

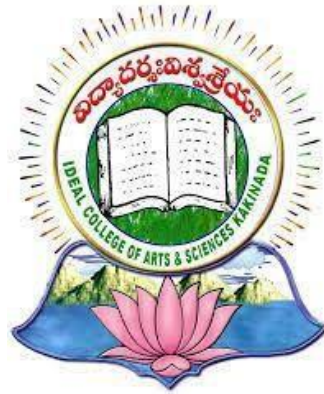
**IDEAL COLLEGE OF ARTS AND SCIENCES**  
**(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)**  
**DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA**

**SYLLABUS**  
**FOR**  
**B.VOC., INDUSTRIAL AQUACULTURE**

# **IDEAL COLLEGE OF ARTS AND SCIENCES**

(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)

**DR. P.V.N. RAJU VIDYAPRANGANAM  
KAKINADA**



**BOARD OF STUDIES  
2021-2022**

**COURSE: B.VOC., INDUSTRIAL AQUACULTURE & FISHERIES**

First & Second Year (I ,II , III & IV Semester)

**DEPARTMENT OF  
FISHERIES AND AQUACULTURE**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

Date: 28.08.2021

**Board of Studies of B.Voc., INDUSTRIAL Aquaculture and Fisheries**

A meeting of Board of studies of the Department of Fisheries and Aquaculture will be held on **28.08.2022 at 12.30 P.M** in Ideal College of Arts and Sciences (Autonomous), Vidyutnagar, Kakinada, to consider the following Agenda.

You are cordially invited to attend the meeting and make it a success.

**Agenda:**

- 1.To ratify the syllabus for the First year & Second year (I, II, III & IV Semesters).
- 2.To prepare and ratify scheme of Examinations for both internal and external examinations.
- 3.Model Question paper for First year & Second year).
- 4.To fix Panel of paper setters and Examiners.
- 5.Additional inputs into the curriculum and up gradation of syllabus incorporate the Apprenticeship.
- 6.Other academic activities of Department.

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM

**KAKINADA**

**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**Board of Studies of B.Voc., INDUSTRIAL Aquaculture and Fisheries**

The Board of Studies for the Department of Fisheries and Aquaculture for the year 2021-2022 is constituted with the following Members.

**Sl.No. Members Present**

- |                           |                |
|---------------------------|----------------|
| 1. Dr. K. Narasimha Murty | Chairman       |
| 2. P V Lovaraju           | Member         |
| 3. V.Manikanta            | Student Member |
| 4. A.Janaki Devi          | Student Member |

**Adikavi Nannaya University Nominee**

1. Dr. K. Ramaneswarai  
Dept. of Zoology  
HOD, Adikavi Nannaya University  
Rajamahendravaram  
Cell No: 8074112754

**Members from other Colleges**

1. Dr. Muralidhar P. Ande  
Senior Scientist & Office In-Charge, CIFE, Kakinada  
Cell No: 7396182790
2. Dr. P. Sandeep  
Scientist, FRS (SVVU), Balabhadrapuram, Kakinada Cell  
No: 8185039772

**Industry/Scientific Organization**

1. Dr. M. Srinivasa Rao  
Senior Product Development Manager & Marketing Head-India Growel  
Formulation Pvt. Ltd.  
Cell No: 7989548040

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

The syllabus and model question papers in Industrial Aquaculture and Fisheries subject for B.Vocation course for the First year & Second Year (I, II, III & IV Semesters) in the academic year 2021-2022, list of Examiners and paper setter, Department activities is approved in the Board of Studies meeting held in the Department of Fisheries and Aquaculture at 12:30 PM.

<u>Sl.No.</u>	<u>Members Present</u>	<u>Signatures of Members</u>
1.	Dr. K. Narasimha Murty	Chairman
2.	Dr. K. Ramaneswarai	University Nominee
3.	Dr. Muralidhar P. Ande	Expert
4.	Dr. P. Sandeep	Expert
5.	Dr. M. Srinivas Rao	Representative from Industry
6.	P V Lovaraju	Member
7.	V.Manikanta	Student Member
8.	A.Janaki Devi	Student Member

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**  
**A.Y.2021-2022**  
**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**B.VOC., INDUSTRIAL Aquaculture\_& Fisheries**

**Resolutions:**

1. Resolved to follow the following pattern for Examinations.
  - a) The syllabus is divided in to two semesters each paper has 30% internal and 70% semester (15+10+5) for I, II, III & IV (First year & Second Year).
  - b) During each semester two internal Examinations for each paper will be conducted as per schedule. Introduction of objective type questions and online pattern partially in internal examinations subject to the condition.
  - c) No internal examination/semester examination will be conducted separately for the absentees.
  - d) Average of the two internal Examinations will be considered. Absentee will be awarded zero marks.
  - e) The minimum pass mark for external examination is 35%, Candidate should get a total of 40 marks in internal and external examination put together.
  - f) The pattern of semester examinations and practical I, II, III & IV is herewith appended.
  - g) Practical examination will be conducted at each Semester end.
2. Resolved to approve the model question papers for I, II, III & IV semesters are here with appended.
3. Resolved to approve the panel of paper setter and examiners as appended herewith.
4. Additional inputs into the curriculum and up gradation of syllabus will be incorporated the OJT (On Job Training) and Project Work.
5. It Resolved to fishing methods is introduced in the place of Fish Seed Production in second semester.
6. It resolved to fish seed production is introduced in the place of fishing methods in third semester.
7. First semester and Third semester followed as per university syllabus in the year of 2021-2022 onwards.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B), KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture 2021-**  
**2022 , Course structure , Semester I**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course	50	-	70	2	2
4.	Skill Development Course	50	-	50	2	2
<b>Skill Education</b>						
1	Animal Diversity – I Biology of Non-Chordates	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Biology of Fishes	100	30	70	4	4
4	Lab Practical	50	-	50	2	1
5	Principles of Aquaculture	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Fresh water aqua culture(no practical)	100	30	70	4	4
8	OJT	50	-	50	2	1
	<b>Total</b>	<b>900</b>			<b>36</b>	<b>28</b>

**IDEAL COLLEGE OF ARTS & SCIENCES**  
(A.P. Govt. Aided, Autonomous, NAAC Accredited B)  
Dr. PVN RAJU VIDYAPRANGANAM  
SAMALKOTA ROAD, KAKINADA  
**ZOOLOGY SYLLABUS FOR I SEMESTER 2021 – 2022**  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
**PAPER – I ANIMAL DIVERSITY – BIOLOGY OF NON CHORDATES**  
**Periods: 60** **Max. Marks: 100**

---

**UNIT I**

- 1.1 Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature
- 1.2 Whittaker's five kingdom concept and classification of Animal Kingdom.
- Phylum Protozoa**
- 1.3 General Characters and classification of protozoa up to classes with suitable examples
- 1.4 Locomotion, nutrition and reproduction in Protozoans
- 1.5 Elphidium (type study)

**UNIT –II**

**Phylum Porifera**

- 2.1 General characters and classification up to classes with suitable examples
- 2.2 Skelton in Sponges
- 2.3 Canal system in sponges

**Phylum Coelenterata**

- 2.4 General characters and classification up to classes with suitable examples
- 2.5 Metagenesis in Obelia
- 2.6 Polymorphism in coelenterates
- 2.7 Corals and coral reefs **Phylum**

**Ctenophora :**

- 2.8 General Characters and Evolutionary significance(affinities)

**Unit – III**

**Phylum Platyhelminthes**

- 3.1 General characters and classification up to classes with suitable examples
- 3.2 Life cycle and pathogenecity of Fasciola hepatica
- 3.3 Parasitic Adaptations in helminthes

**Phylum Nemathelminthes**

- 3.4 General characters and classification up to classes with suitable examples
- 3.5 Life cycle and pathogenecity of Ascaris lumbricoides

**Unit – IV**

**Phylum Annelida**

- 4.1 General characters and classification up to classes with suitable examples
- 4.2 Evolution of Coelom and Coelom ducts

**Phylum Arthropoda**

- 4.4 General characters and classification up to classes with suitable examples
- 4.5 Vision and respiration in Arthropoda
- 4.6 Metamorphosis in Insects



4.7 Peripatus - Structure and affinities

4.8 Social Life in Termites

## Unit – V

### Phylum Mollusca

5.1 General characters and classification up to classes with suitable examples

5.2 Pearl formation in Pelecypoda

5.3 Sense organs in Mollusca

### Phylum Echinodermata

5.4 General characters and classification up to classes with suitable examples

5.5 Water vascular system in star fish

### Phylum Hemichordata

5.6 General characters and classification up to classes with suitable examples

5.7 Balanoglossus - Structure and affinities.

### REFERENCE BOOKS:

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS
6. P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). Invertebrate Zoology, V Edition" ZOOLOGY

# IDEAL COLLEGE OF ARTS & SCIENCES

(A.P. Govt. Aided, Autonomous, NAAC Accredited B)

Dr. PVN RAJU VIDYAPRANGANAM

SAMALKOTA ROAD, KAKINADA

## ZOOLOGY MODEL PAPER FOR I SEMESTER

### ZOOLOGY - PAPER - I

#### ANIMAL DIVERSITY – BIOLOGY OF NON CHORDATES

---

**Time: 3 hrs**

**Max. Marks: 70**

**I. Answer any FIVE of the following. Draw labelled diagrams wherever necessary 4x5=20M**

1. Locomotion in protozoa
2. Metamorphosis in insects
3. Skeleton in sponges
4. Rotifera
5. Coelom and coelom ducts
6. Class echinoidea
7. Enteropneusta
8. Castes of Termites

**II. Answer the following. Draw labelled diagrams wherever necessary 5X10=50M**

- 9.a) Explain the life history of Elphidium  
OR
- b) Explain Whittaker's five kingdom concept
- 10.a) Describe Canal system in sponges  
OR
- b) Describe polymorphism in Coelenterates  
OR
- 11.a). Describe the life cycle of Fasciola hepatica  
OR
- b) Explain the Life cycle of Ascaris lumbricoides
- 12.a) Write general characters of phylum Arthropoda and classify up to classes with examples  
OR
- b) Describe the structure and affinities of Peripatus
- 13.a) Describe the structure and affinities of Balanoglossus  
OR
- b) Describe the pearl formation in Pelicyrca

\*\*\*

**IDEAL COLLEGE OF ARTS & SCIENCES**  
(A.P. Govt. Aided, Autonomous, NAAC Accredited B)  
Dr. PVN RAJU VIDYAPRANGANAM  
SAMALKOTA ROAD, KAKINADA  
**ZOOLOGY SYLLABUS FOR I SEMESTER 2021 – 2022**  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
**PRACTICAL PAPER – I ANIMAL DIVERSITY – BIOLOGY OF NON**  
**CHORDATES**

(Credits:2) 3 hrs/week

Work load: 30 hrs per semester

**Practical Syllabus:**

**1. Study of museum slides / specimens / models (Classification of animals up to orders)**

**Protozoa:** Amoeba, Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoebahistololytica, Plasmodium vivax

**Porifera:** Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gem mule Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatulav.

**Platyhelminthes:** Planaria, Fasciola hepatica, Fasciolalarval forms – Miracidium, Redia, Cercaria, Echinococcusgranulosus, Taeniasolium, Schistosomahaematobiumvii.

**Nemathelminthes:** Ascaris (Male & Female), Drancunculus, Ancylostoma, Wuchereria

**Annelida:** Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva

**Arthropoda:** Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Periap't's, Larvae - Nauplius, Mysis, Zoa, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly.

**Mollusca:** Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva

**Echinodermata:** Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Ante don, Bipinnaria larva

**Hemichordata:** Balanoglossus, Tornaria larva.

**2. Dissections:**

**Prawn:** Appendages, Digestive system, Nervous system, Mounting of Statocyst.  
Insect Mouth Parts

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**Semester I**  
**BIOLOGY OF FISHES**

Syllabus

Credits 4

---

**Unit 1: General Characteristics and Taxonomy of Fishes**

- 1.1. General characters and classification of fishes, Osteichthyes and Chondrichthyes fishes and its differences.
- 1.2. Bioluminescence in fishes.

**Unit 2: Food and Feeding – Growth**

- 2.1. Food and feeding habits – structural adaptations, classification based on food and feeding habits.
- 2.2. Gastrosomatic index in fishes.

**Unit 3: Digestion, Respiration and Circulation**

- 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, Significance of circulation.

**Unit 4: Reproduction, Excretion**

- 4.1. Reproduction – ovary and testes, structure, development of primary and secondary sexual & Sexual dimorphism in fishes.
- 4.5. Parental care in fishes
- 4.2. Excretion and osmoregulation-freshwater fishes
- 4.4. Osmoregulation in marine fishes.

**Unit 5: Endocrine glands in fishes and Migration**

- 5.1. Sense organs in fishes (Neuromast organs) – lateral line system. Ampullae of Lorenzini.
- 5.2. Endocrine organs in fishes-Pituitary gland, thyroid gland, adrenal gland, Urohypophysis, pancreatic islets and pineal organs.
- 5.3. Migration in fishes –anadromous and catadromous.

### **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 INDUSTRIAL 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. Rogan, 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

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture Semester  
I 2021-2022

**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
**PAPER TITLE: BIOLOGY OF FISHES**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) OR
- b)
10. a) OR
- b)
11. a) OR
- b)
12. a) OR
- b)
13. a) OR
- b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**Practical**  
**I Year, I semester 2021-2022**

Practical Paper: I: Biology of Fishes (Credits:2) 3 hrs/week Work load: 30 hrs per semester

<b>S.NO.</b>	<b>NAME OF THE PRACTICAL</b>
1.	Fish Morphometric characters
2.	Fish Meristic characters
3.	Indian Major carps
	1. <i>Catla catla</i>
	2. <i>Labeo rohita</i>
	3. <i>Cirrhinus mrigala</i>
4.	Exotic Fishes
	1. <i>Hypophthalmichthys molitrix</i>
	2. <i>Ctenopharyngodon idella</i>
	3. <i>Cypinus carpio</i>
5.	Air breathing Fishes
	a. <i>Clarias magur</i>
	b. <i>Wallago attu</i>
	c. <i>Heteropneustes fossilis</i>
	d. <i>Anaba testudineus</i>
	Murrels
	a. <i>Channa striatus</i>
	b. <i>Channa punctatus</i>
6.	Migratory fishes
	1. <i>Hilsa ilisha</i>
	2. <i>Anguilla anguilla</i>
7.	Gut content Analysis of Fish
8.	GaSI
9.	Dissection and study of internal organs: Fishes/Prawns/Shrimps
	a. Digestive system
	b. Respiratory system
	c. Excretory system
	d. Reproductive systems

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch Semester

I

**Principles of Aquaculture**

Syllabus

Credits 4

---

**Unit 1: Introduction of Aquaculture**

- 1.1. History, definition, scope and significance of aquaculture, Blue Revolution, concepts of Blue Revolution.
- 1.2. Different aquaculture systems, classification of Aquaculture, methods of aquaculture
- 1.3. Criteria for the selection of species.

**Unit 2: Pond Ecology**

- 2.1. General concepts of ecology-Ecological factors, pond ecosystem, productivity of culture pond, 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.

**Unit 3: Types of ponds-characteristics of fishes**

- 3.1. Type of ponds – nursery, rearing and Grow-out ponds.
- 3.2. Cultivable freshwater fishes- carps, Airbreathing fishes, tilapia.

**Unit 4: Characteristics of Brackishwater cultivable fishes**

- 4.1. Major brackish water culture systems in India.
- 4.2. General characters – Milk fish, mullet, seabass, shrimps, crabs.

**Unit 5: Characteristics of Marine water cultivable species**

- 5.1. Different cultivable species in Marine water and its characters –Edible oyster, pearl Oyster, mussels and sea weeds and its types



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. Water 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture Semester  
I 2021-2022

**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
**Principles of Aquaculture**

---

Time: 3 Hours

Max.Marks: 70  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**SECTION B**

5 x 10 = 50 Marks

**Answer all questions. Each answer carries 10 marks**

9. a)

OR

b)

10. a)

OR

11. a)

OR

12. a)

OR

13. a)

OR

b)

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**Practical**  
**I Year, I semester 2021-2022**

Practical Paper: II: **Principles of Aquaculture** (Credits:2)  
hrs per semester

2 hrs/week Work load: 30

S.No	NAME OF THE PRACTICAL
1.	Ponds Lay-outs a. Nursery Pond b. Rearing Pond c. Grow-out Pond
2.	Dikes
3.	Types of Aerators a. Pedal wheel aerators b. Propeller-aspirator pumps c. Diffused-air systems
4.	Sluice gate
5.	Aquatic Weeds and their control A. Floating weeds B. Emergent weeds C. Submerged weeds D.Marginal weeds 1. Pistia            1. Typha            1. Vallisneria            1. Marsilia 2. Eichhornia    2. Nymphaea        2. Hydrilla            2. Ipomoea
B.	Mahula oil
C.	Liming
D.	Predatory Fishes and their control a. <i>Channa</i> sp., b. <i>Wallago attu</i> , c. <i>Heteropneustes fossilis</i> , d. <i>Clarias batrachus</i> e. <i>Anabas testudineus</i>
E.	Identification and general characters of Larvivorous fishes a. <i>Gambusia affinis</i> b. <i>Lebistes reticulates</i> c. <i>Puntius ticto</i> d. <i>Colisa fasciatus</i>

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch Semester  
I

**Fresh water Aquaculture**

Syllabus

Credits 4

---

**Unit 1: Freshwater Fish Culture**

- 1.1. Management of carp culture ponds- Nursery rearing and stocking ponds.
- 1.2. Preparation of ponds– different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting.

**Unit 2: Culture of Prawns, cage and pen culture**

- 2.1. Cultivable species of freshwater prawns and their biology
- 2.2. Management techniques of nursery and Grow-out ponds.
- 2.3. Cages and pens.

**Unit 3 Integrated Farming-Organic farming**

- 3.1. Recent development in integrated farming – Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and Pig cum fish culture.
- 3.3. Organic aqua farming.

**Unit 4: Fresh water cultivable fishes**

- 4.1 Culture of air breathing fishes- Channa, Heteropneustes, Clarius, Anabas.
- 4.2. Freshwater pearl culture

**Unit 5: Aquaculture for stable environment**

- 5.1. Sewage fed fish culture
- 5.2. Larvivorous fishes in relation to public health
- 5.3. Effluent Treatment Ponds (ETP).

### **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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture Semester  
I 2021-2022

**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
**Fresh water Aquaculture**

---

Time: 3 Hours

Max.Marks: 70  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**SECTION B**

5 x 10 = 50 Marks

**Answer all questions. Each answer carries 10 marks**

9. a)

OR

b)

10. a)

OR

11. a)

OR

12. a)

OR

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
 Course structure and syllabi: 2021-2022 Admitted Batch Semester  
 I  
**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT / INDUSTRIAL OR INSTITUTE T REPORT & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year ,II semester 2021-2022**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course	50	-	70	2	2
4.	Skill Development Course-1	50	-	50	2	2
5.	Skill Development Course-2	50	-	50	2	2
<b>Skill Education</b>						
1	Animal Diversity – II Biology of Chordates(Zoology)	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Biology of shell fish	100	30	70	4	4
4	Lab Practical	50	-	50	2	1
5	Brackish water aquaculture &mariculture.	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Fishing Methods(No Practical)	100	30	70	4	4
8	OJT	50	-	50	2	1
	<b>Total</b>	<b>950</b>			<b>34</b>	<b>32</b>

**First spell between First year and Second Year Apprenticeship: Credits: 4; Marks: 100**



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch  
Semester II

**ZOOLOGY SYLLABUS FOR II SEMESTER**

**PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

---

**Unit - I**

- 1.1 General characters and classification of Chordata upto classes
- 1.2 Protochordata- Salient features of Cephalochordata , Affinities of Cephalochordata.
- 1.3 Salient features of Urochordata
- 1.4 Structure and life history of *Herdmania*
- 1.5 Retrogressive metamorphosis –Process and Significance

**Unit - II**

- 2.1 Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*
- 2.2 Pisces : General characters of Fishes
- 2.3 *Scoliodon*: External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain.
- 2.4 Migration in Fishes
- 2.5 Types of Scales
- 2.6 Dipnoi

**Unit - III**

- 3.1 General characters of Amphibia
- 3.2 Classification of Amphibia up to orders with examples.
- 3.3 *Rana hexadactyla*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain
- 3.4 Reptilia: General characters of Reptilia, Classification of Reptilia upto orders with examples
- 3.5 *Calotes*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 3.6 Identification of Poisonous snakes and Skull in reptiles

#### Unit - IV

- 4.1 Aves General characters of Aves
- 4.2 *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 4.3 Migration in Birds
- 4.4 Flight adaptation in birds

#### Unit - V

- 5.1 General characters of Mammalia
- 5.2 Classification of Mammalia upto sub - classes with examples
- 5.3 Comparison of Prototherians, Metatherians and Eutherians
- 5.4 Dentition in mammals

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**Zoology-Chordates**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following: **Draw**

4 x 5 = 20 Marks

**labeled diagram wherever necessary**

1. Amphioxus
2. Placoidscale
3. Quillfeather
4. Prototheria
5. Anadromousmigration
6. Draco
7. Emu
8. Apoda

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Explain the life history of Herdmania  
OR  
b) Explain the origin and general characters of chordates
10. a) Compare the characters of Petromyzon and Myxine  
OR  
b) Describe the structure of heart in Scoliodon
11. a) . Describe the brain of Ranahexadactyla  
OR  
b) Explain the external features of Calotes
12. a) Write an essay on flight adaptations in birds  
OR  
b) Explain the respiratory system of Columba livia
13. a) Compare the characters of Metatheria and Eutheria  
OR  
b) Write an essay on dentition in mammals

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**ZOOLOGY-CHORDATES**  
**PRACTICAL SYLLABUS**

**I.Observation of the Following Slides / Spotters / Models :**

Protochordata: Herdmania, Amphioxus, Amphioxus T.S through pharynx.

- **Cyclostomata** : Petromyzon and Myxine.
- **Pisces**: Pristis, Torpedo, Hippocampus, Exocoetus, Echineis, Labeo, Catla, Claries, Channa, Anguilla. □
- **Amphibian** : Ichthyophis, Amblystoma, Axolotl larva, Hyla,
- **Reptilia**: Draco, Chameleon, Uromastix, Testudo, Trionyx, Russels viper, Naja Krait, Hydrophis, Crocodile.
- **Aves**: Psittacula, Eudynamis, Bubo, Alcedo.
- **Mammalian**: Ornithorhynchus, Pteropus, Funambulus.

**II. Dissections**

1. Scoliodon IX and X, Cranial nerves
2. Scoliodon Brain
3. Mounting of fish scales

- Note: 1. Dissections are to be demonstrated only by the faculty or virtual.  
2. Laboratory Record work shall be submitted at the time of practical examination.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**Biology of Shell Fish**

**Syllabus**

**Credits 4**

---

**Unit – I: General Characters and Classification of Cultivable Shell Fish**

- 1.1 General characters and classification of crustaceans and molluscs up to the level of class.
- 1.2 Commercial importance of crustaceans and molluscs.
- 1.3 Prawn external parts and appendages, exoskeleton and integument.
- 1.4 Respiration and circulatory systems of prawn. Structure of gills, mechanism of respiration.
- 1.5 Nervous and excretory system of crustacean molluscs.
- 1.6 Sense organs in crustaceans and molluscs.

**Unit – II: Food, Feeding and Growth**

- 2.1 Natural food, feeding habits, feeding intensity utilization of food, gut content analysis.
- 2.2 Digestive system of shrimp, crab and molluscs.
- 2.3 Integument and exoskeleton of crustaceans, their structure and functions.

**Unit – III: Reproductive Biology**

- 3.1 Induced maturation in shrimp – induced maturation technology physiological changes after induced maturation.
- 3.2 Breeding in Oysters, Mussel, Clams, Pearl Oyster, Pila, Fresh water Mussel and Cephalopods.
- 3.3 Reproductive organs in Shrimp.
- 3.4 Life cycle of Shrimp.

**Unit – IV: Development**

- 4.1 Embryonic and larval development of Shrimp, Crab and Molluscs.
- 4.2 Environmental factors affecting reproduction and development of cultivable shell fish.

**Unit – V: Hormones & Growth**

- 5.1 Endocrine system of Prawn and Crab, Oyster.
- 5.2 Neurosecretary cells Androgenic gland, ovary, cuticle.
- 5.3 Moulting, Moulting stages, Metamorphosis in Crustaceans.

### **Reference Books:**

1. Borradile & R.A. Potts. The Invertebrates. Asia Publishing House, 1962.
2. Kaestner, A. Invertebrate Zoology. Vol. I – III, John Wiley & Sons, 1967.
3. Barrington, F.J.W. Invertebrates : Structure and Functions. EIBS, 1971.
4. Kurian, C.V. & V.O. Sabastian. Prawns and Prawn Fisheries of India. Hindustan Pub. Co., 1976.
5. Parker, J. & W.A. Haswell. The Textbook of Zoology. Vol. I. Invertebrates (eds. A.J. Marshall & W.D. Williams), ELBS & McMillan & Co., 1992.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**Biology of Shell Fish**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**Biology of Shell Fish**  
**PRACTICALS**

**(Credits 1, Hours 2)**

1. Identification of commercially important shell fishes.
2. Study of different larval stages of shrimp.
3. Mouth parts and appendages of cultivable prawns, shrimp and other crustaceans.
4. Study of eggs of shrimps, prawns and other crustaceans.
5. Observations of Molluscan larva.
6. Study of visceral organs of fresh water mussels.
7. Dissections
  - A. Mounting of the shrimp/prawn appendages
  - B. Digestive system of shrimp/prawn
  - C. Nervous system of shrimp/prawn
  - D. Eye stalk ablation in shrimp/Prawn
  - E. Pituitary gland extract in fishes



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**Practical**  
**I Year, II semester 2021-2022**  
**Brackishwater Aquaculture and Mari culture**

**Unit 1: Introduction to Brackishwater and Construction**

- 1.1. Present status of brackishwater farming in India.
- 1.2. Abiotic and biotic factors.

**Unit 2: Brackishwater Finfish Culture**

- 2.1. Biology and culture practices – monoculture and polyculture
- 2.2. Biology and culture - *Chanos chanos*, *Mugil cephalus*, *Lates calcarifer*.

**Unit 3: Brackishwater Shellfish Culture**

- 3.1. Species of shrimps cultured in brackishwater and their biology – *Penaeus monodon*, *Penaeus indicus*, *Litopenaeus vannamei*.
- 3.1. Shrimp culture, Traditional, extensive, modified extensive, semi- intensive culture and intensive
- 3.2. Crab culture

**Unit 4: Water Parameters in Brackishwater Culture Ponds**

- 4.1. Soil parameters: Soil texture, Soil reaction (pH), organic carbon content, Carbon to nitrogen ratio (C:N) and General nutrient status
- 4.2. Water quality parameters: Temperature, Dissolved Oxygen (DO), salinity, pH, Turbidity, Total alkalinity, CO<sub>2</sub>, Ammonia, Nitrite, H<sub>2</sub>S.
- 4.3. Role of Microalgae in Aquaculture.

**Unit 5: Mariculture**

- 5.1. Introduction to mariculture.
- 5.2. Farming of Molluscs (Example: Edible Oyster, Mussel and pearls-Raft )
- 5.3. Seaweed farming in India.

### **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.
6. 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**BRACKISH WATER AQUACULTURE AND MARI CULTURE**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., INDUSTRIAL Aquaculture**

**Semester-II, 2020-2021**

**PRACTICALS PAPER II**

**Title: BRACKISH WATER AQUACULTURE AND MARICULTURE**  
**(Credits 1, Hours 2)**

---

I. Identification of cultivable fishes

A. Brackish water fishes/Estuarine fishes

1. *Chanos chanos*
2. *Etroplus surantensis*
3. *Mugil cephalus*
4. *Megalopa cyprinoides*
5. *Eleutheronema tetradachylum*

B. Marine water fishes

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

C. Migratory fishes

3. *Hilsa ilisha*
4. *Anguilla Anguilla*

D. Soil (Soil texture, pH, organic matter) and Water Quality parameters.(DO, Salinity, pH, Hardness, Alkalinity)

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**Practical**  
**I Year, II semester 2021-2022**  
**FISHING METHODS**

**Unit 1: Inland Fishing Crafts and Gears**

- 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.

