

**Chattogram Veterinary and Animal Sciences University**  
**Faculty of Fisheries**

**Department of Fish Biology and Biotechnology**

MS in Fish Biology and Biotechnology, January-June Semester, Final Examination' 2023

Course Code: **BAA-501 (T)**, Course Title: **Biology of Aquatic Animals (Theory)**

Total Marks: 40

Time: 2 hours

Answer any FIVE questions. Illustrate your answer wherever necessary. The figure in the right margin indicates full marks.

1. a. Name the at least four (04) commercially important catfish family with examples. 2  
b. Discuss the life history pattern of African catfish. 4  
c. What are the potential impacts of snakeheads to aquatic environment? 2
2. a. Describe the secondary sexual characteristics and sexuality of seabass. 4  
b. Do seabass protect their fry? – explain. 2  
c. Why does seabass change their sexes in a certain period of their life? 2
3. a. Differentiate between turtle and tortoise. 2  
b. Briefly describe the life cycle of *Chelonia mydas*. 3  
c. Illustrate the developmental stages of *Penaeus monodon*. 3
4. a. Write down the food and feeding habit, age and growth of *Mugil cephalus*. 2  
b. Write the post spawning behavior of Atlantic salmon. 2  
c. Differentiate between crocodile and alligator. 2  
d. What do you know about the metamorphism of *Bufo viridis*? 2
5. a. Compare and contrast between the sexual dimorphism and reproductive behavior of dolphin and blue whale. 5  
b. How blue whale maintain the overall health of the marine ecosystem? 3
6. a. Write the taxonomic classification of freshwater eel. 2  
b. Briefly describe the pre-spawning behavior of Cichlids. 2  
c. Illustrate the life cycle of mudskippers. 4
7. a. Define amphidromous migration and potamodromous migration? 2  
b. What are the preconditions of fish migration? 2  
c. Compare the migratory pattern of *Tenualosa ilisha* and *Anguilla bengalensis*. 4



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Course Code: **AFP-501 (T)**, Course Title: **Advanced Fish Physiology (Theory)**

Total Marks: 40

Time: 2 hours

Answer any FIVE questions. Illustrate your answer wherever necessary. The figure in the right margin indicates full marks.

1. a. Define stress physiology. 1  
b. "Stress can induce a variety of internal and external changes in fish"-explain. 5  
c. How does fish blood parameters affect during anoxic condition? 2
2. a. Sketch the structure of respiratory organs of the teleost, elasmobranch, and agnathan. 3  
b. What do you know about countercurrent gaseous exchange system? 2  
c. Discuss the cardio-vascular system of hagfish. 3
3. a. What do you know about RMR, FMR and SMR? 2  
b. Discuss the measurement of energy metabolism of Perciforms. 4  
c. What is meant by  $Q = aw^b$ ? 2
4. a. Differentiate between afferent branchial arteries and efferent branchial arteries. 2  
b. Give a schematic representation of major arteries and veins of a teleost. 3  
c. Discuss the transport of CO<sub>2</sub> and O<sub>2</sub> in fish blood. 3
5. a. Schematically show the ventilatory cycle of teleost fish. 4  
b. Describe the adaptive response to cellular hypoxia, exhaustion, and freezing condition in teleost. 4
6. a. Define homeostasis. 1  
b. What kind of physiological changes occurs in fish during migration? 2  
c. Illustrate the water homeostasis of bull shark and minor carp. 5
7. a. How fish can be categorized based on their food habit? 2  
b. Discuss the feeding adaptation found in gill, teeth, stomach, and intestine in fish. 4  
c. Name at least five (05) anesthetic agents used in fisheries science. 2



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Course Code: **FGE-501**, Course Title: **Fish Genetic Engineering**

Total Marks: 40

Time: 2 hours

Answer any FIVE questions. Illustrate your answer wherever necessary. The figure in the right margin indicates full marks.

