

**Chittagong Veterinary and Animal Sciences University, Chittagong**  
**Faculty of Fisheries**

**B.Sc. Fisheries (Hons.), Year-02, Semester-02 (July – December), Final Examination' 2016**

**Course Code: FPH-202 (T); Course Title: Fish Physiology**

**Full Marks: 70; Time: 3 hours**

*Figure in the right margin indicates the full mark. Answer any 05 (five) questions from each section. Use separate answer script for each section.*

**Section –A**

1. a) Distinguish between poikilothermy and homeothermy. 2.0  
b) What do you know about endothermy in fishes? 2.0  
c) How do homeothermic animals regulate their body temperature? 3.0
2. a) Define metabolism with their phases. 2.0  
b) Write down the different stages of catabolism. 2.0  
c) Briefly describe the physical factors of metabolism. 3.0
3. a) What do you know about fish blood? 2.0  
b) Distinguish between open circulatory system and closed circulatory system. 3.0  
c) Write down the components of fish RBC and WBC. 2.0
4. a) What do you mean by hypertonic and hypotonic solution? 2.0  
b) Briefly describe the osmoregulatory mechanisms of a marine fish with diagram 5.0
5. a) Define gametogenesis. 1.0  
b) Briefly explain the oogenesis. 4.0  
c) Give a schematic representation of the Hypothalamic- Pituitary- Gonadal axis in fish. 2.0
6. a) What do you mean by gonadal maturation? 1.0  
b) Enlist the environmental and hormonal factors involved in reproduction. 3.0  
c) Diagrammatically show the interrelationship among the environmental factors, endocrine organs and reproduction. 3.0
7. Write short note on any 02 (two) of the following: 3.5×2=7.0  
a) Bowman's capsule; b) Accessory respiratory organ; c) Vitellogenesis; and d) Bohr effect

**Section B**

8. a) What do you mean by digestion and digestive system? 2.0  
b) How different food molecules are absorbed in fish body? 3.0  
c) Write down the role of bile in digestion. 2.0
9. a) What do you mean by circulatory system? 2.0  
b) Briefly describe the blood circulatory process in fish with diagram. 5.0
10. a) Define excretion. 1.0  
b) Classify fish kidney on the basis of configuration. 5.0  
c) Write down the function of kidney. 1.0
11. a) Define respiration and respiratory volume. 2.0  
b) Why gill is primary respiratory organ in fish? 3.0  
c) Differentiate between unimodal and bimodal organisms. 2.0
12. a) Define breeding behavior. 1.0  
b) Briefly describe the breeding behavior of three spine stickleback. 6.0
13. a) Define osmoregulation. 1.0  
b) How does a freshwater fish maintain osmotic regulation? 6.0
14. Write notes on any 02 (two) of the following: 3.5×2=7.0  
a) Fick's law of diffusion; b) Chyme; c) Negative feedback; and d) Pituitary gland.

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**Faculty of Fisheries**

**B. Sc Fisheries (Hons.), Year -02, Semester-02 (July-December), Final Examination, 2016**

**Course Code: FPA-202(T), Course Title: Fish Parasitology**

**Full Marks: 70, Time: 3 hours**

*Figure in the right margin indicates the full mark. Answer any 05 (five) questions from each section. Use separate answer script for each section.*

**Section-A**

1. a. What do you understand by parasitism and parasitic infestation? 2  
b. Discuss different types of host-parasitic relationship with special reference to fish host with examples. 5
2. a. Name the parasitic group of fish known to infest the external surface of fish. 2  
b. Describe the identity of flatworm, spiny headed worm and round worm. Give diagrams and examples from each group. 5
3. a. What is 'Ich'? 1  
b. Illustrate its life cycle development. 3  
c. Describe its effects on host fish in relation to clinical signs, pathology and control measures. 3
4. Describe two protozoan and three metazoan parasitic diseases of fish with their causative agents, symptoms, prevention and control measures. 7
5. a. Distinguish between temporary and permanent parasitism. 2  
b. Describe different types of permanent parasitism with example. 5
6. a. What are the main sources of health hazards associated with fish culture? 2  
b. Enlist the name of some important fish borne zoonotic diseases with its causative agents. 5
7. Write short notes on **any 02 (two)** of the following: 3.5X2=7  
a. Prophylaxis and therapy  
b. Host specificity  
c. Parasite as indicator of pollution