**Unit 2: Marine Fishing Crafts and Gears**

- 2.1. Introduction, - 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 hooks.
- 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.

**Unit 3: Active Fishing Gears, Passive Gears**

- 3.1. Active fishing gears- 1. Fishing hooks:Parts of hooks, Numbering of hooks, Artificial baits or jigs, Trolling lines; 2. Seining:Trawls, Surrounding net, Lift net
- 3.2. Passive gears- 1. Gill net; 2. Fish traps, Traps, Pots; 3. Hooks and lines (passively operated), Bottom set line, Drift longline, Demersal longline, Drifting long line

**Unit 4: Unconventional Fishing methods**

- 4.1. Destructive and Prohibited fishing practices,
- 4.2. Fishing methods like electrical fishing,
- 4.3. Light fishing; Angling (line fishing) poisoning and use of dynamites.

**Unit 5: Fish Finding Devices**

- 5.1 Introductory information on echo sounder, sonar, net sonde, global positioning systems, remote sensing.
- 5.2 Geographic Information Systems (GIS) in aquaculture.

### **Suggested reading**

#### **Core reading**

1. Boopendranath, M.R., Meenakumari, B., Joseph, J., Sankar, T.V., Pravin, P., and Edwin, L. (Eds.) 2002, Riverine and Reservoir Fisheries 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**FISHING METHODS**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
 Course structure and syllabi: 2021-2022 Admitted Batch  
 Semester II  
**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT / INDUSTRIAL OR INSTITUTE T REPORT & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC  
B) DR. P.V.N. RAJU VIDYAPRANGANAM,  
KAKINADA

**Bachelor of Vocation: INDUSTRIAL  
Aquaculture Course structure and syllabi:  
2021-2022 Admitted Batch II Year,  
Semester III**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course-1	50	-	70	2	2
4.	Life Skill Course-2	50	-	50	2	2
5.	Skill Development Course	50	-	50	2	2
<b>Skill Education</b>						
1	Zoology (Cell biology, Genetics, Molecular Biology & Evolution)	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Capture fisheries	100	30	70	4	4
4	Lab practical	50	-	50	2	1
5	Aquaculture nutrition	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Fish Seed Production (nopractical)	100	30	70	4	4
8	OJT	50	-	50	2	1
9	Yoga	-	-	-	-	1
	<b>Total</b>	<b>950</b>			<b>38</b>	<b>33</b>

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture II Year, Semester III**  
**Cell biology, Genetics, Molecular Biology & Evolution**

---

**Unit – I      Cell Biology**

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
- 1.2 Electron microscopic structure of animal cell.
- 1.3 Plasma membrane –Models and transport functions of plasma membrane.
- 1.4 Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes
- 1.5 Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

(Note: 1. General pattern of study of each cell organelle – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams)  
2. Need not study cellular respiration under mitochondrial functions)

**Unit – II      Genetics - I**

2. 1 Mendel's work on transmission of traits
2. 2 Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes
2. 3 Polygenes (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance)
2. 4 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)
2. 5 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

**Unit – III      Genetics - II**

- 3.1 Mutations & Mutagenesis
- 3.2 Chromosomal Disorders (Autosomal and Allosomal)
- 3.3 Human Genetics – Karyotyping, Pedigree Analysis (basics)
- 3.4 Basics on Genomics and Proteomics

**UNIT IV:      Molecular Biology**

- 4.1 Central Dogma of Molecular Biology

4.2 Basic concepts of -

- a. DNA replication – Overview (Semi-conservative mechanism, Semi-discontinuous mode, Origin & Propagation of replication fork)
- b. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications (basics)
- c. Translation – Initiation, Elongation and Termination

4.3 Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

**Unit - V**

5.1 Origin of life

5.2 Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory

5.3 Neo-Darwinism: Modern Synthetic Theory of Evolution, Hardy-Weinberg Equilibrium

5.4 Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**II Year, III semester 2021-2022**  
**Cell biology, Genetics, Molecular Biology & Evolution**  
**MODEL PAPER**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

**Answer any FOUR of the following:**

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Prokaryotic cell
2. Golgi complex
3. Polygenes
4. Multiple alleles
5. Mutations
6. Karyotyping
7. Lac operon concept
8. Genetic drift

**PART - B**

**Answer any FIVE of the following:**

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Describe the ultra structure of animal cell  
OR  
b) Explain the structure of mitochondria. Add a note on its functions.
10. a) Write an essay on gene interactions  
OR  
b) Discuss sex linked inheritance.
11. a) What are chromosomal disorders? Explain various types of autosomal and allosomal disorders  
OR  
b) Explain About Human Karyotyping ?
12. a) Give an account of DNA replication  
OR  
b) Explain the mechanism of Prokaryotic transcription
13. a) An essay on modern synthetic theory of evolution  
OR  
b) Define isolation. Discuss various isolating mechanisms.

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**II Year, III semester 2021-2022**  
**Cell biology, Genetics, Molecular Biology & Evolution**  
**PRACTICAL SYLLABUS**

---

**I. Cell Biology**

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of Chironomus.

**II. Genetics**

1. Study of Mendelian inheritance using suitable examples and problems.
2. Problems on blood group inheritance and sex linked inheritance.
3. Study of human Karyo types (Down's syndrome, Edwards, syndrome, Patausyndrome, Turner's syndrome and Klinefelter syndrome).

**III. Evolution**

1. Study of fossil evidences.
2. Study of homology and analogy from suitable specimens and pictures.
3. Phylogeny of horse with pictures.
4. Study of Genetic Drift by using examples of Darwin's finches(pictures).
5. Visit to Natural History Museum and submission of report.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture II Year, Semester III**  
**CAPTURE FISHERIES**

**Unit 1: Riverine and Estuarine Fisheries**

- 1.1. Riverine fisheries – Major river systems in India, important characteristic features of Rivers
- 1.2. Estuarine fisheries- definition, Ecological significance of estuary, Biota of estuary, classification and categories of estuaries- capture fisheries- resident and migrant species.

**Unit 2: Reservoir and Lakesterine Fisheries**

- 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.

**Unit 3: Coastal fisheries**

- 3.1. Coastal fisheries – Elasmobranch fishery; Teleost fishery- Sardines, Anchovies, Mackerel, Mumbai duck, Catfishes, Eels, Ribbon fish, Perches, Mulletts, Polnemids, Pomfrets, Scianids, Seer fishes, Flying fishes

**Unit 4: Marine Pelagic, Demersal and Deep Sea Resources**

- 4.1. Pelagic resources and Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources.
- 4.2. Introduction-Fisheries potential, Major Deep sea resources and scope of their exploitation, Present fishing pattern and deep sea fishing in India
- 4.3. Regulations-Conservation and regulation of fishing pressure - closed season, mesh size regulations, sanctuaries., Deep Sea Fishing Policy

## **Unit 5: Fisheries institutes**

- 5.1. Different organizations and institutes involved in fisheries and aquaculture research and development – FAO, NACA, SEAFDEC, INFOFISH, MPEDA, World Fish Centre, Bay of Bengal Programme.
- 5.2. Institutes under ICAR, CSIR; NABARD, Ministry of Agriculture and Ministry of Commerce, Aquaculture Authority of India, NRSA, INCOIS etc.
- 5.3. State organizations like Matsyafed, FFDA, BFFDA, ADAK, FIRMA and State Fisheries Department.

### **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 Myanmar*. 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 and graphic guide version 4*. 2000. SAS Institute Inc. United State of America. 613 pp.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**CAPTURE FISHERIES**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., INDUSTRIAL Aquaculture**

**II Year, III semester 2021-2022**

**CAPTURE FISHERIES**

**PRACTICAL SYLLABUS**

- I. Identification of Reservoir Fisheries
  1. *Labeo rohita*, *L. calbasu*,
  2. *Cirrhinus mrigala*
  3. *Catla catla*
- II. Identification of Estuarine Fisheries
  1. Chanos
  2. Lates
  3. Mulletts
- III. Identification of Marine Fisheries
  - a. Pelagic Fisheries (3 to 5 species)
  - b. Demersal Fisheries (3 to 5 species)
  - c. Deep sea Fisheries (3 to 5 species)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture II Year, Semester III**  
**AQUACULTURE NUTRITION**

**Unit 1: Nutritional Requirements of Fish**

- 1.1. Principles of fish nutrition (Proteins, Carbohydrates and lipids)
- 1.2. Vitamin and mineral requirements, vitamin C for fish and shell fishes.
- 1.3. Feeds and feed additives

**Unit 2: Feed ingredients & quality**

- 1.1. Different feed ingredients
- 1.2. Types of feeds, Compounded feeds, pellets, crumbles and microencapsulated feed. Storage, quality standards, proximate composition.
- 1.3. Digestibility studies and methods.

**Unit 3: Feed & Feed Manufacturing**

- 3.1. Feed formulation - methods, square method.
- 3.2. Feed manufacturing processes, Extrusion, Pelletization.

**Unit 4: Feed Management**

- 4.1. Feed schedule in finfish and shellfish, calculations and daily ration.
- 4.2. Artificial feed formulations of different cultural species.
- 4.3. Feed Check tray observations and management.

**Unit 5: Feed Quality**

- 5.1. Feed energetic, Feed Conversion Efficiency(FCE), Protein Efficiency Ratio (PER),
- 5.2. Feed Conversion Ratio (FCR), Net Protein Utilization NPU, leaching,
- 5.3. Water stability. Quality standards

### **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. Hephher,B. and Pruginin,Y. Commercial Fish Farming

#### **Supplementary Reading**

1. Halver J.E. Fish Nutrition
2. Hephher 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**AQUACULTURE NUTRITUTION**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., INDUSTRIAL Aquaculture**

**II Year, III semester 2021-2022**

**AQUACULTURE NUTRITION**

**PRACTICAL SYLLABUS**

I. Feed management (Proximate Analysis)

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

II. Preparation of supplementary feeds with locally available ingredients,

III. Determination of water stability of pellet feeds.

V. Feed calculation and daily ration

VI. Check-trays in shrimp farming ponds.

VIII. Estimation of FCR.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture II Year, Semester III**  
**FISH SEED PRODUCTION**

**Unit1: Carp Hatchery and Seed production**

- 1.1. Types of hatcheries
- 1.2. Carp brood management; Recruitment, pond management, management of spent broods
- 1.3. Induced breeding technology and Synthetic hormones.

**Unit 2: Carp Seed procurement-Bundh Breeding**

- 2.1. Carp seed resources in major rivers India.
- 2.2. Bundh breeding, types of bundh breeding techniques.

**Unit 3: Seed Production of Crustaceans**

- 3.1. Seed production shrimp and prawn
- 3.2. Operation and management of maturation section.

**Unit 4: Seed Production of Molluscs**

- 4.1. Hatchery operations of pearl oysters
- 4.2. Hatchery operations of Edible oysters

**Unit 5: Transportation seed**

- 5.1. Transportation of brooders (Fin fish/shrimp/prawn)
- 5.2. Transportation of fish seed

### **Suggested Reading**

#### **Core reading**

1. Chodar SL Hypophysation in Indian Major Carps
2. CMFRI Spl. Bul. Hatchery Operation of Penaeid 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. Hopher, B. & Y. Prugin. 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**I Year, II semester 2021-2022**  
**FISH SEED PRODUCTION**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
 Course structure and syllabi: 2021-2022 Admitted Batch Semester  
 III  
**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT REPORT/ INDUSTRIAL OR TRAINING & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B) DR.  
P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL**  
**Aquaculture II Year, IV**  
**semester 2021-2022**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
	<b>Core Papers</b>					
1.	Zoology(Physiology, Cellular Metabolism & Embryology)	100	30	70	4	4
2.	Lab	50	-	50	2	1
3.	Zoology(Immunology &Animal Biotechnology)	100	30	70	4	4
4.	Lab	50	-	50	2	1
5.	Fish Genetics and aquaculture Biotechnology	100	30	70	4	4
6.	Lab-Practical	50	-	50	2	1
7.	Fish Pathology and Fish Immunology	100	30	70	4	4
8.	Lab-Practical	50	-	50	2	1
9.	Ornamental fish culture	100	30	70	4	4
10.	Lab	50	-	50	2	1
11.	Larval Nutrition&culture of fish food organisms.(nopractical)	100	30	70	4	4
12.	OJT	50	-	50	2	1
13.	NCC/NSS/Sports/Extra Curricular	-	-	-	-	2
14.	Yoga	-	-	-	-	1
	Total		180	720	<b>36</b>	<b>33</b>
	<b>Grand Total</b>	<b>900</b>				

**Second spell between First year and Second Year Apprenticeship: Credits: 4; Mark-100**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture II Year, Semester IV**

**ZOOLOGY SYLLABUS FOR IV SEMESTER**  
**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND**  
**EMBRYOLOGY**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

---

**UNIT I      Animal Physiology - I**

1.1 Process of digestion and assimilation

1.2 Respiration - Pulmonary ventilation, transport of oxygen and CO<sub>2</sub>

(Note: Need not study cellular respiration here)

1.3 Circulation - Structure and functioning of heart, Cardiac cycle

1.4 Excretion - Structure and functions of kidney urine formation, counter current  
Mechanism

**UN IT II     Animal Physiology - II**

2.1 Nerve impulse transmission - Resting membrane potential, origin and  
propagation of action potentials along myelinated and non-myelinated nerve  
fibers

2.2 Muscle contraction - Ultra structure of muscle, molecular and chemical basis of  
muscle contraction

2.3 Endocrine glands - Structure, functions of hormones of pituitary, thyroid,  
parathyroid, adrenal glands and pancreas

2.4 Hormonal control of reproduction in a mammal

**UNIT III     Cellular Metabolism – I (Biomolecules)**

3.1 Carbohydrates - Classification of carbohydrates. Structure of glucose

3.2 Proteins - Classification of proteins. General properties of amino acids

3.3 Lipids - Classification of lipids

3.4 Enzymes: Classification and Mechanism of Action

**UNITIV     Cellular Metabolism – II**

4.1 Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain,  
Glycogen metabolism, Gluconeogenesis

4.2 Lipid Metabolism –  $\beta$ -oxidation of palmitic acid

#### 4.3 Protein metabolism - Transamination, Deamination and Urea Cycle

#### **Unit – V      Embryology**

5.1 Gametogenesis

5.2 Fertilization

5.3 Types of eggs

5.4 Types of cleavages

5.5 Development of Frog upto formation of primary germ layers

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**Title : ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY  
MODEL PAPER**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Assimilation
2. Cardiac cycle
3. Ultra structure of muscle
4. Pancreas
5. Structure of glucose
6. Lipids
7. Gluconeogenesis
8. Types of eggs

**PART - B**

Answer any **FIVE** of the following:

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9.a) Explain the process of digestion.

OR

b) Describe the structure and function of heart

10. a) Give an account of nerve impulse transmission.

OR

b) Write an essay on the hormonal control of reproduction in mammals

11. a) Write an essay on the classification of carbohydrates

OR

b) Classify the enzymes. Discuss the mechanism of enzyme action

12. a) Write an account on Kreb's cycle.

OR

b) Explain B- oxidation of palmitic acid

13. a) Discuss the process of fertilization

OR

b) Write an essay on gametogenesis.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**Title : ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY  
PRACTICAL SYLLABUS**

---

**Practical Syllabus:**

**I. Animal physiology**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Study of activity of salivary amylase under optimum conditions
3. T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
4. Differential count of human blood

**II. Cellular metabolism** 1. Estimation of total proteins in given solutions by Lowry's method.

2. Estimation of total carbohydrate by Anthrone method.
3. Qualitative tests for identification of ammonia, urea and uric acid
4. Protocol for Isolation of DNA in animal cells

**III. Embryology**

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Construction of fate map of frog blastula

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: INDUSTRIAL Aquaculture II Year, Semester IV**

**ZOOLOGY SYLLABUS FOR SEMESTER - IV**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

---

- Unit – I      Immunology – I (Overview of Immune system)**
- 1.1 Introduction to basic concepts in Immunology
  - 1.2 Innate and adaptive immunity, Vaccines and Immunization programme
  - 1.3 Cells of immune system
  - 1.4 Organs of immune system
- Unit – II      Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)**
- 2.1 Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants; Factors influencing immunogenicity
  - 2.2 Antibodies: Structure of antibody, Classes and functions of antibodies
  - 2.3 Structure and functions of major histocompatibility complexes
  - 2.4 Exogenous and Endogenous pathways of antigen presentation and processing
  - 2.5 Hypersensitivity – Classification and Types
- Unit – III      Techniques**
- 2.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
  - 2.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures
  - 2.3 Stem cells: Types of stem cells and applications
  - 2.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)
- Unit – IV      Applications of Animal Biotechnology**

- 3.1 Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology
- 3.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery
- 3.3 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications
- 3.4 Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

#### Unit - V

- 1.1 PCR: Basics of PCR
- 4.2 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)
- 4.3 Hybridization techniques: Southern, Northern and Western blotting
- 4.4 DNA fingerprinting: Procedure and applications
- 4.5 Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**  
**Title : IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**  
**MODELPAPER**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Vaccines
2. Primary lymphoid organs
3. Hapten
4. Hypersensitivity
5. Natural media
6. Cell lines
7. Endo nucleases
8. Polyploidy in fishes

**PART - B**

Answer any **FIVE** of the following:

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Define immunity. Write in detail about innate immunity.  
OR  
b) Explain various cells of immune system
10. a) Describe the structure of antibody. Add a note on their functions.  
OR  
b) Describe the structure of MHC molecules. Discuss their role in the mechanism of exogenous and endogenous pathway of antigen processing and presentation
11. a) Write an essay on different types of stem cells and their applications  
OR  
b) Explain the production and applications of monoclonal antibodies.
12. a) Write an account on recombinant DNA technology  
OR  
b) Write an essay on transgenic animals
13. a) Explain hybridization techniques.  
OR  
b) Write an essay on PCR

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**Title : IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY  
PRACTICAL SYLLABUS**

**I. Immunology**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
  - a. ELISA
  - b. Immune electrophoresis .

**II. Animal biotechnology**

1. DNA quantification using DPA Method.
2. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
4. Cleaning and sterilization of glass and plastic wares for cell culture.
5. Preparation of culture media.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**Title : FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY**

**Syllabus**

**Credits 4**

---

**Unit 1: Basic Genetics and Biotechnology**

- 1.1. Introduction- Genetics, Mendel's law of inheritance, interaction of gene.
- 1.2. Supplementary and complementary genes.
- 1.3. Introduction to Biotechnology in Aquaculture.

**Unit 2: Selection and Hybridization**

- 2.1. Introduction-Hybridization of fish-Indian studies; Objectives of fish hybridization
- 2.2. Interspecific hybrids, Intergeneric hybrids among Indian carps.
- 2.3. Hybrid vigor, Inbreeding, cross-breeding and hybridization

**Unit 3: Sex determination & Chromosome manipulation in fish and shell fishes**

- 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. Induction of Gynogenesis and Androgenesis, Performance of Gynogens and Androgens, Monosex Populations.

**Unit 4: Aquaculture Biotechnology**

- 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. Cryopreservation technique in Aquaculture.

**Unit 5: Marine Biotechnology**

- 5.1. Introduction-Scope and the present status of marine biotechnology;
- 5.2. Industries Based on Marine Biotechnology
- 5.3. Use of probiotics and antibiotics in aquaculture operations.

### **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. Hephher, 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**II Year, IV semester 2021-2022**  
**FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022  
**B.Voc., INDUSTRIAL Aquaculture**

**PRACTICAL PAPER -I**  
**FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY**  
**(Credits :1, Hours: 2)**

1. Problems on Mendelian inheritance.
2. Mitotic and meiotic chromosomes preparation.
3. Demonstration of protocol of androgenesis, gynogenesis and polyploidy.
4. Cryopreservation protocols, Quality evaluation of fish milt.
5. Isolation and quantification of Fish and Prawn DNA
6. Electrophoresis
7. ELISA
8. Immunofluorescence
9. DNA Hybridisation
10. Bioprocessing of organic wastes
11. Practicals on genbank sequence database.
12. PCR

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**Title : FISH PATHOLOGY AND FISH IMMUNOLOGY**

**Syllabus**

**Credits 4**

---

**Unit 1: Pathology and Parasitology**

- 1.1. Introduction, Symptoms of sick/diseased fish, causes of fish diseases.
- 1.2. Stress as a factor in the occurrence of diseases.
- 1.3. Types of parasites-Ectoparasites, Endoparasites, Commensalism; Mutualism.

**Unit 2: Fungal and Bacterial Diseases**

- 2.1. Fungal diseases in fish: Saprolegniasis, Branchiomycosis and Ichthyophonosis; Fungal diseases in prawns/shrimps: Fusarium, Lagenidium and Prevention and therapy.
- 2.2. Bacterial diseases of fish caused by Aeromonas, pseudomonas, columnaris, Vibro sps., Epizootic Ulcerative Syndrome Identification, epidemiology, preventive and therapeutic methods. Bacterial diseases in prawns/shrimps: caused by Vibrio sps, luminous bacterial disease, Aeromonas, pseudomonas, filamentous bacterial disease.
- 2.3. Viral Diseases in shrimp: Monodon Baculo Virus (MBV), White Spot Syndrome (WSSV), Yellow Head Virus (YHV), Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV). Prevention and therapeutic methods.

**Unit 3: Protozoan and Metazoan Diseases.**

- 3.1. Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis.
- 3.2. Metazoan Diseases- diseases caused by annelids, helminthes, crustaceans and molluscs.

**Unit 4: Fish Microbiology and Nutritional diseases**

- 4.1. Spoilage microflora of fish and shell fish
- 4.2. Intrinsic and extrinsic factors affecting spoilage of fish and shell fish.
- 4.3. Nutritional deficiency diseases in fish and shell fishes.

**Unit 5: Immunology and Fish Health Management**

- 5.1. Application and development of vaccines.
- 5.2. Diagnostic tools – immune detection- DNA/RNA techniques (PCR). Evaluation criteria of healthy seeds.
- 5.3. Best Management Practices in Aquaculture. Quarantine management.

### **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 Pisciculture –
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 Disease.

#### **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. Schaperclaus. Fish Diseases. Vol. I & II.
6. Lightner, D.V. Shrimp Disease Diagnosis, 1998.
7. Sinderman. Fish Diseases, Vol. I. Shell Fish Diseases, Vol. II.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**II Year, IV semester 2021-2022**  
**FISH PATHOLOGY AND FISH IMMUNOLOGY**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022  
**B.Voc., INDUSTRIAL Aquaculture**

**FISH PATHOLOGY AND FISH IMMUNOLOGY**  
**(Credits:1, Hours 2)**

- I. Collection preservation, Identification of disease-causing agents.
- II. Preparation of media for culture, Familiarisation with techniques of bacterial culture and identification, fungal isolation, characterization.
- III. Preparation of the list of chemicals and drugs used to control the diseases and medicines, visit to fish and shrimp farms and Disease diagnostic centers.
- IV. Collection, preservation and identification of parasites, preparation of case studies of diseased fish and prawns.
- V. Study of life-cycle stages. Estimation of dose and administration of various chemicals and drugs.
- VI. Visit to fish farms. Shrimp farms and diagnosis of diseases.
- VII. PCR Technique Demonstration.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**  
**Title : ORNAMENTAL FISH CULTURE**

**Syllabus**

**Credits 4**

---

**Unit 1: Introduction**

- 1.1. Introduction to aquarium, ornamental fishes and Equipment and accessories- Aerators, filters and lighting.
- 1.2. World aquarium trade and present status. Design and construction of public fresh water and marine aquaria and oceanarium.
- 1.3. Water quality management in aquarium fishes, Biofilters in aquarium.

**Unit 2: Aquarium Management**

- 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.
- 2.4. Food and feeding-Source of feed, different types of food for aquarium fish, monitoring and adjusting.

**Unit 3: Freshwater Ornamental Fishes**

- 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. Setting up the tank-Choosing the tank, lighting and heating, filtration and aeration, choosing plants, preparing the tank.
- 3.3. Reproduction-General principles, Vitellin sack, Reproduction strategies, Egg-laying.

**Unit 4: Marine Ornamental Fishes**

- 4.1. Marine ornamental fishes – varieties and their habitat.
- 4.2. Setting up the tank-lighting considerations, siting and substrate, heating and filtration, preparing the tank.

- 4.3. Reproduction and breeding- Breeding of marine ornamental fishes (clown fishes).
- 4.4. Other ornamental organisms – Sponges, anemones, Crustaceans, mollusks, annelids, Echinoderms.

#### **Unit 5: Nutrition and Disease**

- 5.1. Nutritional requirements of aquarium fishes. Different kinds of feeds. Culture of fish food organisms; Preparation of dry feeds; feeding methods.
- 5.2. Use of pigments for colour enhancement. Larval feeds and feeding.
- 5.3. Common parasites infecting ornamental fishes. Bacterial, viral, fungal diseases of ornamental fishes and their control and prophylaxis.

#### **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 et al – 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**II Year, IV semester 2021-2022**  
**ORNAMENTAL FISH CULTURE**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**ORNAMENTAL FISH CULTURE**

**(Credits:1, Hours 2)**

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

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., INDUSTRIAL Aquaculture**

**Title : LARVAL NUTRITION AND CULTURE OF FISH FOOD ORGANISMS**

**Syllabus**

**Credits 4**

---

**Unit 1: Live Feeds**

- 1.1. Different live feeds and their nutritional value. Manipulation of pond for natural feed production.
- 1.2. Candidate species of phytoplankton and zooplankton for fish and shell fish culture – diatoms, micro algae, nano planktons, Artemia, copepods, cladocera and rotifers.

**Unit 2: Culture of Phytoplankton**

- 2.1 Methods of collection and preservation; maintenance of pure culture of Phytoplankton.
- 2.2 Mass culture. Culture of important microalgae, Chaetoceros, Tetraselmis, Skeletonema, Spirulina and Chlorella.

**Unit 3: Culture of Zooplankton**

- 1.1. Methods of collection and preservation; maintenance and rearing of Rotifers, Cladocerans, Copepods, and insect larvae. Mass culture of zooplankton.
- 1.2. Harvest, storage and feeding.

**Unit 4: Artemia culture**

- 4.1 Different strains of Artemia. Artemia culture. Cyst production. Enrichment of Artemia cyst and larvae.
- 4.2 Decapsulation of Artemia cysts. Hatching, storage and feeding.

**Unit 5: Alternative live feeds and Periphyton culture**

- 5.1. Culture methods of Infusoria, Chironomids, polychaetes.
- 5.2. Nutritional qualities of alternative live feeds.
- 5.3. Applications Importance of periphyton in aquaculture.