1. a) What do you understand by genetic engineering and biotechnology? 2  
b) Differentiate between GMO and LMO. 2  
c) Write down the applications of genetic engineering in real life. 4
2. a) What do you understand by the term plasmid, vector and ligase? 2  
b) Write down the importance of cloning in biological and medical science. 2  
c) Diagrammatically show the steps of cloning in *E. coli*. 4
3. a) What do you know about the enzyme reverse transcriptase? 2  
b) Enumerate the synthesis procedure of cDNA with diagram. 6
4. a) Explain the following term: T<sub>m</sub>, primer dimer, and dNTP. 2  
b) Design a forward and a reverse primer for the following sequence in the marked position- 3  
AATGGGAGTTGGGTTGATAACCGGAAAAAGTGTTTGGCCATTGACGACAGTC  
TAGGGATCAGTTACGCCGTTGGCTTTAAGGCTAACTTACATTCTGACTCGGAT  
GAAGCTTTCGGACGCGGGACTGCAGACGGGATTGGGAGTGGAGGCCCTTCAGG  
CTTGTAGCCTTTCGCACGAGCGGAGTTCCAACGGAACAAGCTTCGATTTAAAC  
AGAGTCAACTATGAGGAGCCAAGACATGAGGGGTGGAGCCCAAATCTGGCGA  
GAAAGATTGGACCTGTATCATCACCATCATTGTGAA  
c) Prepare a 50 nmol/ml stock solution for a primer having the 10.3 nmol concentration using TE buffer. 3
5. a) What do you understand by the DNA library? 2  
b) Write down the advantage of genomic DNA library. 2  
c) Diagrammatically show the construction of genomic DNA library. 4
6. a) What do you understand by the term restriction enzyme, recognition site and restriction fragment? 3  
b) If BamH I cuts the following sequence, what will be the resulting fragment? 3  
CATACGTAGGATCCTACGTCATTA  
c) Differentiate between blunt end and sticky end. 2
7. a) What are the characters of fish you will choose for the transgenic modifications in your target species? 2  
b) What will be the source of the engineered genes in fish? 2  
c) Point out and discuss some major drawbacks of transgenesis with example. 4
8. a) What do you know about bioethics in genetic engineering? 2  
b) Briefly describe the key aspects of biosafety in genetic engineering especially for the transgenic fishes. 6



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Course Code: **PCG-501**, Course Title: **Fish Population and Conservation Genetics**

Total Marks: 40

Time: 2 hours

Answer any FIVE questions. Illustrate your answer wherever necessary. The figure in the right margin indicates full marks.

1. a) What do you understand by the term genetic drift, gene flow and natural selection? 3  
b) Differentiate between genetic drift and natural selection. 2  
c) Enlist the causes and consequences of founder effect. 3
2. a) Summarize the major conservation methods for the overexploited and endangered fish species of Bangladesh. 8
3. a) What do you know about molecular marker? 2  
b) Write down the principles of microsatellite marker. 3  
c) Point out the advantage of microsatellite marker. 3
4. a) What do you mean by cryopreservation? 1  
b) Mention the benefits of cryopreservation techniques in conservation genetics. 2  
c) Briefly describe the steps of cryopreservation of fish sperm. 5
5. a) State the principle of Hardy-Weinberg equilibrium. 2  
b) Enlist the assumptions of Hardy-Weinberg equilibrium. 2  
c) If, 285 out of 570 individuals in a population express the recessive phenotype, what percent of the population would you predict would be heterozygote? 4
6. a) What do you understand by the term genetic distance? 2  
b) Enlist the major techniques for calculating genetic distance in population genetics. 3  
c) Point out the challenges, limitation and future perspectives of genetic distance in biotechnology. 3
7. a) What do you know about agarose? 2  
b) What will be the percentage of agarose for 200bp DNA product? 2  
c) Write down the principles of agarose gel electrophoresis. 4



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Course Code: **FEN-501 (T)**, Course Title: **Fish Endocrinology (Theory)**

Total Marks: 40

Time: 2 hours

Answer any FIVE questions. Illustrate your answer wherever necessary. The figure in the right margin indicates full marks.

