

ADITYA DEGREE COLLEGE (A)
Autonomous and NAAC Accredited with A++ Grade (3.66/4 CGPA)
KAKINADA
Dept. of Fisheries and Aquaculture
B.Sc., Fisheries

Course Structure

I SEMESTER				
S.No.		Name of the Course	Hr	Credits
1	Major	Introduction to Classical Biology	5	4
2		Introduction to Applied Biology	5	4
4	Language	English	4	3
5		Telugu/Hindi	4	3
	Multi.Dis	Introduction to Social Work	2	2
6	Skill Enhancement courses	Entrepreneurship Development	2	2
7		Communication Skills	2	2
		Total	24	20
II Semester				
1	Major	Taxonomy and Functional Anatomy of Fin Fish and Shellfish - (T)	3	3
		Practical	2	1
2		Biology of fin fish & shell fish - (T)	3	3
		Practical	2	1
3	Minor	Introduction to Microbiology	3	3
		Practical	2	1
4	Language	English	4	3
5		Telugu/Hindi	4	3
6	Skill Enhancement courses	Digital Literacy	2	2
7		Business Writing	2	2
		Total	27	22

Community service Project of 180 Hrs with 4 credits

Course Structure

I SEMESTER				
S.No.		Name of the Course	Hr	Credits
1	Major	Introduction to Classical Biology	5	4
2		Introduction to Applied Biology	5	4
4	Language	English	4	3
5		Telugu/Hindi	4	3
	Multi.Dis	Introduction to Social Work	2	2
6	Skill Enhancement courses	Entrepreneurship Development	2	2
7		Communication Skills	2	2
		Total	24	20

**ADITYA DEGREE COLLEGE (A)
KAKINADA**

**Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; I SEMESTER**

Course: 1: INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives:

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes:

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit 1: Introduction to systematics, taxonomy and ecology.

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

Unit 2: Essentials of Botany.

- 1.1. The classification of plant kingdom.
- 1.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 1.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4 Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
- 4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
- 4.3. Central Dogma of Molecular Biology.
- 4.4. Origin of life

Unit 5: Essentials of chemistry

- 5.1. Definition and scope of chemistry, applications of chemistry in daily life.
- 5.2. Branches of chemistry
- 5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.
- 5.4. Green chemistry

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of non flowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

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Course: 1: INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits: 4

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Unit	MCQ
Unit 1	15
Unit 2	15
Unit 3	15
Unit 4	15
Unit 5	10
Total	70x1 mark: 70 Marks

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Course: 1: INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits: 4

QUESTION PAPER TAXONOMY										
Level of Bloom's Taxonomy	Type of Question & m Assigned									
	MCQs		FIB		VSQ		MC		T/F	
	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE
Remembering	3 m	10 m								
Understanding	3 m	10 m								
Applying	4 m	10 m								
Analyzing					5 m	10 m				
Evaluating							5 m	10 m	5 m	10 m
Creating			5 m	10 m						

**ADITYA DEGREE COLLEGE (A)
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**Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; I SEMESTER**

Course: 2: INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology and Immunology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I – Carbohydrates, Lipids.
- 2.2. Biomolecules II – Amino acids & Proteins.
- 2.3. Biomolecules III – Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism – Anabolism and catabolism.

Unit 3: Essentials of Biotechnology

- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
- 3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.
- 3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

- 4.1. Applications in forensics – PCR and DNA fingerprinting
- 4.2. Immunological techniques – Immunoblotting and ELISA.
- 4.3. Monoclonal antibodies – Applications in diagnosis and therapy.
- 4.4. Eugenics and Gene therapy

Unit 5: Biostatistics and Bioinformatics

- 5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
- 5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.
- 5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment
- 5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5 th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding Microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

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Course: 2: INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5

Credits: 4

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Unit	MCQ
Unit 1	15
Unit 2	15
Unit 3	15
Unit 4	15
Unit 5	10
Total	70x1 mark: 70 Marks

