

BVoc PROGRAM (4 years Honors)
2020-21 onwards (21jan21)



B. Vocation

INDUSTRIAL AQUACULTURE & FISHERIES

Members of BOS (Contact details)		
Dr. K. Ramaneswari	Dept of Zoology, Adikavi Nannayya University	Mobile No: 9491520547 Email: ramaneswari1@gmail.com
Dr. N. Srinivas	PR Govt College(A), Kakinada	Mobile No:9912760880 Email: zoonsrinivas4@gmail.com
Dr. Ali Baba	PR Govt College(A), Kakinada	Mobile No:8522956447 Email: bollojubaba@gmail.com
Mr. Jayanth Kumar	Vaisakhi Bio Marine Pvt. Ltd	Mobile No:9866344468 Email:
Dr. P.V.V. Satish	PVRT (Pydah) Degree College, Kakinada	Mobile No:8074194098 Email: psatish728@gmail.com
Dr. D. Sridhar	Asst. Professor (Ad-hoc), Dept of Aquaculture, UCST, AKNU	Mobile No :9440608066 Email: sridhardumpala3 @gmail.com

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Note: BOS is to provide final soft copy in PDF and word formats and four copies of hard copies in bounded form to the office of Dean Academic affairs.

1. Resolutions of the Board of Studies

Meeting held on:21-1-21.....Time:10.30 am
At: Convention center, Adikavi Nannaya Univrsity
RAJAMAHENDRAVARAM

Agenda:

Members present:

1.

Resolutions:

2. DETAILS OF PAPER TITLES & CREDITS

ADIKAVI NANNYA UNIVERSITY
Bachelor of Vocation: Industrial Aquaculture & Fisheries
Course structure and syllabi: w.e from 2020-2021 Admitted Batch

I Year; Semester I								
S e m	Course no	Course name	Course type (T/L/P)	Hrs/Week (Sciences 4+2)	Credits (Science 4+1)	Each course Evaluation		
						Conti- Assess	Univ- exam	Total
I	1	Zoology (Animal Diversity -I Biology of Non-Chordates) *	T	4	4	25	75	100
	2	Zoology (Biology of Non-Chordates Practical) *	L	2	1	0	50	50
	3	Biology of Fishes	T	4	4	25	75	100
	4	Biology of Fishes Practical	L	2	1	0	50	50
	5	Principles of Aquaculture	T	4	4	25	75	100
	6	Principles of Aquaculture Practical	L	2	1	0	50	50
	7	Fresh Water Aquaculture (No Practical)	T	4	4	25	75	100
	8	On Job Training	L	2	1	0	50	50
		Total		24	20			
I Year; Semester II								
II	1	Zoology (Animal Diversity -II Biology of Chordates) *	T	4	4	25	75	100
	2	Zoology (Biology of Chordates Practical) *	L	2	1	0	50	50
	3	Biology Of Shell Fish	T	4	4	25	75	100
	4	Biology Of Shell Fish Practical	L	2	1	0	50	50
	5	Brackishwater Aquaculture and Mari culture	T	4	4	25	75	100
	6	Brackishwater Aquaculture and Mari culture Practical	L	2	1	0	50	50
	7	Hatchery Technology in Culture Organisms (No Practical)	T	4	4	25	75	100
	8	On Job Training	L	2	1	0	50	50
		Total		24	20			

* Common With B.Sc

II Year; Semester III								
S e m	Course no	Course name	Course type (T/L/P)	Hrs/Week (Sciences 4+2)	Credits (Science 4+1)	Each course Evaluation		
						Conti- Assess	Univ- exam	Total
III	1	Zoology (Cell biology, Genetics, Molecular Biology & Evolution) *	T	4	4	25	75	100
	2	Zoology (Cell biology, Genetics, Molecular Biology & Evolution Practical) *	L	2	1	0	50	50
	3	Inland and marine Fisheries	T	4	4	25	75	100
	4	Inland and marine Fisheries Practical	L	2	1	0	50	50
	5	Aquaculture Nutrition	T	4	4	25	75	100
	6	Aquaculture Nutrition Practical	L	2	1	0	50	50
	7	Crafts and Gears in Capture Fisheries (No Practical)	T	4	4	25	75	100
	8	On Job Training	L	2	1	0	50	50
		Total		24	20			
II Year; Semester IV								
IV	1	Zoology (Physiology, Cellular Metabolism & Embryology) *	T	4	4	25	75	100
	2	Zoology (Physiology, Cellular Metabolism & Embryology Practical) *	L	2	1	0	50	50
	3	Zoology (Immunology & Animal Biotechnology) *	T	4	4	25	75	100
	4	Zoology (Immunology & Animal Biotechnology Practical) *	L	2	1	0	50	50
	5	Fish Genetics and Aquaculture Biotechnology	T	4	4	25	75	100
	6	Fish Genetics and Aquaculture Biotechnology Practical	L	2	1	0	50	50
	7	Pathology in Aquaculture	T	4	4	25	75	100
	8	Pathology in Aquaculture Practical	L	2	1	0	50	50
	9	Ornamental Fish Culture	T	4	4	25	75	100
	10	Ornamental Fish Culture Practical	L	2	1	0	50	50
	11	Larval Nutrition and Culture of Fish Food organisms (No Practical)	T	4	4	25	75	100
	12	On Job Training	L	2	1	0	50	50
		Total		36	30			