1. a. Define hormone and enzyme. 2  
b. Describe the synthesis, release, and transport of steroid hormones in fish. 6
2. a. Write down the functions of LH, FSH, ABP and calcitonin in fish. 2  
b. Describe the HPG axis of the teleost. 3  
c. Draw and label the histological structure of fish testes and ovary. 3
3. a. What are the roles of ribosome and golgi bodies during synthesis of peptide hormone? 2  
b. What do you know about negative feedback regulation of hormone? 2  
c. Enlist the name of hormones that are synthesized from pituitary gland and pancreas of fish. 2  
d. Give an account of the G-protein coupled receptor (GPCR). 2
4. a. Define neuroendocrinology and neurosecretion. 2  
b. Discuss the roles of dopamine and serotonin in different groups of fishes. 3  
c. What is autonomic innervation? Briefly describe the autonomic innervation of adrenal gland in fish. 3
5. a. What do you know about hormonal regulation of testicular function? 2  
b. Differentiate between spermiation and ovulation. 2  
c. Illustrate the endocrine regulation of male reproductive system of sturgeon fish. 4
6. a. Define circadian rhythms. 1  
b. Diagrammatically show the position endocrine glands found in a typical fish body. 2  
c. What do you know about the histophysiology of thyroid gland? 2  
d. How does the pineal gland regulate circadian cycle in fish? 3
7. a. Define vitellogenesis? Illustrate the vitellogenesis process of carps. 4  
b. Discuss the endocrine regulation of ovarian maturation in fish with appropriate figure. 4



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Course Code: RDA-501, Course Title: Research Design and Genetic Data Analysis

Total Marks: 40

Time: 2 hours

Answer any FIVE questions. Illustrate your answer wherever necessary. The figure in the right margin indicates full marks.

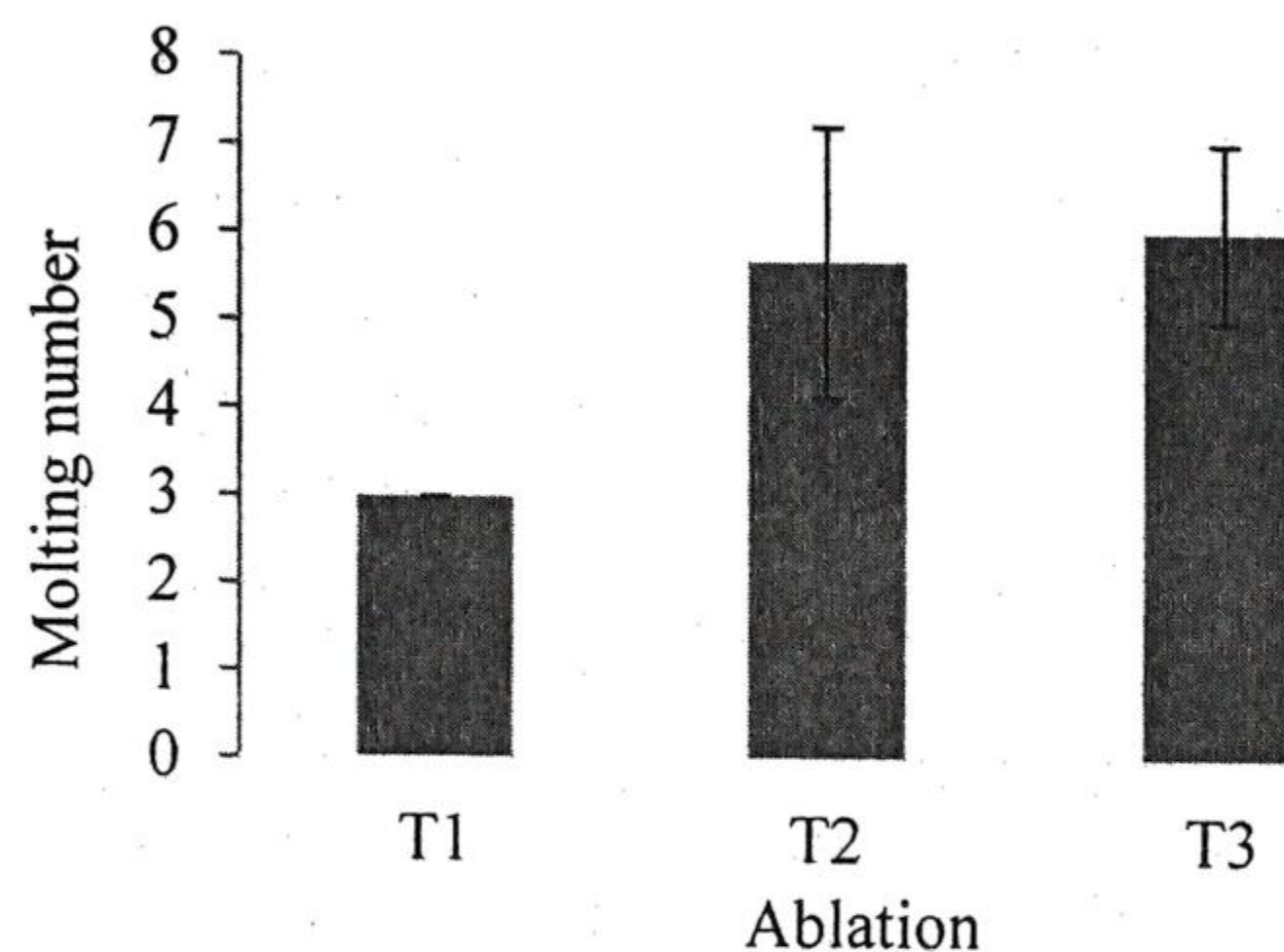
1. a) What do you understand by research design and data analysis? 2  
b) Enlist some commonly used software in data analysis. 3  
c) Point out the key component of an experimental design. 3
2. a) What do you know about Chi-square test? 2  
b) In a cross between two heterozygotes red fleshed Chinook salmon, 245 offspring were found which were grouped into following 2 phenotypically different flesh colour categories: 6
  - Red fleshed Chinook salmon: 145
  - White fleshed Chinook salmon: 110

