

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2012
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALIZATION PAPER for FISHERY SCIENCE

Date	: 14 October 2012
Total Marks	: 100
Examination Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to examination time)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. Write your Roll Number clearly on the Answer Booklet in the space provided.
2. The first 15 minutes is being provided to check the number of pages, printing errors, clarify doubts and to read the instructions. You are NOT PERMITTED TO WRITE during this time.
3. Use either Blue or Black ink pen or ball point pen for the written part and Pencils for the sketches and drawings.
4. All answers should be written on the Answer Booklet provided. Candidates are not allowed to write anything on the question paper or any other materials.
5. This paper is divided into two sections-namely SECTION A and SECTION B.
6. SECTION A consists of two parts: Part I and Part II.

Part I consists of 30 Multiple-Choice Questions carrying one (1) mark each and is compulsory. The answer of your choice should be clearly written in whole along with the question and option number on your answer booklet. Eg. 31(c).

Part II consists of three (3) short answer questions. This Part carries 20 marks in total.

7. SECTION B consists of two Case Studies. Choose only ONE case study and answer the questions under your choice. Each case study carries fifty (50) marks in total.
8. This Paper consists of ELEVEN (11) pages including this Instruction page.

SECTION A

PART I - Multiple Choice Questions

Choose the correct answer and write down the letter of the correct answer chosen in the Answer Sheet against the question number. E.g. 31 (c). Each question carries ONE mark.

- 1) Carps fall under the family:
 - a) Clupeidae
 - b) Cyprinidae
 - c) Centrarchidae
 - d) Cottidae

- 2) Trouts fall under the family:
 - a) Esocidae
 - b) Sciaenidae
 - c) Anguillidae
 - d) Salmonidae

- 3) *Schizothorax sp.* commonly known as Snow Trout fall under the family:
 - a) Cichlidae
 - b) Cyprinidae
 - c) Odacidae
 - d) Salmonidae

- 4) Large amounts of mucus in a diseased fish is a sign of:
 - a) Bacterial infection
 - b) Viral infection
 - c) Parasitic infection
 - d) Temperature stress

- 5) Indian major carps usually spawn in:
 - a) Mid river where the water current is strongest
 - b) Self-created nests
 - c) Inundated areas adjoining river banks
 - d) Winter when water level is lowest

- 6) A totally protected fish species listed in Schedule – I of Forest Conservation Rules of Bhutan 2006 is:
 - a) *Schizothorax progastus*
 - b) *Anguilla bengalensis*

- c) *Tor tor*
d) *Neolissochilus hexagonolepis*
- 7) During transport of fish, 10,000 fingerlings can be transported in:
a) 20 Liters of water
b) 50 Liters of water
c) 60 Liters of water
d) 100 Liters of water
- 8) Amongst different climatic regions the maximum number of fish species occur in:
a) Sub tropical regions
b) Tropical regions
c) Montane regions
d) Temperate regions
- 9) Based on water depth zonations, the maximum number of fish species occur in the Epipelagic zone due to:
a) High productivity
b) Low water current
c) High water current
d) Low water temperature
- 10) Which of the following does not comply with anesthetics requirement of fish?
a) Should induce anesthesia rapidly with minimum hyperactivity or stress
b) Should be able to maintain the animal in the chosen state
c) Should be able to maintain the body temperature at a constant state
d) Should be effective at low doses; toxic dose should greatly exceed the effective dose
- 11) Rate of effectiveness of anesthesia in fish is not related to:
a) Gill area to body weight ratio
b) Metabolic rates
c) Fat solubility
d) Turbidity
- 12) Which of the following is a non-chemical method of inducing anesthesia in fish?
a) Quinaldine
b) Electro-anesthesia
c) Clove Oil
d) Carbon dioxide

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- 13) Which of the following is not a behavioral sign of illness in fish?
- Flashing
 - Whirling
 - Finning
 - Darting
- 14) Which of the following is the causative agent of “whirling disease”?
- Argulus sp.*
 - Ichthyophtherius multifiliis*
 - Myxosoma cerebralis*
 - Vibrio anguillarum*
- 15) Which of the following is the causative agent of “channel catfish virus”?
- Herpevirus
 - Rhabdovirus
 - Ether stable virus
 - Blood cell virus
- 16) Hormone for hypophysation of fish for breeding is prepared from:
- Thymus gland
 - Ovaries
 - Testes
 - Pituitary gland
- 17) Which of the following is an injection site for hormone during hypophysation?
- In the muscle below dorsal fin
 - Inside the gills
 - In the dorsal fin
 - In the pectoral fin
- 18) The scientific name for Common Carp is:
- Aristichthys nobilis*
 - Hypophthalmichthys molitrix*
 - Cyprinus carpio*
 - Ctenopharyngodon idella*
- 19) Which of the following is not a fish processing technology?
- Drying
 - Freezing
 - Brining
 - De-scaling