**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

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., INDUSTRIAL Aquaculture**  
**II Year, IV semester 2021-2022**

**LARVAL NUTRITION AND CULTURE OF FISH FOOD ORGANISMS**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**Bachelor of Vocation: INDUSTRIAL Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch  
Semester IV

**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

<b>CONTENT</b>	<b>EVALUATION</b>	<b>MARKS</b>
FIELD TRIPS	3X5	15
PROJECT REPORT/ INDUSTRIAL OR TRAINING & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
<b>TOTAL</b>		<b>50</b>

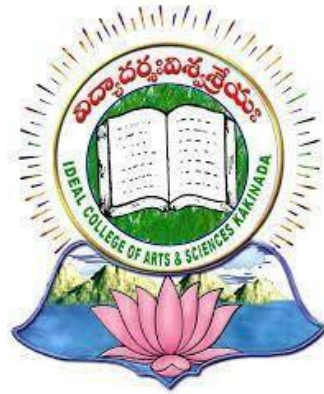
**IDEAL COLLEGE OF ARTS AND SCIENCES**  
**(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)**  
**DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA**

**SYLLABUS**  
**FOR**  
**B.VOC., COMMERCIALAQUACULTURE**

# **IDEAL COLLEGE OF ARTS AND SCIENCES**

(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)

**DR. P.V.N. RAJU VIDYAPRANGANAM  
KAKINADA**



**BOARD OF STUDIES  
2021-2022**

**COURSE: B.VOC., COMMERCIALAQUACULTURE & FISHERIES**

First & Second Year (I ,II , III & IV Semester)

**DEPARTMENT OF  
FISHERIES AND AQUACULTURE**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

Date: 28.08.2021

**Board of Studies of B.Voc., Commercial Aquaculture and Fisheries**

A meeting of Board of studies of the Department of Fisheries and Aquaculture will be held on **28.08.2022 at 12.30 P.M** in Ideal College of Arts and Sciences (Autonomous), Vidyutnagar, Kakinada, to consider the following Agenda.

You are cordially invited to attend the meeting and make it a success.

**Agenda:**

- 1.To ratify the syllabus for the First year & Second year (I, II, III & IV Semesters).
- 2.To prepare and ratify scheme of Examinations for both internal and external examinations.
- 3.Model Question paper for First year & Second year).
- 4.To fix Panel of paper setters and Examiners.
- 5.Additional inputs into the curriculum and up gradation of syllabus incorporate the Apprenticeship.
- 6.Other academic activities of Department.

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**  
**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**Board of Studies of B.Voc., Commercial Aquaculture and Fisheries**

The Board of Studies for the Department of Fisheries and Aquaculture for the year 2021-2022 is constituted with the following Members.

**Sl.No. Members Present**

- |                           |                |
|---------------------------|----------------|
| 1. Dr. K. Narasimha Murty | Chairman       |
| 2. P V Lovaraju           | Member         |
| 3. V.Manikanta            | Student Member |
| 4. A.Janaki Devi          | Student Member |

**Adikavi Nannaya University Nominee**

1. Dr. K. Ramaneswarai  
Dept. of Zoology  
HOD, Adikavi Nannaya University  
Rajamahendravaram  
Cell No: 8074112754

**Members from other Colleges**

1. Dr. Muralidhar P. Ande  
Senior Scientist & Office In-Charge, CIFE, Kakinada  
Cell No: 7396182790
2. Dr. P. Sandeep  
Scientist, FRS (SVVU), Balabhadrapuram, Kakinada Cell  
No: 8185039772

**Industry/Scientific Organization**

1. Dr. M. Srinivasa Rao  
Senior Product Development Manager & Marketing Head-India Growel  
Formulation Pvt. Ltd.  
Cell No: 7989548040

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

The syllabus and model question papers in Industrial Aquaculture and Fisheries subject for B.Vocation course for the First year & Second Year (I, II, III & IV Semesters) in the academic year 2021-2022, list of Examiners and paper setter, Department activities is approved in the Board of Studies meeting held in the Department of Fisheries and Aquaculture at 12:30 PM.

<u>Sl.No.</u>	<u>Members Present</u>	<u>Signatures of Members</u>
1.	Dr. K. Narasimha Murty	Chairman
2.	Dr. K. Ramaneswarai	University Nominee
3.	Dr. Muralidhar P. Ande	Expert
4.	Dr. P. Sandeep	Expert
5.	Dr. M. Srinivas Rao	Representative from Industry
6.	P V Lovaraju	Member
7.	V.Manikanta	Student Member
8.	A.Janaki Devi	Student Member

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**  
**A.Y.2021-2022**

**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**B.VOC., Commercial Aquaculture\_ & Fisheries Resolutions:**

1. Resolved to follow the following pattern for Examinations.
  - a) The syllabus is divided in to two semesters each paper has 30% internal and 70% semester (15+10+5) for I, II, III & IV (First year & Second Year).
  - b) During each semester two internal Examinations for each paper will be conducted as per schedule. Introduction of objective type questions and online pattern partially in internal examinations subject to the condition.
  - c) No internal examination/semester examination will be conducted separately for the absentees.
  - d) Average of the two internal Examinations will be considered. Absentee will be awarded zero marks.
  - e) The minimum pass mark for external examination is 35%, Candidate should get a total of 40 marks in internal and external examination put together.
  - f) The pattern of semester examinations and practical I, II, III & IV is herewith appended.
  - g) Practical examination will be conducted at each Semester end.
2. Resolved to approve the model question papers for I, II, III & IV semesters are here with appended.
3. Resolved to approve the panel of paper setter and examiners as appended herewith.
4. Additional inputs into the curriculum and up gradation of syllabus will be incorporated the OJT (On Job Training) and Project Work.
5. It Resolved to fishing methods is introduced in the place of Fish Seed Production in second semester.
6. It resolved to fish seed production is introduced in the place of fishing methods in third semester.
7. First semester and Third semester followed as per university syllabus in the year of 2021-2022 onwards.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B), KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture 2021-2022**  
, Course structure , Semester I

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course	50	-	70	2	2
4.	Skill Development Course	50	-	50	2	2
<b>Skill Education</b>						
1	Animal Diversity – I Biology of Non-Chordates	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Biology of Fishes	100	30	70	4	4
4	Lab Practical	50	-	50	2	1
5	Principles of Aquaculture	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Fresh water aqua culture(no practical)	100	30	70	4	4
8	OJT	50	-	50	2	1
	<b>Total</b>	<b>900</b>			<b>36</b>	<b>28</b>



**IDEAL COLLEGE OF ARTS & SCIENCES**  
(A.P. Govt. Aided, Autonomous, NAAC Accredited B)  
Dr. PVN RAJU VIDYAPRANGANAM  
SAMALKOTA ROAD, KAKINADA  
**ZOOLOGY SYLLABUS FOR I SEMESTER 2021 – 2022**  
**Bachelor of Vocation: Commercial Aquaculture**  
**PAPER – I ANIMAL DIVERSITY – BIOLOGY OF NON CHORDATES**  
**Periods: 60** **Max. Marks: 100**

---

**UNIT I**

- 1.1 Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature
- 1.2 Whittaker's five kingdom concept and classification of Animal Kingdom.
- Phylum Protozoa**
- 1.3 General Characters and classification of protozoa up to classes with suitable examples
- 1.4 Locomotion, nutrition and reproduction in Protozoans
- 1.5 Elphidium (type study)

**UNIT –II**

**Phylum Porifera**

- 2.1 General characters and classification up to classes with suitable examples
- 2.2 Skelton in Sponges
- 2.3 Canal system in sponges

**Phylum Coelenterata**

- 2.4 General characters and classification up to classes with suitable examples
- 2.5 Metagenesis in Obelia
- 2.6 Polymorphism in coelenterates
- 2.7 Corals and coral reefs **Phylum**

**Ctenophora :**

- 2.8 General Characters and Evolutionary significance(affinities)

**Unit – III**

**Phylum Platyhelminthes**

- 3.1 General characters and classification up to classes with suitable examples
- 3.2 Life cycle and pathogenecity of Fasciola hepatica
- 3.3 Parasitic Adaptations in helminthes

**Phylum Nemathelminthes**

- 3.4 General characters and classification up to classes with suitable examples 3.5.
- Life cycle and pathogenecity of Ascaris lumbricoides

**Unit – IV**

**Phylum Annelida**

- 4.1 General characters and classification up to classes with suitable examples
- 4.2 Evolution of Coelom and Coelom ducts

**Phylum Arthropoda**

- 4.4 General characters and classification up to classes with suitable examples
- 4.5 Vision and respiration in Arthropoda
- 4.6 Metamorphosis in Insects
- 4.7 Peripatus - Structure and affinities
- 4.8 Social Life in Termites

## Unit – V

### **Phylum Mollusca**

5.1 General characters and classification up to classes with suitable examples

5.2 Pearl formation in Pelecypoda

5.3 Sense organs in Mollusca

### **Phylum Echinodermata**

5.4 General characters and classification up to classes with suitable examples

5.5 Water vascular system in star fish

### **Phylum Hemichordata**

5.6 General characters and classification up to classes with suitable examples

5.7 Balanoglossus - Structure and affinities.

### **REFERENCE BOOKS:**

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS
- 6 P.S. Dhama and J.K. Dhama. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). Invertebrate Zoology, V Edition" ZOOLOGY

# IDEAL COLLEGE OF ARTS & SCIENCES

(A.P. Govt. Aided, Autonomous, NAAC Accredited B)

Dr. PVN RAJU VIDYAPRANGANAM

SAMALKOTA ROAD, KAKINADA

## ZOOLOGY MODEL PAPER FOR I SEMESTER

### ZOOLOGY - PAPER - I

#### ANIMAL DIVERSITY – BIOLOGY OF NON CHORDATES

**Time: 3 hrs**

**Max. Marks: 70**

**I. Answer any FIVE of the following. Draw labelled diagrams wherever necessary 4x5=20M**

1. Locomotion in protozoa
2. Metamorphosis in insects
3. Skeleton in sponges
4. Rotifera
5. Coelom and coelom ducts
6. Class echinoidea
7. Enteropneusta
8. Castes of Termites

**II. Answer the following. Draw labelled diagrams wherever necessary 5X10=50M**

- 9.a) Explain the life history of Elphidium  
OR  
b) Explain Whittaker's five kingdom concept
- 10.a) Describe Canal system in sponges  
OR  
b) Describe polymorphism in Coelenterates  
OR
- 11.a). Describe the life cycle of Fasciola hepatica  
OR  
b) Explain the Life cycle of Ascaris lumbricoides
- 12.a) Write general characters of phylum Arthropoda and classify up to classes with examples  
OR  
b) Describe the structure and affinities of Peripatus
- 13.a) Describe the structure and affinities of Balanoglossus  
OR  
b) Describe the pearl formation in Pelicy-poda

**IDEAL COLLEGE OF ARTS & SCIENCES**  
(A.P. Govt. Aided, Autonomous, NAAC Accredited B)  
Dr. PVN RAJU VIDYAPRANGANAM  
SAMALKOTA ROAD, KAKINADA  
**ZOOLOGY SYLLABUS FOR I SEMESTER 2021 – 2022**  
**Bachelor of Vocation: Commercial Aquaculture**  
**PRACTICAL PAPER – I ANIMAL DIVERSITY – BIOLOGY OF NON**  
**CHORDATES**

(Credits:2) 3 hrs/week

Work load: 30 hrs per semester

**Practical Syllabus:**

**1. Study of museum slides / specimens / models (Classification of animals up to orders)**

**Protozoa:** Amoeba, Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoebahistoltyca, Plasmodium vivax

**Porifera:** Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gem mule Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatulav.

**Platyhelminthes:** Planaria, Fasciola hepatica, Fasciolalarval forms – Miracidium, Redia, Cercaria, Echinococcusgranulosus, Taeniasolium, Schistosomahaematobiumvii.

**Nemathelminthes:** Ascaris (Male & Female), Drancunculus, Ancylostoma, Wuchereria

**Annelida:** Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva

**Arthropoda:** Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Periap't's, Larvae - Nauplius, Mysis, Zoa, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly.

**Mollusca:** Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva

**Echinodermata:** Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Ante don, Bipinnaria larva

**Hemichordata:** Balanoglossus, Tornaria larva.

**2. Dissections:**

**Prawn:** Appendages, Digestive system, Nervous system, Mounting of Statocyst.  
Insect Mouth Parts

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**Semester I**  
**BIOLOGY OF FISHES**

**Syllabus**

**Credits 4**

---

**Unit 1: General Characteristics and Taxonomy of Fishes**

- 1.1. General characters and classification of fishes, Osteichthyes and Chondrichthyes fishes and its differences.
- 1.2. Bioluminescence in fishes.

**Unit 2: Food and Feeding – Growth**

- 2.1. Food and feeding habits – structural adaptations, classification based on food and feeding habits.
- 2.2. Gastrosomatic index in fishes.

**Unit 3: Digestion, Respiration and Circulation**

- 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, Significance of circulation.

**Unit 4: Reproduction, Excretion**

- 4.1. Reproduction – ovary and testes, structure, development of primary and secondary sexual & Sexual dimorphism in fishes.
- 4.5. Parental care in fishes
- 4.2. Excretion and osmoregulation-freshwater fishes
- 4.4. Osmoregulation in marine fishes.

**Unit 5: Endocrine glands in fishes and Migration**

- 5.1. Sense organs in fishes (Neuromast organs) – lateral line system. Ampullae of Lorenzini.
- 5.2. Endocrine organs in fishes-Pituitary gland, thyroid gland, adrenal gland, Urohypophysis, pancreatic islets and pineal organs.
- 5.3. Migration in fishes –anadromous and catadromous.

### **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



\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**Practical**  
**I Year, I semester 2021-2022**

Practical Paper: I: Biology of Fishes (Credits:2) 3 hrs/week Work load: 30 hrs per semester

<b>S.NO.</b>	<b>NAME OF THE PRACTICAL</b>
1.	Fish Morphometric characters
2.	Fish Meristic characters
3.	Indian Major carps
	1. <i>Catla catla</i>
	2. <i>Labeo rohita</i>
	3. <i>Cirrhinus mrigala</i>
4.	Exotic Fishes
	1. <i>Hypophthalmichthys molitrix</i>
	2. <i>Ctenopharyngodon idella</i>
	3. <i>Cyprinus carpio</i>
5.	Air breathing Fishes
	a. <i>Clarias magur</i>
	b. <i>Wallago attu</i>
	c. <i>Heteropneustes fossilis</i>
	d. <i>Anaba testudineus</i>
	Murrels
	a. <i>Channa striatus</i>
	b. <i>Channa punctatus</i>
6.	Migratory fishes
	1. <i>Hilsa ilisha</i>
	2. <i>Anguilla anguilla</i>
7.	Gut content Analysis of Fish
8.	GaSI
9.	Dissection and study of internal organs: Fishes/Prawns/Shrimps
	a. Digestive system
	b. Respiratory system
	c. Excretory system
	d. Reproductive systems



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch Semester  
I  
**Principles of Aquaculture**

Syllabus

Credits 4

---

**Unit 1: Introduction of Aquaculture**

- 1.1. History, definition, scope and significance of aquaculture, Blue Revolution, concepts of Blue Revolution.
- 1.2. Different aquaculture systems, classification of Aquaculture, methods of aquaculture
- 1.3. Criteria for the selection of species.

**Unit 2: Pond Ecology**

- 2.1. General concepts of ecology-Ecological factors, pond ecosystem, productivity of culture pond, 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.

**Unit 3: Types of ponds-characteristics of fishes**

- 3.1. Type of ponds – nursery, rearing and Grow-out ponds.
- 3.2. Cultivable freshwater fishes- carps, Airbreathing fishes, tilapia.

**Unit 4: Characteristics of Brackishwater cultivable fishes**

- 4.1. Major brackish water culture systems in India.
- 4.2. General characters – Milk fish, mullet, seabass, shrimps, crabs.

**Unit 5: Characteristics of Marine water cultivable species**

- 5.1. Different cultivable species in Marine water and its characters –Edible oyster, pearl Oyster, mussels and sea weeds and its types

### 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture Semester  
I 2021-2022

**Bachelor of Vocation: Commercial Aquaculture**  
**Principles of Aquaculture**

---

Time: 3 Hours

Max.Marks: 70  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**SECTION B**

5 x 10 = 50 Marks

**Answer all questions. Each answer carries 10 marks**

9. a)

OR

b)

10. a)

OR

11. a)

OR

12. a)

OR

13. a)

OR

b)

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**Practical**  
**I Year, I semester 2021-2022**

Practical Paper: II: **Principles of Aquaculture** (Credits:2)  
 hrs per semester

2 hrs/week Work load: 30

S.No	NAME OF THE PRACTICAL
1.	Ponds Lay-outs a. Nursery Pond b. Rearing Pond c. Grow-out Pond
2.	Dikes
3.	Types of Aerators a. Pedal wheel aerators b. Propeller-aspirator pumps c. Diffused-air systems
4.	Sluice gate
5.	Aquatic Weeds and their control A. Floating weeds B. Emergent weeds C. Submerged weeds D. Marginal weeds 1. Pistia            1. Typha            1. Vallisneria            1. Marsilia 2. Eichhornia    2. Nymphaea        2. Hydrilla            2. Ipomoea
B.	Mahula oil
C.	Liming
D.	Predatory Fishes and their control a. <i>Channa sp.</i> , b. <i>Wallago attu</i> , c. <i>Heteropneustes fossilis</i> , d. <i>Clarias batrachus</i> e. <i>Anabas testudineus</i>
E.	Identification and general characters of Larvivorous fishes a. <i>Gambusia affinis</i> b. <i>Lebistes reticulatus</i> c. <i>Puntius ticto</i> d. <i>Colisa fasciatus</i>

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch Semester

I

**Fresh water Aquaculture**

Syllabus

Credits 4

---

**Unit 1: Freshwater Fish Culture**

- 1.1. Management of carp culture ponds- Nursery rearing and stocking ponds.
- 1.2. Preparation of ponds– different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting.

**Unit 2: Culture of Prawns, cage and pen culture**

- 2.1. Cultivable species of freshwater prawns and their biology
- 2.2. Management techniques of nursery and Grow-out ponds.
- 2.3. Cages and pens.

**Unit 3 Integrated Farming-Organic farming**

- 3.1. Recent development in integrated farming – Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and Pig cum fish culture.
- 3.3. Organic aqua farming.

**Unit 4: Fresh water cultivable fishes**

- 4.1 Culture of air breathing fishes- Channa, Heteropneustes, Clarius, Anabas.
- 4.2. Freshwater pearl culture

**Unit 5: Aquaculture for stable environment**

- 5.1. Sewage fed fish culture
- 5.2. Larvivorous fishes in relation to public health
- 5.3. Effluent Treatment Ponds (ETP).

### **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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture Semester  
I 2021-2022

**Bachelor of Vocation: Commercial Aquaculture**  
**Fresh water Aquaculture**

---

Time: 3 Hours

Max.Marks: 70  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**SECTION B**

5 x 10 = 50 Marks

**Answer all questions. Each answer carries 10 marks**

9. a)

OR

b)

10. a)

OR

11. a)

OR

12. a)

OR

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
 Course structure and syllabi: 2021-2022 Admitted Batch Semester  
 I  
**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT / INDUSTRIAL OR INSTITUTE T REPORT & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year ,II semester 2021-2022**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course	50	-	70	2	2
4.	Skill Development Course-1	50	-	50	2	2
5.	Skill Development Course-2	50	-	50	2	2
<b>Skill Education</b>						
1	Animal Diversity – II Biology of Chordates(Zoology)	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Biology of shell fish	100	30	70	4	4
4	Lab Practical	50	-	50	2	1
5	Brackish water aquaculture &mariculture.	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Fishing Methods(No Practical)	100	30	70	4	4
8	OJT	50	-	50	2	1
	<b>Total</b>	<b>950</b>			<b>34</b>	<b>32</b>

**First spell between First year and Second Year Apprenticeship: Credits: 4; Marks: 100**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch  
Semester II

**ZOOLOGY SYLLABUS FOR II SEMESTER**

**PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

---

**Unit - I**

- 1.1 General characters and classification of Chordata upto classes
- 1.2 Protochordata- Salient features of Cephalochordata , Affinities of Cephalochordata.
- 1.3 Salient features of Urochordata
- 1.4 Structure and life history of *Herdmania*
- 1.5 Retrogressive metamorphosis –Process and Significance

**Unit - II**

- 2.1 Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*
- 2.2 Pisces : General characters of Fishes
- 2.3 *Scoliodon*: External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain.
- 2.4 Migration in Fishes
- 2.5 Types of Scales
- 2.6 Dipnoi

**Unit - III**

- 3.1 General characters of Amphibia
- 3.2 Classification of Amphibia up to orders with examples.
- 3.3 *Rana hexadactyla*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain
- 3.4 Reptilia: General characters of Reptilia, Classification of Reptilia upto orders with examples
- 3.5 *Calotes*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 3.6 Identification of Poisonous snakes and Skull in reptiles

#### **Unit - IV**

- 4.1 Aves General characters of Aves
- 4.2 *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 4.3 Migration in Birds
- 4.4 Flight adaptation in birds

#### **Unit - V**

- 5.1 General characters of Mammalia
- 5.2 Classification of Mammalia upto sub - classes with examples
- 5.3 Comparison of Prototherians, Metatherians and Eutherians
- 5.4 Dentition in mammals

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**Zoology-Chordates**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following: **Draw**

4 x 5 = 20 Marks

**labeled diagram wherever necessary**

1. Amphioxus
2. Placoidscale
3. Quillfeather
4. Prototheria
5. Anadromousmigration
6. Draco
7. Emu
8. Apoda

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Explain the life history of Herdmania  
OR  
b) Explain the origin and general characters of chordates
10. a) Compare the characters of Petromyzon and Myxine  
OR  
b) Describe the structure of heart in Scoliodon
11. a) . Describe the brain of Ranahexadactyla  
OR  
b) Explain the external features of Calotes
12. a) Write an essay on flight adaptations in birds  
OR  
b) Explain the respiratory system of Columba livia
13. a) Compare the characters of Metatheria and Eutheria  
OR  
b) Write an essay on dentition in mammals

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**ZOOLOGY-CHORDATES**  
**PRACTICAL SYLLABUS**

**I.Observation of the Following Slides / Spotters / Models :**

Protochordata: Herdmania, Amphioxus, Amphioxus T.S through pharynx.

- **Cyclostomata** : Petromyzon and Myxine.
- **Pisces**: Pristis, Torpedo, Hippocampus, Exocoetus, Echineis, Labeo, Catla, Claries, Channa, Anguilla. □
- **Amphibian** : Ichthyophis, Amblystoma, Axolotl larva, Hyla,
- **Reptilia**: Draco, Chameleon, Uromastix, Testudo, Trionyx, Russels viper, Naja Krait, Hydrophis, Crocodile.
- **Aves**: Psittacula, Eudynamis, Bubo, Alcedo.
- **Mammalian**: Ornithorhynchus, Pteropus, Funambulus.

**II. Dissections**

1. Scoliodon IX and X, Cranial nerves
2. Scoliodon Brain
3. Mounting of fish scales

- Note: 1. Dissections are to be demonstrated only by the faculty or virtual.  
2. Laboratory Record work shall be submitted at the time of practical examination.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**Biology of Shell Fish**

**Syllabus**

**Credits 4**

---

**Unit – I: General Characters and Classification of Cultivable Shell Fish**

- 1.1 General characters and classification of crustaceans and molluscs up to the level of class.
- 1.2 Commercial importance of crustaceans and molluscs.
- 1.3 Prawn external parts and appendages, exoskeleton and integument.
- 1.4 Respiration and circulatory systems of prawn. Structure of gills, mechanism of respiration.
- 1.5 Nervous and excretory system of crustacean molluscs.
- 1.6 Sense organs in crustaceans and molluscs.

**Unit – II: Food, Feeding and Growth**

- 2.1 Natural food, feeding habits, feeding intensity utilization of food, gut content analysis.
- 2.2 Digestive system of shrimp, crab and molluscs.
- 2.3 Integument and exoskeleton of crustaceans, their structure and functions.

**Unit – III: Reproductive Biology**

- 3.1 Induced maturation in shrimp – induced maturation technology physiological changes after induced maturation.
- 3.2 Breeding in Oysters, Mussel, Clams, Pearl Oyster, Pila, Fresh water Mussel and Cephalopods.
- 3.3 Reproductive organs in Shrimp.
- 3.4 Life cycle of Shrimp.

**Unit – IV: Development**

- 4.1 Embryonic and larval development of Shrimp, Crab and Molluscs.
- 4.2 Environmental factors affecting reproduction and development of cultivable shell fish.

**Unit – V: Hormones & Growth**

- 5.1 Endocrine system of Prawn and Crab, Oyster.
- 5.2 Neurosecretory cells Androgenic gland, ovary, cuticle.
- 5.3 Moulting, Moulting stages, Metamorphosis in Crustaceans.

### **Reference Books:**

1. Borradile & R.A. Potts. The Invertebrates. Asia Publishing House, 1962.
2. Kaestner, A. Invertebrate Zoology. Vol. I – III, John Wiley & Sons, 1967.
3. Barrington, F.J.W. Invertebrates : Structure and Functions. EIBS, 1971.
4. Kurian, C.V. & V.O. Sabastian. Prawns and Prawn Fisheries of India. Hindustan Pub. Co., 1976.
5. Parker, J. & W.A. Haswell. The Textbook of Zoology. Vol. I. Invertebrates (eds. A.J. Marshall & W.D. Williams), ELBS & McMillan & Co., 1992.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**Biology of Shell Fish**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**Biology of Shell Fish**  
**PRACTICALS**

**(Credits 1, Hours 2)**

1. Identification of commercially important shell fishes.
2. Study of different larval stages of shrimp.
3. Mouth parts and appendages of cultivable prawns, shrimp and other crustaceans.
4. Study of eggs of shrimps, prawns and other crustaceans.
5. Observations of Molluscan larva.
6. Study of visceral organs of fresh water mussels.
7. Dissections
  - A. Mounting of the shrimp/prawn appendages
  - B. Digestive system of shrimp/prawn
  - C. Nervous system of shrimp/prawn
  - D. Eye stalk ablation in shrimp/Prawn
  - E. Pituitary gland extract in fishes

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**Practical**  
**I Year, II semester 2021-2022**  
**Brackishwater Aquaculture and Mari culture**

**Unit 1: Introduction to Brackishwater and Construction**

- 1.1. Present status of brackishwater farming in India.
- 1.2. Abiotic and biotic factors.

**Unit 2: Brackishwater Finfish Culture**

- 2.1. Biology and culture practices – monoculture and polyculture
- 2.2. Biology and culture - *Chanos chanos*, *Mugil cephalus*, *Lates calcarifer*.

**Unit 3: Brackishwater Shellfish Culture**

- 3.1. Species of shrimps cultured in brackishwater and their biology – *Penaeus monodon*, *Penaeus indicus*, *Litopenaeus vannamei*.
- 3.1. Shrimp culture, Traditional, extensive, modified extensive, semi- intensive culture and intensive
- 3.2. Crab culture

**Unit 4: Water Parameters in Brackishwater Culture Ponds**

- 4.1. Soil parameters: Soil texture, Soil reaction (pH), organic carbon content, Carbon to nitrogen ratio (C:N) and General nutrient status
- 4.2. Water quality parameters: Temperature, Dissolved Oxygen (DO), salinity, pH, Turbidity, Total alkalinity, CO<sub>2</sub>, Ammonia, Nitrite, H<sub>2</sub>S.
- 4.3. Role of Microalgae in Aquaculture.

**Unit 5: Mariculture**

- 5.1. Introduction to mariculture.
- 5.2. Farming of Molluscs (Example: Edible Oyster, Mussel and pearls-Raft )
- 5.3. Seaweed farming in India.

### **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.
6. 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**BRACKISH WATER AQUACULTURE AND MARI CULTURE**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., Commercial Aquaculture**

**Semester-II, 2020-2021**

**PRACTICALS PAPER II**

**Title: BRACKISH WATER AQUACULTURE AND MARICULTURE**  
**(Credits 1, Hours 2)**

---

I. Identification of cultivable fishes

A. Brackish water fishes/Estuarine fishes

1. *Chanos chanos*
2. *Etroplus surantensis*
3. *Mugil cephalus*
4. *Megalopa cyprinoides*
5. *Eleutheronema tetradachylum*

B. Marine water fishes

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

C. Migratory fishes

3. *Hilsa ilisha*
4. *Anguilla Anguilla*

D. Soil (Soil texture, pH, organic matter) and Water Quality parameters.(DO, Salinity, pH, Hardness, Alkalinity)

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**Practical**  
**I Year, II semester 2021-2022**  
**FISHING METHODS**

**Unit 1: Inland Fishing Crafts and Gears**

- 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.