Note; Course type code: T: Theory, L: Lab, P: Problem solving

* Common With B.Sc

a. Proposed combination subjects

Zoology / Chemistry/ Microbiology/Biotechnology (Choose any one as a M1)

b. Student eligibility for joining the course

Intermediated passed with combination of Bi.P.C, M.P.C and Diploma in Fisheries

c. Faculty eligibility for teaching the course

Fisheries – M.Sc., Ph.D. M.Sc- NET and SET Qualified, M.Sc, M.FSc.,
Ph.D. M.FSc - NET and SET, M.FSc,

Aquaculture – M.Sc., Ph.D. M.Sc- NET and SET Qualified, M.Sc, M.FSc.,
Ph.D. M.FSc - NET and SET, M.FSc,

Zoology - M.Sc., Ph.D. M.Sc- NET and SET Qualified, M.Sc,

d. List Proposed Skill enhancement courses with syllabus, if any

All Core papers are skill enhancement courses

e. Any newly proposed Skill development / Life skill courses with drafts syllabus and required resources

No

f. Required instruments / software / computers for the course (Lab/ Practical course – wise required i.e ., for a batch of 15 students)

Sem No	Lab/Practical Name	Name of Instruments /software/computers required with specifications	Brand Name	Qty Required
1	Biology of Fishes	Virtual Dissection software+15 CPUs	Biolab HP	1 15
2	Hatchery Technology in culture organisms	Traditional Crafts and Boats	Local Made	2+2

g. List of suitable levels of positions eligible in the Govt/Pvt organization

S.No	Position	Company/Govt organization	Remarks	Additional skills required, if any
1	Fisheries Development officers	Govt- Fisheries Dept	Nil	Nil
2	Village fisheries officers	Govt- Fisheries Dept	Nil	Nil
3	Field assistants	Private Sector Fisheries Industries	Nil	Nil
4	Lab Technicians	Private Sector Fisheries Industries	Nil	Nil

h. List of Govt. organizations/ Pvt companies for employment opportunities or internships or projects

S.No	Company/ Govt organization	Position type	Level of Position		
1	Govt- Fisheries Dept	Fisheries Development officers	Group -II	Technical	
2	Govt- Fisheries Dept	Village fisheries officers	Group -IV	Technical	
3	Private Sector Fisheries Industries	Field assistants	Marketing	Marketing	
4	Private Sector Fisheries Industries	Lab Technicians	Technician	Technical	

I. Any specific instructions to the teacher/ paper setters/ papers setters/Exam -Chief Superintendent

Nil

3. Program objectives, outcomes, co-curricular and assessment methods

B. VOCATION	INDUSTRIAL AQUACULTURE & FISHERIES
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1. Aim and objectives of UG program in Subject:

- Promote, facilitate and influence the best possible standards of fisheries management across the British Isles.
- Provide the technical and general knowledge necessary for competent fisheries management.
- Be the organization of choice for evidence-based advice and guidance for sustainable fisheries management.
- Be the membership body of choice for fisheries managers, and to provide good value fisheries management services to members and customers of the Institute.

2. Learning outcomes of Subject

- To exchange and circulate information, ideas and practical experience on all matters relating to fisheries and their management.
- To admit students to the Institute and to increase the number of professionally qualified fisheries managers through the provision of training courses.
- To designate the categories of membership appropriate to the experience, qualifications and contribution of members to the profession and determine the letters that may be placed after the names of members indicating these designations.
- To establish and maintain an appropriate Branch and Specialist section structure to meet the local, specialist and overall needs of fisheries interests.
- To promote the interests of members.
- To co-operate with other institutions and associations in order to achieve common goals.