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Hours/Week: 5

Credits: 4

QUESTION PAPER TAXONOMY										
Level of Bloom's Taxonomy	Type of Question & m Assigned									
	MCQs		FIB		VSQ		MC		T/F	
	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE
Remembering	3 m	10 m								
Understanding	3 m	10 m								
Applying	4 m	10 m								
Analyzing					5 m	10 m				
Evaluating							5 m	10 m	5 m	10 m
Creating			5 m	10 m						

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B.Sc., Fisheries
Course Structure

II Semester				
			Hr	Credits
1	Major	Taxonomy and Functional Anatomy of Fin Fish and Shellfish - (T)	3	3
		Practical	2	1
2		Biology of fin fish & shell fish - (T)	3	3
		Practical	2	1
3	Minor	Introduction to Microbiology	3	3
		Practical	2	1
4	Language	English	4	3
5		Telugu/Hindi	4	3
6	Skill Enhancement courses	Digital Literacy	2	2
7		Business Writing	2	2
		Total	27	22

ADITYA DEGREE COLLEGE (A)
KAKINADA
Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 3 Taxonomy and Functional Anatomy of Fin Fish and Shellfish
credits :3

Course Outcomes

1. Acquire knowledge on the Classification of major groups of Finfish and Shell fish
2. Students will be familiar with the general characters of Finfish and Shell fish
3. Gain knowledge on the structure and functions of Digestive system
4. Understand the difference between the brain of fish and prawn
5. Acquire knowledge on the functional anatomy of fish and prawn

Unit I: General characters & Classification of Cultivable fin fish and shell fish

- 1.1. General Characters of Crustacea
- 1.2. Classification of Crustacean: Major groups up to orders and their important characters.
- 1.3. General Characters of fishes
- 1.4. Classification of Fishes: Major groups up to subclass and their important characters.

Unit 2: Digestive and Respiratory systems of Fish and shell fish

- 2.1. Digestive system of fish
- 2.2. Respiratory system of fish
- 2.3. Digestive system of Prawn
- 2.4. Respiratory system of prawn

Unit 3: Circulatory systems of Fish and shell fish

- 3.1. Cardiovascular system: Structure of heart in fishes
- 3.2. Blood vascular system in prawn

Unit 4: Nervous system of Fish and shell fish

- 4.1. Nervous system in fish: Structure and functions of Brain
- 4.2. Central Nervous system in prawn.

Unit 5 Reproductive system of Fish and shell fish

- 5.1. Urino-genital system in fishes
- 5.2. Reproductive system in prawn

PRACTICALS

II SEMESTER

Course No.: 3 Taxonomy and Functional Anatomy of Fin Fish and Shellfish

Credits :1

1. Study of mouth parts in herbivorous and carnivorous fishes
2. Comparative study of digestive system of herbivorous and carnivorous fishes
3. Demonstration of brain of fish
4. Demonstration of cranial nerves of fish
5. Demonstration of Nervous system of prawn
6. Exposure of gills of prawn
7. Exposure of gills of fish

REFERENCE BOOKS

1. Bond E. Carl. 1979. Biology of Fishes, Saunders.
2. Halver JE. 1972. Fish Nutrition. Academic Press.
3. Hoar WS and Randall DJ. 1970. Fish Physiology, Vol. I-IX, Academic Press, New York.
4. Lagler KF, Bardach, JE, Miller, RR, Passino DRM. 1977. Ichthyology, 2nd Ed. John Wiley & Sons, New York.
5. Lovell J. 1989. Nutrition and Feeding of Fish. Van Nostrand Reinhold, New York.
6. Moyle PB and Joseph J. Cech Jr. 2004. Fishes: An Introduction to Ichthyology. 5 th Ed. Prentice Hall.
7. Nikolsky GV. 1963. Ecology of Fishes, Academic Press.
8. Norman JR and Greenwood PH. 1975. A History of Fishes, Halsted Press.
9. Potts GW and Wootten RJ. 1984. Fish Reproduction: Strategies and Tactics, Academic Press.