**Unit 2: Marine Fishing Crafts and Gears**

- 2.1. Introduction, - 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 hooks.
- 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.

**Unit 3: Active Fishing Gears, Passive Gears**

- 3.1. Active fishing gears- 1. Fishing hooks:Parts of hooks, Numbering of hooks, Artificial baits or jigs, Trolling lines; 2. Seining:Trawls, Surrounding net, Lift net
- 3.2. Passive gears- 1. Gill net; 2. Fish traps, Traps, Pots; 3. Hooks and lines (passively operated), Bottom set line, Drift longline, Demersal longline, Drifting long line

**Unit 4: Unconventional Fishing methods**

- 4.1. Destructive and Prohibited fishing practices,
- 4.2. Fishing methods like electrical fishing,
- 4.3. Light fishing; Angling (line fishing) poisoning and use of dynamites.

**Unit 5: Fish Finding Devices**

- 5.1 Introductory information on echo sounder, sonar, net sonde, global positioning systems, remote sensing.
- 5.2 Geographic Information Systems (GIS) in aquaculture.

### **Suggested reading**

#### **Core reading**

1. Boopendranath, M.R., Meenakumari, B., Joseph, J., Sankar, T.V., Pravin, P., and Edwin, L. (Eds.) 2002, Riverine and Reservoir Fisheries 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**FISHING METHODS**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
 Course structure and syllabi: 2021-2022 Admitted Batch  
 Semester II  
**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT / INDUSTRIAL OR INSTITUTE T REPORT & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC  
B) DR. P.V.N. RAJU VIDYAPRANGANAM,  
KAKINADA

**Bachelor of Vocation: Commercial  
Aquaculture Course structure and syllabi:  
2021-2022 Admitted Batch II Year,  
Semester III**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course-1	50	-	70	2	2
4.	Life Skill Course-2	50	-	50	2	2
5.	Skill Development Course	50	-	50	2	2
<b>Skill Education</b>						
1	Zoology (Cell biology, Genetics, Molecular Biology & Evolution)	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Capture fisheries	100	30	70	4	4
4	Lab practical	50	-	50	2	1
5	Aquaculture nutrition	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Fish Seed Production (nopractical)	100	30	70	4	4
8	OJT	50	-	50	2	1
9	Yoga	-	-	-	-	1
	<b>Total</b>	<b>950</b>			<b>38</b>	<b>33</b>

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture II Year, Semester III**  
**Cell biology, Genetics, Molecular Biology & Evolution**

---

**Unit – I      Cell Biology**

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
- 1.2 Electron microscopic structure of animal cell.
- 1.3 Plasma membrane –Models and transport functions of plasma membrane.
- 1.4 Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes
- 1.5 Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

(Note: 1. General pattern of study of each cell organelle – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams)  
2. Need not study cellular respiration under mitochondrial functions)

**Unit – II      Genetics - I**

2. 1 Mendel's work on transmission of traits
2. 2 Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes
2. 3 Polygenes (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance)
2. 4 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)
2. 5 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

**Unit – III      Genetics - II**

- 3.1 Mutations & Mutagenesis
- 3.2 Chromosomal Disorders (Autosomal and Allosomal)
- 3.3 Human Genetics – Karyotyping, Pedigree Analysis (basics)
- 3.4 Basics on Genomics and Proteomics

**UNIT IV:      Molecular Biology**

- 4.1 Central Dogma of Molecular Biology

4.2 Basic concepts of -

- a. DNA replication – Overview (Semi-conservative mechanism, Semi-discontinuous mode, Origin & Propagation of replication fork)
- b. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications (basics)
- c. Translation – Initiation, Elongation and Termination

4.3 Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

**Unit - V**

5.1 Origin of life

5.2 Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory

5.3 Neo-Darwinism: Modern Synthetic Theory of Evolution, Hardy-Weinberg Equilibrium

5.4 Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**II Year, III semester 2021-2022**  
**Cell biology, Genetics, Molecular Biology & Evolution**  
**MODEL PAPER**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

**Answer any FOUR of the following:**

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Prokaryotic cell
2. Golgi complex
3. Polygenes
4. Multiple alleles
5. Mutations
6. Karyotyping
7. Lac operon concept
8. Genetic drift

**PART - B**

**Answer any FIVE of the following:**

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Describe the ultra structure of animal cell  
OR  
b) Explain the structure of mitochondria. Add a note on its functions.
10. a) Write an essay on gene interactions  
OR  
b) Discuss sex linked inheritance.
11. a) What are chromosomal disorders? Explain various types of autosomal and allosomal disorders  
OR  
b) Explain About Human Karyotyping ?
12. a) Give an account of DNA replication  
OR  
b) Explain the mechanism of Prokaryotic transcription
13. a) An essay on modern synthetic theory of evolution  
OR  
b) Define isolation. Discuss various isolating mechanisms.

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**II Year, III semester 2021-2022**  
**Cell biology, Genetics, Molecular Biology & Evolution**  
**PRACTICAL SYLLABUS**

---

**I. Cell Biology**

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of Chironomus.

**II. Genetics**

1. Study of Mendelian inheritance using suitable examples and problems.
2. Problems on blood group inheritance and sex linked inheritance.
3. Study of human Karyo types (Down's syndrome, Edwards, syndrome, Patausyndrome, Turner's syndrome and Klinefelter syndrome).

**III. Evolution**

1. Study of fossil evidences.
2. Study of homology and analogy from suitable specimens and pictures.
3. Phylogeny of horse with pictures.
4. Study of Genetic Drift by using examples of Darwin's finches(pictures).
5. Visit to Natural History Museum and submission of report.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture II Year, Semester III**  
**CAPTURE FISHERIES**

**Unit 1: Riverine and Estuarine Fisheries**

- 1.1. Riverine fisheries – Major river systems in India, important characteristic features of Rivers
- 1.2. Estuarine fisheries- definition, Ecological significance of estuary, Biota of estuary, classification and categories of estuaries- capture fisheries- resident and migrant species.

**Unit 2: Reservoir and Lakesterine Fisheries**

- 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.

**Unit 3: Coastal fisheries**

- 3.1. Coastal fisheries – Elasmobranch fishery; Teleost fishery- Sardines, Anchovies, Mackerel, Mumbai duck, Catfishes, Eels, Ribbon fish, Perches, Mulletts, Polnemids, Pomfrets, Scianids, Seer fishes, Flying fishes

**Unit 4: Marine Pelagic, Demersal and Deep Sea Resources**

- 4.1. Pelagic resources and Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources.
- 4.2. Introduction-Fisheries potential, Major Deep sea resources and scope of their exploitation, Present fishing pattern and deep sea fishing in India
- 4.3. Regulations-Conservation and regulation of fishing pressure - closed season, mesh size regulations, sanctuaries., Deep Sea Fishing Policy

## **Unit 5: Fisheries institutes**

- 5.1. Different organizations and institutes involved in fisheries and aquaculture research and development – FAO, NACA, SEAFDEC, INFOFISH, MPEDA, World Fish Centre, Bay of Bengal Programme.
- 5.2. Institutes under ICAR, CSIR; NABARD, Ministry of Agriculture and Ministry of Commerce, Aquaculture Authority of India, NRSA, INCOIS etc.
- 5.3. State organizations like Matsyafed, FFDA, BFFDA, ADAK, FIRMA and State Fisheries Department.

### **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 Myanmar*. 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 and graphic guide version 4*. 2000. SAS Institute Inc. United State of America. 613 pp.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**CAPTURE FISHERIES**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., Commercial Aquaculture**

**II Year, III semester 2021-2022**

**CAPTURE FISHERIES**

**PRACTICAL SYLLABUS**

- I. Identification of Reservoir Fisheries
  1. *Labeo rohita*, *L. calbasu*,
  2. *Cirrhinus mrigala*
  3. *Catla catla*
- II. Identification of Estuarine Fisheries
  1. Chanos
  2. Lates
  3. Mulletts
- III. Identification of Marine Fisheries
  - a. Pelagic Fisheries (3 to 5 species)
  - b. Demersal Fisheries (3 to 5 species)
  - c. Deep sea Fisheries (3 to 5 species)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture II Year, Semester III**  
**AQUACULTURE NUTRITION**

**Unit 1: Nutritional Requirements of Fish**

- 1.1. Principles of fish nutrition (Proteins, Carbohydrates and lipids)
- 1.2. Vitamin and mineral requirements, vitamin C for fish and shell fishes.
- 1.3. Feeds and feed additives

**Unit 2: Feed ingredients & quality**

- 1.1. Different feed ingredients
- 1.2. Types of feeds, Compounded feeds, pellets, crumbles and microencapsulated feed. Storage, quality standards, proximate composition.
- 1.3. Digestibility studies and methods.

**Unit 3: Feed & Feed Manufacturing**

- 3.1. Feed formulation - methods, square method.
- 3.2. Feed manufacturing processes, Extrusion, Pelletization.

**Unit 4: Feed Management**

- 4.1. Feed schedule in finfish and shellfish, calculations and daily ration.
- 4.2. Artificial feed formulations of different cultural species.
- 4.3. Feed Check tray observations and management.

**Unit 5: Feed Quality**

- 5.1. Feed energetic, Feed Conversion Efficiency(FCE), Protein Efficiency Ratio (PER),
- 5.2. Feed Conversion Ratio (FCR), Net Protein Utilization NPU, leaching,
- 5.3. Water stability. Quality standards

### **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. Hephher,B. and Pruginin,Y. Commercial Fish Farming

#### **Supplementary Reading**

1. Halver J.E. Fish Nutrition
2. Hephher 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**AQUACULTURE NUTRITUTION**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., Commercial Aquaculture**  
**II Year, III semester 2021-2022**  
**AQUACULTURE NUTRITION**  
**PRACTICAL SYLLABUS**

I. Feed management (Proximate Analysis)

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

II. Preparation of supplementary feeds with locally available ingredients,

III. Determination of water stability of pellet feeds.

V. Feed calculation and daily ration

VI. Check-trays in shrimp farming ponds.

VIII. Estimation of FCR.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture II Year, Semester III**  
**FISH SEED PRODUCTION**

**Unit1: Carp Hatchery and Seed production**

- 1.1. Types of hatcheries
- 1.2. Cap brood management; Recruitment, pond management, management of spent broods
- 1.3. Induced breeding technology and Synthetic hormones.

**Unit 2: Carp Seed procurement-Bundh Breeding**

- 2.1. Carp seed resources in major rivers India.
- 2.2. Bundh breeding, types of bundh breeding techniques.

**Unit 3: Seed Production of Crustaceans**

- 3.1. Seed production shrimp and prawn
- 3.2. Operation and management of maturation section.

**Unit 4: Seed Production of Molluscs**

- 4.1.Hatchery operations of pearl oysters
- 4.2.Hatchery operations of Edible oysters

**Unit 5: Transportation seed**

- 5.1. Transportation of brooders (Fin fish/shrimp/prawn)
- 5.2. Transportation of fish seed

### **Suggested Reading**

#### **Core reading**

1. Chodar SL Hypophysation in Indian Major Carps
2. CMFRI Spl. Bul. Hatchery Operation of Penaeid 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. Hopher, B. & Y. Prugin. 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.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**I Year, II semester 2021-2022**  
**FISH SEED PRODUCTION**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture**  
 Course structure and syllabi: 2021-2022 Admitted Batch Semester  
 III  
**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT REPORT/ INDUSTRIAL OR TRAINING & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B) DR.  
P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial**  
**Aquaculture II Year, IV**  
**semester 2021-2022**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
	<b>Core Papers</b>					
1.	Zoology(Physiology, Cellular Metabolism & Embryology)	100	30	70	4	4
2.	Lab	50	-	50	2	1
3.	Zoology(Immunology &Animal Biotechnology)	100	30	70	4	4
4.	Lab	50	-	50	2	1
5.	Fish Genetics and aquaculture Biotechnology	100	30	70	4	4
6.	Lab-Practical	50	-	50	2	1
7.	Fish Pathology and Fish Immunology	100	30	70	4	4
8.	Lab-Practical	50	-	50	2	1
9.	Ornamental fish culture	100	30	70	4	4
10.	Lab	50	-	50	2	1
11.	Larval Nutrition&culture of fish food organisms.(nopractical)	100	30	70	4	4
12.	OJT	50	-	50	2	1
13.	NCC/NSS/Sports/Extra Curricular	-	-	-	-	2
14.	Yoga	-	-	-	-	1
	Total		180	720	<b>36</b>	<b>33</b>
	<b>Grand Total</b>	<b>900</b>				

**Second spell between First year and Second Year Apprenticeship: Credits: 4; Mark-100**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture II Year, Semester IV**

**ZOOLOGY SYLLABUS FOR IV SEMESTER**  
**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND**  
**EMBRYOLOGY**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

---

**UNIT I      Animal Physiology - I**

1.1 Process of digestion and assimilation

1.2 Respiration - Pulmonary ventilation, transport of oxygen and CO<sub>2</sub>

(Note: Need not study cellular respiration here)

1.3 Circulation - Structure and functioning of heart, Cardiac cycle

1.4 Excretion - Structure and functions of kidney urine formation, counter current  
Mechanism

**UN IT II     Animal Physiology - II**

2.1 Nerve impulse transmission - Resting membrane potential, origin and  
propagation of action potentials along myelinated and non-myelinated nerve  
fibers

2.2 Muscle contraction - Ultra structure of muscle, molecular and chemical basis of  
muscle contraction

2.3 Endocrine glands - Structure, functions of hormones of pituitary, thyroid,  
parathyroid, adrenal glands and pancreas

2.4 Hormonal control of reproduction in a mammal

**UNIT III     Cellular Metabolism – I (Biomolecules)**

3.1 Carbohydrates - Classification of carbohydrates. Structure of glucose

3.2 Proteins - Classification of proteins. General properties of amino acids

3.3 Lipids - Classification of lipids

3.4 Enzymes: Classification and Mechanism of Action

**UNITIV     Cellular Metabolism – II**

4.1 Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain,  
Glycogen metabolism, Gluconeogenesis

4.2 Lipid Metabolism –  $\beta$ -oxidation of palmitic acid

#### 4.3 Protein metabolism - Transamination, Deamination and Urea Cycle

#### **Unit – V      Embryology**

5.1 Gametogenesis

5.2 Fertilization

5.3 Types of eggs

5.4 Types of cleavages

5.5 Development of Frog upto formation of primary germ layers

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**Title : ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY  
MODEL PAPER**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Assimilation
2. Cardiac cycle
3. Ultra structure of muscle
4. Pancreas
5. Structure of glucose
6. Lipids
7. Gluconeogenesis
8. Types of eggs

**PART - B**

Answer any **FIVE** of the following:

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9.a) Explain the process of digestion.

OR

b) Describe the structure and function of heart

10. a) Give an account of nerve impulse transmission.

OR

b) Write an essay on the hormonal control of reproduction in mammals

11. a) Write an essay on the classification of carbohydrates

OR

b) Classify the enzymes. Discuss the mechanism of enzyme action

12. a) Write an account on Kreb's cycle.

OR

b) Explain B- oxidation of palmitic acid

13. a) Discuss the process of fertilization

OR

b) Write an essay on gametogenesis.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**Title : ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY  
PRACTICAL SYLLABUS**

---

**Practical Syllabus:**

**I. Animal physiology**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Study of activity of salivary amylase under optimum conditions
3. T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
4. Differential count of human blood

**II. Cellular metabolism** 1. Estimation of total proteins in given solutions by Lowry's method.

2. Estimation of total carbohydrate by Anthrone method.
3. Qualitative tests for identification of ammonia, urea and uric acid
4. Protocol for Isolation of DNA in animal cells

**III. Embryology**

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Construction of fate map of frog blastula

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Commercial Aquaculture II Year, Semester IV**

**ZOOLOGY SYLLABUS FOR SEMESTER - IV**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

---

- Unit – I      Immunology – I (Overview of Immune system)**
- 1.1 Introduction to basic concepts in Immunology
  - 1.2 Innate and adaptive immunity, Vaccines and Immunization programme
  - 1.3 Cells of immune system
  - 1.4 Organs of immune system
- Unit – II      Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)**
- 2.1 Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants; Factors influencing immunogenicity
  - 2.2 Antibodies: Structure of antibody, Classes and functions of antibodies
  - 2.3 Structure and functions of major histo compatibility complexes
  - 2.4 Exogenous and Endogenous pathways of antigen presentation and processing
  - 2.5 Hypersensitivity – Classification and Types
- Unit – III      Techniques**
- 2.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
  - 2.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures
  - 2.3 Stem cells: Types of stem cells and applications
  - 2.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)
- Unit – IV      Applications of Animal Biotechnology**



- 3.1 Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology
- 3.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery
- 3.3 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications
- 3.4 Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

#### Unit - V

- 1.1. PCR: Basics of PCR.
- 4.2 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)
- 4.3 Hybridization techniques: Southern, Northern and Western blotting
- 4.4 DNA fingerprinting: Procedure and applications
- 4.5 Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**  
**Title : IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**  
**MODELPAPER**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Vaccines
2. Primary lymphoid organs
3. Hapten
4. Hypersensitivity
5. Natural media
6. Cell lines
7. Endo nucleases
8. Polyploidy in fishes

**PART - B**

Answer any **FIVE** of the following:

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Define immunity. Write in detail about innate immunity.  
OR  
b) Explain various cells of immune system
10. a) Describe the structure of antibody. Add a note on their functions.  
OR  
b) Describe the structure of MHC molecules. Discuss their role in the mechanism of exogenous and endogenous pathway of antigen processing and presentation
11. a) Write an essay on different types of stem cells and their applications  
OR  
b) Explain the production and applications of monoclonal antibodies.
12. a) Write an account on recombinant DNA technology  
OR  
b) Write an essay on transgenic animals
13. a) Explain hybridization techniques.  
OR  
b) Write an essay on PCR

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**Title : IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY  
PRACTICAL SYLLABUS**

**I. Immunology**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
  - a. ELISA
  - b. Immune electrophoresis .

**II. Animal biotechnology**

1. DNA quantification using DPA Method.
2. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
4. Cleaning and sterilization of glass and plastic wares for cell culture.
5. Preparation of culture media.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**Title : FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY**

**Syllabus**

**Credits 4**

---

**Unit 1: Basic Genetics and Biotechnology**

- 1.1. Introduction- Genetics, Mendel's law of inheritance, interaction of gene.
- 1.2. Supplementary and complementary genes.
- 1.3. Introduction to Biotechnology in Aquaculture.

**Unit 2: Selection and Hybridization**

- 2.1. Introduction-Hybridization of fish-Indian studies; Objectives of fish hybridization
- 2.2. Interspecific hybrids, Intergeneric hybrids among Indian carps.
- 2.3. Hybrid vigor, Inbreeding, cross-breeding and hybridization

**Unit 3: Sex determination & Chromosome manipulation in fish and shell fishes**

- 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. Induction of Gynogenesis and Androgenesis, Performance of Gynogens and Androgens, Monosex Populations.

**Unit 4: Aquaculture Biotechnology**

- 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. Cryopreservation technique in Aquaculture.

**Unit 5: Marine Biotechnology**

- 5.1. Introduction-Scope and the present status of marine biotechnology;
- 5.2. Industries Based on Marine Biotechnology
- 5.3. Use of probiotics and antibiotics in aquaculture operations.

### **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. Hephher, 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**II Year, IV semester 2021-2022**  
**FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**PRACTICAL PAPER -I**

**FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY**

**(Credits :1, Hours: 2)**

1. Problems on Mendelian inheritance.
2. Mitotic and meiotic chromosomes preparation.
3. Demonstration of protocol of androgenesis, gynogenesis and polyploidy.
4. Cryopreservation protocols, Quality evaluation of fish milt.
5. Isolation and quantification of Fish and Prawn DNA
6. Electrophoresis
7. ELISA
8. Immunofluorescence
9. DNA Hybridisation
10. Bioprocessing of organic wastes
11. Practicals on genbank sequence database.
12. PCR

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**Title : FISH PATHOLOGY AND FISH IMMUNOLOGY**

**Syllabus**

**Credits 4**

---

**Unit 1: Pathology and Parasitology**

- 1.1. Introduction, Symptoms of sick/diseased fish, causes of fish diseases.
- 1.2. Stress as a factor in the occurrence of diseases.
- 1.3. Types of parasites-Ectoparasites, Endoparasites, Commensalism; Mutualism.

**Unit 2: Fungal and Bacterial Diseases**

- 2.1. Fungal diseases in fish: Saprolegniasis, Branchiomycosis and Ichthyophonosis; Fungal diseases in prawns/shrimps: Fusarium, Lagenidium and Prevention and therapy.
- 2.2. Bacterial diseases of fish caused by Aeromonas, pseudomonas, columnaris, Vibro sps., Epizootic Ulcerative Syndrome Identification, epidemiology, preventive and therapeutic methods. Bacterial diseases in prawns/shrimps: caused by Vibrio sps, luminous bacterial disease, Aeromonas, pseudomonas, filamentous bacterial disease.
- 2.3. Viral Diseases in shrimp: Monodon Baculo Virus (MBV), White Spot Syndrome (WSSV), Yellow Head Virus (YHV), Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV). Prevention and therapeutic methods.

**Unit 3: Protozoan and Metazoan Diseases.**

- 3.1. Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis.
- 3.2. Metazoan Diseases- diseases caused by annelids, helminthes, crustaceans and molluscs.

**Unit 4: Fish Microbiology and Nutritional diseases**

- 4.1. Spoilage microflora of fish and shell fish
- 4.2. Intrinsic and extrinsic factors affecting spoilage of fish and shell fish.
- 4.3. Nutritional deficiency diseases in fish and shell fishes.

**Unit 5: Immunology and Fish Health Management**

- 5.1. Application and development of vaccines.
- 5.2. Diagnostic tools – immune detection- DNA/RNA techniques (PCR). Evaluation criteria of healthy seeds.
- 5.3. Best Management Practices in Aquaculture. Quarantine management.



### **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 Pisciculture –
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 Disease.

#### **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. Schaperclaus. Fish Diseases. Vol. I & II.
6. Lightner, D.V. Shrimp Disease Diagnosis, 1998.
7. Sinderman. Fish Diseases, Vol. I. Shell Fish Diseases, Vol. II.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**II Year, IV semester 2021-2022**  
**FISH PATHOLOGY AND FISH IMMUNOLOGY**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**FISH PATHOLOGY AND FISH IMMUNOLOGY**  
**(Credits:1, Hours 2)**

- I. Collection preservation, Identification of disease-causing agents.
- II. Preparation of media for culture, Familiarisation with techniques of bacterial culture and identification, fungal isolation, characterization.
- III. Preparation of the list of chemicals and drugs used to control the diseases and medicines, visit to fish and shrimp farms and Disease diagnostic centers.
- IV. Collection, preservation and identification of parasites, preparation of case studies of diseased fish and prawns.
- V. Study of life-cycle stages. Estimation of dose and administration of various chemicals and drugs.
- VI. Visit to fish farms. Shrimp farms and diagnosis of diseases.
- VII. PCR Technique Demonstration.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**  
**Title : ORNAMENTAL FISH CULTURE**

**Syllabus**

**Credits 4**

---

**Unit 1: Introduction**

- 1.1. Introduction to aquarium, ornamental fishes and Equipment and accessories- Aerators, filters and lighting.
- 1.2. World aquarium trade and present status. Design and construction of public fresh water and marine aquaria and oceanarium.
- 1.3. Water quality management in aquarium fishes, Biofilters in aquarium.

**Unit 2: Aquarium Management**

- 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.
- 2.4. Food and feeding-Source of feed, different types of food for aquarium fish, monitoring and adjusting.

**Unit 3: Freshwater Ornamental Fishes**

- 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. Setting up the tank-Choosing the tank, lighting and heating, filtration and aeration, choosing plants, preparing the tank.
- 3.3. Reproduction-General principles, Vitellin sack, Reproduction strategies, Egg-laying.

**Unit 4: Marine Ornamental Fishes**

- 4.1. Marine ornamental fishes – varieties and their habitat.
- 4.2. Setting up the tank-lighting considerations, siting and substrate, heating and filtration, preparing the tank.

- 4.3. Reproduction and breeding- Breeding of marine ornamental fishes (clown fishes).
- 4.4. Other ornamental organisms – Sponges, anemones, Crustaceans, mollusks, annelids, Echinoderms.

### **Unit 5: Nutrition and Disease**

- 5.1. Nutritional requirements of aquarium fishes. Different kinds of feeds. Culture of fish food organisms; Preparation of dry feeds; feeding methods.
- 5.2. Use of pigments for colour enhancement. Larval feeds and feeding.
- 5.3. Common parasites infecting ornamental fishes. Bacterial, viral, fungal diseases of ornamental fishes and their control and prophylaxis.

### **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 et al – 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Commercial Aquaculture**  
**II Year, IV semester 2021-2022**  
**ORNAMENTAL FISH CULTURE**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**ORNAMENTAL FISH CULTURE**

**(Credits:1, Hours 2)**

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

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Commercial Aquaculture**

**Title : LARVAL NUTRITION AND CULTURE OF FISH FOOD ORGANISMS**

**Syllabus**

**Credits 4**

---

**Unit 1: Live Feeds**

- 1.1. Different live feeds and their nutritional value. Manipulation of pond for natural feed production.
- 1.2. Candidate species of phytoplankton and zooplankton for fish and shell fish culture – diatoms, micro algae, nano planktons, Artemia, copepods, cladocera and rotifers.

**Unit 2: Culture of Phytoplankton**

- 2.1 Methods of collection and preservation; maintenance of pure culture of Phytoplankton.
- 2.2 Mass culture. Culture of important microalgae, Chaetoceros, Tetraselmis, Skeletonema, Spirulina and Chlorella.

**Unit 3: Culture of Zooplankton**

- 1.1. Methods of collection and preservation; maintenance and rearing of Rotifers, Cladocerans, Copepods, and insect larvae. Mass culture of zooplankton.
- 1.2. Harvest, storage and feeding.

**Unit 4: Artemia culture**

- 4.1 Different strains of Artemia. Artemia culture. Cyst production. Enrichment of Artemia cyst and larvae.
- 4.2 Decapsulation of Artemia cysts. Hatching, storage and feeding.

**Unit 5: Alternative live feeds and Periphyton culture**

- 5.1. Culture methods of Infusoria, Chironomids, polychaetes.
- 5.2. Nutritional qualities of alternative live feeds.
- 5.3. Applications Importance of periphyton in aquaculture.