3. Recommended Skill enhancement courses:

Core subjects are all Skill enhancement courses

4. Recommended Co-curricular activities:

A. Measurable:

1. Assignments
2. Student seminar
3. Quiz Programmes
4. Individual Field Studies/ projects
5. Group discussion
6. Group/Team Projects

B. General:

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
2. Group Discussions on new trends Aquaculture related industries
3. Watching TV discussions and preparing summary points record of paper – cuttings relating to topics covered in syllabus
4. Any similar activities with imaginative thinking.

5. Recommended Continuous Assessment methods:

4. Details of course – wise Syllabus (Five units with each unit having 12 hours of class work)

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-I, 2020-2021
BIOLOGY OF FISHES

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUTCOMES
<ul style="list-style-type: none">➤ To introduce the learner to general morphology and taxonomy of fin fishes.➤ To study the Biological, Morphological and physiological characteristics of fin fishes➤ To provide the knowledge on the taxonomic characteristics of the fin fishes	<ul style="list-style-type: none">➤ By the end of the course the student will be equipped with the knowledge of taxonomy, morphology & physiology of fin fishes.➤ Knowledge on the basic taxonomic tools for the identification of fin fishes will be learnt by the student.

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. Gastroscopic 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

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-I, 2020-2021
PRINCIPLES OF AQUACULTURE

Credits 4

Teaching Hours 4

OBJECTIVES	LEARNING OUTCOMES
<ul style="list-style-type: none"> ➤ To study the aquatic environment their components. ➤ To study the pond ecosystem ➤ To study the cultivable fresh water fishes 	<ul style="list-style-type: none"> ➤ By the end of the course the student will be equipped with the aquatic ecosystem ➤ Knowledge on the pond ecosystem will be learnt by the student. ➤ Knowledge on the cultivable fishes will be learnt by the student.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-I, 2020-2021
FRESH WATER AQUACULTURE

Credits 4

Teaching Hours 4

OBJECTIVES	LEARNING OUT COME
<input type="checkbox"/> To give an introduction to Fresh water aquaculture practices.	➤ At the end of the course student can able to gain the knowledge on the fresh water aquaculture practices.
<input type="checkbox"/> To develop the basic knowledge of Fin fish and shellfish culture systems.	➤ Knowledge on the culture systems be learnt by the student.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-I, 2020-2021
Practical Paper: I: BIOLOGY OF FISHES (Credits:1 Hours: 2)

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>Cypinus carpio</i>
5.	Air breathing Fishes a. <i>Clarias batrachus</i> b. <i>Wallago attu</i> c. <i>Heteropneustes</i> d. <i>Anabas</i>
	Murrels a. <i>Chenna striatus</i> b. <i>Chenna 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: a. Digestive system b. Respiratory system c. Excretory system d. Reproductive systems

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-I, 2020-2021

Practical Paper:II: PRINCIPLES OF AQUACULTURE (Credits:1 Hours: 2)

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 reticulates</i> c. <i>Puntius ticto</i> d. <i>Colisa fasciatus</i>

ADIKAVI NANNAYA UNIVERSITY
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Semester-I, 2020-2021

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

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

II SEMESTER

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-II, 2020-2021
BIOLOGY OF SHELL FISH

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUTCOMES
<ul style="list-style-type: none"> ➤ To introduce the learner to general morphology and taxonomy of Shell fishes. ➤ To study the Biological, Morphological and physiological characteristics of shell fishes ➤ To provide the knowledge on the taxonomic characteristics of the Shell fishes 	<ul style="list-style-type: none"> ➤ By the end of the course the student will be equipped with the knowledge of taxonomy, morphology & physiology of Shell fishes. ➤ Knowledge on the basic taxonomic tools for the identification of shell fishes will be learnt by the student.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC - Industrial Aquaculture & Fisheries
Semester-II, 2020-2021

BRACKISH WATER AQUACULTURE AND MARI CULTURE

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"> ➤ To provide basic biology of the species used for brackish water aquaculture and mariculture. ➤ To give an introduction to brackish water aquaculture practices. ➤ To provide a basic idea about various Mari culture practices. 	<ul style="list-style-type: none"> ➤ Knowledge on the biology and biological cycle of the brackish water & marine cultivable species will be learnt. ➤ Knowledge on the brackish water culture practices will be learnt by the student. ➤ Knowledge on the Mari culture will be learnt by the student.

