

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2020
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR FISHERY SCIENCE

Date	: February 27, 2021
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
 2. The first 15 minutes is to check the number of pages of the Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
 3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions
Part II - 4 Short Answer QuestionsAll questions under SECTION A are COMPULSORY.
 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
 5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
 6. Begin each Section and Part on a fresh page of the Answer Booklet.
 7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
 8. Use of any other paper including paper for rough work is not permitted.
 9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
 10. This paper has **7 printed pages**, including this instruction page.

GOOD LUCK!

SECTION A

PART I: Multiple Choice Questions (30 marks)

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. The objectives of fisheries management are
 - a) MSY
 - b) MEY
 - c) Maintenance of minimum spawning stock
 - d) All of the above

2. If more than single species of fish is cultured at a time, then it is called
 - a) Monoculture
 - b) Aquaculture
 - c) Polyculture
 - d) Sericulture

3. Cartilaginous fishes are
 - a) Placoderms
 - b) Acanthodians
 - c) Chondrichthyes
 - d) Osteichthyes

4. Microscopic organisms that float near the surface of the water are called
 - a) Plankton
 - b) Benthic
 - c) Littoral
 - d) Jelly fish

5. Catch per unit effort data gives a measure of
 - a) Absolute stock abundance
 - b) Relative stock abundance
 - c) Fishing effort
 - d) None of the above

6. Which fish acts as scavenger?
 - a) Magur
 - b) Catla
 - c) Rohu
 - d) Silver Carp

7. Disease is a very complex interaction between three important factors namely the
- oxygen, carbon-dioxide and water.
 - environment, fish pond and water.
 - environment, host and pathogen.
 - pathogen, host and Benthos.
8. The major osmoregulatory organ in fishes is
- Kidney
 - Gills
 - Liver
 - Stomach
9. Which organism produces most of the food in an aquatic ecosystem?
- Fish
 - Zooplankton
 - Phytoplankton
 - Moina
10. For induced breeding in carps, which of the following is NOT used?
- Ovaprim
 - Ovatide
 - Wova-FH
 - Methyltestosterone
11. _____ is a process of production of all female species.
- Oogenesis
 - Vitellogenesis
 - Hybridogenesis
 - Heterosis
12. Which component detects sound in fishes?
- Lateral line
 - Brain
 - Olfactory receptors
 - Cranial nerves
13. The scientific name of Golden Mahseer is
- Tor putitora
 - Tor tor
 - Tor khudree
 - Tor tambroids
14. What distinguishes nekton from benthos?
- One is a predator and the other is a primary producer.
 - One lives only in rivers and the other lives only in lakes.
 - One lives in freshwater and the other lives in salt water.
 - One swims freely and the other is often attached to hard surfaces.

15. MSY refers to
- Maximum Social Yield
 - Minimum Social Yield
 - Maximum Sustainable Yield
 - Minimum Sustainable Yield
16. Whirling disease in trout is caused by
- Parasites
 - Virus
 - Bacteria
 - Fungi
17. The introduction of new species and the escape of exotic species from aquaculture into indigenous water will be of concern because these species
- have the potential to alter the new host environment.
 - can disrupt the indigenous plant and animal communities.
 - can introduce parasites and diseases.
 - All of the above.
18. Harachu community fishery in Wangdiphodrang is known for
- Trout production
 - Nye-Dotshem production
 - Carp production
 - Fish fillet production
19. Which fish is important for caviar?
- Snow trout
 - Mackerel
 - Carps
 - Sturgeon
20. The omega 3 fatty acid is
- Palmitic acid
 - Linolenic acid
 - Stearic acid
 - Oleic acid
21. A wetland that contains a mixture of fresh water and salt water is called
- Estuary
 - River
 - Stream
 - Pond
22. What is the scientific name of rainbow trout?
- Salvelinus fontinalis
 - Salmo trutta
 - Oncorhynchus mykiss
 - Schizothroaxrichardsonii

23. Which of the following is NOT the basic method used in taxonomic studies?
- Colour patterns
 - Karyotypes
 - Electrophoresis
 - Feeding behaviour
24. Von Bertalanffy Growth Equation is used to determine growth in terms of _____ as a function of time.
- length and weight
 - weight
 - length
 - none of the above
25. The major cause of spoilage of fish is by the action of
- Virus
 - Protozoa
 - Fungus
 - Bacteria
26. Which is the most modern method of fish preservation?
- Freezing
 - Drying
 - Salting
 - Chilling
27. Which of the following fishes is viviparous?
- Salmons
 - Lamprey
 - Sharks
 - Chimeras
28. The types of organisms found in a pond or lake depend on
- the amount of sunlight available.
 - the presence of nutrients.
 - the temperature of the water.
 - All of the above.
29. Fish that can be used in biological control of mosquito is
- Carp
 - Gambusia
 - Eel
 - Chocolate Mahseer
30. Trammel net is a
- Drift gill net
 - Bottom set gill net
 - Multiple layer gill net
 - Single layer gill net

PART II – Short Answer Questions (20 marks)

This part has 3 Short Answer Questions. Answer ALL the questions. Mark for each question is indicated in the brackets.

1. Write short notes on the following: (5x2 marks)
 - a) Oviparous and viviparous.
 - b) Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).
 - c) Integrated fish farming.
 - d) Environmental impact assessment (EIA) for fisheries and aquaculture projects.
 - e) Ecosystem Based Fisheries Management (EBFM).
2. What is fish biodiversity? What are the threats to fish diversity? (5 marks)
3. Explain the difference between extensive, semi-intensive, and intensive aquaculture systems, and give examples of each. (5 marks)

SECTION B: CASE STUDY [50 marks]

Choose either Case I or Case II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE I

1. You are planning to farm trout.
 - a) Draw and label a diagram of your trout farm and describe the main components of the farm. (10 marks)
 - b) Discuss atleast five essential management considerations you would make to ensure successful and sustainable productivity in your trout farm. (10 marks)
2. Community Based Fisheries Management (CBFM) is a recent initiative in Bhutan. The Harachu Community Fisheries in Wangduephodrang is one such example of CBFM.
 - a) Explain the principle of CBFM? (5 marks)
 - b) Discuss the benefits of CBFM. (5 marks)
3. Write a detailed account of freshwater aquaculture systems that prevail in Bhutan. (10 marks)
4. Drying and smoking of fish are two common fish processing methods being practiced in Bhutan.
 - a) Explain in short, the principle of these two fish processing methods. (5 marks)
 - b) Discuss the importance of fish processing technology. (5 marks)

CASE II

1. Environmental impacts in aquaculture may be a consequence of poor planning, inappropriate site selection and inappropriate management. Discuss all of the issues identified below in terms of the potential negative impacts they present to the environment and the management strategies that can be adopted to mitigate these issues.
 - a) Waste water effluent. (5 marks)
 - b) Escapees. (5 marks)
 - c) Parasite transmission between wild and farmed organisms. (5 marks)
 - d) Low-value wild fish as the protein source of manufactured diets. (5 marks)
2. Describe hatchery culture of Indian Major Carps, including the general protocols used for brood-stock conditioning, breeding and fish fry rearing. (15 marks)
3. As a fishery officer, you are responsible for coordinating fish seed (fry/fingerling) distribution and transportation from fish seed center to fish farmers.
 - a) List two systems of live fish transport and explain their principle. (5 marks)
 - b) Explain the factors that affect live fish transport. (10 marks)

TASHI DELEK