Show, weather the data fit for the nearest phenotypic ratio or not. (The tabulated value is 3.841 for 1 degree of freedom at 5% level of significance).

3. a) Following table shows the ANOVA results after Tukey HSD post hoc test for the molting data of shrimp among three different group (no ablation, unilateral ablation and bilateral ablation). 5

Tukey HSD	Group	N	Subset for alpha = 0.05	
			1	2
	1	10	10.00	
	2	10		13.33
	3	10		14.67
	Significance		1.000	0.441

Interpret the results and denote different superscripts for three different treatment group for the following graphs.



- b) Write down the assumptions of single factor ANOVA. 3
4. a) What do you understand by the term correlation and regression? 2  
b) Compare and contrast between correlation and linear regression. 3  
c) In a given data for length-weight relationship of *Liza parsia*, *Liza tade* and *Mugil cephalus*, the correlation analysis shows the *r* value as 0.98, 0.35 and 0.78. Interpret the correlation between length and weight. 3



5. a) Briefly discuss the major factors for the deviations of Hardy-Weinberg equilibrium. 3  
 b) If 81% of a population is homozygous recessive for given trait. 5  
 (i) Calculate the frequency of homozygous dominant  
 (ii) Calculate the frequency of heterozygous

6. a) Explain the following terms: data, variable, sample, and hypothesis? 2  
 b) What do you know about standard deviation, standard error and t-test? 3  
 c) Differentiate between standard deviation and standard error. 3

7. a) Calculate and interpret the following data set of GnRH gene expression using  $\Delta\Delta Ct$  methods. 5

Sample	$\beta$ actin		GnRH	
	Ct 1	Ct 2	Ct 1	Ct 2
Control 1	18.3	18.5	19.2	19.4
Control 2	18.1	18.9	19.4	19.7
Control 3	18.6	18.7	19.3	19.2
Treatment 1	19.0	18.8	21.2	21.3
Treatment 2	18.9	18.6	21.5	21.9
Treatment 3	18.7	18.1	21.8	21.4

- b) Enlist the application of  $\Delta\Delta Ct$  analysis in biotechnology. 3
8. a) What do you know about mean, median and mode? 3  
 b) Calculate the mean, median and mode for the following data set of anesthesia time (sec) of *Mystus gulio*. 5

63, 45, 76, 89, 56, 49, 81, 68, 92, 88, 71, 59, 102, 47, 55, 72, 83, 50, 67, 79, 91, 97, 70, 44, 69, 62, 73, 80, 88, 93, 100, 55, 48, and 77