine Biotechnology (10 Hrs)

4.1. Recombinant DNA technology, determinants of DNA replication, cloning, vectors, transformation. Gene manipulation in fish, transgenic fish production.
4.2. Use of PCR for the detection of white spot syndrome in shrimp.
4.3. Scope and the present status of marine biotechnology, general application of molecular biological techniques to the marine sciences.
4.4. Application of tissue culture in sea weed.
4.5. Use of probiotics and antibiotics in aquaculture operations. Cryopreservation.

Internal Evaluation

- Assignment
- Seminars
- Quiz
- Field visits

Suggested reading

Core reading

1. Karinasagar I, Karunasagar I and Reily A. Aquaculture Biotechnology
2. Varun Mehta. Fisheries and Aquaculture biotechnology
3. Pandian TD, Kumar A and Prasad K. Aquaculture and Biotechnology
4. Lopes L.- Gene transfer in aquatic organisms
5. Singleton – Elementary Genetics
6. Gjedrem T- Genetics in aquaculture
7. Gupta,S.C. and Kapoor,V.K. Fundamentals of Applied Statistics.
8. Snedecor and Cochran,W.G. Statistical Methods.

Supplementary Reading

1. Sandhya Mitra- Genteics
2. Varma and Agarwal- Genetics
3. Rath RK- Freshwater Aquaculture

Advance Reading

1. NBFGR- Training manual for DNA finger printing
2. Gupta PK- Elements of Biotechnology
3. Padhi BR – Genetics and Aquaculture

Reference Text Books :

1. Hepher, B. and Y. Pruginin. Commercial fish farming. John Wiley & Sons Inc., 1981.
2. Jhingran, V.G. Fish and Fisheries of India, 1982.
3. Bhattacharya, S. Hormones in Pisciculture. Biology Education. Vol.9, No.1, pp.31-41, 1992.
4. Subramonium, T. Endocrine regulation of reproduction and molting in crustacean and its importance in shrimp aquaculture development.
5. Summer School Manuals of CIFE. Recent Developments in Biotechnology. CIFE, 1998.
6. Genetics and Biotechnological tools in Aquaculture and Fisheries, CIFE, 1998.
7. I.C.A.R. Biotechnology in Aquaculture – Training Manual. CIKA, Bhubaneswar, 1992.
8. Darnell. Molecular Cell Biology.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II[nd] B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-IV,
CORE-X GENETICS AND BIOTECHNOLOGY
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	01	03
MODULE- III	01	02	03
MODULE-IV	02	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
IInd B.Voc., COMMERCIAL AQUACULTRE SEMESTER-IV, 2015-16
MODEL QUESTION PAPER
TITLE: GENETICS AND BIOTECHNOLOGY, CORE-X

Time: 3 hrs. **Marks: 70**

PART – 1

Note: Answer any THREE questions choosing at least one question from each section **3 x 10 = 30**

SECTION- A

1. Describe the principles of fish genetics? Explain the biochemical genetics.
2. Write an essay on principles of breeding? Explain the selective hybridisation .
3. Write an essay storage and transportation of feeds.

SECTION- B

4. Describe the practical application of genetics in aquaculture.
5. Explain the polyploidy and discussion about androgenesis.
6. Write essay on tissue culture in sea weed.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Cytogenetics
8. Mass selection
9. Intra specific hybridisation
10. Hermaphroditism
11. Sex determination
12. Gynogenesis
13. Cryopreservation

Part – III

Answer any **TEN** Questions **10x2=20**

14. Genetics
15. Complementary genes
16. Sib selection
17. Hybridisation
18. Protandry
19. Gonochorism
20. Protandy
21. DNA
22. PCR
23. Polyploidy
24. Sea weed
25. Probiotics

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-IV, Core-XI PATHOLOGY IN AQUACULTURE
Syllabus

Hours – 4 **Credits 4**

OBJECTIVES	LEARNING OUT COME
➢ To understand the various types of diseases among the cultivable fishes, to learn and apply methods of control and precaution of diseases. ➢ To understand the tools for diagnosis, and disease management strategies available today. ➢ To understand the role of environment as an important player in infectious diseases. .	➢ Knowledge on the diseases will be learnt. ➢ Precautionary measures will be known to prevent the spread of the disease. ➢ Knowledge on the diagnostic tools will be learnt. ➢ Environmental quality disease free practice will be learnt.

Module 1: Pathology and Parasitology (10 Hrs)

1.1. Introduction to fish diseases –Definition and categories of diseases – Disease and environment. pathology and parasitology.
1.2. Stress as a factor in the occurrence of diseases. Parasitism – host-parasite relationship.