**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



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., Commercial Aquaculture**

**II Year, IV semester 2021-2022**

**LARVAL NUTRITION AND CULTURE OF FISH FOOD ORGANISMS**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**Bachelor of Vocation: Commercial Aquaculture**

Course structure and syllabi: 2021-2022 Admitted Batch  
Semester IV

**OJT (ON THE JOB TRAINING) (Credits: 1, Hours 2)**

<b>CONTENT</b>	<b>EVALUATION</b>	<b>MARKS</b>
FIELD TRIPS	3X5	15
PROJECT REPORT/ INDUSTRIAL OR TRAINING & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
<b>TOTAL</b>		<b>50</b>

**IDEAL COLLEGE OF ARTS AND SCIECNES (A)**  
**KAKINADA**  
**ADIKAVI NANNAYA UNIVERISITY**  
**POST GRADUTE DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**Semester I**

**Total Marks: 650**

**Total Credits: 30**

**COURSE STRUCTURE**

S.No	Title of the paper	Total Marks	Mid Sem Exam*	Sem End Exam	Teachning Hours	Credits
<b>Semester I</b>						
1	Basic Morphology & General physiology of Cultivable Fishes	100	25	75	4	4
2	Principles of Aquaculture & Pond Management	100	25	75	4	4
3	Lab	50	0	0	2	3
4	Water and Soil quality Management	100	25	75	4	4
5	Lab	50	0	0	2	3
6	Culture systems of Finfish & Shellfish (Freshwater, Brackishwater & Marine)	100	25	75	4	4
7	Business Environment & Organization Behavior	100	25	75	4	4
8	OJT	50	0	0	2	4
		<b>650</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>

**DEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B) DR. P.V.N. RAJU  
VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
2021-2022, Admitted Batch Semester I  
**Basic Morphology & General physiology of Cultivable Fishes**  
**Syllabus** **Credits 4**

---

**Unit: 1 General Features of Finfish & Shellfishes**

- 1.1. General characters of Fishes, Basic morphological feature of digestive system in fishes.
- 1.2. Cultivable Fishes: Indian Major Carps, Exotic Carps, Air breathing Fishes, Brackishwater Fishes
- 1.3. General Characters of Prawns, Shrimps and Crabs, Basic morphological feature of digestive system in Prawns/Shrimps.
- 1.4. Cultivable Species of Prawn, Shrimps and Crabs and their Identification Features

**Unit: 2 Food and Feeding Habits**

- 2.1. Food and feeding habits; Types of Food, Types of fishes differentiated.
- 2.2. Types of fishes differentiated on the basis of selection of Food.
- 2.3. Types of fishes on the basis of the manner of capture and ingestion. Gastrosomatic index in fishes (GaSI).

**Unit: 3 Respiration**

- 3.1. Respiratory system of Finfishes: Types of gills, Structure of gill, mechanism of gill respiration.
- 3.2. Respiratory system of Prawn/shrimps: Structure of gill, mechanism of gill respiration.
- 3.3. Structure of Heart: Fish and Shrimp

**Unit: 4 Reproduction & Excretion**

- 4.1. Reproductive organs in Fishes. Difference between male and female ones.
- 4.2. Reproductive organs in Prawns/shrimps. Difference between male and female ones.
- 4.3. Excretion and Osmoregulation in Fishes

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022  
**Basic Morphology & General physiology of Cultivable Fishes**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Write about Indian Major Carps?  
(OR)  
b) Explain the morphological structure of shrimp digestive system?
2. a) Classify the food and feeding habits of Fish?  
(OR)  
b) Describe the structural adaptations in feeding habits of fishes?
3. a) Explain the mechanism of gill respiration in fishes?  
(OR)  
b) Describe the structure of heart in Fish?
4. a) Write an essay on Excretion and Osmoregulation in Fishes?  
(OR)  
b) Explain the Reproductive organs in shrimps?

**Section - B**

Answer any **FIVE** of the following:  
Marks

5 x 3 = 15

- a) Exotic carps
- b) Prawns
- c) GaSI
- d) Feeding Habits of Fishes
- e) Fish Gill
- f) Shrimp Gill
- g) Excretion in fishes
- h) Reproductive organs in shrimp

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022

**Principles of Aquaculture & Pond Management**  
**Syllabus** **Credits 4**

---

Unit: 1

- 1.1. Scope and significance of aquaculture, Blue Revolution and its concept.
- 1.2. Different aquaculture systems, classification of Aquaculture, methods of aquaculture.
- 1.3. Criteria for the selection of species.

Unit: 2

- 2.1. General concepts of ecology-Ecological factors, pond ecosystem.
- 2.2. Productivity of culture Pond, Food chain and food web.
- 2.3. Nutrient cycles (Biogeochemical cycles) – Nitrogen, Phosphorous and Carbon.

Unit: 3

- 3.1. Type of ponds – Nursery, Rearing and Grow-out ponds.
- 3.2. Pond layout, Design, construction and Topographical conditions.
- 3.3. Drainage channel, inlet, outlets and sluice gates.

Unit: 4

- 4.1. Types of plankton and its Significance.
- 4.2. Role of Phytoplankton in Aquaculture; Diatoms, Dinoflagellates, BGA, HAB's etc.,
- 4.3. Role of Zooplankton in Aquaculture; Meroplankton, Holoplankton

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022  
**Principles of Aquaculture & Pond Management**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Write about different aquaculture systems?  
(OR)  
b) Discuss the criteria for the selection of species?
2. a) Give an account on Nitrogen cycle?  
(OR)  
b) Describe the Pond ecosystem?
3. a) Describe the Pond construction?  
(OR)  
b) Write an essay on types of ponds in Aquaculture?
4. a) Write an essay on role of phytoplankton in culture ponds?  
(OR)  
b) Explain the importance of zooplankton in Aquaculture?

**Section - B**

Answer any **FIVE** of the following:  
Marks

5 x 3 = 15

- a) Blue Revolution
- b) Classification of Aquaculture
- c) Carbon cycle
- d) Productivity
- e) Nursery Pond
- f) Dike
- g) Significance of Plankton
- h) HAB's

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022

**Water and Soil quality Management**

**Syllabus**

**Credits 4**

---

Unit: 1

- 1.1. Analytical methods and Role of water quality parameters in Aquaculture.
- 1.2. Dissolved Oxygen, pH.
- 1.3. Ammonia, Nitrite and Nitrate.

Unit: 2

- 2.1. Alkalinity and Hardness.
- 2.2. H<sub>2</sub>S, CO<sub>2</sub> and Transparency.
- 2.3. Suspended solids in culture ponds: (TDS, TSS, TVS, TVDS)

Unit: 3

- 3.1. Collection and preparation of soil samples
- 3.2. Determination of soil texture, waterholding capacity
- 3.3. pH, conductivity, organic carbon, nitrogen, phosphorous, lime requirement.

Unit: 4

- 4.1. Soil and Water amendments: Lime, manures, fertilizers
- 4.2. Micronutrients, zeolite, alum, gypsum
- 4.3. Environmental amelioratives: chlorination, de-odourizers and bacterial formulations.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022  
**Water and Soil quality Management**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Write about role of water quality parameters in culture ponds?  
(OR)  
b) Give an account importance of Dissolved Oxygen in ponds?
2. a) Give an account on Alkalinity?  
(OR)  
b) Explain the Hardness?
3. a) How to collection soil samples and its preparation?  
(OR)  
b) Write an essay on soil texture?
4. a) Write an essay on role of lime in Aquaculture?  
(OR)  
b) Explain the use of fertilizers in Aquaculture?

**Section - B**

Answer any **FIVE** of the following:  
Marks

5 x 3 = 15

- a) Ammonia
- b) pH
- c) CO<sub>2</sub>
- d) TDS & TSS
- e) Organic matter
- f) Soil pH
- g) Zeolite
- h) Manures

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022  
**Culture systems of Finfish & Shellfish (Freshwater, Brackishwater & Marine)**  
**Syllabus** **Credits 4**

---

**Unit: 1 Freshwater Aquaculture**

- 1.1. Management of carp culture ponds- Nursery rearing and stocking ponds.
- 1.2. Preparation of ponds– different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting.

**Unit: 2 Freshwater Aquaculture**

- 2.1. Composite Fish culture system of Indian. Monoculture system and Polyculture system.
- 2.2. Recent developments in the culture of air breathing fishes; Murrels, catfishes: Clarias, Heteropneustes, culture of other finfishes; Tilapia, merits and demerits of exotic fishes. Freshwater pearl culture

**Unit: 3 Brackishwater Aquaculture**

- 3.1. Biology and culture practices – monoculture and polyculture.
- 3.2. Biology and culture - *Chanos chanos*, *Mugil cephalus*, *Lates calcarifer*.
- 3.3. Species of shrimps cultured in brackishwater and their biology – *Penaeus monodon*, *Penaeus indicus*, *Penaeus vannamei*. Crab culture: Crab fattening and box culture.

**Unit: 4 Mariculture & Aquaculture for stable environment**

- 4.1. Introduction to mariculture. Seaweed farming in India.
- 4.2. Farming of Molluscs (Example: Edible Oyster, Mussel and pearls-Raft )
- 4.3. Sewage fed fish culture, Effluent Treatment Ponds (ETP).

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
 P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
 Semester I; 2021-2022  
**Culture systems of Finfish & Shellfish (Freshwater, Brackishwater & Marine)**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Give an account on Nursery pond management?  
 (OR)  
 b) Write an essay on methods of eradication of unwanted fishes and aquatic weeds?
2. a) Give an account on Culture practices of Air breathing fishes?  
 (OR)  
 b) Explain the freshwater pearl culture?
3. a) Discuss the culture practices of Seabass?  
 (OR)  
 b) Write an essay on culture of *Penaeus vannamei*?
4. a) Write an essay on seaweed farming in India?  
 (OR)  
 b) Explain the Effluent Treatment Ponds?

**Section - B**

Answer any **FIVE** of the following:  
 Marks

5 x 3 = 15

- a) Stocking Pond
- b) Predators
- c) Polyculture
- d) Tilapia
- e) Crab fattening
- f) Milk Fish
- g) Edible Oyster
- h) Sewage

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B) DR. P.V.N. RAJU  
 VIDYAPRANGANAM, KAKINADA  
 P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
 2021-2022, Admitted Batch Semester I  
**Business Environment & Organisational Behaviour**  
**Syllabus** **Credits 4**

---

Unit-I Business Environment: Components and Significance – Economic Scope – Cultural, Political, Technological and External Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

Unit-II: Structure of Indian Economy ; Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy of the Government - Policy Resolutions of 1956, 1991 Industrial Policy and Economic Policy - Subsequent policy Statements

Unit – III: International business environment: Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trading Blocks – Their Objectives; WTO Origin, Objectives, Organization Structure and Functioning – WTO and India.

Unit-IV: Meaning and scope of Organisational Behaviour-Challenges and opportunities – Foundations of Individual behaviour, values, attitude, job satisfaction, personality, perception and emotions. Motivation-Theories, Group dynamics – Leaderships styles.

**Suggested Books:**

1. Chidambaram, Indian Business Environment, Vikas, New Delhi
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.
4. Pandey G.N., Environmental Management, Vikas Publishing House.
5. Udai Pareek, Organizational Behaviour, Oxford University Press.
6. Karam Pal, Management Process and Organisational Behaviour, IK Int Pub House, ND
7. Moorhead & Griffin, Introduction to Organizational Behaviour, Cengage, New Delhi
8. Arun Kumar and Meenakshi, Organizational Behaviour, Vikas, ND

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester I; 2021-2022  
**Business Environment & Organisational Behaviour**

---

Time: 3 Hour

Max.Marks: 75

**Model question paper**

Time: 3 hrs

Max. Marks: 75

Answer all the questions. Each question carries 15 marks.

**Section-A**

**4x15=60**

**Q1. Unit-1**

a or b

**Q2. Unit-2**

a or b

**Q3. Unit-3**

a or b

**Q4. Unit-4**

a or b

**Section-B**

**5x3=15**

**Q5.** It contains 8 short questions with at least two from each unit, carrying 3 marks.

5 questions are to be answered at least one from each unit.

## PRACTICALS

### Principles of Aquaculture & Pond Management

#### I.

1. Morphometri and Meristic characters  
Identification of IMC
2. Identification of Exotic carps
3. Gut content Analysis of Fish

#### II.

1. Ponds Lay-outs
  - a. Nursery Pond
  - b. Rearing Pond
  - c. Grow-out Pond
2. Dikes
3. Types of Aerators
  - a. Paddle wheel aerators
  - b. Long arm aerators
  - c. Spiral aerators
4. Sluice gate
5. Aquatic Weeds and their control
 

A. Floating weeds	B. Emergent weeds	C. Submerged weeds	D. Marginal weeds
1. Pistia	1. Typha	1. Vallisneria	1. Marsilia
2. Eichhornia	2. Nymphaea	2. Hydrilla	2. Ipomoea
- B. Mahua oil
- C. Liming
- D. Predatory Fishes and Weed Fishes
  - a. *Channa* species
  - b. *Wallago attu*
  - c. *Clarius magur*
 Weed Fishes
  - a. *Puntius* sp.
  - b. *Barilius* sp.

#### III. Dissections

1. Fish/shrimp digestive system
2. Prawn/shrimp appendages

## PRACTICALS

### Water and Soil quality Management

#### I. Identification of cultivable fishes

##### A. Brackish water fishes/Estuarine fishes

1. *Chanos chanos*
2. *Etroplus suratensis*
3. *Mugil cephalus*
4. *Megalops cyprinoides*
5. *Eleutheronema tetradactylum*

##### B. Marine water fishes

1. *Lates calcarifer*
2. *Scomberomorus guttatus*
3. *Scomberomorus commersoni*
4. *Rachycentron canadom*
5. *Stromateus argenteus*

##### C. Migratory fishes

1. *Hilsa ilisha*
2. *Anguilla anguilla*

##### D. Soil and Water Quality parameters.

**IDEAL COLLEGE OF ARTS AND SCIENCES (A)**  
**KAKINADA**  
**ADIKAVI NANNAYA UNIVERSITY**  
**POST GRADUATE DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**Semester II**

**Total Marks: 650**

**Total Credits: 30**

**COURSE STRUCTURE**

<b>S.No</b>	<b>Title of the paper</b>	<b>Total Marks</b>	<b>Mid Sem Exam*</b>	<b>Sem End Exam</b>	<b>Teaching Hours</b>	<b>Credits</b>
	<b>Semester II</b>					
1	Aquaculture Seed & Feed Technology	100	25	75	4	4
2	Lab	50	0	0	2	3
3	Aquaculture Disease Management	100	25	75	4	4
4	Lab	50	0	0	2	3
5	Fish & Shrimp Processing Technology & Management	100	25	75	4	4
6	Human Resource Management	100	25	75	4	4
7	Lab	50	0	0	2	3
8	Project	100	-	-	-	5
	<b>Total</b>	<b>650</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>30</b>



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester II; 2021-2022  
**Aquaculture Seed & Feed Technology**

**Syllabus** **Credits 4**

---

**Unit: 1 Carp Hatchery**

- 1.1. Types of hatcheries.
- 1.2. Carp broodstock management.
- 1.3. Induced breeding technology and Synthetic hormones.

**Unit: 2 Shrimp Hatchery**

- 2.1. Hatchery layout, Design and Hatchery Components
- 2.2. Operation and management of maturation section, Artemia rearing and Algal culture (Indoor & Outdoor).
- 2.3. Operation and management of Larval Rearing Tanks and Bio-security

**Unit: 3 Feed requirements, Ingredients & Formulations**

- 3.1. Principles of fish nutrition (Proteins, Carbohydrates and lipids).
- 3.2. Different feed ingredients. Feed manufacturing processes: Crumble, Extruded feeds (Floating feeds), Pellet feeds (sinking feeds).
- 3.3. Feed formulation - methods, square method.

**Unit: 4 Feed Management**

- 4.1. Feeding schedule in finfish and shellfish, calculations and daily ration.
- 4.2. Artificial feed formulations of different cultural species.
- 4.3. Feed Check tray observations and management. Water stability and Quality standards. Nutritional deficiency diseases.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester II; 2021-2022  
**Aquaculture Seed & Feed Technology**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Give an account on Carp Broodstock management?  
(OR)  
b) Write an essay on induced Breeding Technology in carps?
2. a) Give an account on Operation and management of maturation section?  
(OR)  
b) Discuss the Operation and management of Larval Rearing Tanks?
3. a) Discuss the requirement of proteins?  
(OR)  
b) Write an essay on types of feeds?
4. a) Write an essay on Feeding schedule in culture ponds?  
(OR)  
b) Explain the Nutritional deficiency diseases?

**Section - B**

Answer any **FIVE** of the following:  
Marks

5 x 3 = 15

- a) Circular Hatchery
- b) Synthetic hormones
- c) Artemia
- d) Algae culture
- e) Carbohydrates
- f) Extruded feeds
- g) Water stability of feeds
- h) FCR & PER

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
 P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
 Semester II; 2021-2022  
**Aquaculture Disease Management**

**Syllabus**

**Credits 4**

**UNIT – I: Bacterial and Fungal diseases**

1. **Fish Diseases:** Clinical symptoms, pathology, prevention and control measures of Bacterial Hemorrhagic Septicemia (BHS), Bacterial gill disease and Tail and fin rot.
2. Pathology, clinical symptoms, prevention and control measures of Saprolegniasis and Branchiomycosis.
3. **Shrimp Diseases:** Clinical symptoms, pathology, prevention and control measures of Black gill disease, Filamentous bacterial gill disease.
4. Clinical symptoms, pathology, prevention and control measures of Lagenidium disease (Larval Mycosis) and Brown gill disease.

**UNIT – II: Viral diseases**

1. **Fish Diseases:** Clinical symptoms, pathology and control measures of Viral Hemorrhagic Septicemia (VHS) and Infectious Hematopoietic Necrosis (IHN).
2. **Shrimp Diseases:** Pathology, clinical symptoms, prevention and treatment of Monodon Baculoviral disease (MBV), Infectious Hypodermal and Hematopoietic Necrosis (IHHN), Hepato Pancreatic Parvovirus disease (HPPV), Yellow-head virus disease, Taura syndrome (TSV) and White spot syndrome (WSSV).

**UNIT – III: Protozoan, Helminthic and Crustacean diseases**

1. **Fish Diseases:** Clinical symptoms, pathology and control measures of Ichthyophthiriasis, Enterococcidiasis, Whirling disease and Nodular disease.
2. Clinical symptoms, pathology and control measures of Gyrodactylosis and Dactylogyrosis.
3. Clinical symptoms, pathology and control measures of Argulosis and Lernaeiasis.
4. **Shrimp Diseases:** Etiology, morphology and control measures of ectocommensal protozoa, Zoothamnium and Acineta.
5. Clinical symptoms, pathology and control measures of Microsporidiasis or EHP.

**UNIT – IV: Nutritional and Ecological diseases**

1. Fish Diseases: Diseases of vitamin deficiency and Fatty liver degeneration.
2. Clinical symptoms, pathology and control measures of gas bubble disease and lack of oxygen.
3. Shrimp Diseases: Clinical symptoms, pathology and control measures of Cramped tails, Muscle Necrosis, Gas bubble disease, Black death disease, Chronic soft shell syndrome and Blue shell syndrome.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
 P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
 Semester II; 2021-2022  
**Aquaculture Seed & Feed Technology**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Explain the Bacacterial gill disease of fish?  
 (OR)  
 b) Give an account on Brown gill disease in shrimp?
2. a) Give an account on viral diseases of IHN and VHS in fishes?  
 (OR)  
 b) Discuss the White spot syndrome (WSSV)?
3. a) Discuss the pathology and control measures of Ichthyophthiriasis?  
 (OR)  
 b) Write an essay on pathology and control measures of EHP?
4. a) Write an essay on pathology and control measures of gas bubble disease?  
 (OR)  
 b) Explain the Chronic soft shell syndrome and Blue shell syndrome.  
 ?

**Section - B**

Answer any **FIVE** of the following:  
 Marks

5 x 3 = 15

- a) Hemorrhagic Septicemia
- b) Lagenidium
- c) MBV
- d) TSV
- e) Argulosis
- f) Zoothamnium
- g) Vitamin deficiency
- h) Muscle Necrosis

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester II; 2021-2022  
**Fish & Shrimp Processing Technology & Management**  
**Syllabus** **Credits 4**

---

**Unit 1: Fishery By-Products**

- 1.1. Fish meal, fish protein concentrate, shark fin rays, fish maws, isinglass, fish liver oil, fish body oil, fish hydrolysates.
- 1.2. 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.

**Unit 2: Value Addition in Sea Foods**

- 2.1. Value addition in sea food. Different types of value added products from fish and shell fish – status of value addition in Indian seafood sector.
- 2.2. Advantages of value addition. Significance of value addition in the seafood industry.

**Unit 3: Preservation techniques of Finfish/Shell Fish processing**

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

**Unit 4: Packing and Export of Fishery Products, QA & QC**

- 4.1. Packing requirements and regulations. Labeling of fish and fishery products.
- 4.2. Different types of cold storages. Requirements in retail outlet; Insulated and refrigerated vehicles.
- 4.3. Export of fishery products from India – major countries, important products, export documents and procedures.
- 4.4. Concepts of Hazard Analysis Critical Control Point (HACCP).

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
 P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
 Semester II; 2021-2022  
**Fish & Shrimp Processing Technology & Management**

---

Time: 3 Hour

Max.Marks: 75

**Answer ALL Questions**  
**All questions carry equal marks**  
**Section – A**

4 x 15 = 60 Marks

1. a) Explain the fish By products?  
 1. Fish meal 2. Fish protein concentrate 3. Fish body oil  
 (OR)  
 b) Give an account on Chitin, pearl essence and gelatin?
2. a) Give an account on Different types of value added products from fish and shell fish?  
 (OR)  
 b) Discuss the Advantages of value addition?
3. a) Discuss the Principles of preservative methods?  
 (OR)  
 b) Write an essay on Principles of freeze drying?
4. a) Write an essay on Different types of cold storages?  
 (OR)  
 b) Explain the Concepts of Hazard Analysis Critical Control Point?

**Section - B**

Answer any **FIVE** of the following:  
 Marks

5 x 3 = 15

- a) Fish hydrolysates
- b) Chitosan
- c) Significance of value addition
- d) Indian seafood sector
- e) Canning
- f) IQF
- g) Packing requirements and regulations
- h) Export of fishery products from India

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
 P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
 Semester II; 2021-2022  
**Human Resource Management**

<b>Syllabus</b>		<b>Credits 4</b>
-----------------	--	------------------

---

Unit-I: Introduction: Definition and Functions of HRM; Principles of HRM; Changing Environment of HRM; Challenges; Ethical Aspects of HRM.

Unit –II: HR Planning; Concepts; Factors Influencing ; HR planning ; HR Planning Process; Job Analysis ; Recruitment and Selection; Tests and Interview Techniques .

Unit –III: Training and Development – Need, Process, Methods and Techniques, Evaluation, Management Development; Evaluating Employee Performance; Career Development and Counseling.

Unit – IV: Compensation – Concepts and Principles; Influencing Factors; Current Trends in Compensation – Methods of Payment – Incentives and Rewards. Managing Industrial Relations – Trade Unions – Employee Participation Schemes – Collective Bargaining – Marketing Knowledge Workers.

**Suggested Books:**

1. Venkata Raman C.S., and Srivastiva BK Personnel / Human Resource Management, TMH,ND
2. Cynthia D. Fisher & Lyle F. Schoenfeld; / Human Resource Management, Wiley India, New Delhi.
3. DK Tripathi, Human Resource Management: Text & Cases, Wisdom, Delhi
4. Fisher, Managing Human Resource, Cengage, ND
5. N.K.Singh / Human Resource Management, Excel Publications.
6. Jyothi - / Human Resource Management, Pearso Education, New Delhi.
7. Biswajeet Pattnayak / Human Resource Management, Prentic hell of India New Delhi.
8. P.S Rao , Essentials of Human Resource Managemen & IR, Himaliya ,Mumbai
9. Dwivedi & Agarwal, Human Resource Management, Vikas, ND
10. R.Wayne Mondy and Robert M.Noel, Human Resource Management, Pearson

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
P G DIPLOMA IN FISHERIES AND AQUACULTURE BUSINESS MANAGEMENT  
Semester II; 2021-2022  
**Human Resource Management**

---

Time: 3 Hour

Max.Marks: 75

**Model question paper**

Time: 3 hrs

Max. Marks: 75

Answer all the questions. Each question carries 15 marks.

**Section-A**

**4x15=60**

**Q1. Unit-1**

a or b

**Q2. Unit-2**

a or b

**Q3. Unit-3**

a or b

**Q4. Unit-4**

a or b

**Section-B**

**5x3=15**

**Q5.** It contains 8 short questions with at least two from each unit, carrying 3 marks.

5 questions are to be answered at least one from each unit.



## PRACTICALS

### Aquaculture Seed & Feed Technology

- I. Identification of shrimps (Marine/Brackish water)
  1. *Penaeus monodon*
  2. *P. indicus*
  3. *P. vannamei*
- II. Biology and Identification of crabs
  1. *Scylla serrata*
  2. *S. oceanica*
- III. Dissections
  - A. Mounting of the shrimp/prawn appendages
  - B. Digestive system of shrimp/prawn
  - C. Nervous system of shrimp/prawn
  - D. Eye stalk ablation in shrimp/Prawn
  - E. Pituitary gland extract in fishes

### I. Feed management (Proximate Analysis)

1. Estimation of Crude proteins in fish feed.
  2. Estimation of carbohydrates
  3. Estimation of Fats
  4. Estimation of Ash content
  5. Estimation fiber
- II. Preparation of supplementary feeds with locally available ingredients,
- III. Determination of water stability of pellet feeds.
- V. Feed calculation and daily ration
- VI. Check-trays in shrimp farming ponds.
- VIII. Estimation of FCR.
- IX. Estimation of Survival rate and its calculation

## **PRACTICALS**

### **Aquaculture Disease Management**

#### **PATHOLOGY IN AQUACULTURE**

- I. Collection preservation, Identification of disease causing agents.
- II. Preparation of media for culture, Familiarisation with techniques of bacterial culture and identification, fungal isolation, characterization.
- III. Preparation of the list of chemicals and drugs used to control the diseases and medicines, visit to fish and shrimp farms and Disease diagnostic centers.
- IV. Collection, preservation and identification of parasites, preparation of case studies of diseased fish and prawns.
- V. Study of life-cycle stages. Estimation of dose and administration of various chemicals and drugs.
- VI. Visit to fish farms. Shrimp farms and diagnosis of diseases.
- VII. PCR Technique Demonstration.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**SYLLABUS**  
**FOR**  
**B.VOC., INDUSTRIAL AQUACULTURE**

# **IDEAL COLLEGE OF ARTS AND SCIENCES**

(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)

**DR. P.V.N. RAJU VIDYAPRANGANAM**

**KAKINADA**



**BOARD OF STUDIES**

**2021-2022**

**COURSE: B.VOC., Industrial Aquaculture & Fisheries**

First & Second Year (I ,II , III & IV Semester)

**DEPARTMENT OF  
FISHERIES AND AQUACULTURE**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

Date: 28.08.2021

**Board of Studies of B.Voc., Industrial Aquaculture and Fisheries**

A meeting of Board of studies of the Department of Fisheries and Aquaculture will be held on **28.08.2022 at 12.30 P.M** in Ideal College of Arts and Sciences (Autonomous), Vidyutnagar, Kakinada, to consider the following Agenda.

You are cordially invited to attend the meeting and make it a success.

**Agenda:**

- 1.To ratify the syllabus for the First year & Second year (I, II, III & IV Semesters).
- 2.To prepare and ratify scheme of Examinations for both internal and external examinations.
- 3.Model Question paper for First year & Second year).
- 4.To fix Panel of paper setters and Examiners.
- 5.Additional inputs into the curriculum and up gradation of syllabus incorporate the Apprenticeship.
- 6.Other academic activities of Department.

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**  
**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**Board of Studies of B.Voc., Industrial Aquaculture and Fisheries**

The Board of Studies for the Department of Fisheries and Aquaculture for the year 2021-2022 is constituted with the following Members.

**Sl.No. Members Present**

- |                           |                |
|---------------------------|----------------|
| 1. Dr. K. Narasimha Murty | Chairman       |
| 2. P V Lovaraju           | Member         |
| 3. K.Teja Rajesh          | Student Member |
| 4. A.Neelima Devi         | Student Member |

**Adikavi Nannaya University Nominee**

1. Dr. K. Ramaneswarai  
Dept. of Zoology  
HOD, Adikavi Nannaya University  
Rajamahendravaram  
Cell No: 8074112754

**Members from other Colleges**

1. Dr. Muralidhar P. Ande  
Senior Scientist & Office In-Charge, CIFE, Kakinada  
Cell No: 7396182790
2. Dr. P. Sandeep  
Scientist, FRS (SVVU), Balabhadrapuram, Kakinada  
Cell No: 8185039772

**Industry/Scientific Organization**

1. Dr. M. Srinivasa Rao  
Senior Product Development Manager & Marketing Head-India  
Growel Formulation Pvt. Ltd.  
Cell No: 7989548040

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
KAKINADA

The syllabus and model question papers in Industrial Aquaculture and Fisheries subject for B.Vocation course for the First year & Second Year (I, II, III & IV Semesters) in the academic year 2021-2022, list of Examiners and paper setter, Department activities is approved in the Board of Studies meeting held in the Department of Fisheries and Aquaculture at 12:30 PM.