**Section-B**

8. a. Define prevalence and mean intensity. 2  
b. Briefly describe the ecological parameters those are used in parasitological studies. 5
9. Discuss the following diseases with causative agent, sign and control measures: 7  
i. Dactylogyrosis; ii. Gyrodactylosis
10. a. Distinguish between definitive host and final host. 2  
b. Describe the cell and tissue reactions of host due to parasitic infestation. 5
11. a. Define stress. 2  
b. What are the symptoms of a stressed fish? 2  
c. Describe the mechanism of disease production from stress condition. 3
12. a. Define symbiosis and symbionts. 3  
b. Describe with examples the various types of symbiosis found in nature. 4
13. a. What do you know about immunity and defense mechanism? 2  
b. Briefly describe the preventive measures those can be taken to improve the defense mechanism of fish host. 5
14. Write short notes on **any 02 (two)** of the following: 3.5X2=7  
a. Infrapopulation and suprapopulation  
b. Control of aquatic vector  
c. Biological stressors

**Chittagong Veterinary and Animal Sciences University, Chittagong**  
**Faculty of Fisheries**

**B.Sc. Fisheries (Hons.), Year-02, Semester-02 (July – December), Final Examination' 2016**  
**Course Code: FPD-202 (T); Course Title: Fish Population Dynamics**  
**Full Marks: 70; Time: 3 hours**

*Figure in the right margin indicates the full mark. Answer any 05 (five) questions from each section. Use separate answer script for each section.*

**Section –A**

1. a. Define Fish Population and Fish Population Dynamics. 3  
 b. How does the number of individuals of a fish population fluctuate? Explain diagrammatically. 4
2. a. What is unit stock? Mention at least two cases where individuals of a fish species living in a greater geographical area exist as only one stock. 3  
 b. Define fishing effort, catch per unit effort (CPUE), catchability coefficient and vulnerability. 4
3. a. What is catchability coefficient? How does it vary? 2  
 b. What is the assumption to be made in running the depletion method? 2  
 c. A research vessel completes a standard trawl at 41 station on a unit stock distributed over an area of 360 km<sup>2</sup>. The trawl net has an effective width of 20m and was towed at a velocity of 8 Km/h for 20 minutes at each station. The mean catch per trawl was 64 Kg and the standard error of the mean ( $\frac{s}{\sqrt{n}}$ ) was 18, Assuming that vulnerability of fish to the trawl net is 50 percent (v=0.5), use the swept area method to estimated the total stock size with 95% confidence limits. 3
4. a. What do you mean by selectivity of fishing gear? 1  
 b. Define L<sub>C</sub>. 1  
 c. An experiment involving covering the codend of a trawl net with a cover made of smaller mesh netting producing the following small sample. Make a initial estimate of the mean length at first capture, L<sub>C</sub>. 5

Length (cm)	10	11	12	13	14	15	16	17	18
Frequency (cover)	2	24	27	26	35	22	12	5	0
Frequency (codend)	0	3	8	11	26	47	72	67	48

5. a. How is the cumulative catch proposed for adjustment in depletion methods? 3  
 b. The catchability coefficient of a crab stock of 24 Km<sup>2</sup> is 0.001. If a survey of an adjacent larger stock of 150 Km<sup>2</sup> resulted in CPUE of 15.6 crabs per trap, estimate the stock size in this larger area. 4
6. a. Define L<sub>m</sub>. 1  
 b. What is GSI? 1  
 c. Estimate the mean length at sexual maturity (L<sub>m</sub>) of the sample of female Tiger prawn (*Penaeus semisulcatus*) in the Persian gulf. Using the following data. 5

Total length (cm)	Total number in sample	Number ripe
12.5	109	5
13.5	73	7
14.5	42	10
15.5	48	21
16.5	321	158
17.5	458	215
18.5	771	396
19.5	535	280
20.5	180	85
21.5	29	18

7. a. Mention the three models, which describe stock recruitment relationship. 1  
 b. Discuss them all with the equations and graphical representation. 6

**Section –B**

8. a. Describe various kinds of data used for the estimation of population parameters. Discuss their merits and demerits. 4  
 b. How the losses due to death balanced in an exploited population? What happens when the population is fished at high level? 3
9. a. Write down the names of three computer softwares used in population dynamics study. 2  
 b. Following table presents five modal lengths for a hilsha shad population. Estimate the von Bertalanffy growth parameters K and  $L_{\infty}$ . 5