Module 2: Fungal and Viral Diseases (10 Hrs)

2.1. Fungal diseases (finfish) – Saprolegniosis, brachiomycosis, ichthyophorus diseases.
2.2. Lagenidium diseases – Fusarium disease Viral diseases (finfish) – IPN, IHN, Viral Hemorrhagic Septicemia, Spring Viremia of carps – Major CCVD, Carp lymphocytes.
2.3. Major shrimp viral diseases – *Bacculovirus penaeii*, Monodon Bacculovirus, Bacculoviral midgut necrosis, IHHNV, Hepatopancreatic parvo like virus, Yellow head bacculovirus, white spot bacculovirus.

Module 3 Bacterial, Protozoan and Metazoan Diseases. (10 Hrs)

3.1. Common bacterial diseases (Enteric red mouth disease, Bacterial cold water disease, furunculosis, vibriosis, dropsy and Gill and fin rot) their diagnosis and treatment.
3.2. Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis. 3.3. Metazoan Diseases- diseases caused by annelids, helminthes, crustaceans and molluscs.

Module 4: Nutritional diseases & Immunology (10 Hrs)

4.1. Nutritional pathology – lipid liver degeneration, Vitamin and mineral deficiency diseases.
4.2. Nutritional cataract. Genetically and environmentally induced diseases.
4.3. Defense mechanism in fish and shell fish, Application and development of vaccines.
4.4. Diagnostic tools – immune detection- DNA/RNA techniques.
4.5. General preventive methods and prophylaxis.Methods of pathological examination of fish and infectious diseases, BMP in Aquacultue

Internal Evaluation

- Assignment
- Seminars
- Quiz
- Field visits

Suggested reading

Core reading

1. R. Ramachandran Nair Encyclopedia of fish disease –
2. K.P. Biswas Prevention and control of fish and Prawn diseases –
3. B.K. Mishra, P. Swain, P.K.Sahoo, B.K.Das, N.Sarangi. Disease management in FW Pisicultue –
4 Wheaton,F.W. Aquacultural Engineering
5 Bose et al. Coastal Aquacultural Engineering

Supplementary Reading

1. Sinderman C.J. Principle diseases of Marine fish and shell fish
2. Schaperclaus Fish Diseass.

Advanced Reading

1. Roberts R.J.Fish Pathology..
2. Post, G. Text Book of Fish Health.

Other Reference Text Books :

1. Cheng, T.C. The Biology of Animal Parasites. Saunders, Philadelphia, 1964.
2. Reichenbach, H.H. Fish Pathology. T.F.H. (Great Britain) Ltd., England, 1965.
3. Conroy, D.A. & R.L. Herman. Textbook of Fish Diseases. Ibid, 1968.
4. Ribelin, W.E. & G. Miguki. The Pathology of Fishes. The Univ. of Wisconsin Press Ltd., Great Russel st., London, 1975.
5. Schauperclaus. Fish Diseases. Vol. I & II.
6. Lightner, D.V. Shrimp Disease Diagnosis, 1998.
7. Sinderman. Fish Diseases, Vol. I. Shell Fish Diseases, Vol. II.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II[nd] B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-IV,
CORE-XI PATHOLOGY IN AQUACULTURE
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	01	03
MODULE- III	01	02	03
MODULE-IV	02	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
IInd B.Voc., COMMERCIAL AQUACULTRE SEMESTER-IV, 2015-16
MODEL QUESTION PAPER
TITLE: PATHOLOGY IN AQUACULTURE, CORE-XI

Time: 3 hrs. **Marks: 70**

PART – 1

Note: Answer any THREE questions choosing at least one question from each section **3 x 10 = 30**

SECTION- A

1. What is parasitism? Explain the host parasite relationship.
2. Write an essay on shrimp viral diseases and prophylaxis.
3. Explain about the protozoan diseases and their treatment.