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, CO₂, Ammonia, Nitrite, H₂S.
- 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. Iverson 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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC - Industrial Aquaculture & Fisheries
Semester-II, 2020-2021

HATCHERY TECHNOLOGY IN CULTURE ORGANISMS

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"><input type="checkbox"/> To understand the current methodology and various techniques of commercial seed production.<input type="checkbox"/> To develop basic knowledge on the spawning, larval rearing and feeding of the commercially important species.<input type="checkbox"/> Hatchery management strategies.	<ul style="list-style-type: none"><input type="checkbox"/> Knowledge on the biology and biological cycle of the brackish water & marine cultivable species will be learnt.<input type="checkbox"/> . Knowledge on the brackish water culture practices will be learnt by the student.<input type="checkbox"/> Knowledge on the Mari culture will be learnt by the student.

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. 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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
PRACTICAL I
BIOLOGY OF SHELL FISH
(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

ADIKAVI NANNAYA UNIVERSITY
B.VOC - Industrial Aquaculture & Fisheries
Semester-II, 2020-2021
PRACTICALS PAPER II
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)

ADIKAVI NANNAYA UNIVERSITY
B.VOC - Industrial Aquaculture & Fisheries
Semester-II, 2020-2021

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

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

III SEMESTER

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-III, 2020-2021
INLAND AND MARINE FISHERIES

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"> ➤ To study the Riverine, Reservoir and Estuarine fisheries. ➤ To understand pelagic fishery resources and demersal resources 	<ul style="list-style-type: none"> ➤ Student learns the knowledge on the inland fishery resources ➤ Student learns the knowledge on the pelagic and demersal fishery resources

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-III, 2020-2021
AQUACULTURE NUTRITION

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"> □ To provide a basic understanding about fish nutrition. □ Provide the knowledge on the Fish feeding physiology, nutritional requirements. □ Providing the basic knowledge on the feed composition, formulation of nutritionally balanced feed, production and use of live feed for optimal production. 	<ul style="list-style-type: none"> ➤ Student will learn the concept of the fish nutrition, ➤ Knowledge on the physiology of fish feeding and nutritional requirements will be learnt by the students. ➤ Knowledge on the fish feed composition, formulation and balanced diet will be learned.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC - Industrial Aquaculture & Fisheries
Semester-III, 2020-2021
CRAFT AND GEARS IN CAPTURE FISHERIES

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"> <input type="checkbox"/> To develop basic knowledge about various crafts <input type="checkbox"/> To understand operation of various fishing gears <input type="checkbox"/> To create awareness about fish finding devices. 	<ul style="list-style-type: none"> ➤ Student will learn the knowledge on the crafts. ➤ Mechanism involved in the operation of the fishing gear will be learnt by the student. ➤ Tools for the identification of fishery resources will be learnt by the student.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-III, 2020-2021
PRACTICAL PAPER: I
INLAND AND MARINE FISHERIES
(Credits 1 Hours 2)

- 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)

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-III, 2020-2021
PRACTICAL PAPER: II
AQUACULTURE NUTRITION
(Credits: 1 Hours: 2)

- 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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-III, 2020-2021

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

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

IV SEMESTER

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021

FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"> ➤ To provide basic idea about the principles of genetics and depict the hereditary mechanism in cultured species. ➤ To acquaint with the state of the art techniques in biotechnology as applied to aquaculture industry. 	<ul style="list-style-type: none"> ➤ Student will learn the concept of Medalian genetic principles ➤ Knowledge on heredity determination will be learnt. ➤ Principles of Biotechnology and its applications in the aquaculture will be learnt

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. Hefher, 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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
PATHOLOGY IN AQUACULTURE

Credits 4

Teaching Hours 4

OBJECTIVES	LEARNING OUT COME
<ul style="list-style-type: none"> ➤ To understand the various types of diseases among the cultivable fishes, to learn and apply methods of control and precaution of diseases. ➤ To understand the tools for diagnosis, and disease management strategies available today. ➤ To understand the role of environment as an important player in infectious diseases. 	<ul style="list-style-type: none"> ➤ Knowledge on the diseases will be learnt. ➤ Precautionary measures will be known to prevent the spread of the disease. ➤ Knowledge on the diagnostic tools will be learnt. ➤ Environmental quality disease free practice will be learnt.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
ORNAMENTAL FISH CULTURE

Credits 4

Teaching Hours 4

OBJECTIVES	LEARNING OUT COME
<ul style="list-style-type: none"> ➤ To give overview on the potential ornamental fishes and their breeding habits. ➤ To develop idea about the various management practices for breeding and rearing of ornamental fishes ➤ To have a basic understanding of aquarium setting and aquarium accessories involved. 	<ul style="list-style-type: none"> ➤ Knowledge on the ornamental fish breeding will be learnt by the student. ➤ Management practices of ornamental fishes will be learnt. ➤ Able to gain knowledge on the aquarium maintenance and accessories.