Mode	1st	2nd	3rd	4th	5th
Length (cm)	18	24	29	32	35

10. a. What do you mean by isometric growth? 2  
 b. Write down the power curve equation. Derive the straight line equation from length weight relationship. 2  
 c. Define condition factor. What is its usefulness? 3
11. a. Name six methods by which spawning season of fish could be determined. 3  
 b. Describe briefly how you estimate fecundity of a mature female individual. 4
12. a. How is dietary energy used by the fish? 1  
 b. What is  $L_{\infty}$ ? 1  
 c. Derive the equations to estimate the parameters of von Bertalanffy growth model. 5
13. a. What is  $L_r$ ? 1  
 b. Discuss the factors that influence recruitment. 3  
 c. Illustrate a generalized life history triangle for fishes. What are the event and inter event phases of life history of exploited species? 3
14. a. Draw a comparison between age-based catch curve and length based catch curve. 3  
 b. Estimate the natural mortality rate of a fish population using data of fishing effort and annual total mortality (Z) shown in the table below: 4

Year	1	2	3	4
Effort (h)	1360	2800	3640	4120
Z ( $\text{yr}^{-1}$ )	0.56	0.54	0.79	0.89

# Chittagong Veterinary and Animal Sciences University, Chittagong

## Faculty of Fisheries

B. Sc Fisheries (Hons.), Year -02, Semester-02 (July-December), Final Examination, 2016

Course Code: FOC-202 (T), Course Title: Fisheries Oceanography

Full Marks: 70, Time: 3 hours

Figure in the right margin indicates the full mark. Answer any 05 (five) questions from each section. Use separate answer script for each section.

### Section-A

1. a. 'Oceanography' is a multidisciplinary subject- explain the statement. 2.0  
b. Compare among the terms Bay, Gulf and Ocean. 2.0  
c. Briefly describe how turbidity, currents, submarine canyons and continental rise are very much interrelated terms in ocean bottom topography. 3.0
2. a. What do you mean by fisheries oceanography? 1.0  
b. Mention the marine fisheries resources of Bangladesh. 2.0  
c. Draw a map and mark the important fishing grounds of Bangladesh's EEZ. 4.0
3. a. Seawater but not pure water has the colligative properties. What are these colligative properties of seawater? 2.0  
b. 'Seawater heat capacity is less than pure water'. Justify the statement. 2.0  
c. Show in diagram how the salt is added and lost in oceanic environment. 3.0
4. a. What do you know about flood tide and ebb tide? 2.0  
b. Classify tide on the basis of tidal bulging. 3.0  
c. Tide is principally one kind of wave. Justify the statement. 2.0
5. a. Show a typical food-web of the marine environment. 2.0  
b. Why bottom water of the ocean contains more nutrients? 2.0  
c. How nutrient-rich water reach the surface? 3.0
6. a. Compare different types of waves based on period, source, wavelength and depth of influences. 3.0  
b. Briefly describe the mechanism of wave formation. 4.0
7. Write short notes on *any 02 (two)* of the following: 3.5×2=7.0  
a) Longshore current b) Challenger expedition c) Coriolis effect d) World ocean

### Section: B

8. a. Define fish migration. Why do they migrate? 2.0  
b. Classify different types of fish migration we observed in various ecosystems. 3.0  
c. What are the 'cost' and 'benefits' of fish migration? 2.0
9. a. 'Fisheries oceanography is a young subject'- justify the statement. 2.0  
b. What are the characters and dynamic properties used to identify the new fishing ground? 3.0  
c. What do you know about straddling species? 2.0
10. a. Name the marine regulations of marine fishing in Bangladesh. 3.0  
b. What do you know about FAO's 'Code of Conduct for Responsible Fisheries'? 4.0
11. a. In many oceans water colours look very attractive blue. Why some ocean colours appear blue in our eyes? 2.0  
b. 'The ratio of dissolved solids in the ocean is constant'- justify the statement. 2.0  
c. Briefly describe the factors affecting the salinity of sea and ocean water. 3.0
12. a. What do you know about spring tide and neap tide? 2.0  
b. Briefly describe how tide affects the marine life? 2.0  
c. Discuss how gravitational and centrifugal force produce tide. 3.0
13. a. What do you know about the gulf stream? 2.0  
b. What are the impacts of gulf stream on climate? 2.0  
c. Write down the mechanism of coastal upwelling. 3.0
14. Compare *any 03 (three)* among the following terms: 7.0  
a) Constructive wave and destructive wave  
b) Oceanic crust and continental crust  
c) Seamount, knoll and pinnacle  
d) Catadromous, potamodromous and oceanodromous species