<b><u>Sl.No.</u></b>	<b><u>Members Present</u></b>	<b><u>Signatures of Members</u></b>
1.	Dr. K. Narasimha Murty	Chairman
2.	Dr. K. Ramaneswarai	University Nominee
3.	Dr. Muralidhar P. Ande	Expert
4.	Dr. P. Sandeep	Expert
5.	Dr. M. Srinivas Rao	Representative from Industry
6.	P V Lovaraju	Member
7.	K.Teja Rajesh	Student Member
8.	A.Neelima Devi	Student Member

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**  
**A.Y.2021-2022**  
**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**B.VOC., Industrial Aquaculture & Fisheries**

**Resolutions:**

1. Resolved to follow the following pattern for Examinations.
  - a) The syllabus is divided in to two semesters each paper has 30% internal and 70% semester (15+10+5) for I, II, III & IV (First year & Second Year).
  - b) During each semester two internal Examinations for each paper will be conducted as per schedule. Introduction of objective type questions and online pattern partially in internal examinations subject to the condition.
  - c) No internal examination/semester examination will be conducted separately for the absentees.
  - d) Average of the two internal Examinations will be considered. Absentee will be awarded zero marks.
  - e) The minimum pass mark for external examination is 35%, Candidate should get a total of 40 marks in internal and external examination put together.
  - f) The pattern of semester examinations and practical I, II, III & IV is herewith appended.
  - g) Practical examination will be conducted at each Semester end.
2. Resolved to approve the model question papers for I, II, III & IV semesters are here with appended.
3. Resolved to approve the panel of paper setter and examiners as appended herewith.
4. Additional inputs into the curriculum and up gradation of syllabus will be incorporated the OJT (On Job Training) and Project Work.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B), KAKINADA  
**Bachelor of Vocation: Industrial Aquaculture**  
**2021-2022 , Course structure , Semester I**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course	50	-	70	2	2
4.	Skill Development Course	50	-	50	2	2
<b>Skill Education</b>						
1	Animal Diversity – I Biology of Non-Chordates	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Chemistry	100	30	70	4	4
4	Lab Practical	50	-	50	2	1
5	Biology of Finfishes and shellfishes	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Principles of Aquaculture	50	-	50	2	2
8	Lab Practical	50	-	50	2	1
	<b>Total</b>	<b>850</b>			<b>34</b>	<b>28</b>

**IDEAL COLLEGE OF ARTS & SCIENCES**  
(A.P. Govt. Aided, Autonomous, NAAC Accredited B)  
Dr. PVN RAJU VIDYAPRANGANAM  
SAMALKOTA ROAD, KAKINADA

**ZOOLOGY SYLLABUS FOR I SEMESTER 2021 – 2022**

**Bachelor of Vocation: Industrial Aquaculture**

**PAPER – I ANIMAL DIVERSITY – BIOLOGY OF NON CHORDATES**

**Periods: 60**

**Max. Marks: 100**

---

**UNIT I**

- 1.1 Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature
- 1.2 Whittaker's five kingdom concept and classification of Animal Kingdom.
- Phylum Protozoa**
- 1.3 General Characters and classification of protozoa up to classes with suitable examples
- 1.4 Locomotion, nutrition and reproduction in Protozoans
- 1.5 Elphidium (type study)

**UNIT –II**

**Phylum Porifera**

- 2.1 General characters and classification up to classes with suitable examples
- 2.2 Skelton in Sponges
- 2.3 Canal system in sponges

**Phylum Coelenterata**

- 2.4 General characters and classification up to classes with suitable examples
- 2.5 Metagenesis in Obelia
- 2.6 Polymorphism in coelenterates
- 2.7 Corals and coral reefs

**Phylum Ctenophora :**

- 2.8 General Characters and Evolutionary significance(affinities)

**Unit – III**

**Phylum Platyhelminthes**

- 3.1 General characters and classification up to classes with suitable examples
- 3.2 Life cycle and pathogenicity of Fasciola hepatica
- 3.3 Parasitic Adaptations in helminthes

**Phylum Nematelminthes**

- 3.4 General characters and classification up to classes with suitable examples
- 3.5. Life cycle and pathogenicity of Ascaris lumbricoides

**Unit – IV**

**Phylum Annelida**

- 4.1 General characters and classification up to classes with suitable examples
- 4.2 Evolution of Coelom and Coelom ducts

**Phylum Arthropoda**

- 4.4 General characters and classification up to classes with suitable examples
- 4.5 Vision and respiration in Arthropoda
- 4.6 Metamorphosis in Insects
- 4.7 Peripatus - Structure and affinities
- 4.8 Social Life in Termites

**Unit – V**

**Phylum Mollusca**

- 5.1 General characters and classification up to classes with suitable examples
- 5.2 Pearl formation in Pelecypoda
- 5.3 Sense organs in Mollusca

**Phylum Echinodermata**

- 5.4 General characters and classification up to classes with suitable examples
- 5.5 Water vascular system in star fish

**Phylum Hemichordata**

- 5.6 General characters and classification up to classes with suitable examples

## 5.7 Balanoglossus - Structure and affinities.

### **REFERENCE BOOKS:**

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS
- 6 P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). Invertebrate Zoology, V Edition" ZOOLOGY

# IDEAL COLLEGE OF ARTS & SCIENCES

(A.P. Govt. Aided, Autonomous, NAAC Accredited B)

Dr. PVN RAJU VIDYAPRANGANAM

SAMALKOTA ROAD, KAKINADA

## ZOOLOGY MODEL PAPER FOR I SEMESTER

### ZOOLOGY - PAPER - I

#### ANIMAL DIVERSITY – BIOLOGY OF NON CHORDATES

---

**Time: 3 hrs**

**Max. Marks: 70**

**I. Answer any FIVE of the following. Draw labelled diagrams wherever necessary 4x5=20M**

1. Locomotion in protozoa
2. Metamorphosis in insects
3. Skeleton in sponges
4. Rotifera
5. Coelom and coelom ducts
6. Class echinoidea
7. Enteropneusta
8. Castes of Termites

**II. Answer the following. .Draw labelled diagrams wherever necessary 5X10=50M**

- 9.a) Explain the life history of Elphidium  
OR  
b) Explain Whittaker's five kingdom concept
- 10.a) Describe Canal system in sponges  
OR  
b) Describe polymorphism in Coelenterates  
OR
- 11.a). Describe the life cycle of Fasciola hepatica  
OR  
b) Explain the Life cycle of Ascaris lumbricoides
- 12.a) Write general characters of phylum Arthropoda and classify up to classes with examples  
OR  
b) Describe the structure and affinities of Peripatus
- 13.a) Describe the structure and affinities of Balanoglossus  
OR  
b) Describe the pearl formation in Pelicypoda

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Industrial Aquaculture**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**Semester I**  
**BIOLOGY OF FINFISH AND SHELLFISHES**

**Syllabus**

**Credits 4**

---

**Unit 1: General Characteristics and Taxonomy of Fishes and Prawns/shrimps**

- 1.1. General characters and classification of fishes, osteichthyes and chondrichthyes fishes and its differences.
- 1.2. Bioluminescence in fishes.
- 1.3. General characters and classification of prawns and shrimps.

**Unit 2: Food and Feeding – Growth**

- 2.1. Food and feeding habits; Types of Food, Types of fishes differentiated.
- 2.2. Types of fishes differentiated on the basis of selection of Food
- 2.2. Types of fishes on the basis of the manner of capture and ingestion.  
Gastrosomatic index in fishes (GaSI).

**Unit 3: Anatomy (Fin fish and shell Fishes) Digestion, Respiration and Circulation**

- 3.1. Digestive system – General morphological feature of digestive system in fishes, Digestive system and process of digestion. Digestive system of Prawn/shrimp
- 3.2. Respiratory system (Fish & Prawn/shrimp) – Types of gills, Structure of gill, mechanism of gill respiration.
- 3.3. Cardiovascular system (Fish & Prawn/shrimp) – General features of heart and physiology of circulation, Significance of circulation.

**Unit 4: Reproduction, Excretion (Fish and Shrimp)**

- 4.1. Reproduction – ovary and testes, structure, development of primary and secondary sexual & Sexual dimorphism in fishes.
- 4.5. Parental care in fishes
- 4.2. Excretion and osmoregulation-freshwater fishes & Marine Fishes
- 4.4. Prawn/shrimp: Reproduction and Excretion

**Unit 5: Endocrine glands in fishes and Migration**

- 5.1. Sense organs in fishes (Neuromast organs) – lateral line system. Ampullae of Lorenzini.
- 5.2. Endocrine organs in fishes-Pituitary gland, thyroid gland, adrenal gland, Urohypophysis, pancreatic islets and pineal organs.
- 5.3. Migration in fishes –anadromous and catadromous.

### **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

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture  
Semester I 2021-2022

**PAPER TITLE: BIOLOGY OF FINFISH AND SHELLFISH**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. General characters of Fishes
2. Gastrosomatic Index
3. Significance of circulation fish
4. Sexual dimorphism in fishes
5. Neuromast organs
6. Chondrichthyes fishes
7. Excretion in fishes
8. Types of gills in fishes

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) Write about Classification of Fishes?  
OR  
b) Explain the Bioluminescence in fishes?
10. a) Classify the food and feeding habits of Fish?  
OR  
b) Describe the structural adaptations in feeding habits of fishes?
11. a) Describe the morphological features of digestive system in Fishes?  
OR  
b) Explain the respiratory system in Fish?
12. a) Process of reproduction in fishes?  
OR  
b) Explain the excretion in Fish?
13. a) Write an essay on migration in fishes?  
OR  
b) Endocrine glands in fishes?

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**Practical**  
**I Year, I semester 2021-2022**

Practical Paper: I: Biology of Fin Fish and Shell Fishes (Credits:2) 3 hrs/week  
Work load: 30 hrs per semester

S.NO.	NAME OF THE PRACTICAL
1.	Fish Morphometric characters
2.	Fish Meristic characters
3.	Indian Major carps
	1. <i>Catla catla</i>
	2. <i>Labeo rohita</i>
	3. <i>Cirrhinus mrigala</i>
4.	Exotic Fishes
	1. <i>Hypophthalmichthys molitrix</i>
	2. <i>Ctenopharyngodon idella</i>
	3. <i>Cyprinus carpio</i>
5.	Air breathing Fishes
	a. <i>Clarias magur</i>
	b. <i>Wallago attu</i>
	c. <i>Heteropneustes fossilis</i>
	d. <i>Anaba testudineus</i>
	Murrels
	a. <i>Channa striatus</i>
	b. <i>Channa punctatus</i>
6.	Migratory fishes
	1. <i>Hilsa ilisha</i>
	2. <i>Anguilla anguilla</i>
7.	Identifications of Prawns/shrimps
8.	Gut content Analysis of Fish
9.	GaSI
10.	Dissection and study of internal organs: Fishes/Prawns/Shrimps
	a. Digestive system
	b. Respiratory system
	c. Excretory system
	d. Reproductive systems



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Industrial Aquaculture**  
Course structure and syllabi: 2021-2022 Admitted Batch  
Semester I

**Principles of Aquaculture**

Syllabus

Credits 4

---

**Unit 1: Introduction of Aquaculture**

- 1.1. History, definition, scope and significance of aquaculture, Blue Revolution, concepts of Blue Revolution.
- 1.2. Different aquaculture systems, classification of Aquaculture, methods of aquaculture
- 1.3. Criteria for the selection of species.

**Unit 2: Pond Ecology**

- 2.1. General concepts of ecology-Ecological factors, pond ecosystem, productivity of culture pond.
- 2.2. Significance and important groups of phytoplankton and its role in Aquaculture.
- 2.3. Zooplankton and benthos in culture ponds and its role in Aquaculture.
- 2.4. Pond layout, Design, construction and maintenance of farm ponds. Drainage channel, inlet, outlets and sluice gates.

**Unit 3: Types of ponds-characteristics of fishes and Soil & Water Quality**

- 3.1. Type of ponds – Nursery, Rearing and Grow-out ponds.
- 3.2. Soil Quality management: Soil pH; Soil Texture; Soil organic matter; soil phosphates
- 3.3. Water Quality parameters in culture ponds: Dissolved Oxygen; Water pH; Temp., Ammonia, Nitrite, Nitrate, Salinity, Alkalinity, Hardness, CO<sub>2</sub>, H<sub>2</sub>S, Transparency.

## **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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture  
Semester I 2021-2022  
**Bachelor of Vocation: Industrial Aquaculture**  
**Principles of Aquaculture**

---

Time: 1½ Hour

Max.Marks: 50  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**  
**At least 1 question should be given from each Unit**

1. Blue Revolution
2. Significance of phytoplankton
3. Types of Ponds.
4. Aquaculture methods
5. Soil pH
6. Soil organic matter
7. Zooplankton and Benthos
8. Sluice gate

**SECTION B**

3 x 10 = 30 Marks

**Answer any three questions. Each answer carries 10 marks**  
**At least 1 question should be given from each Unit**

1. Write scope and significance of Aquaculture?
2. Define Ecosystem? Explain the ecosystem components?
3. Define pH? Explain about the acidity and alkalinity of culture ponds?
4. Write an essay on Dissolved Oxygen in Aquaculture ponds?
5. Explain about the criteria for species selection?

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**Practical**  
**I Year, I semester 2020-2021**

Practical Paper: II: Principles of Methods in Aquaculture (Credits:2)  
 Work load: 30 hrs per semester

3 hrs/week

<b>S.No</b>	<b>NAME OF THE PRACTICAL</b>			
1.	Ponds Lay-outs			
	a. Nursery Pond			
	b. Rearing Pond			
	c. Grow-out Pond			
2.	Dikes			
3.	Types of Aerators			
	a. Peddle wheel aerators			
	b. Long arm aerators			
	c. Spiral aerators			
4.	Sluice gate			
5.	Aquatic Weeds and their control			
	A. Floating weeds	B. Emergent weeds	C. Submerged weeds	D. Marginal weeds
	1. Pistia	1. Typha	1. Vallisneria	1. Marsilia
	2. Eichhornia	2. Nymphaea	2. Hydrilla	2. Ipomoea
	B. Mahua oil			
	C. Liming			
	D. Predatory Fishes and Weed Fishes			
	a. <i>Channa</i> species			
	b. <i>Wallago attu</i>			
	c. <i>Clarius magur</i>			
	Weed Fishes			
	a. <i>Puntius</i> sp.			
	b. <i>Barilius</i> sp.			
	E. Identification and general characters of Larvivorous fishes			
	<b>Exotic species</b>		<b>Indigenous species</b>	
	a. <i>Gambusia affinis</i>		a. <i>Anabas testudineus</i>	
	b. <i>Lebistes reticulatus</i>		b. <i>Notopterus Notopterus</i>	
	c. <i>Carassius auratus</i>		c. <i>Glossogobius giuris</i>	
			d. <i>Danio rerio</i>	

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**I Year ,II semester 2021-2022**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course	50	-	70	2	2
4.	Skill Development Course-1	50	-	50	2	2
5.	Skill Development Course-2	50	-	50	2	2
<b>Skill Education</b>						
1	Animal Diversity – II Biology of Chordates	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Chemistry	100	30	70	4	4
4	Lab Practical	50	-	50	2	1
5	Freshwater Aquaculture, Brackishwater and Mariculture	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Crafts and Gears in Fisheries	50	-	50	2	2
8	Lab Practical	50	-	50	2	1
	<b>Total</b>	<b>900</b>			<b>36</b>	<b>30</b>

**First spell between First year and Second Year Apprenticeship: Credits: 4; Marks: 100**

## ZOOLOGY SYLLABUS FOR II SEMESTER

### PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

HOURS: 60 (5X12)

Max. Marks: 100

---

#### Unit - I

- 1.1 General characters and classification of Chordata upto classes
- 1.2 Protochordata- Salient features of Cephalochordata , Affinities of Cephalochordata.
- 1.3 Salient features of Urochordata
- 1.4 Structure and life history of *Herdmania*
- 1.5 Retrogressive metamorphosis –Process and Significance

#### Unit - II

- 2.1 Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*
- 2.2 Pisces : General characters of Fishes
- 2.3 *Scoliodon*: External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain.
- 2.4 Migration in Fishes
- 2.5 Types of Scales
- 2.6 Dipnoi

#### Unit - III

- 3.1 General characters of Amphibia
- 3.2 Classification of Amphibia up to orders with examples.
- 3.3 *Rana hexadactyla*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain
- 3.4 Reptilia: General characters of Reptilia, Classification of Reptilia upto orders with examples
- 3.5 *Calotes*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 3.6 Identification of Poisonous snakes and Skull in reptiles

#### **Unit - IV**

- 4.1 Aves General characters of Aves
- 4.2 *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 4.3 Migration in Birds
- 4.4 Flight adaptation in birds

#### **Unit - V**

- 5.1 General characters of Mammalia
- 5.2 Classification of Mammalia upto sub - classes with examples
- 5.3 Comparison of Prototherians, Metatherians and Eutherians
- 5.4 Dentition in mammals

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**I Year, II semester 2021-2022**  
**Zoology-Chordates**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

9. a) OR
- b)
10. a) OR
- b)
11. a) OR
- b)
12. a) OR
- b)
13. a) OR
- b)

\*\*\*



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., Industrial Aquaculture**

**I Year, II semester 2021-2022**

**Freshwater Aquaculture, Brackishwater Aquaculture and Mariculture**

**Syllabus**

**Credits 4**

---

**Unit 1: Freshwater Fish Culture & Prawn**

- 1.1. Management of carp culture ponds- Nursery rearing and stocking ponds.
- 1.2. 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. Cultivable species of freshwater prawns and their culture practices.

**Unit 2: Fresh water cultivable fishes**

- 2.1. Recent development in integrated farming – Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture and Pig cum fish culture.
- 2.2. Organic Fish farming and Polyculture or mixed fish farming or composite fish culture
- 2.3. Recent developments in the culture of air breathing fishes; Murrels, catfishes: Clarias, Heteropneustes, culture of other finfishes; Tilapia, merits and demerits of exotic catfishes.
- 2.4. Freshwater pearl culture

**Unit 3: Introduction to Brackishwater and Brackishwater Finfish Culture**

- 3.1. Present status of brackishwater farming in India.
- 3.2. Biology and culture practices – monoculture and polyculture
- 3.3. Biology and culture - *Chanos chanos*, *Mugil cephalus*, *Lates calcarifer*.

**Unit 4 : Brackishwater Shellfish Culture**

- 5.1. Species of shrimps cultured in brackishwater and their biology – *Penaeus monodon*, *Penaeus indicus*, *Penaeus vannamei*.
- 5.2. Shrimp culture methods, Traditional, extensive, modified extensive, semi- intensive culture and intensive
- 5.3. Crab culture: Crab fattening and box culture.

**Unit 5: Mariculture and Cage culture**

- 4.1. Introduction to mariculture.
- 4.2. Farming of Molluscs (Example: Edible Oyster, Mussel and pearls-Raft )
- 4.3. Cage culture and Seaweed farming in India.

### **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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**I Year, II semester 2021-2022**

**Freshwater Aquaculture, Brackishwater Aquaculture and Mari culture**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

1. Eradication of predatory and weed fishes.
2. Composite fish culture
3. Monoculture
4. Crab fattening
5. Edible Oyster
6. Aquatic weeds
7. Giant freshwater prawn
8. Murrels

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

10. a) Write an essay on nursery pond management?  
OR  
b) Explain about the freshwater prawn culture practices?
10. a) Explain about the Integrated fish farming-Rice cum fish culture?  
OR  
b) Write an essay on Culture practices of Air Breathing fishes?
11. a) Write an essay on Present status of brackishwater farming in India?  
OR  
b) Explain about Biology and culture practices of Milkfish?
12. a) Write an account on *Penaeus vannamei* culture management?  
OR  
b) Write about the shrimp culture methods?
13. a) Write an essay on Seaweed farming in India?  
OR  
b) Write an account on pearl oysters?

\*\*\*

### **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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA

**B.Voc., Industrial Aquaculture**

**Practical**

**I Year, II semester 2021-2022**

Practical Paper: III: **Freshwater, Brackishwater Aquaculture and Mari culture**

(Credits:2)

3 hrs/week

Work load: 30 hrs per semester

- I. Identification of cultivable fishes
  - A. Brackish water fishes/Estuarine fishes
    - 1. *Chanos chanos*
    - 2. *Etroplus suratensis*
    - 3. *Mugil cephalus*
    - 4. *Megalops cyprinoides*
    - 5. *Eleutheronema tetradactylum*
  - B. Marine water fishes
    - 1. *Lates calcarifer*
    - 2. *Scomberomorus guttatus*
    - 3. *Scomberomorus commersoni*
    - 4. *Rachycentron canadom*
    - 5. *Stromateus argnteus*
  - C. Migratory fishes
    - 3. *Hilsa ilisha*
    - 4. *Anguilla anguilla*
  - D. Soil and Water Quality parameters.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**I Year, II semester 2021-2022**  
**Craft and Gears in Capture Fisheries**

**Syllabus**

**Credits 2**

---

**Unit 1: Inland Fishing Crafts and Gears**

- 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.

**Unit 2: Marine Fishing Crafts and Gears**

- 2.1. Introduction, - 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 hooks.
- 2.2. Introduction to netting materials - natural and synthetic fishing gear materials. Yarn numbering systems.
- 3.1. Active fishing gears- 1. Fishing hooks:Parts of hooks, Numbering of hooks, Artificial baits or jigs, Trolling lines; 2. Seining:Trawls, Surrounding net, Lift net
- 3.2. Passive gears- 1. Gill net; 2. Fish traps, Traps, Pots; 3. Hooks and lines (passively operated), Bottom set line, Drift longline, Demersal longline, Drifting long line

**Unit 3: Unconventional Fishing methods and Fish Finding Devices**

- 3.1.Destructive and Prohibited fishing practices; Fishing methods like electrical fishing,
- 3.2.Light fishing; Angling (line fishing) poisoning and use of dynamites.
- 3.3.Introductory information on echo-sounder, sonar, net sonde, global positioning systems, remote sensing.
- 3.4.Geographic Information Systems (GIS) in aquaculture.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
I B.Voc. Department of Fisheries and Aquaculture  
Semester II 2021-2022

**B.Voc., Industrial Aquaculture**  
**Craft and Gears in Capture Fisheries**

---

Time: 1 $\frac{1}{2}$  Hour

Max.Marks: 50  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**  
**At least 1 question should be given from each Unit**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**SECTION B**

3 x 10 = 30 Marks

**Answer any three questions. Each answer carries 10 marks**  
**At least 1 question should be given from each Unit**

- 1.
- 2.
- 3.
- 4.
- 5.

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**Practical**  
**I Year, II semester 2021-2022**

Practical Paper: II: Craft and Gears in Capture Fisheries

(Credits:2)

3 hrs/week

Work load: 30 hrs per semester

1. Study on Traditional crafts & various boat building materials.
2. Drawing of traditional crafts: catamaran & Satpati, etc. Drawing of backbone assembly & U & V bottom hull of wooden boat.
3. Drawing of deck lay outs of various fishing crafts: Trawlers, gill netters, long liners, squid jiggers etc.
4. Designing of fishing vessel from a parent vessel. Study of propeller & stern gear assembly.
5. Study on marine fouler & borers. Visiting to harbors, boat building yards & dry docking yard.
6. Handling of net braiding tools, making different knots, bends, hitches, net braiding using different knots- shaping, creasing, baiting, fly mesh tailoring – T-cuts, Ncuts, B-cuts. Calculations- joining of netting, lacing, seaming.
7. Damages on the netting, mending of net, identification of synthetic and natural fibres by various methods.
8. Calculation of bouncy, negative buoyancy – identification of fibres, twines, ropes, iron wares, fish hook.
9. Specification of ropes, wire ropes, iron wares, rigging materials, methods. Seining, boat seines, beach seines, gill netting, drift set, trammel nets.
10. Line fishing – pole and line, tuna long lines, squid jigging. Falling gear - cast nets. Lift nets, Chinese dip nets. Deck layout of trawlers. Purse seiners, tuna long liners, gill netters and combination fishing vessels.



### **Suggested reading**

#### **Core reading**

1. Boopendranath, M.R., Meenakumari, B., Joseph, J., Sankar, T.V., Pravin, P., and Edwin, L. (Eds.) 2002, Riverine and Reservoir Fisheries 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.
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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Industrial Aquaculture**  
**Course structure and syllabi: 2021-2022**  
**Admitted Batch II Year, Semester III**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	English	100	30	70	4	3
2.	Second language-Telugu	100	30	70	4	3
3.	Life Skill Course-1	50	-	70	2	2
4.	Life Skill Course-2	50	-	50	2	2
5.	Skill Development Course	50	-	50	2	2
<b>Skill Education</b>						
1	Cell biology, Genetics, Molecular Biology & Evolution	100	30	70	4	4
2	Lab Practical	50	-	50	2	1
3	Organic Chemistry and Spectroscopy	100	30	70	4	4
4	Practical – III Organic preparations and IR Spectral Analysis	50	-	50	2	1
5	Hatchery Technology in Finfish & Shellfish	100	30	70	4	4
6	Lab Practical	50	-	50	2	1
7	Inland and marine Fisheries	50	-	50	2	2
8	Lab Practical	50	-	50	2	1
9	Yoga	-	-	-	-	1
	<b>Total</b>	<b>900</b>			<b>36</b>	<b>31</b>

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Industrial Aquaculture**  
**II Year, Semester III**  
**Cell biology, Genetics, Molecular Biology & Evolution**

---

**Unit – I      Cell Biology**

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
- 1.2 Electron microscopic structure of animal cell.
- 1.3 Plasma membrane –Models and transport functions of plasma membrane.
- 1.4 Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes
- 1.5 Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

(Note: 1. General pattern of study of each cell organelle – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams)  
2. Need not study cellular respiration under mitochondrial functions)

**Unit – II      Genetics - I**

- 2.1 Mendel's work on transmission of traits
- 2.2 Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes
- 2.3 Polygenes (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance)
- 2.4 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)
- 2.5 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

**Unit – III      Genetics - II**

- 3.1 Mutations & Mutagenesis
- 3.2 Chromosomal Disorders (Autosomal and Allosomal)
- 3.3 Human Genetics – Karyotyping, Pedigree Analysis (basics)
- 3.4 Basics on Genomics and Proteomics

**UNIT IV:      Molecular Biology**

- 4.1 Central Dogma of Molecular Biology

4.2 Basic concepts of -

- a. DNA replication – Overview (Semi-conservative mechanism, Semi-discontinuous mode, Origin & Propagation of replication fork)
- b. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications (basics)
- c. Translation – Initiation, Elongation and Termination

4.3 Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

**Unit - V**

5.1 Origin of life

5.2 Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory

5.3 Neo-Darwinism: Modern Synthetic Theory of Evolution, Hardy-Weinberg Equilibrium

5.4 Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**II Year, III semester 2021-2022**  
**Cell biology, Genetics, Molecular Biology & Evolution**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

11. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**Bachelor of Vocation: Industrial Aquaculture**  
**II Year, Semester III**  
**Title: Hatchery Technology in Finfish & Shell Fish**

**Syllabus**

**Credits 4**

---

**Unit 1: Natural seed resources & Bundh breeding**

- 1.1. Freshwater and marine fish seed resources; Natural breeding of finfishes.
- 1.2. Wet and dry bundhs; Collection and hatching of eggs; Factors involved in bundh breeding; Advantages and disadvantages of bundh breeding.