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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
LARVAL NUTRITION AND CULTURE OF FISH FOOD ORGANISMS

Credits 4

Teaching Hours 4

OBJECTIVES:	LEARNING OUT COME
<ul style="list-style-type: none"> <input type="checkbox"/> To provide a basic understanding about fish live feeds. <input type="checkbox"/> Provide the knowledge on the Fish live feeds culture. <input type="checkbox"/> Providing the basic knowledge on the Artemia and alternative fish live feeds culture. 	<ul style="list-style-type: none"> ➤ Student will learn the significance of the fish live feeds. ➤ Knowledge on the Fish live feeds culture will be learnt by the students. ➤ Knowledge the Artemia and alternative fish live feeds culture will be learned.

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

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
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

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
PRACTICAL PAPER: II
PATHOLOGY IN AQUACULTURE
(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.

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
PRACTICAL PAPER: III
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

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021

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

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

5. Model Question Paper (Sem-end, Exam)

ADIKAVI NANNAYA UNIVERSITY
Bachelor of Vocation: Industrial Aquaculture & Fisheries
2020-21 Admitted Batch
I Year Semester – I-Biology of Fishes

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A

ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Osteichthyes
2. Chondrichthyes
3. Fish classification based on food
4. Fish feeding habits
5. Fish pancreas
6. Fish ovary
7. Ampullae of Lorenzini
8. Anadromous migration

SECTION-B

ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. Write General characters and classification of fishes
(OR)
Bioluminescence in fishes.
10. Gastrosomatic index in fishes.
(OR)
Fish classification based on food and feeding habits.
11. Write an essay on fish Digestive system.
(OR)
Write an essay on fish Cardiovascular system
12. Describe the fish Reproduction
(OR)
Describe the Parental care in fishes.
13. Write in detail manner the Sense organs in fishes
(OR)
Write the notes on Endocrine organs in fishes

ADIKAVI NANNAYA UNIVERSITY
Bachelor of Vocation: Industrial Aquaculture & Fisheries
2020-21 Admitted Batch
I Year Semester – I-Principles of Aquaculture
MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A

ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Blue Revolution
2. Classification of Aquaculture
3. Food chain
4. Phosphorous cycle
5. Nursery Pond
6. Milk fish
7. Pearl Oyster
8. Sea weeds

SECTION-B

ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. Write history, definition, scope and significance of aquaculture
(OR)
Write the general Criteria for the selection of culture species
10. Productivity of culture pond.
(OR)
Nutrient cycles
11. Type of ponds
(OR)
Cultivable freshwater fishes
12. Major brackish water culture systems in India
(OR)
General characters – Milk fish, mullet, seabass, shrimps, crabs
13. Different cultivable species in Marine water and its characters
(OR)
Describe about the sea weeds and its types

ADIKAVI NANNAYA UNIVERSITY
Bachelor of Vocation: Industrial Aquaculture & Fisheries
2020-21 Admitted Batch
I Year Semester – I-Fresh Water Aquaculture

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A

ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Stocking ponds
2. Weed fishes
3. Cages
4. Pig cum fish culture
5. Rice cum fish culture
6. Channa
7. Anabas
8. Larvivorous fishes

SECTION-B

ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. Write the Management of carp culture ponds
(OR)
Describe different methods for the eradication of aquatic insects and aquatic weeds
10. Cultivable species of freshwater prawns.
(OR)
Management techniques of nursery and Grow-out ponds.
11. Write an essay on integrated farming.
(OR)
Write an essay on Organic aqua farming
12. Describe the Culture of air breathing fishes
(OR)
Describe the Freshwater pearl culture.
13. Write in detail about Sewage fed fish culture
(OR)
Write the Effluent Treatment Ponds (ETP)

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, I SEMESTER 2020-2021
PRACTICAL PAPER TITLE: BIOLOGY OF FISHES
MODEL PAPER

Time : 3 Hrs

MAX.MARKS: 50

- | | | |
|------|------------------------------|-----------------|
| I. | Identification of Spotters | 5x05 = 25 Marks |
| II. | Dissection (Major) | 1x10 = 10 M |
| III. | Dissection/ Analysis (Minor) | 1x 05 = 05 M |
| IV. | Record+ Viva Voce | 10 M |