SECTION- B

4. Describe the vitamin deficiency diseases .
5. Explain the diagnostic tools of immunology.
6. Write essay on fish health management.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Fish diseases
8. Brachiomycosis
9. Metazoan diseases
10. Bacterial diseases
11. Nutritional cataract
12. Diagnostic tools
13. Sustainable aquaculture

Part – III

Answer any **TEN** Questions **10x2=20**

14. Pathology
15. Parasitism
16. CCVD
17. IHN
18. Trypanosomiasis
19. Vitamin
20. Aflatoxixn
21. DNA
22. Prophylaxix
23. Immunology
24. Evalution
25. Quarantine

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-IV, Core-XII ORNAMENTAL FISH CULTURE
Syllabus

HOURS 4 **CREDITS 4**

OBJECTIVES	LEARNING OUT COME
➢ To give overview on the potential ornamental fishes and their breeding habits. ➢ To develop idea about the various management practices for breeding and rearing of ornamental fishes . ➢ To have a basic understanding of aquarium setting and aquarium accessories involved.	➢ Knowledge on the ornamental fish breeding will be learnt by the student. ➢ Management practices of ornamental fishes will be learnt. ➢ Able to gain knowledge on the aquarium maintenance and accessories.

Module 1: Introduction (10 Hrs)

1.1.1. Introduction to aquarium, ornamental fishes and aquarium accessories- Aerators, filters and lighting.

1.1.2. World aquarium trade and present status. Design and construction of public fresh water and marine aquaria and oceanarium..

1.2. Water quality management in aquarium fishes, Biofilters in aquarium.

Module 2: Aquarium Management (10 Hrs)

2.1. Setting up of aquarium – under gravel filter, pebbles, plants, drift wood, ornamental objects and selection of fishes, Quarantine measures.

2.2. Aquarium maintenance and water quality. Control of snail and algal growth.

2.3. Handling, care and transportation of fish. Temperature acclimation, oxygen packing.

Module 3: Freshwater Ornamental Fishes (10 Hrs)

3.1. Species of ornamental fishes; their taxonomy and biology- Live bearers, Gold fish and koi, Gourami, Barbs and Tetras, angel fish, cichlids.

3.2. Maturation, secondary sexual characters, breeding habits, spawning, parental care, fertilization and development of eggs.

3.3. Hatching, larval rearing and their health.

3.4. Freshwater plants – their taxonomy and morphology, multiplication of aquarium plants – different methods.

Module 4: Marine Ornamental Fishes & Disease (10 Hrs)

5.1. Marine ornamental fishes – varieties and their habitat.

5.2. Major marine ornamental fish resources of India. Method of collection of live fish. Use of anesthetics.

5.3. Breeding of marine ornamental fishes (clown fishes and Damsel fishes). Reef aquarium and live rocks.

5.4. Other ornamental organisms – anemones, worms, lobsters, shrimps, octopus, starfish.

6.4. Common parasites infecting ornamental fishes. Bacterial, viral, fungal diseases of ornamental fishes and their control and prophylaxis.

Internal Evaluation

- Assignment
- Seminars
- Quiz
- Field visits

Suggested reading

Core reading

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

Supplementary Reading :

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

Advanced Reading

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

Other Reference Books:

1. Bardach, et. Al. Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms. John Wiley & Sons, NY, 1972.
2. Stickney, R.R. Principles of Water Aquaculture. John Wiley & Sons, NY, 1979.
3. Chondar, C.L. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, 1980.
4. Jhingran, V.G. Fish and fisheries of India. Hindustan Publ. Corporation (India), 1982.
5. Santhanam, R. et. Al. A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
6. Pilley, T.V.R. Aquaculture – Principles and Practices. Fishing News (Books) Ltd., London, 1990.
7. Pandey, A.C. Air Breathing Fishes. Reliance Publishing House, New Delhi, 1990.
8. Janardhana Rao, K. & S.D. Tripathi. A Manual of Giant Freshwater Prawn Hatchery. CIFA, Kausalyaganga, Orissa, India, 1993.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II[nd] B.Voc., (COMMERCIAL AQUACULTURE), SEMESTER-IV,
CORE-XII AQUARICULTURE
BLUE PRINT FOR QUESTION PAPER SETTER

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS	VERY SHORT ANSWER QUESTIONS
MODULE-I	01	02	03
MODULE-II	02	01	03
MODULE- III	02	02	03
MODULE-IV	01	02	03

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

P.R.GOVERNMENT COLLEGE (A), KAKINADA
CHOICE BASED CREDIT SYSTEM
II[nd] B.Voc., COMMERCIAL AQUACULTRE SEMESTER-IV, 2015-16
MODEL QUESTION PAPER

Time: 3 hrs. **TITLE: AQUARICULTURE, CORE-XII** **Marks: 70**

PART – 1

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

3 x 10 = 30

SECTION- A

1. Write an essay on water quality parameters in aquariculture.
2. Describe the transportation of aquarium fish and following methods.
3. Explain the maturation of ornamental fishes.