**Unit2: Carp Hatchery and Seed production**

- 1.1. Types of hatcheries
- 1.2. Carp Brood Husbandry: Brood rising, Brood health care and management
- 1.3. Induced breeding technology and Synthetic hormones.

**Unit 3: Seed Production of Crustaceans**

- 3.1. Seed production shrimp and prawn
- 3.2. Operation and management of maturation section.

**Unit 4: Seed Production of Molluscs**

- 4.1. Hatchery operations of pearl oysters
- 4.2. Hatchery operations of Edible oysters

**Unit 5: Transportation seed**

- 5.1. Transportation of brooders (Fin fish/shrimp/prawn)
- 5.2. Transportation of fish seed

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester III 2021-2022  
**Bachelor of Vocation: Industrial Aquaculture**  
**Title: Hatchery Technology in Finfish & Shell Fish**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

12. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

### **Suggested Reading**

#### **Core reading**

1. Chodar SL Hypophysation in Indian Major Carps
2. CMFRI Spl. Bul. Hatchery Operation of Penaeid 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. Hopher, 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.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester III 2021-2022  
**Bachelor of Vocation: Industrial Aquaculture**  
**PRACTICAL PAPER II**  
**Title: Hatchery Technology in Aquatic Organisms**  
**Hours 2, credits 2**

---

- I. Identification of shrimps (Marine/Brackish water)
  1. *Penaeus monodon*
  2. *P. indicus*
  3. *Litopenaeus vannamei*
- II. Biology and Identification of crabs
  1. *Scylla serrata*
  2. *S. oceanica*
- III. Dissections
  - A. Mounting of the shrimp/prawn appendages
  - B. Digestive system of shrimp/prawn
  - C. Nervous system of shrimp/prawn
  - D. Eye stalk ablation in shrimp/Prawn
  - E. Pituitary gland extract in fishes

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
**Bachelor of Vocation: Industrial Aquaculture**  
Semester III 2021-2022

**Title :Inland and Marine Fisheries**

**Syllabus**

**Credits 2**

---

**Unit 1: Riverine and Estuarine Fisheries**

- 1.1. Riverine fisheries – Major river systems in India, important characteristic features of Rivers
- 1.2. Estuarine fisheries- definition, Ecological significance of estuary, Biota of estuary, classification and categories of estuaries- capture fisheries- resident and migrant species.

**Unit 2: Reservoir, Lakesterine Fisheries & Coastal fisheries**

- 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. Coastal fisheries – Elasmobranch fishery; Teleost fishery- Sardines, Anchovies, Mackerel, Mumbai duck, Catfishes, Eels, Ribbon fish, Perches, Mulletts, Polnemids, Pomfrets, Scianids, Seer fishes, Flying fishes

**Unit 3: Marine Pelagic, Demersal and Deep Sea Resources**

- 4.1. Pelagic resources and Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources.
- 4.3. Introduction-Fisheries potential, Major Deep sea resources and scope of their exploitation, Present fishing pattern and deep sea fishing in India
- 4.4. Regulations-Conservation and regulation of fishing pressure - closed season, mesh size regulations, sanctuaries., Deep Sea Fishing Policy

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester III 2021-2022  
**B.VOC Industrial Aquaculture**  
**Semester-III, 2021-2022**  
**Inland and Marine Fisheries**

**Syllabus**

**Credits 2**

---

Time: 1 $\frac{1}{2}$  Hour

Max.Marks: 50  
4 x 5 = 20 Marks

**SECTION- A**

**Answer any four questions. Each answer carries 5 marks**  
**At least 1 question should be given from each Unit**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**SECTION B**

**3 x 10 = 30 Marks**  
**Answer any three questions. Each answer carries 10 marks**  
**At least 1 question should be given from each Unit**

- 1.
- 2.
- 3.
- 4.
- 5.

\*\*\*

### **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 Myanmar*. 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 and graphic 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 Chantarawatid C. 2000. *Fishery and fisheries management in Thai reservoirs: review and assessment*. Mekong River Commission. Vientiane. 42 pp.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester III 2021-2022

**B.VOC : Industrial Aquaculture**

**Semester-III, 2021-2022**

**PRACTICAL PAPER:I**

**Title : Inland and Marine Fisheries**

I. Identification of Reservoir Fisheries

1. *Labeo rohita, L. calbasu,*
2. *Cirrhinus mrigala*
3. *Catla catla*

II. Identification of Estuarine Fisheries

1. Chanos
2. Lates
3. Mulletts

III. Identification of Marine Fisheries

a. Pelagic Fisheries

- 1.
- 2.
- 3.

a. Demersal Fisheries

- 1.
- 2.
- 3.

b. Deep sea Fisheries

- 1.
- 2.
- 3.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
**B.Voc., Industrial Aquaculture**  
**II Year, IV semester 2021-2022**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
	<b>Core Papers</b>					
1.	Physiology, Cellular Metabolism & Embryology	100	30	70	4	4
2.	Lab	50	-	50	2	1
3.	Immunology & Animal Biotechnology	100	30	70	4	4
4.	Lab	50	-	50	2	1
5.	Inorganic, Organic and Physical Chemistry	100	30	70	4	4
6.	Practical – IV Organic Qualitative analysis	50	-	50	2	1
7.	Inorganic and Physical Chemistry	100	30	70	4	4
8.	Practical-V Course Conductometric and Potentiometric Titrimetry	50	-	50	2	1
9.	Fish Nutrition and Feed Technology	100	30	70	4	4
10.	Lab	50	-	50	2	1
11.	Fish and shellfish Pathology	100	30	70	4	4
12.	Lab	50	-	50	2	1
13.	NCC/NSS/Sports/Extra Curricular	-	-	-	-	2
14.	Yoga	-	-	-	-	1
	Total		180	720	<b>36</b>	<b>33</b>
	<b>Grand Total</b>	<b>900</b>				

**Second spell between First year and Second Year Apprenticeship: Credits: 4; Marks:100**

**ZOOLOGY SYLLABUS FOR IV SEMESTER**  
**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND**  
**EMBRYOLOGY**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

---

**UNIT I      Animal Physiology - I**

- 1.1 Process of digestion and assimilation
- 1.2 Respiration - Pulmonary ventilation, transport of oxygen and CO<sub>2</sub>

(Note: Need not study cellular respiration here)

- 1.3 Circulation - Structure and functioning of heart, Cardiac cycle
- 1.4 Excretion - Structure and functions of kidney urine formation, counter current Mechanism

**UN IT II     Animal Physiology - II**

- 2.1 Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers
- 2.2 Muscle contraction - Ultra structure of muscle, molecular and chemical basis of muscle contraction
- 2.3 Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas
- 2.4 Hormonal control of reproduction in a mammal

**UNIT III     Cellular Metabolism – I (Biomolecules)**

- 3.1 Carbohydrates - Classification of carbohydrates. Structure of glucose
- 3.2 Proteins - Classification of proteins. General properties of amino acids
- 3.3 Lipids - Classification of lipids
- 3.4 Enzymes: Classification and Mechanism of Action

**UNIT IV     Cellular Metabolism – II**

- 4.1 Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis
- 4.2 Lipid Metabolism –  $\beta$ -oxidation of palmitic acid

#### 4.3 Protein metabolism - Transamination, Deamination and Urea Cycle

#### **Unit – V      Embryology**

5.1 Gametogenesis

5.2 Fertilization

5.3 Types of eggs

5.4 Types of cleavages

5.5 Development of Frog upto formation of primary germ layers



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Industrial Aquaculture**

**Title : ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

13. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**ZOOLOGY SYLLABUS FOR SEMESTER - IV**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

---

**Unit – I Immunology – I (Overview of Immune system)**

- 1.1 Introduction to basic concepts in Immunology
- 1.2 Innate and adaptive immunity, Vaccines and Immunization programme
- 1.3 Cells of immune system
- 1.4 Organs of immune system

**Unit – II Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)**

- 2.1 Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants; Factors influencing immunogenicity
- 2.2 Antibodies: Structure of antibody, Classes and functions of antibodies
- 2.3 Structure and functions of major histo compatibility complexes
- 2.4 Exogenous and Endogenous pathways of antigen presentation and processing
- 2.5 Hypersensitivity – Classification and Types

**Unit – III Techniques**

- 2.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
- 2.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures
- 2.3 Stem cells: Types of stem cells and applications
- 2.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

**Unit – IV Applications of Animal Biotechnology**

- 3.1 Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology
- 3.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery
- 3.3 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications
- 3.4 Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

#### Unit - V

- 1.1. PCR: Basics of PCR.
- 4.2 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)
- 4.3 Hybridization techniques: Southern, Northern and Western blotting
- 4.4 DNA fingerprinting: Procedure and applications
- 4.5 Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Industrial Aquaculture**

**Title : ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

---

Time: 3 Hour

Max.Marks: 70

**PART - A**

Answer any **FOUR** of the following:

4 x 5 = 20 Marks

**Draw labeled diagram wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**PART - B**

Answer all Questions

5 x 10 = 50 Marks

**Draw labeled diagram wherever necessary**

14. a)

OR

b)

10. a)

OR

b)

11. a)

OR

b)

12. a)

OR

b)

13. a)

OR

b)

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.Voc., Industrial Aquaculture**  
Title : **FISH NUTRITION AND FEED TECHNOLOGY**

**Syllabus**

**Credits 4**

---

**Unit 1: Nutritional Requirements of Fish**

- 1.1. Principles of fish nutrition (Proteins, Carbohydrates and lipids)
- 1.2. Vitamin and mineral requirements, vitamin C for fish and shell fishes.
- 1.3. Feeds and feed additives

**Unit 2: Feed ingredients & quality**

- 4.1. Different feed ingredients
- 4.2. Types of feeds, Compounded feeds, pellets, crumbles and microencapsulated feed. Storage, quality standards, proximate composition.
- 4.3. Digestibility studies and methods.

**Unit 3: Feed & Feed Manufacturing**

- 2.1. Feed formulation - methods, square method.
- 2.2. Feed manufacturing processes, Extrusion, Pelletization.

**Unit 4: Feed Management**

- 3.1. Feed schedule in finfish and shellfish, calculations and daily ration.
- 3.2. Artificial feed formulations of different cultural species.
- 3.4. Feed Check tray observations and management.

**Unit 5: Feed Quality**

- 5.1. Feed energetic, Feed Conversion Efficiency(FCE), Protein Efficiency Ratio (PER),
- 5.2. Feed Conversion Ratio (FCR), Net Protein Utilization NPU, leaching,
- 5.3. Water stability. Quality standards.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022  
**B.Voc., Industrial Aquaculture**  
FISH NUTRITION AND FEED TECHNOLOGY  
**MODEL PAPER 2021-2022**

---

Max.Marks: 75

**I. Answer any FIVE of the following:**

**5x5=25**

**Marks Draw labeled diagram wherever necessary**

1. Ascorbic acid
2. Pellet feed
3. Extrusion
4. Artificial feeds
5. FCR
6. Feed additives
7. Types of Feeds
8. PER

**II. Answer any FIVE of the following:**

**5x10=50**

**Marks Draw labeled diagram wherever necessary**

9. a) Write an essay on the Proteins and its sources?

OR

b) Write about the Feeds and feed additives?

10. a) Explain the different types of feed ingredients?

OR

b) Write an essay on proximate feed composition?

11.a) Write about the fish Feed formulations?

OR

b) Write about the fish Feed manufacturing processes?

12. a) Describe the feeding schedule in shrimp farming?

OR

b) Write an essay on Artificial feed formulations of different cultural species?

13. a) Explain about the Feed energetic and Protein efficiency ratio?

OR

- b) Write a short notes on
1. FCE
  2. Water stability of feeds

### **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. Hephher,B. and Pruginin,Y. Commercial Fish Farming

#### **Supplementary Reading**

1. Halver J.E. Fish Nutrition
2. Hephher 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.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**PRACTICAL PAPER: FISH NUTRITION AND FEED TECHNOLOGY**

I. Feed management (Proximate Analysis)

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

II. Preparation of supplementary feeds with locally available ingredients,

III. Determination of water stability of pellet feeds.

V. Feed calculation and daily ration

VI. Check-trays in shrimp farming ponds.

VIII. Estimation of FCR.



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.VOC Industrial Aquaculture**  
**Semester-IV, 2021-2022**

**FISH AND SHELLFISH PATHOLOGY**

**Syllabus**

**Credits 4**

---

**Unit 1: Introduction to fish diseases**

- 1.1. Introduction, Symptoms of sick/diseased fish, causes of fish diseases.
- 1.2. Stress as a factor in the occurrence of diseases.
- 1.3. Types of parasites-Ectoparasites, Endoparasites, Commensalism; Mutualism.

**Unit 2: Fungal and Bacterial Diseases**

- 2.1. Fungal diseases in fish: Saprolegniasis, Branchiomycosis and Ichthyophonus; Fungal diseases in prawns/shrimps: Fusarium, Lagenidium and Prevention and therapy.
- 2.2. Bacterial diseases of fish caused by Aeromonas, pseudomonas, columnaris, Vibrio spp., Epizootic Ulcerative Syndrome Identification, epidemiology, preventive and therapeutic methods. Bacterial diseases in prawns/shrimps: caused by Vibrio spp, luminous bacterial disease, Aeromonas, pseudomonas, filamentous bacterial disease.
- 2.3. Viral Diseases in shrimp: Monodon Baculo Virus (MBV), White Spot Syndrome (WSSV), Yellow Head Virus (YHV), Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV). Prevention and therapeutic methods.

**Unit 3: Protozoan and Metazoan Diseases.**

- 3.2. Protozoan diseases- Ichthyophthiriasis, Costiasis, whirling diseases, trypanosomiasis.
- 3.3. Metazoan Diseases- diseases caused by annelids, helminthes, crustaceans and molluscs.

**Unit 4: Fish Microbiology and Nutritional diseases**

- 4.1. Spoilage microflora of fish and shell fish
- 4.2. Intrinsic and extrinsic factors affecting spoilage of fish and shell fish.
- 4.3. Nutritional deficiency diseases in fish and shell fishes.

**Unit 5: Immunology and Fish Health Management**

- 5.1. Application and development of vaccines.
- 5.2. Diagnostic tools – immune detection- DNA/RNA techniques (PCR). Evaluation criteria of healthy seeds.
- 5.3. Best Management Practices in Aquaculture. Quarantine management.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.VOC Industrial Aquaculture**  
Semester-IV, 2021-2022

**PAPER TITLE: FISH AND SHELLFISH PATHOLOGY**  
**MODEL PAPER**

**Time: 3 Hrs**

**Max.Marks:75**

---

I. Answer any **FIVE** of the following:

**Draw labeled diagram wherever necessary**

**5x5=25 Marks**

1. Mutualism
2. I.H.H.N.V
3. Helminthic diseases
4. Nutritional diseases in shellfish
5. PCR.
6. Costiasis
7. Symptoms of sick or diseased fish
8. Quarantine protocol

II. Answer any **FIVE** of the following:

**Draw labeled diagram wherever necessary**

**5x10=50 Marks**

9. a) Explain stress as a factor in the occurrence of diseases?  
or  
b) Explain briefly about symptoms of sick or diseased fish and what are the causes?
10. Brief note on fungal diseases in fishes and causative organisms with preventive measures?  
or  
b) Brief note on fungal diseases in shrimp and its causative agents with preventive measures?
11. a) Write a note on protozoan causative organisms with preventive measures?  
or  
b) Write a note on ichthyophthiriasis and trypanosomiasis along with preventive measures?
12. a) What are the intrinsic and extrinsic factors affecting spoilage of finfish and shellfish?  
or  
b) Write a note on nutritional deficiency diseases caused in shellfish?
13. a) Give briefly about application and development of vaccines?  
or  
b) Write a short notes on Best management practices in aquaculture?.

\*\*\*

### **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 Pisciculture –
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 Diseases.

#### **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. Schaperclaus. Fish Diseases. Vol. I & II.
6. Lightner, D.V. Shrimp Disease Diagnosis, 1998.
7. Sinderman. Fish Diseases, Vol. I. Shell Fish Diseases, Vol. II.

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM, KAKINADA  
II B.Voc. Department of Fisheries and Aquaculture  
Semester IV 2021-2022

**B.VOC Industrial Aquaculture**  
**PRACTICAL PAPER**

**PAPER TITLE: FISH AND SHELLFISH PATHOLOGY**

**PRACTICAL PAPER: I, CREDITS::2**

---

- I. Collection preservation, Identification of disease causing agents.
- II. Preparation of media for culture, Familiarisation with techniques of bacterial culture and identification, fungal isolation, characterization.
- III. Preparation of the list of chemicals and drugs used to control the diseases and medicines, visit to fish and shrimp farms and Disease diagnostic centers.
- IV. Collection, preservation and identification of parasites, preparation of case studies of diseased fish and prawns.
- V. Study of life-cycle stages. Estimation of dose and administration of various chemicals and drugs.
- VI. Visit to fish farms. Shrimp farms and diagnosis of diseases.
- VII. PCR Technique Demonstration.

\*\*\*

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
**DR. P.V.N. RAJU VIDYAPRANGANAM**  
**KAKINADA**



**BOARD OF STUDIES**  
**2021-2022**

**COURSE: B.VOC., Industrial Aquaculture & Fisheries**

Third Year (V & VI Semester)

**DEPARTMENT OF**  
**FISHERIES AND AQUACULTURE**

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

Date: 28.08.2021

**Board of Studies of B.Voc., Industrial Aquaculture and Fisheries**

A meeting of Board of studies of the Department of Fisheries and Aquaculture will be held on **28.08.2021 at 12.30 P.M** in Ideal College of Arts and Sciences (Autonomous), Vidyutnagar, Kakinada, to consider the following Agenda.

You are cordially invited to attend the meeting and make it a success.

**Agenda:**

- 1.To ratify the syllabus for the First year & Second year (V & VI semesters).
- 2.To prepare and ratify scheme of Examinations for both internal and external examinations.
- 3.Model Question paper for Third year.
- 4.To fix Panel of paper setters and Examiners.
- 5.Additional inputs into the curriculum and up gradation of syllabus incorporate the OJT/Project Work for Third year.
- 6.Other academic activities of Department.

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
 (A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
 DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**  
**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**Board of Studies of B.Voc., Industrial Aquaculture and Fisheries**

The Board of Studies for the Department of Fisheries and Aquaculture for the year 2021-2022 is constituted with the following Members.

**Sl.No. Members Present**

- |                           |                |
|---------------------------|----------------|
| 1. Dr. K. Narasimha Murty | Chairman       |
| 2. P V Lovaraju           | Member         |
| 3. P. Ajay                | Student Member |
| 4. G. Deva Suvarna Raman  | Student Member |

**Adikavi Nannaya University Nominee**

1. Dr. K. Ramaneswarai  
 Dept. of Zoology  
 HOD, Adikavi Nannaya University  
 Rajamahendravaram  
 Cell No: 8074112754

**Members from other Colleges**

1. Dr. Muralidhar P. Ande  
 Senior Scientist & Office In-Charge, CIFE, Kakinada  
 Cell No: 7396182790
2. Dr. P. Sandeep  
 Scientist, FRS (SVVU), Balabhadrapuram, Kakinada  
 Cell No: 8185039772

**Industry/Scientific Organization**

1. Dr. M. Srinivasa Rao  
 Senior Product Development Manager & Marketing Head-India  
 Growel Formulation Pvt. Ltd.  
 Cell No: 7989548040

PRINCIPAL

**IDEAL COLLEGE OF ARTS AND SCIENCES**  
**(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)**  
**DR. P.V.N. RAJU VIDYAPRANGANAM**  
**KAKINADA**

The syllabus and model question papers in Industrial Aquaculture and Fisheries subject for B.Vocation course for the Third Year ( V & VI semester) in the academic year 2021-2022, list of Examiners and paper setter, Department activities is approved in the Board of Studies meeting held in the Department of Fisheries and Aquaculture at 12:30 PM.

<b><u>Sl.No.</u></b>	<b><u>Members Present</u></b>	<b><u>Signatures of Members</u></b>
1.	Dr. K. Narasimha Murty	Chairman
2.	Dr. K. Ramaneswarai	University Nominee
3.	Dr. Muralidhar P. Ande	Expert
4.	Dr. P. Sandeep	Expert
5.	Dr. M. Srinivas Rao	Representative from Industry
6.	P V Lovaraju	Member
7.	P. Ajay	Student Member
8.	G. Deva Suvarna Raman	Student Member



**IDEAL COLLEGE OF ARTS AND SCIENCES**  
(A.P. GOVT., AIDED, AUTONOMOUS & NAAC B)  
DR. P.V.N. RAJU VIDYAPRANGANAM  
**KAKINADA**

**A.Y.2021-2022**

**DEPARTMENT OF FISHERIES AND AQUACULTURE**  
**B.VOC., Industrial Aquaculture & Fisheries**

**Resolutions:**

1. Resolved to follow the following pattern for Examinations.
  - a) The syllabus is divided in to two semesters each paper has 25% internal and 75% semester (15+5+5) for V and VI semester (Third Year).
  - b) During each semester two internal Examinations for each paper will be conducted as per schedule. Introduction of objective type questions and online pattern partially in internal examinations subject to the condition.
  - c) No internal examination/semester examination will be conducted separately for the absentees.
  - d) Average of the two internal Examinations will be considered. Absentee will be awarded zero marks.
  - e) The minimum pass mark for external examination is 35%, Candidate should get a total of 40 marks in internal and external examination put together.
  - f) The pattern of semester examinations and practical V and VI is herewith appended.
  - g) Practical examination-Semester I and semester II will be conducted at each Semester end.
2. Resolved to approve the model question papers for V and VI semesters are here with appended.
3. Resolved to approve the panel of paper setter and examiners as appended herewith.
4. Additional inputs into the curriculum and up gradation of syllabus will be incorporated the OJT (On Job Training) and Project Work.

**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
**AFFILIATED TO ADIKAVI NANNYA UNIVERSITY**  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi 2021-2022 Admitted Batch**  
**III Year; Semester V**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	Inorganic, Organic and Physical chemistry-1	100	25	75	4	4
2.	Lab Practical	50	0	50	2	2
3.	Zoology ( Animal-Biotechnology)	100	25	75	4	4
4.	Lab Practical	50	-	50	2	2
<b>Skill Education</b>						
1.	Fish Processing Technology and Quality Control	100	25	75	4	4
2.	Lab Practical	50	-	50	2	2
3.	Aquatic Pollution	100	25	75	4	4
4.	Lab	50	0	50	2	2
5.	Fisheries Policy, Law and Disaster Management	100	25	75	4	4
6.	Project-1	100	-	100	2	2
	<b>Total</b>	<b>800</b>			<b>34</b>	<b>30</b>

**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
 AFFILIATED TO ADIKAVI NANNYA UNIVERSITY  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
 Course structure and syllabi 2021-2022 Admitted Batch  
**III Year; Semester V**  
**ZOOLOGY SYLLABUS FOR V SEMESTER**  
**ZOOLOGY - PAPER - V**  
**ANIMAL BIOTECHNOLOGY**

**Periods:60**

**Max. Marks:100**

**Unit 1: Tools of Recombinant DNA technology - Enzymes and Vectors**

**1.1 Restriction modification systems:** Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering.

**1.2 DNA modifying enzymes and their applications:** DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases.

**1.3 Cloning Vectors:** Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs.

**Unit 2 Techniques of Recombinant DNA technology**

**2.1 Cloning:** Use of linkers and adaptors

**2.2 Gene delivery:** Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery.

**2.3 PCR:** Basics of PCR.

**2.4 DNA Sequencing:** Sanger's method of DNA sequencing- traditional and automated sequencing.

**2.5 Hybridization techniques:** Southern, Northern and Western blotting.

**2.6 Genomic and cDNA libraries:** Preparation and uses.

**UNIT 3 Animal Cell Technology**

**3.1 Cell culture media:** Natural and Synthetic.

**3.2 Cell cultures:** primary culture, secondary culture, continuous cell lines; Protocols for Primary Cell Culture; Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures.

**3.3 Hybridoma Technology:** Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb.

**3.4 Stem cells:** Types of stem cells, applications.

**Unit 4 Reproductive Technologies & Transgenic Animals**

**4.1 Manipulation of reproduction in animals:** Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning.

**4.2 Transgenic Animals:** Strategies of Gene transfer; Transgenic - sheep, - fish; applications.

**Unit 5 Applied Biotechnology**

**5.1 Industry:** Fermentation: Different types of Fermentation: Short notes on - Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized; Downstream processing - Filtration, centrifugation, extraction, chromatography, spray drying and lyophilization.

**5.2 Agriculture:** fisheries – monoculture in fishes, polyploidy in fishes; DNA fingerprinting.

**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
**AFFILIATED TO ADIKAVI NANNYA UNIVERSITY**  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi 2021-2022 Admitted Batch**  
**III Year; Semester V**  
**ZOOLOGY MODEL PAPER FOR V SEMESTER**  
**ZOOLOGY - PAPER - V**  
**ANIMAL BIOTECHNOLOGY**

**Time: 3 hrs Max.**

**Marks: 75**

**Time: 3 hrs**

**Max. Marks: 75**

---

**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

9.

OR

10.

OR

11.

OR

12.

OR

13.

OR



**ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER**  
**ZOOLOGY - PAPER - V**  
**ANIMAL BIOTECHNOLOGY**

**Periods: 24**

**Max. Marks: 50**

**Any SIX of the following:**

1. Maintenance and storage of *E. coli* DH5 alpha cells.
2. Isolation of Plasmid DNA from *E. coli*.
3. Preparation of genomic DNA from *E. coli*/animals/ human.
4. DNA quantification using agarose gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda ( $\lambda$ ) DNA using EcoR1 and Hind III.
6. Preparation for insertion and vector for ligation.
7. Performance of ligation reaction using T4 DNA ligase.
8. Preparation of competent cells.
9. Transformation of *E. coli* with plasmid DNA using CaCl<sub>2</sub>.
10. Selection of transformants on X-gal and IPTG.
11. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting.
12. Interpretation of sequencing gel electropherograms.
13. Amplification of DNA by PCR.
14. Packing and sterilization of glass and plastic wares for cell culture.
15. Preparation of culture media.

**SUGGESTED READING**

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
5. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
6. Brown TA. (2007). Genomes-3. Garland Science Publishers
7. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
8. Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994. BIOS Scientific Publishers Limited.
9. Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
10. P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
11. B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001).

IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)  
AFFILIATED TO ADIKAVI NANNYA UNIVERSITY  
Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES  
Course structure and syllabi 2021-2022 Admitted Batch  
III Year; Semester V  
B.VOC Industrial Aquaculture and Fisheries  
Semester-V, 2021-2022

**Fish Processing Technology and Quality Control**

Syllabus

CREDITS 4

---

**Unit 1: Fish Processing and Freezing**

- 1.1. **Methods of freezing:** Atmospheric Freeze Drying (AFD), sharp freezing, contact plate freezing, air blast freezing, IQF, Cryogenic freezing and deep freezing
- 1.2. **Freezing of Fish:** Preparation of fish for freezing, Unit operations involved in freezing, freezing of fish in Different styles, Packaging grades of frozen fish.
- 1.3. **Freezing of Shrimps:** Preparation of shrimp for freezing, Unit operations involved in freezing, freezing of shrimp in Different styles, Packaging grades of frozen shrimp.

**Unit 2: Preservation techniques of Finfish/Shell Fish processing**

- 2.1. Reasons for spoilage of fish: Microbial action, enzymatic action and chemical action
- 2.2. Methods of fish Preservation: Salting, drying, smoking, chilling
- 2.3. Fish canning Technology: Concepts of canning and Canning process.

**Unit 3: Fish Packing Technology**

- 3.1. Functions of Packing & Levels of packing
- 3.2. Types of packing materials: Plastic, Paper and paper board, Glass Containers, Metal containers. Methods of packaging: Biodegradable films, vacuum packaging, active packaging. MAP, Polymeric Packaging, CAP etc.
- 3.3. Packaging regulations: Safety and legislation aspects of packing. Labelling and bar coding.