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, I SEMESTER 2020-2021
PRACTICAL PAPER TITLE: PRINCIPLES OF AQUACULTURE
MODEL PAPER

Time: 3 Hours

MAX.MARKS: 50

- | | | |
|------|------------------------------|----------------|
| I. | Identification of Spotters | 5x5 = 25 Marks |
| II. | Dissection/ Analysis (Major) | 1x10 = 10M |
| III. | Dissection/ Analysis (Minor) | 1x05 = 05 M |
| IV. | Record+ Viva Voce | 10 M |

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-I, 2020-2021
OJT (ON JOB TRAINING
MODEL PAPER

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

ADIKAVI NANNAYA UNIVERSITY
Bachelor of Vocation: Industrial Aquaculture & Fisheries
2020-21 Admitted Batch
I Year Semester – II-Biology of Shell fish
MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Sense organs in crustaceans.
2. Gastropoda
3. Feeding intensity.
4. Radula
5. Pearl Oyster
6. Megalopa
7. Neuro secretory cells
8. Androgenic glands

SECTION-B
ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

- 9 (a) Describe respiratory system in Prawn.
(OR)
(b) Give a detailed account on Cephalic appendages of Prawn.
- 10 (a) Write an essay on integument in Crustaceans.
(OR)
(b) Explain digestive system of Crab.
- 11 (a) Give a detailed account on induced maturation in Shrimp.
(OR)
(b) Write an essay on breeding in Oysters.
- 12.(a) Write an essay on different larval stages of Shrimp.
(OR)
(b) Give an account on development of molluscs.
- 13.(a) Describe endocrine glands in Prawn.
(OR)
(b) Describe the moulting stages in Crustaceans.

ADIKAVI NANNAYA UNIVERSITY

Bachelor of Vocation: Industrial Aquaculture & Fisheries

2020-21 Admitted Batch

I Year Semester – II-Brackishwater Aquaculture and Mariculture

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A

ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Abiotic factors
2. Brackishwater fishes
3. Monoculture
4. *Chanos chanos*
5. *Penaeus indicus*
6. pH
7. Dissolved Oxygen (DO)
8. Mariculture

SECTION-B

ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. Write Present status of brackishwater farming in India.
(OR)
Describe the Abiotic and biotic factors in brackishwater culture pond.
10. Write an essay on brackishwater finfish culture.
(OR)
Write in detail about monoculture and polyculture.
11. Write an essay on brackishwater shellfish culture.
(OR)
Write an essay on shrimp culture
12. Describe the soil parameters in brackishwater culture pond
(OR)
Describe role of Microalgae in Aquaculture
13. Write in detail about mariculture
(OR)
Explain the Molluscs farming

ADIKAVI NANNAYA UNIVERSITY

Bachelor of Vocation: Industrial Aquaculture & Fisheries

2020-21 Admitted Batch

I Year Semester – II-Hatchery Technology in Culture Organisms

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A

ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Synthetic hormones
2. Fish Pituitary gland
3. Bundh breeding
4. Eye stalk ablation
5. Hatchery
6. Edible oysters
7. Open seed transport method
8. Characters of finfish brooders

SECTION-B

ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. Write the types of hatcheries
(OR)
Explain Carp brood management.
10. Carp seed resources in major rivers India
(OR)
Write about Bundh breeding and its types
11. Write an essay on seed production of shirmp.
(OR)
Write an essay on Operation and management of maturation section
12. Describe the Hatchery operations of pearl oysters
(OR)
Describe the Hatchery operations of Edible oysters.
13. Write in detail manner the Transportation of brooders
(OR)
Write the notes on Transportation of fish seed

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, II SEMESTER 2020-2021
PRACTICAL PAPER TITLE: BIOLOGY OF SHELL FISH
MODEL PAPER

Time: 3 Hours

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+ Viva Voce | | 10 M |

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, II SEMESTER 2020-2021
PRACTICAL PAPER TITLE: BRACKISH WATER AQUACULTURE AND
MARICULTURE
MODEL PAPER

Time: 3 Hours

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+ Viva Voce | | 10 M |

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-II, 2020-2021
OJT (ON JOB TRAINING
MODEL PAPER

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

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES
II YEAR, III SEMESTER 2019-20
PAPER TITLE: INLAND AND MARINE FISHERIES
MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Biota of Estuary
2. Reservoir fisheries
3. Costal fishery
4. Pelagic resources
5. FAO & NABARD
6. Sanctuaries
7. Lakesterine fisheries
8. Capture fisheries