SECTION- B

4. Describe the marine ornamental fish habitat and varieties.
5. Explain the breeding of marine ornamental fishes.
6. Write essay on nutritional requirement of aquarium fish.

Part – II

Answer any **FOUR** Questions **4x5=20**

7. Biofilters in aquarium
8. Quarantine measures
9. Species of ornamental fishes
10. Commercial production of goldfish
11. Aquarium plants
12. Marine ornamental fishes
13. Culture of fish food organisms

Part – III

Answer any **TEN** Questions **10x2=20**

14. Aquariculture
15. Biofilters
16. Pebbles
17. Quarantine
18. Live bearers
19. Cichlids
20. Gourami
21. Angel fish
22. Clown fishes
23. Anemones
24. Laval feeds
25. Prophylaxis

B.Voc IInd Year Practaicals
At the end of IV semester
Paper I: Water and Soil quality parameters & Biostatistics

I.Soil quality parameters

A. Types of soil
B. Soil pH
C. Soil Organic carbon
D. Soil Phosphates
E. Soil Nitrogen
F. Fertility of soil (N, P, K elements)
G. Water retention capacity of soil

II.Water quality parameters

Chemical methods

A. Dissolved Oxygen (DO)
B. Salinity
C. Water pH
D. Alkalinity
E. Hardness of water
F. Transparency (Secchi disc)
G. Determination of Nitrites
H. Determination of Nitrates
I. Determination of Phosphates
J. Determination of Ammonia
K. Determination of Hydrogen Sulphide

Paper II: Feed analysis, Fish pathology and Aquarium fishes

I. Feed management (Analysis)

1. Estimation of proteins in fish feed.
2. Estimation of carbohydrates
3. Estimation of Fats
4. Estimation of Ash content
5. Estimation fiber

II. Microbiology & Pathology

1. Sterilization techniques
2. Preparation of microbiological media
3. Culture of micro organisms
4. Isolation of identification of micro organisms
5. Staining
6. PCR technique
7. Identification of WSSV by PCR

III. Breeding and Rearing of Aquarium Fishes

1. Identification of common Fresh water aquarium fishes (10 Nos.)
3. Construction of aquarium
4. Setting up of aquarium (maintained by students can be evaluated after one month)
5. Water quality management in aquariums
6. Aquarium plants and décor materials
7. Air pump and biological filter
8. Breeding of live bearers-Guppy
9. Breeding of egg layers- gold fishes
10. Breeding of bubble nest builder- Gourami

PRACTICAL PAPER III
SKILL COMPONENT AND BENCH WORK

1. Training – OJT (On Job Training)
2. Internship
3. Project
4. Seminar
5. Field visits

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-V, Core-XIII Fishery Microbiology and Fishery By-Products
Syllabus

HOURS 4 **CREDITS 4**

Module 1: Introduction of Microbiology

1.1. History and development of microbiology-Contributions of Louis Pasteur, Koch and Winogradsky. General characteristics of bacteria, fungi, viruses, algae and protozoans.
1.2. Microscopy- general principles; bright field, dark field, phase contrast and electron microscopy.
1.3. Structure of fungi and yeast cell. Ultrastructure of virus and bacteria – classification of viruses. Life cycle of bacteriophages-lytic and lysigenic cycle.

Module 2: Aquatic Microbiology

2.1. Microflora and fauna of aquatic environment. Effect of environmental factors on microbiology of fish culture pond.
2.2. Prokaryotic growth - characteristic features of bacterial growth curve.
2.3. Autochthonous and Allochthonous microorganisms in culture pond. Health significant bacteria in culture pond.

Module 3: Fish Microbiology

3.1. Fish as an excellent medium for growth of microoraganisms.
3.2. Perishability of sea food – Spoilage microflora of fish and shell fish.
3.3. Intrinsic and extrinsic factors affecting spoilage of fish and shell fish.

Module 4: Fishery By-Products and value added products

4.1. Fish By-Products – Fish meal, isinglass, fish oils, fish glue, fish manure, chitin, chitosan, fish silage, fish ensilage, aesthetic values of fish.
4.2. Value addition in sea food – different types of value added products from fish and shell fishes. Advantages of value addition.
4.3. Fish mince and Surimi. Analog and fabricated products.

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-V, Core- XIV Fish Processing Technology and Quality Control
Syllabus

HOURS 4 **CREDITS 4**

Module 1: Introduction of Fish Processing and Freezing

1.1. Introduction of fish processing. Principles of fish preservation-Precautions taken in handling fish in the fishing vessel, landing center and processing plant.
1.2. Fundamental principles involved in chilling and freezing of fish and fishery products. Various freezing methods used in shrimps and fishes.
1.3. Preservation by refrigerated seawater and chilled sea water.