**Unit 4: Quality Assurance**

- 4.1. Quality Management – Concepts of Hazard Analysis Critical Control Point (HACCP), Applications of the HACCP principles
- 4.2. Good Manufacturing Practice (GMP), Sanitary Standard Operating Procedure (SSOP).
- 4.3. Determining the quality assurance of sea food.

**Unit 5: Quality Control**

- 5.1. Quality control – Basic concepts and quality control of fish processing.
- 5.2. Salient features of sea food quality and factors.
- 5.3. Standards of Sea food.

**Suggested reading****Core reading**

1. Fish Processing Technology – T.K.Govindan
2. Fish Processing Technology – Ed. K. Gopakumar
3. Post Harvest Technology – K.K. Balachandran
4. Seafood Processing – V. Venugopal
5. Arora, S. Domkundwar. 1989. *Refrigeration and Air Conditioning*. Dhanpatrai & Sons, Delhi.
6. Cowly, J. 1993. *The Running and Maintenance of Marine Machinery*. Published by Marine Management Ltd for the Institute of Marine Engineers.
7. Dag Pike. 1992. *Fishing Boats and their Equipment*. Food and Agriculture Organization of the United Nations. Published by Fishing News Books Ltd, England.

**Supplementary Reading**

1. Fish Processing Technology – Ed. G.M. Hall – Chapman & Hall, Madras
2. Tropical Fishery Products – K. Gopakumar

**Advanced Reading**

1. Kreuzer,R. Fishery Products.
2. Borgstrom,G .Fish as Food
3. Kondrashova, N.G. 1984. *Shipboard Refrigeration and Fish Processing Equipment*.
4. Amerind Publishing Co Private Ltd. New Delhi.

**B.VOC Industrial Aquaculture and Fisheries**  
**Semester-V, 2021-2022**  
**Fish Processing Technology and Quality Control**

Syllabus

CREDITS 4

Time: 3 hrs

Max. Marks: 75

**I. Answer any FIVE of the following:**

5x5=25

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

5x10=50

**Draw labeled diagrams wherever necessary**

9.

OR

10.

OR

11.

OR

12.

OR

13.

OR





**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
**AFFILIATED TO ADIKAVI NANNYA UNIVERSITY**  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi 2021-2022 Admitted Batch**  
**III Year; Semester V**  
**Fish Processing Technology and Quality Control**

**PRACTICAL: II**

**CREDITS::2**

1. Lay – out of processing plant.
2. Determination of quality assurance of sea food.
3. General description – freezing.
4. Canning – Flow chart.
5. Smoking – Flow chart.
6. Drying – Flow chart.
7. Preparation of surimi – Flow chart.
8. Collection of Air-bladder.
9. Preparation of fishery by products.
10. Preparation of value added fish products.

**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
**AFFILIATED TO ADIKAVI NANNYA UNIVERSITY**  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi 2021-2022 Admitted Batch**  
**III Year; Semester V**  
**AQUATIC POLLUTION**

Syllabus

CREDITS 4

**Unit:1**

**1.1. Water and its pollution:** Water resources of the Earth; Classification of natural waters; Hydrologic cycle;

**1.2. Definition of pollution;** Point and non-point source of pollution, Fundamental concepts; Categories of additions / inputs: degradable wastes, disease causing wastes, particulate wastes, conservative wastes; dissipating wastes.

**1.3. Water quality:** Quality of water for drinking: bacteriological quality, physical characteristics, chemical characteristics. Quality of water for industrial use; Quality of water for recreation.

**Unit:2**

**2.1. Adverse effects of water pollutant: Oxygen-demanding wastes:** Importance of dissolved oxygen; Oxygen demand; Biochemical Oxygen Demand (BOD); Chemical Oxygen Demand (COD); Oxygen budget; Biological effects of organic matter.

**2.2. Excessive plant nutrients:** Eutrophication; Red tides and fish kills; Sources of excess nutrients; Hypertrophic ecosystems and their characteristics; Cultural eutrophication.

**2.3. Agents of biological dysfunction:** Pesticide types and categories; Organo-chlorine compounds; Organophosphorous compounds; polychlorinated biphenyls (PCBs); Bioaccumulation and impact on aquatic fauna and human health; Toxicology.

**Unit:3**

**3.1. Adverse effects of water pollutant: Oil Pollution:** Crude oil and its fractions; Source of oil pollution; Treatment of oil spill at sea; Beach cleaning; Toxicity of petroleum hydrocarbons; Ecological impact of oil pollution-case studies.

**3.2. Sewage and domestic wastes:** Composition, pollution effects, treatment and reuse; **Heavy metals:** Interaction of heavy metals with water and aquatic organisms, their ill effects.

**3.3. Radioactive wastes:** Radioactivity and background radiation of the Earth; Radionuclide polluting; Special effects of pollution. **Thermal pollution:** Thermal pollution and its effects; Physical and chemical nature of possible effluents from major industries.

**Unit:4**

**4.1. Microbial pollution:** Types of aquatic microbes; Autotrophs and Heterotrophs; Saprotrophs and Necrotrophs; Sewage fungus complex; Transmission of human pathogenic organisms; Zoonosis

**4.2.** Development of antibiotic resistance and its impact.

**4.3. Ground water pollution:** Underground source of drinking water; Contamination of ground water and its impact.

**Unit:5**

**5.1. Monitoring and Control of pollution:** Biological indicators of pollution in Natural Waters.

**5.2.** Solid waste management; Bioremediation; Phytoremediation

**5.3.** Advanced waste treatment measures and Pollution control boards.

**Prescribed Books**

1. Chhatwal, G.R., M.C. Mehra, T. Katyal, M. Satake, Mohan, K. and T. Nagahiro. 1995. *Environmental Water Pollution and its Control*. Anmol Publications Pvt. Ltd., New Delhi.
2. Edward A. Laws. 1993. *Aquatic Pollution*. Second Edition. Wiley Interscience, John Wiley & Sons Inc., New York.

**Reference Books**

1. APHA. 1995. *Standard Methods for the Examination of Water and Wastewater*. 19th Edition, American Public Health Association, Washington.
2. Clark, R.B. 1994. *Marine Pollution*. Clarendon Press, Oxford.
3. Hynes, H.B.N. 1978. *The Biology of Polluted Waters*. Liverpool University Press, UK.
4. Subba Rao, M.V. 1998. *A Manual of Practical Methods in Environmental Science*. Andhra University, Visakhapatnam.

**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
Course structure and syllabi 2021-2022 Admitted Batch  
**III Year; Semester V**  
**AQUATIC POLLUTION**  
**Model Paper**

---

Time: 3 hrs

Max. Marks: 75

**I. Answer any FIVE of the following:**

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

5x10=50

Draw labeled diagrams wherever necessary

9.

OR

10.

OR

11.

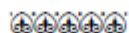
OR

12.

OR

13.

OR



**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi 2021-2022 Admitted Batch**  
**III Year; Semester V**  
**Aquatic Pollution-Practical**

**Practicals**

1. Water sampling devices: Shallow water sampler, Deep water sampler, Sterile water sampler.
2. Physical characteristics of polluted waters: Colour, Odour, Turbidity.
3. Chemical characteristics of polluted waters: Determination of pH and Conductivity.
4. Determination of Alkalinity / Hardness.
5. Determination of BOD.
6. Determination of COD.
7. Determination of H<sub>2</sub>S.
8. Determination of Phosphates.
9. Determination of Nitrates.
10. Sediment sampling devices and Sediment analysis (pH, Organic Carbon, H<sub>2</sub>S etc.)
11. Study of Pathogenic and Coliform bacteria
12. Bacteriological quality of water: Coliforms tests, IMViC test, Standard plate count. Methods of enumerating bacterial biomass in waters & waste waters.
13. Pollution Flora and Fauna: Study of Sewage fungus complex.
14. Study of Indicator species—Algae; Protozoa, and Insect larvae.
15. Pesticides pollution: Acquaintance with different types of pesticides; Warning pictograms and symbols. Methods of pesticide residue analysis in waters and fish tissues; Bioassay and toxicity study.
16. Visit to an Industrial pollution affected water body/ ETP Unit/ Dist. Pollution Control Board office.

**B.VOC Industrial Aquaculture and Fisheries**  
**Semester-V, 2021-2022**

**FISHERIES POLICY, LAW AND DISASTER MANAGEMENT**

**Syllabus**

**CREDITS 4**

---

**Unit-1: Fisheries Policy**

- 1.1. Introduction to public administration, Principles of organization and Management of public enterprise. Central and State responsibilities for fisheries development.
- 1.2. Organizational set up of fisheries administration at the Central and State levels. Functions and powers of functionaries of department of fisheries, corporations and co- operatives.
- 1.3. Different Central and State level fisheries institutions. Role of central and state government in the regulatory activities of aquaculture and fisheries.

**Unit-2: Fisheries Institutions**

- 2.1. Central and State level fisheries institutions. Role of central and state government in the regulatory activities of aquaculture and fisheries.
- 2.2. Implementation of community based resource management plans. Historical review of fisheries development and management in India and the World.
- 2.3. Fisheries development over Five year plans (PMMSY, NFDB Schemes). International agencies/ organizations for promotion of fisheries Worldwide.

**Unit-3: Fisheries Legislation**

- 3.1. Fishery Resources, constitutional provision, Indian fisheries Legislations, The Merchant shipping Act-1958; Indian wild life (Protection) Act-1972.
- 3.2. The MPEDA Act-1972; Territorial waters, continental shelf, EEZ and other maritime zones Act-1976; The Coast Guard Act-1978; Marine Fishery Legislation in the maritime states of India.
- 3.3. The Maritime Zones of India Act-1981; The Environment Protection-1986; Biological Diversity Act-2002; Inland Fisheries Legislation ; CAA-2005.

**Unit-4: Disaster Management in Fisheries**

- 4.1. Basic concepts: Hazard, risk, vulnerability, disaster, capacity building. Multi -hazard and disaster vulnerability of India.
- 4.2. Types of natural and manmade hazards in fisheries and aquaculture - cyclones, floods, droughts, tsunami, El-nino, algal blooms, avalanches, pollution, habitat destruction, over fishing, introduction of exotic species, landslides, epidemics, loss of bio-diversity etc.
- 4.3. Causes, characteristics and effects of disasters.

**Unit-5: Management strategies**

- 5.1. **Pre-disaster:** prevention, preparedness and mitigation; different ways of detecting and predicting disasters; early warning, communication and dissemination, community based disaster preparedness, structural and nonstructural mitigation measures.
- 5.2. **During disaster:** response and recovery systems at national, state and local, coordination between different agencies, international best practices.
- 5.3. **Post disaster:** Methods for assessment of initial and long term damages, reconstruction and rehabilitation. Prevalent national and global management practices in disaster management.

**Prescribed Books**

1. Chhatwal, G.R., M.C. Mehra, T. Katyal, M. Satake, Mohan, K. and T. Nagahiro. 1995. *Environmental Water Pollution and its Control*. Anmol Publications Pvt. Ltd., New Delhi.
2. Edward A. Laws. 1993. *Aquatic Pollution*. Second Edition. Wiley Interscience, John Wiley & Sons Inc., New York.

**Reference Books**

1. APHA. 1995. *Standard Methods for the Examination of Water and Wastewater*. 19th Edition, American Public Health Association, Washington.
2. Clark, R.B. 1994. *Marine Pollution*. Clarendon Press, Oxford.
3. Hynes, H.B.N. 1978. *The Biology of Polluted Waters*. Liverpool University Press, UK.
4. Subba Rao, M.V. 1998. *A Manual of Practical Methods in Environmental Science*. Andhra University, Visakhapatnam.

**B.VOC Industrial Aquaculture and Fisheries**  
**Semester-V, 2021-2022**  
**FISHERIES POLICY, LAW AND DISASTER MANAGEMENT**

**Syllabus**

**CREDITS 4**

---

**Time: 3 hrs**

**Max. Marks: 75**

---

**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

9.

OR

10.

OR

11.

OR

12.

OR

13.

OR





**B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES**  
**III YEAR, V SEMESTER 2021-2022**  
**PRACTICAL PAPER**  
**MODEL PAPER**

---

**MAX.MARKS: 50**

I. Identification of Spotters	5x5 = 25 Marks
II. Dissection/ Analysis (Major)	1x10= 10M
III. Dissection/ Analysis (Minor)	1x5= 05 M
IV. Record	10 M

**OJT (ON JOB TRAINING) CREDITS:2**

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT REPOT & SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
<b>TOTAL</b>		<b>50</b>

**IDEAL COLLEGES OF ARTS AND SCIENCES (ATONOMOUS)**  
**AFFILIATED TO ADIKAVI NANNYA UNIVERSITY**  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**

S.No	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
<b>General Education</b>						
1.	Environmental Chemistry	100	25	75	4	4
2.	Lab Practical	50	0	50	2	2
3.	Zoology (Immunology)	100	25	75	4	4
4.	Lab Practical	50	0	50	2	2
<b>Skill Education</b>						
1	Fisheries Economics and Marketing	100	25	75	4	4
2	Lab Practical	50	0	50	2	2
3	Aquaculture Engineering	100	25	75	4	4
4	Lab Practical	50	0	50	2	2
5	Fisheries Cooperatives and Marketing	100	25	75	4	4
6	Project Work-2	100	0	100	2	2
	<b>Total</b>	<b>800</b>			<b>30</b>	<b>30</b>

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**ZOOLOGY SYLLABUS FOR VI SEMESTER**  
**IMMUNOLOGY**

**Periods:60**

**Max. Marks:100.**

**Unit - I**

**1.1 Overview of Immune system**

1.1.1 Introduction to basic concepts in Immunology.

1.1.2 Innate and adaptive immunity.

**1.2 Cells and organs of Immune system**

1.2.1 Cells of immune system.

1.2.2 Organs of immune system.

**Unit - II**

**2.1 Antigens**

2.1.1 Basic properties of antigens.

2.1.2 B and T cell epitopes, haptens and adjuvants.

2.1.3 Factors influencing immunogenicity.

**Unit - III**

**3.1 Antibodies**

3.1.1 Structure of antibody

3.1.2 Classes and functions of antibodies

3.1.3 Monoclonal antibodies.

**Unit - IV**

**4.1 Working of Immune system**

4.1.1 Structure and functions of major histocompatibility complexes.

4.1.2 Exogenous and Endogenous pathways of antigen presentation and processing.

4.1.3 Basic properties and functions of cytokines.

**Unit - V**

**5.1 Immune system in health and disease**

5.1.1 Classification and brief description of various types of hyper sensitivities.

5.1.2 Introduction to concepts of autoimmunity and immunodeficiency.

**5.2 Vaccines**

5.2.1 General introduction to vaccines.

5.2.2 Types of vaccines.

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**ZOOLOGY MODEL PAPER**  
**IMMUNOLOGY**

**Time: 3 hrs**

**Max. Marks: 75**

---

**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

9.

OR

10.

OR

11.

OR

12.

OR

13.

OR



**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**ZOOLOGY PRACTICAL SYLLABUS FOR VI SEMESTER**  
**IMMUNOLOGY**

**Periods: 24.**

**Max. Marks: 50M**

1. Demonstration of lymphoid organs (as per UGC guidelines).
2. Histological study of spleen, thymus and lymph nodes (through prepared slides).
3. Blood group determination.
4. Demonstration of
  - a. ELISA.
  - b. Immunoelectrophoresis.

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
 (AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**AQUACULTURE ENGINEERING**

**Syllabus****CREDITS 4****Unit-1: Site survey:**

- 1.1. Definition, principles of surveying, classification of surveying- Chain surveying, Compass surveying - Definitions, bearing, meridians, whole circle bearing system, reduced bearing system, theory of magnetic compass, prismatic compass.
- 1.2. Leveling - definitions, methods of leveling, leveling instruments, terms and abbreviations, types of spirit leveling. Plane table surveying- instruments required, working operation, methods.
- 1.3. Contour surveying- definition, instruments required, contour interval, characteristics of contour, contouring methods and uses of contour.

**Unit-2: Unit Regulations in aquaculture farm construction:**

- 2.1. Coastal Aquaculture Authority (CAA): Environment impact assessment, Environment monitoring and management plans
- 2.2. Coastal Aquaculture Authority (CAA): Cluster management, record maintenance and networking, integrated coastal zone management
- 2.3. Coastal Regulation Zone (CRZ).

**Unit-3: Design and construction of farm and Hatchery Structures:**

- 3.1. Soil – Soil and its properties; classification of soil; soil sampling methods; three phase system of soil, definitions of soil properties and permeability of soil.
- 3.2. Types of farms; Layout and design of farms, Tide – fed /Pump fed farms. Design and construction of Race Ways. Open canals and their types. Earth work calculation - Ponds, Dykes, Canals and Roads. Design and construction of Ponds and Dykes.
- 3.3. Effect of Seepage and Evaporation and their control. Design and construction of Hatcheries. Cages – Design and construction.

**Unit-4: Water supply, filtration and aeration systems:**

- 4.1. Water budgeting. Water distribution system – Main feeder channel, Drainage channel. Water control structure – Types of inlets and outlet and their construction.
- 4.2. Computation of water intake and discharge. Aerators – Principles, classification and placement.
- 4.3. Pumps – purpose of pumping, types, selection of pump, total head, and horse power calculation. Filters – Types and construction.

**Unit-5: Effluent Treatment Plant:**

- 5.1. Concept of reservoir
- 5.2. Bio-ponds
- 5.3. Effluent treatment plan design.

**Prescribed Books**

1. Anand, S. Upadhyay. 1994. *Handbook on Design Construction and Equipments in Coastal Aquaculture*. Allied Publishers Ltd. Mumbai.
2. Bose, A.N., Ghose, S.N., Yang, C.T., Mitra, A. 1991. *Coastal Aquaculture Engineering*. Mohan Pramlani for Oxford and IBH Publishing Co Private Ltd. New Delhi.

**Reference Book**

1. Fredrick, W.Wheaton. 1972. *Aquaculture Engineering*. John Wiley and Sons, New York.

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
Course structure and syllabi: 2021-2022 Admitted Batch  
**III Year; Semester VI**  
**AQUACULTURE ENGINEERING**  
**MODEL PAPER**

**Syllabus**

**CREDITS 4**

---

**Time: 3 hrs**

**Max. Marks: 75**

---

**I. Answer any FIVE of the following:**

**5x5=25**

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

Draw labeled diagrams wherever necessary

- 9.
- 10.
- 11.
- 12.
- 13.

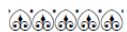
OR

OR

OR

OR

OR





**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
Course structure and syllabi: 2021-2022 Admitted Batch  
III Year; Semester VI  
**AQUACULTURE ENGINEERING**  
**PRACTICAL SYLLABUS**

**PRACTICAL:I**

**CREDITS:2**

**Practicals:**

1. Evaluation of potential site for aquaculture.
2. Land survey – Chain and Compass.
3. Site survey: preparation of site map and Counter maps using Dumpy level.
4. Site survey: preparation of site map and Counter maps using Theodolite.
5. Site survey: preparation of site map and Counter maps using Total Station.
6. Design and layout of Freshwater Fish farm.
7. Design and layout of Brackish water Fish / Shrimp farm.
8. Design and layout of Shrimp / Fish Hatchery.
9. Design of farm structures; Ponds, Dikes, Sluices and Channels.
10. Design of farm structures: Earthwork calculations.
11. Calculations on water and oxygen requirement.
12. Pumps: Design and Operation.
13. Filters and aerator: Design and Operation.
14. Cages: Design and Layout.
15. Design and layout of Effluent Treatment Plant.
16. Visit to Shrimp / Fish Farm.

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
 (AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**FISHERIES ECONOMICS AND MARKETING**  
**Syllabus** **CREDITS 4**

---

**Unit-1: Introduction to fisheries economics**

- 1.1. Basic economic terminologies: Micro and macroeconomics. Positive and normative economics, environmental economics.
- 1.2. Resource, scarcity, farm-firm relationships production.
- 1.3. Contribution of fisheries sector to the economic development of the country.

**Unit-2:Micro-economics:**

- 2.1. **Demand & Supply:** Theories of demand and supply. Market – equilibrium price, consumption, utility, Consumer surplus. Elasticity – price, income, cross, application of elasticity in fisheries managerial decision.
- 2.2. **Farm production economics:** Production functions in capture and culture fisheries. Farm planning and budgeting.
- 2.3. **Costs and returns:** Breakeven analysis of fish production system. Costs and returns – concepts of externalities and social cost. Factors of production- land, labour, capital and organization. Law of diminishing marginal return, returns to scale, economies of scale and scope, revenue, profit maximization, measurement of technological change.

**Unit-3:Macro-economics:**

- 3.1. Introduction to national income, accounting, measurement.
- 3.2. Determinants of national income.
- 3.3. Contribution of fisheries to GNP and employment.

**Unit-4:Globalization:**

- 4.1. Introduction to GATT and WTO.
- 4.2. Functions of WTO. Agreement on Sanitary and Phytosanitary Measures (SPS). Seafood Export Regulations; Fisheries Subsidies and WTO.
- 4.3. Fisheries Trade and Environment; protests against globalization and WTO. Agreement on TRIPS. Bio-piracy. GMOs in fisheries. Salient features of Indian Patent (Amendment) Act 2005.

**Unit-5: Fisheries in economic development:**

- 5.1. Role of fisheries in economic development.
- 5.2. International trade- import and export policy.
- 5.3. Rationalization of fishery trade and industry.

**Suggested Seminar topics**

Primary fisheries cooperative society.  
Emerging fisheries tourism.  
Economics of a shrimp hatchery.  
Kerala budget - allocation to fisheries.

**Core reading**

Mithani,D.M. Principles of Economics.  
Stonier,A.W and Hague,D.C. A Textbook of Economic Theory.  
Anderson,L.G.The Economics of Fisheries Management.  
Shang,Y.C. Aquaculture Economics.  
Korakandy,R. Technological Change and the Development of Marine Fishing Industry in India.  
Ibrahim,P. Fisheries Development in India.

**Supplementary Reading**

Lawson,R.M. Economics of Fisheries Development.  
Panayatou,T. Smallscale Fisheries in Asia.. Socio-economic Analysis and Policy.

**Advanced Reading**

1) Ralph,T and Jack,W. The Economics of Fisheries, FAO

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
 (AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**FISHERIES ECONOMICS AND MARKETING**  
**MODEL PAPER**

**Syllabus**

**CREDITS 4**

**Time: 3 hrs**

**Max. Marks: 75**

**I. Answer any FIVE of the following:**

**5x5=25**

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

Draw labeled diagrams wherever necessary

- 9.
- 10.
- 11.
- 12.
- 13.

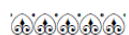
OR

OR

OR

OR

OR



**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
 (AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**FISHERIES ECONOMICS AND MARKETING**  
**PRACTICAL PAPER**

**PRACTICAL:II.**

**CREDITS:2**

**Practicals**

1. Scope of Economics: Microeconomics and Macroeconomics Flow charts.
2. Economic analysis: Static and Dynamic analysis.
3. Demand Analysis: Demand schedule and Demand curves.
4. Price elasticity: Ratio method with example and outlay method with example.
5. Production function models: Linear and Non linear Relationships.
6. Factor product relationships with examples.
7. Costs and Return Analysis: Cost curves.
8. Costs and Returns in Traditional Marine Fishing unit: Case study.
9. Costs and Returns in Fresh water fisheries production unit: Case study.
10. Costs and Returns in a fresh water fish hatchery: Case study.
11. Costs and Returns in a prawn and shrimp hatchery: Case study.
12. Farm Appraisal: A case study.
13. Visit to a fish market.
14. Visit to a Commercial Fisheries Enterprise.
15. Garden – Schafer bio economic model.
16. Organizing and conducting Socio – Economic surveys in fishing villages.

**Prescribed Books**

1. Jayaraman, R. 1996. *Fisheries Economics*. Tamilnadu Veterinary and Animal Science University, Tuticorn.
2. Rao, N. Subba. 1986. *Economics of Fisheries*. Daya Publishing House, Delhi.

**Reference Books**

1. Dewett, K.K. and Varma, J.D. 1993. *Elementary Economic Theory*. S.Chand, New Delhi.
2. Korakandy, R. 1996. *Economics of Fisheries Management*. Daya Publishing House, Delhi.
3. Singh, R.K.P. 2003. *Economics of Aquaculture*. Daya Publishing House, Delhi

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**FISHERIES CO-OPERATIVES AND MARKETING**

**Syllabus****CREDITS 2**

---

**Unit-1: Fisheries Co-Operatives**

- 1.1. Definition, Principles and objectives of co-operation.
- 1.2. Co-operative movement in fisheries sector in India.
- 1.3. Structure, functions, status and problems of fisheries co-operatives management in relation to resources, production and marketing.

**Unit-2: Finance and Book keeping**

- 2.1. Role of credit for fisheries development. Credit requirements of fishers.
- 2.2. Source and type of credit/finance. Micro-credit, indigenous and institutional finance.
- 2.3. Structure of institutional finance in fisheries, returns, risk bearing ability and recovery in fisheries sector.

**Unit-3: NABARD**

- 3.1. Role of NABARD in fisheries development.
- 3.2. Role of insurance in fish and shrimp farming and industry.
- 3.3. Basic accounting procedures, profit and loss account.

**Unit-4: Marketing**

- 4.1. Introduction to marketing management, marketing concepts: Market structure, functions and types.
- 4.2. Marketing channels and supply chain, marketing margins, marketing environment, marketing strategies.
- 4.3. Product development and product mix, consumer behavior and marketing research.

**Unit-5: Marketing**

- 5.1. Fish markets and marketing in India, demand and supply of fish, market structure and price formation in marine and inland fish markets
- 5.2. Cold storage and other marketing infrastructure in India; Sea food export; case study on product and market diversification- export and import policies (fisheries).
- 5.3. New product development and market segmentation. Export and import policies relevant to fisheries sector.

**IDEAL COLLEGES OF ARTS AND SCIENCES (AUTONOMOUS)**  
(AFFILIATED TO ADIKAVI NANNYA UNIVERSITY)  
**Bachelor of Vocation: INDUSTRIAL AQUACULTURE & FISHERIES**  
**Course structure and syllabi: 2021-2022 Admitted Batch**  
**III Year; Semester VI**  
**FISHERIES CO-OPERATIVES AND MARKETING**  
**MODEL PAPER**

---

**Time: 3 hrs**

**Max. Marks: 75**

**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

- 9.
- 10.
- 11.
- 12.
- 13.

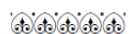
OR

OR

OR

OR

OR



**B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES**  
**III YEAR, VI SEMESTER 2021-2022**  
**PRACTICAL PAPER TITLE: AQUACULTURE ENGINEERING**  
**MODEL PAPER**

---

**MAX.MARKS: 50**

I. Identification of Spotters	5x5 = 25 Marks
II. Dissection/ Analysis (Major)	1x10= 10M
III. Dissection/ Analysis (Minor)	1x5= 05 M
IV. Record	10 M

**B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES**  
**III YEAR, VI SEMESTER 2021-2022**  
**PRACTICAL PAPER TITLE: AQUACULTURE ECONOMICS AND MARKETING**  
**MODEL PAPER**

---

**MAX.MARKS: 50**

I. Identification of Spotters	5x5 = 25 Marks
II. Dissection (Major)	1x10= 10M
III. Dissection/ Analysis (Minor)	1x5= 05 M
IV. Record	10 M



**B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES**  
**III YEAR, VI SEMESTER 2021-2022**  
**PRACTICAL PAPER TITLE: PROJECT WORK**  
**MODEL PAPER**

---

**Credits: 6**

**MAX.MARKS: 100**

1. Name of the Project
  2. Place of work and Duration
  3. Introduction
  4. Significance of the study
  5. Results and Discussions
  6. References
- And  
Field visit Reports