SECTION-B

5×10=50M

ANSWER ANY FIVE OF THE QUESTIONS

9. a) Define Estuary? Explain about the Ecological significance of estuary?
OR
b) Write an essay on Major river systems in India?
10. a) Define Reservoir? Major reservoirs in India
OR
b) Write an essay on Types of lakes and based on circulation?
11. a) Write about the general characters of teleost fishes?
OR
b) Write about the general characters of Eels and Mulletts?
12. a) Explain the pelagic fish resources?
OR
b) Write an essay on deep sea fishing policy?
13. a) Explain about the FAO and MPEDA?
OR
b) Write a short notes on
 1. ICAR
 2. INCOIS

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES
II YEAR, III SEMESTER 2019-20
PAPER TITLE: AQUACULTURE NUTRITION
MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Ascorbic acid
2. Pellet feed
3. Extrusion
4. Artificial feeds
5. FCR
6. Feed additives
7. Types of Feeds
8. PER

SECTION-B
ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. a) Write an essay on the Principles of fish nutrition?
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

ADIKAVI NANNAYA UNIVERSITY

Bachelor of Vocation: Industrial Aquaculture & Fisheries

2020-21 Admitted Batch

II Year Semester – III-Crafts and Gears in Capture Fisheries

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A

ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Trap net
2. Rafts
3. Trawl nets
4. Hooks
5. Artificial baits
6. Gill net
7. Eco sounder
8. Remote sensing

SECTION-B

ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. Write Different types of fishing crafts and gears in India
(OR)
Boat building materials.
10. Write Crafts of the east coast and west coast.
(OR)
Write about the Factors affecting the design of fishing gears
11. Write an essay on active fishing gears
(OR)
Write an essay on passive gears
12. Describe the fishing methods
(OR)
Describe the Destructive and Prohibited fishing practices,
13. Write in detail about fish finding devices
(OR)
Write the notes on Geographic Information Systems (GIS) in aquaculture

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, III SEMESTER 2020-2021
PRACTICAL PAPER TITLE: INLAND AND MARINE FISHERIES
MODEL PAPER

Time: 3 Hours

MAX.MARKS: 50

- | | | |
|------|---------------------------------------|---------------|
| I. | Identification of Reservoir Fisheries | 2x05= 10M |
| II. | Identification of Estuarine Fisheries | 1x5= 05 M |
| III. | Identification of Marine Fisheries | 5x5= 25 Marks |
| IV. | Record+ Viva Voce | 10 M |

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, III SEMESTER 2020-2021
PRACTICAL PAPER TITLE: AQUACULTURE NUTRITION
MODEL PAPER

Time: 3 Hours

MAX.MARKS: 50

- | | | |
|------|----------------------------|---------------|
| I. | Identification of Spotters | 5x5= 25 Marks |
| II. | Analysis (Major) | 1x10= 10M |
| III. | Analysis (Minor) | 1x5= 05 M |
| IV. | Record+ Viva Voce | 10 M |

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-III, 2020-2021
OJT (ON JOB TRAINING
MODEL PAPER

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

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES
II YEAR, IV SEMESTER 2019-20
PAPER TITLE: FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY
MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Mendals law of inhritence
2. Complementary genes
3. Inbreeding depression
4. Vectors
5. Probiotics
6. Cryopreservation
7. Gynogenesis
8. Hermaphroditism

SECTION-B
ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. a) Role of biotechnology in aquaculture
OR
b) Write briefly about supplementary and complimentary genes
10. a) Hybridization techniques in fishes
OR
b) Intergeneric hybrids in imc
11. a) Gynogenesis
OR
b) Genetics of sex determination in aquaculture
12. a) Gene manipulation in fishes
OR
b) Define PCR? role of PCR in WSSV in shrimp
13. a) Present status of marine biotechnology in aquaculture
OR
b) Explain briefly about industries based on marine biotechnology

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES
II YEAR, IV SEMESTER 2019-20
PAPER TITLE: PATHOLOGY IN AQUACULTURE

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Commensalism
2. Causative factors for diseased shrimp
3. IHHNV
4. Ichthyophonosis
5. Microflora
6. Quarantine management
7. Vaccines
8. Trypanosomiasis