Module 2: Preservation techniques of Finfish/Shell Fish processing

2.1. Principles of preservative methods - Drying, Salting, Smoking and Canning.
2.2. Principles of freeze drying. Accelerated freeze drying and packing of freeze dried products.
2.3. Modern methods of preservation by irradiation and modified atmospheric storage.

Module 3: Packing and labeling, storage and Export of Fishery Products

3.1. Packing requirements and regulations. Labeling of fish and fishery products.
3.2. Different types of cold storages. Requirements in retail outlet; Insulated and refrigerated vehicles.
3.3. Export of fishery products from India – major countries, important products, export documents and procedures.

Module 4: Quality Assurance and Quality Control

4.1. Quality Assurance – Concepts of Hazard Analysis Critical Control Point (HACCP), Good Manufacturing Practice (GMP), Sanitary Standard Operating Procedure (SSOP).
4.2. Quality control – Basic concepts and quality control of fish processing. Salient features of sea food quality and factors.
4.3. Standards of Sea food.

P.R. Govt. College (A), Kakinada
Bachelor of Vocational course (Commercial Aquaculture)
Semester-VI, Core- XV AQUACULTURE ENGINEERING
Control
Syllabus

HOURS 4 **CREDITS 4**

OBJECTIVES	LEARNING OUT COME

Module 1: Introduction

1.1. Introduction of Aquaculture engineering.
1.2. Technical components of farm designing.
1.3. Recent trends in aquaculture engineering.

Module 2: Aquaculture facilities

2.1. Planning process, site selection and evaluation, design, components.
2.2. Construction of tanks, ponds, cages and hatcheries.
2.3. Mapping of Transportation from culture ponds to urban.

Module 3: Water intake and outlet, treatment

3.1. Pipe line, water flow and head loss, pumps-different types.
3.2. Equipment used for water treatment, filters, ultraviolet light, ozone, heating and cooling and other processes of disinfection.
3.3. Planning of drainage system of Aquaculture ponds.

Module 4: Aeration, oxygenation and Recirculation

4.1. Design and fabrication of aerators, compressors, blowers, paddle wheel aerators, oxygen injection system.
4.2. Recirculation and water use systems Definition, components and design.
4.3. Instruments for measuring water quality.

Bachelor of Vocational course (Commercial Aquaculture)

Semester-VI, Core- XIV FISHERIES ECONOMICS AND MARKETING

Control

Syllabus

HOURS 4 **CREDITS 4**

OBJECTIVES	LEARNING OUT COME

Module 1: Principles of economics and Economy of fishermen

1.1. Definition, subject matter and scope of economics. Law of diminishing returns, laws of increasing, constant and decreasing utility and returns.
1.2. Law of equimarginal returns. Importance of economics in aquaculture development.
1.3. Fishermen populations, GDP from fisheries sector, foreign exchange earnings and
employment potential of fishing industry.

Module 2: Prospective of Aquaculture in Socio-Economic impact & Rural Development

2.1. Resource use and development, Socio-economic analysis, Socio-demographic Profile, work contribution.
2.2. Household expenditure, income contribution, decision making.
2.3. Female headed household, impact of different age groups, socioeconomic condition of fisherman.

Module 3: Marketing and Planning and extension

3.1. Markets and their kinds. Law of demand and supply, price determination, problems of fish marketing in India.
3.2. Exports of fish and fishery products, trends ;and problems therein. Role of MPEDA in exports of fish and fishery products.
3.3. Fishery development plans and various schemes, with particular reference to FishFarmer's Development Agencies, their achievements.

Module 4: Fishery co-operatives

4.1. Functions, financial assistance, input supplies, marketing of fish. Socio-economic development.
4.2. Role of fisheries corporations and Missionary Organizations in fisheries development.
4.3. Present Economical and Trade market status of fisheries in India.

P.R. GOVT. COLLEGE (A)
DEPARTMENT OF ZOOLOGY
BACHELOR OF VOCATIONAL COURSE
(COMMERCIAL AQUACULTURE)
LIST OF EXAMINERS

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

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P.R. GOVT. COLLEGE (A)
DEPT. OF ZOOLOGY
BACHELOR OF VOCATIONAL COURSE
(COMMERCIAL AQUACULTURE)
QUESTION PAPER SETTERS

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