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**Faculty of Fisheries**

**B.Sc. Fisheries (Hons.), Year-02, Semester-02 (July – December), Final Examination' 2016**

**Course Code: CZM-202 (T); Course Title: Coastal Zone Management**

**Full Marks: 70; Time: 3 hours**

*Figure in the right margin indicates the full mark. Answer any 05 (five) questions from each section. Use separate answer script for each section.*

**Section –A**

1. a. What do you mean by Integrated Coastal Zone Management (ICZM)? 1.0  
b. Draw the coastal map of Bangladesh showing three district zone boundaries. 3.0  
c. Briefly describe the use of southeastern coastal zone of Bangladesh. 3.0
2. a. What do you mean by coastal zone and coastal zone management? 2.0  
b. What are the objectives and goals of the responsible coastal planning and management? 2.0  
c. Sketch the coastal morphology with brief discussion. 3.0
3. a. World's poor are crowded in the coastal area. Explain the statement. 2.0  
b. What is the landward and seaward boundary of coastal zone in Bangladesh and Myanmar? 2.0  
c. Enumerate the issues related to biodiversity loss in the coastal zone of Bangladesh. 3.0
4. a. Goods and Services of mangroves create an ecologically sustainable shore management. Explain the statement. 3.0  
b. Briefly discuss the waste on the aquatic environment of coast. 4.0
5. a. Define Sustainable Livelihood Approach (SLA). 1.5  
b. Illustrate the asset categories of Sustainable Livelihood Approach. 2.5  
c. Design the DFID approach to livelihood in the field of Sustainable Livelihood Approach. 3.0
6. a. Briefly describe the shore protection options with examples. 3.0  
b. What are the roles of mangrove forest in reducing destruction by cyclones and storm surges? 2.0  
c. What are the major causes of mangrove forest destruction in Bangladesh? 2.0
7. a. What do you mean by strategic planning in coastal zone management? 2.0  
b. What are the roles of strategic planning in coastal zone management? 2.0  
c. Industrial development deteriorates the coastal hydrological condition. Justify the statement. 3.0

**Section –B**

8. a. Define Bogle and Ballast water. 2.0  
b. What is the significance of ICZM for the coastal development of Bangladesh? 2.0  
c. Briefly discuss about the present status of coastal zone of Bangladesh.
9. a. What do you know about coastal zone management plan? 1.0  
b. Discuss seven tier management of the coastal zone. 3.0  
c. Illustrate the vulnerability management life cycle. 3.0
10. a. Land-Sea interaction influences the coastal zone with act as a system. Explain statement. 3.0  
b. Briefly discuss the boundaries of coastal zone. 2.0  
c. What do you know about archipelagic concept? 2.0
11. a. Give a short description on the land use pattern change of Chakaria Sunderban. 4.0  
b. What are the natural and anthropogenic causes of coastal land use changes? 3.0
12. a. What do you know about resilience? 1.0  
b. What are the key features of poverty and vulnerability among the coastal communities of Bangladesh? 3.0  
c. Illustrate the zoning extent of coastal zone. 3.0
13. a. What do you mean by restoration? 1.0  
b. Discuss the importance of GIS techniques to design a sustainable coastal zone planning and management. 3.0  
c. Briefly discuss about management mechanisms or assessment tools of coastal zone management. 3.0
14. Write short notes on any 02 (two) of the followings: 3.5x2=7.0  
a. Salt production technique; b. Marine protected areas; c. Guiding principles of SLA;  
d. Policy formation for CZM.

# Chittagong Veterinary and Animal Sciences University, Chittagong

## Faculty of Fisheries

**B. Sc Fisheries (Hons.), Year -02, Semester-02 (July-December), Final Examination' 2016**

**Course Code: FMI-202 (T), Course Title: Fisheries Microbiology**

**Full Marks: 70, Time: 3 hours**

*Individual part of a question should be answered together. Answer any 05 (five) questions from each section. Use separate answer script for each section.*