ADITYA DEGREE COLLEGE (A)
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Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 3 Taxonomy and Functional Anatomy of Fin Fish and Shellfish
credits :3

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Unit	Essays	Shorts
Unit 1	2	2
Unit 2	2	2
Unit 3	2	1
Unit 4	2	1
Unit 5	2	2
Total	10 Out of 10, 5 questions should be answered 5x10=50 Marks	8 Out of 8, 5 questions should be answered 5x4=20 Marks

ADITYA DEGREE COLLEGE (A)
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Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 3 Taxonomy and Functional Anatomy of Fin Fish and Shellfish
credits :3

SEMESTER END EXAMINATION MODEL QUESTION PAPER

SECTION-A

5x4=20 Marks

Answer any **FIVE** Questions

1. General characters of crustacean
2. Osteichthyes and chondrichthyes
3. Gills of Prawn
4. Types of Gills in Fishes
5. Physiology of Fish heart
6. Cranial Nerves in Fishes
7. Urino genital organs in Fishes
8. Prawn Reproductive organs

SECTION-B

5x10=50 Marks

Answer **ALL** Questions

9. a) Write in detail about General characters of Fishes.
(OR)
b) Write in detail about Classification of Crustaceans groups up to orders.
10. a) Write in detailed account on digestive system of Fish.
(OR)
b) Write about respiratory system of Prawn.
11. a) Discuss in detail about Fish heart.
(OR)
b) Write an account on blood vascular system in Prawns.
12. a) Discuss in detail about structure and function of fish brain.
(OR)
b) Write an account on central nervous system of prawn.
13. a) Discuss in detail about Reproductive system in Fishes.
(OR)
b) Write an account on reproductive system of prawn.

ADITYA DEGREE COLLEGE (A)
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Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 3 Taxonomy and Functional Anatomy of Fin Fish and Shellfish
Semester End Examination - Practical
credits :1

Time: 3 Hrs

Max.Marks: 50

I. Major Experiment	1x20 : 20 Marks
II. Minor Experiment	1x10 : 10 Marks
III. Identification of spotters	5x2 : 10 Marks
IV. Viva	5 Marks
V. Record	5 Marks

ADITYA DEGREE COLLEGE (A)
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Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 4 -Biology of Fin Fish & Shellfish
Credits:3

Course outcomes:

1. Gain Knowledge of feeding habits, gut content analysis and growth factors in fishes.
2. Understand the commercial importance of crustaceans and Fish
3. Understand and learn breeding in fishes, breeding habits, method of induced breeding in fishes.
4. To create awareness on parental care of Fishes and embryonic and larval development and environmental factors affecting development of major aquaculture organisms.
5. Acquire knowledge about Endocrine system in fishes.

SYLLABUS

UNIT- I: Specialised organs in fish

- 1.1. Sense organs of fishes and shrimps and crabs.
- 1.2. Specialized organs in fishes – electric organ, venom and toxins and its functions
- 1.3. Buoyancy in fishes- swim bladder and mechanism of gas secretion
- 1.4. Hepatopancreas in Prawn/Shrimp and crab.

UNIT- II: Food, Feeding and Growth

- 2.1. Natural fish food, feeding habits, feeding intensity, stimuli for feeding, utilization of food, gut content analysis, GST & VSI in fishes and forage ratio
- 2.2. Types of Fish Scales, Principles of Age and growth determination; growth regulation, Growth rate measurement – scale method, otolith method, skeletal parts as age indicators
- 2.3. Meristic and Morphometric characters in Fishes, Length-frequency method, age composition, age-length keys and annual survival rate.
- 2.4. Length-weight relationship in Fishes

UNIT- III: Reproductive Biology

- 3.1. Breeding in fishes, breeding places, breeding habits & places, breeding in natural environment and in artificial ponds, courtship and reproductive cycles
- 3.2. Induced breeding in fishes
- 3.3. Breeding in shrimp, oysters, mussels, clams & pearl oyster.