SECTION-B
ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. a) Explain briefly about different types of parasites with examples.
OR
b) Explain disease caused by stress as a factor.
10. a) Brief note on Bacterial diseases and its causative organisms with preventive measures
OR
b) Brief note on Viral disease and its causative organisms with preventive measures
11. a) Protozoan disease causative organisms with preventive measures
OR
b) Metazoan disease causative organisms with preventive measures
12. a) Disease caused by deficiency of nutrients both shell and fin fishes
OR
b) What are the factors affecting the spoilage of fin and shell fishes
13. a) Explain briefly about best management practices in quarantine ponds
OR
b) Give briefly about application and development of vaccines

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES
II YEAR, IV SEMESTER 2019-20
PAPER TITLE: ORNAMENTAL FISHERIES

MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. Aerators
2. Oceanarium
3. Gravel filters
4. Types of food for aquarium
5. Live bearers
6. Clown fishes
7. Prophylaxis
8. Importance of ornamental fishes

SECTION-B
ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. a) Water quality management in aquarium fishes.
OR
b) Design and construction of public fresh water aquaria.
10. a) Set up the aquaria with quarantine measure.
OR
b) Maintenance of Aquaria with control of snail and algal growth.
11. a) Explain briefly taxonomy and biology of ornamental fishes.
OR
b) General principles of reproduction in ornamental fishes.
12. a) Breeding of marine ornamental fishes.
OR
b) Explain habit and habitat of different types of marine ornamental fishes.
13. a) Give notes on bacterial disease and causative organisms and prophylaxis.
OR
b) Importance of pigments in ornamental fishes.

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE AND FISHERIES
II YEAR, IV SEMESTER 2019-20
PAPER TITLE: LARVAL NUTRITION AND CULTURE OF FISH FOOD ORGANISMS
MODEL PAPER

Time: 3 Hours

Maximum: 75 Marks

SECTION-A
ANSWER ANY FIVE OF THE QUESTIONS

5×5=25M

1. *Artemia salina*
2. Phytoplankton
3. Rotifers
4. Mysis larva
5. Periphyton
6. Feed additives
7. Micro Algae
8. Polychaete culture

SECTION-B
ANSWER ANY FIVE OF THE QUESTIONS

5×10=50M

9. a) Write an essay on Different live feeds and their nutritional value
OR
b) Write about the important species of plankton in fish culture?
10. a) Explain the Methods of collection and preservation of phytoplankton?
OR
b) Write an essay on Culture of important microalgae?
11. a) Write about the Methods of collection and preservation of zooplankton?
OR
b) Write about the Mass culture of zooplankton?
12. a) Describe the culture of Artemia?
OR
b) Write an essay on Decapsulation of Artemia cysts?
13. a) Explain about the Applications Importance of periphyton in aquaculture?
OR
b) Describe the Nutritional qualities of alternative live feeds.

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, IV SEMESTER 2020-2021

PRACTICAL PAPER TITLE: FISH GENETICS AND AQUACULTURE BIOTECHNOLOGY

MODEL PAPER

Time: 3 Hours

MAX.MARKS: 50

- | | | |
|------|----------------------------|---------------|
| I. | Identification of Spotters | 5x5= 25 Marks |
| II. | Experiment (Major) | 1x10= 10M |
| III. | Experiment (Minor) | 1x5= 05 M |
| IV. | Record+ Viva Voce | 10 M |

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, IV SEMESTER 2020-2021

PRACTICAL PAPER TITLE: PATHOLOGY IN AQUACULTURE
MODEL PAPER

Time: 3 Hours

MAX.MARKS: 50

- | | | |
|------|----------------------------|---------------|
| I. | Identification of Spotters | 5x5= 25 Marks |
| II. | Experiment (Major) | 1x10= 10M |
| III. | Experiment (Minor) | 1x5= 05 M |
| IV. | Record+ Viva Voce | 10 M |

ADIKAVI NANNAYA UNIVERISTY
B.VOC. INDUSTRIAL AQUACULTURE & FISHERIES
I YEAR, IV SEMESTER 2020-2021
PRACTICAL PAPER TITLE: ORNAMENTAL FISH CULTURE
MODEL PAPER

Time: 3 Hours

MAX.MARKS: 50

I.	Identification of Spotters	5x5= 25 Marks
II.	Experiment (Major)	1x10= 10M
III.	Experiment (Minor)	1x5= 05 M
IV.	Record + Viva Voce	10 M

ADIKAVI NANNAYA UNIVERSITY
B.VOC: Industrial Aquaculture & Fisheries
Semester-IV, 2020-2021
OJT (ON JOB TRAINING
MODEL PAPER

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