### Section-A

1. a. Define Microbiology. How will you use the knowledge of microbiology in the field of Fisheries science? 3
- b. "Microbiology is a multidisciplinary science"- explain. 4
2. a. "Spontaneous generation" was a matter of controversy at the early history of Microbiology- why? 3
- b. What do you know about the germ theory of disease? 2
- c. Write down the significant contributions by the father of Microbiology. 2
3. a. Write down the fundamental differences between prokaryotic and eukaryotic cells. 2
- b. How do you define aquatic bacteria? Describe the salient characteristics of marine bacteria. 5
4. a. Compare the biochemical characteristics of Gram positive and Gram negative bacterial cell wall. 4
- b. Classify bacteria on the basis of oxygen requirement and arrangements of flagella on the surface of the bacterial cell with examples. 3
5. a. Give examples of a pathogenic mold, antibiotic producing mold, film yeast and beer yeast. 1
- b. Describe one septate mold having industrial and economic importance. 2
- c. How do you distinguish true yeast and false yeast? Describe one industrially important true yeast. 4
6. a. Why bacterial spores are called cryptobiotic? 1
- b. Define sanitary index organisms. Why they are called so? 2
- c. Show the steps of endospore formation in a bacterial cell with labeled diagram. 4
7. a. Explain whether viruses are living or non-living. 2
- b. What is capsid and envelope of a virion? 2
- c. Classify viruses according to Baltimore with examples. 3

### Section-B

8. a. Differentiate between flagella and fimbriae. 2
- b. Write down the distinguishing characteristics of the following genera with their industrial importance: 5
- i) *Clostridium*; ii) *Lactobacillus*
9. a. Why viruses are called obligate intracellular parasites? Write down the host ranges of virus. 2
- b. Draw and label a typical viral particle. 2
- c. Give five examples each for DNA and RNA viruses. 3
10. a. What are the basic differences between bacterial and piscine growth? 2
- b. What is generation time of microorganisms? Write down the generation time of bacteria, mold and yeast. 1
- c. How nutrients,  $p^H$  and  $a_w$  affect microbial growth? 4
11. a. Define putrefaction and phenol coefficient. 2
- b. What is contamination and spoilage? 1
- c. Briefly discuss the factors affecting the kind and rate of fish spoilage. 4
12. a. Name five bacterial genera responsible for fish spoilage in Bangladesh. 1
- b. Why the fishermen of Bangladesh face more problems in summer than the winter after catching fish? 2
- c. Describe the post-mortem changes occur in fish proteins, carbohydrates and lipids due to bacterial activities. 4
13. a. Differentiate between food infection and food intoxication. 2
- b. Briefly discuss the occurrence, symptoms and prevention of botulism. 5
14. a. What happens when microorganisms act upon amino acids? 2
- b. Enlist some natural anti-microbial components found in foods. 2
- c. Briefly describe the different steps of multiplication of an animal DNA virus. 3

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**B. Sc Fisheries (Hons.), Year -02, Semester-02 (July-December), Final Examination' 2016**

**Course Code: FEC-202 (T), Course Title: Fisheries Economics**

**Full Marks: 70, Time: 3 hours**

*The figures in the right margins indicate full marks. Answer any 05 (five) questions from each section. Use separate answer script for each section.*

**Section-A**

- |    |    |                                                                                                       |         |
|----|----|-------------------------------------------------------------------------------------------------------|---------|
| 1. | a. | Differentiate between fisheries and fisheries economics.                                              | 3       |
|    | b. | Why does a student of fisheries science need to study fisheries economics?                            | 4       |
| 2. | a. | What is demand? State and graphically explain the law of demand.                                      | 4       |
|    | b. | Briefly explain the exceptions to the law of demand.                                                  | 3       |
| 3. | a. | Define gross margin and farm profitability.                                                           | 3       |
|    | b. | Explain the equilibrium of a farm with the help of MR and MC curve.                                   | 4       |
| 4. |    | Differentiate between-                                                                                | 3.5X2=7 |
|    | a) | Indifference Curve analysis and Marshallian Utility analysis;                                         |         |
|    | b) | Demand and want.                                                                                      |         |
| 5. | a. | Define production and production function.                                                            | 3       |
|    | b. | Which stage of production has a rational producer seek?                                               | 4       |
| 6. | a. | Construct a hypothetical short run cost schedule and draw the cost curves in a two dimensional graph. | 4       |
|    | b. | Why is the average curve U-shaped?                                                                    | 3       |
| 7. | a. | Define a project.                                                                                     | 1       |
|    | b. | Discuss the discounted project appraisal techniques with advantages and disadvantages.                | 6       |