UNIT- IV: Development

- 4.1. Parental care in fishes, ovo-viviparity, oviparity, viviparity, nest building and brooding
- 4.2. Embryonic and larval development of fishes
- 4.3. Embryonic and larval development of shrimp, crabs and other crustaceans.
- 4.4. Environmental factors affecting reproduction and development of cultivable aquatic fin & shell fish

UNIT- V: Hormones & Growth.

- 5.1. Endocrine system in fishes.
- 5.2. Neuro-secretory cells, androgenic gland, ovary, chromatophores,
- 5.3. Molting, molting stages, metamorphosis in crustacean shell fish

II SEMESTER
Course No.: 4 -Biology of Fin Fish & Shell Fish
credits :1

PRACTICALS

1. Length-weight relationship of fishes
2. Gut content analysis in fishes and shrimp
3. Mouth parts and appendages of cultivable prawns, shrimps and other crustaceans
4. Study of eggs of fishes, shrimps, prawns and other crustaceans
5. Study of oyster eggs
6. Embryonic and larval development of fish
7. Study of gonadal maturity and fecundity in fishes and shellfish
8. Observation of crustacean larvae 9. Study of nest building and brooding of fishes

PRESCRIBED BOOK(S)

1. Bone Q et al., 1995. Biology of fishes, Blackie academic & professional, LONDON.
2. Saxena AB 1996. Life of Crustaceans. Anmol Publications Pvt.Ltd., New Delh

REFERENCES:

1. Tandon KK & Johal MS 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing House, New Delhi.
2. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
3. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology and Management.
4. Barrington FJW 1971. Invertebrates: Structure and Function.ELBS
5. Parker F & Haswell 1992. The text book of Zoology, VolI. Invertebrates (eds. Marshal AJ & Williams). ELBS & Mc Millan & Co.

ADITYA DEGREE COLLEGE (A)
KAKINADA
Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 4 -Biology of Fin Fish & Shellfish
Credits:3

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Unit	Essays	Shorts
Unit 1	2	2
Unit 2	2	2
Unit 3	2	1
Unit 4	2	1
Unit 5	2	2
Total	10 Out of 10, 5 questions should be answered 5x10=50 Marks	8 Out of 8, 5 questions should be answered 5x4=20 Marks

ADITYA DEGREE COLLEGE (A)
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Dept. of Fisheries and Aquaculture
B.Sc., Fisheries; II SEMESTER
Course No.: 4 -Biology of Fin Fish & Shellfish
Credits:3

SEMESTER END EXAMINATION MODEL QUESTION PAPER

SECTION-A

Answer any FIVE Questions

4X5=20 Marks

1. Electric organs in Fishes
2. Buoyancy in fishes
3. GSI & VSI
4. Scale and otolith method
5. Breeding shrimp
6. Larval development of Fishes
7. Chromatophores in fishes
8. Pituitary Gland

SECTION-B

5X10=50 Marks

Answer ALL Questions

9. a) Write an account on Sense organs of fishes.
(OR)
b) Write in detail about hepatopancreas in Shrimps.
10. a) Write in detailed account on gut content analysis of Fish.
(OR)
b) Write about Length-weight relationship in fishes.
11. a) Discuss in reproductive cycles in Fishes.
(OR)
b) Write an account on Induced Breeding in Fishes.
12. a) Discuss in detail about Parental care in fishes.
(OR)
b) Write an account on Environmental factors affecting reproduction and development.
13. a) Discuss in detail about Parental care in fishes.
(OR)
b) Write an account on molting process in shell fishes.

**ADITYA DEGREE
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KAKINADA
Dept. of Fisheries and
Aquaculture B.Sc.,
Fisheries; II
SEMESTER
Course No.: 4 -Biology of Fin
Fish & Shellfish Semester
End Examination - Practical**

Credits:1

**Time: 3 Hrs
50**

Max.Marks:

VI. Major Experiment	1x20 : 20 Marks
VII. Minor Experiment Marks	1x10 : 10
VIII. Identification of spotters Marks	5x2 : 10
IX. Viva	5 Marks
X. Record	5 Marks