**Section-B**

- |     |    |                                                                                                                                                                                                               |         |
|-----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 8.  | a. | How do you measure point elasticity of demand by geometrical method?                                                                                                                                          | 4       |
|     | b. | If quantity demand of Tilapia fish fall from 15 million ton to 10 million ton due to increase in price from Tk 120/kg to Tk 145/kg, what is Tilapia fish's price elasticity of demand? Interpret your result. | 3       |
| 9.  | a. | Define Iso-quant curve.                                                                                                                                                                                       | 2       |
|     | b. | Graphically explain the equilibrium of a producer by using the Iso-quant curve and Iso-cost line.                                                                                                             | 5       |
| 10. |    | Do you think fish cultivation effects on our environment? Justify your opinion.                                                                                                                               | 7       |
| 11. | a. | What is capital and capital formation?                                                                                                                                                                        | 2       |
|     | b. | Discuss the stages of capital formation.                                                                                                                                                                      | 5       |
| 12. | a. | What are the characteristics of perfect competition? Discuss briefly.                                                                                                                                         | 3       |
|     | b. | How is price of a commodity determined with the help of demand curve and supply curve?                                                                                                                        | 4       |
| 13. | a. | Define money and credit.                                                                                                                                                                                      | 3       |
|     | b. | Discuss the function of money.                                                                                                                                                                                | 4       |
| 14. |    | Write short notes on the following:                                                                                                                                                                           | 3.5X2=7 |
|     | a) | Division of labour; b) Capture fisheries in Bangladesh.                                                                                                                                                       |         |



**Chittagong Veterinary and Animal Sciences University, Chittagong**  
**Faculty of Fisheries**

B. Sc. Fisheries (Hons.) Year -2 Semester-2, Final Examination' 2018

Course No: **FPH-202 (T)**, Course Title: **Fish Physiology (Theory)**

Total Marks: 70, Time: 3 hours

*Answer any 5 (five) questions from each section. Figures in the right margin indicate full mark. Use separate answer script for each section.*

**Section-A**

1. a) Define fish physiology. 1  
b) How will you apply your fish physiological knowledge in aquaculture? 3  
c) Justify fish as a poikilothermic animal. 3
2. a) "Digestion is a physiological process"-explain the statement. 2  
b) Explain the role of an acid and an alkaline solution in food digestion. 2  
c) Define the following terms- proteolytic enzyme, zymogen and emulsification. 3
3. a) Write the biological definition of respiration. 1  
b) How does countercurrent exchange work in teleost? 4  
c) How does high temperature create respiratory problems in fish? 2
4. a) Define fish blood. 1  
b) Write the components and functions of leucocytes. 3  
c) Write the name of the organs taking part in the formation of blood cells in fish and amphibians. 3
5. a) Define excretion. 1  
b) Distinguish between kidney of freshwater and marine teleosts. 3  
c) Diagrammatically show the structural unit of a mesonephric kidney. 3
6. a) Classify fishes on the basis of their reproductive behaviour. 2  
b) Summarize the breeding behaviour of Three Spine Stickleback. 5
7. a) Write the forms of nitrogenous wastes occur in different animals. 3  
b) Explain the osmoregulatory mechanisms of a marine fish. 4

**Section B**

8. a) Define metabolism. 1  
b) Write different types of metabolic activities found in fish. 3  
c) Diagrammatically show the metabolic pathways that involved in cellular respiration. 2  
d) Write the name of the environmental factors that affect metabolism in fish. 1
9. a) Point out the components of the circulatory system and how will you relate among them. 3  
b) Draw and label a fish heart and indicates the flow of blood through the heart. 1  
c) Between 3 chambered and 4 chambered heart, which one is more efficient and why? 3
10. a) Distinguish between homeotherm and poikilotherm animals. 2  
b) Explain how dohomeotherms maintain a constant body temperature? 4  
c) In which situation vasoconstriction mechanism is followed? 1
11. a) What do you mean by spermiogenesis? 1  
b) Illustrate the spermatogenesis process in fish. 4  
c) Draw and label a mature spermatozoon of a teleost. 2
12. a) Define endocrine gland. 1  
b) Is hormone a chemical messenger? Explain. 3  
c) Write the name and function of hormones secreted from the anterior pituitary gland. 3
13. a) "Fish gill use countercurrent oxygen exchange to maximize the uptake of oxygen"- justify this statement. 3  
b) Explain how oxygen is carried out from gill to body tissue. 4
14. Write down short notes on any **TWO (02)** of the followings: 3.5 X 2 = 7  
i) Sexuality in fishes; (ii) HPG-axis (iii) Fick's Law of diffusion