- 20) Minimum temperature for fish growth below which growth is suppressed is:
- 8°C
 - 10°C
 - 15°C
 - 20°C
- 21) Hydropower dams does not cause one of the following:
- River fragmentation
 - Block fish migration
 - Increase pollution
 - Affect fish growth
- 22) *Tor puititora* is commonly known as:
- Snow Trout
 - Katle
 - Golden Mahseer
 - Himalayan Trout
- 23) Which fish display prominent iridescent reflecting rose-colored band on the later side during breeding season?
- Catla catla*
 - Labeo rohita*
 - Oncorhynchus mykiss*
 - Aristichthys nobilis*
- 24) Which reagent is administered to check for egg fertility in artificial fertilization of trout after 24 hours?
- Sulfadimethoxine
 - Benzalkonium
 - Chloramine-T
 - Glatial Acetic Acid
- 25) Which of the following is not a symptom of Bacterial Gill Disease?
- Fish swim near the surface
 - Fish have distended opercles
 - Gills appear inflamed
 - Fish swims in circles

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- 26) Which of the following is not a passive capture gear for fishing?
- a) Trap nets
 - b) Gill nets
 - c) Cast nets
 - d) Trammel nets
- 27) Which of the following is not an active fishing gear?
- a) Seines
 - b) Dredges
 - c) Electrofishing gear
 - d) Minnow trap
- 28) Which of the following does not involve lethal sampling of fish to collect data for monitoring purposes?
- a) Liver weight
 - b) Gonad weight
 - c) Scale samples
 - d) Tissue samples
- 29) Allowable growth rate in fish is not determined by:
- a) Genetic makeup
 - b) Water temperature
 - c) Feed quality
 - d) Feed quantity
- 30) Which of the following is not an effect of increasing feed?
- a) Increased ammonia
 - b) Increased carbon di oxide
 - c) Increased dissolved oxygen
 - d) Increased nitrate

PART – II : Short Answer Questions (20 marks)

Answer the questions. Mark for each sub-question is indicated in the brackets.

Q 1: Define any three of the following terms (2 marks x3 = 6 marks):

- a. Passive Fishing Gears
- b. Active Fishing Gears
- c. Anesthetics
- d. Hypophysation

Q 2: Write short notes on any THREE of the following (3 marks x3 = 9 marks):

- a. Propagation of Common Carp
- b. Propagation of Chinese Major Carps
- c. Propagation of Indian Major Carps
- d. Propagation of Mahseer
- e. Transportation of fish
- f. Impacts of hydropower dams

Q 3: If you were a program manager of National Centre for Aquaculture-Gelephu, Sarpang, what would be your priorities and strategies for development of aquaculture in Bhutan to increase domestic fish production? (5 marks)

SECTION B : Case Study

Choose either Case 1 or Case 2 from this Section. Each Case carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE 1

You are estimating population of fish in a farmers' pond to collect data for fish production. You spent approximately 5 hours angling in the pond. In the initial visit, marked and released 20 fish. After 10 days, you went back to conduct a similar sampling and caught 15 fish among which 8 had their fins clipped.

- (i) Calculate the catch per unit effort for first and second visits? (5 marks)

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- (ii) Using the given formula calculate the population of fish in the pond. (5 marks)

$$N = \frac{(M + 1)(C + 1)}{R + 1}$$

N = population estimate in numbers of fish;

M = number of fish caught, marked and released in first sample;

C = total number of fish caught in second sample (unmarked + recaptures);

R = number of recaptures in second sample (of the fish marked and released in first sample).

- (iii) Using the formula above and Poisson distribution tables below, find the upper and lower limit of estimated fish in the pond. (5 marks)

Poisson distribution					
R	Lower	Upper	R	Lower	Upper
0	0.0	3.7	26	17.0	38.0
1	0.1	5.6	27	17.3	39.2
2	0.2	7.2	28	18.6	40.4
3	0.6	8.8	29	19.4	41.6
4	1.0	10.2	30	20.2	42.8
5	1.6	11.7	31	21.0	44.0
6	2.2	13.1	32	21.3	45.1
7	2.8	14.4	33	22.7	46.3
8	3.4	15.8	34	23.5	47.5
9	4.0	17.1	35	24.3	48.7
10	4.7	18.4	36	25.1	49.3
11	5.4	19.7	37	26.0	51.0
12	6.2	21.0	38	26.8	52.2
13	6.9	22.3	39	27.7	53.3
14	7.7	23.5	40	28.6	54.5
15	8.4	24.8	41	29.4	55.6
16	9.2	26.0	42	30.3	56.8
17	9.9	27.2	43	31.1	57.9
18	10.7	28.4	44	32.0	59.0
19	11.5	29.6	45	32.8	60.2
20	12.2	30.8	46	33.6	61.3
21	13.0	32.0	47	34.5	62.5
22	13.8	33.2	48	35.3	63.6
23	14.6	34.4	49	36.1	64.3
24	15.4	35.6	50	37.0	65.9
25	16.2	36.8			

- (iv) Calculate and suggest a daily feeding program to the farmer based on the following assumptions: (15 marks)
- The pond water temperature is 11°C.
 - The average weight of each fish is 150 grams.
 - Use the answer in (ii) as the number of fishes
 - Feeding Chart as in the next page:

All values are in percent of body weight to be fed each day.					
Temperature in Degrees Celsius					
Nos. of Fish/KG	3-5 °C	5-7 °C	7-9 °C	9-10 °C	11-12 °C
88	2.5	2.7	3	3.5	3.6
66	1.8	2.4	2.7	3.1	3.3
44	1.6	2	2.4	2.7	3
33	1.4	1.7	2.1	2.4	2.7
26	1.3	1.6	1.9	2	2
20	1.2	1.4	1.7	1.8	2.1
15	1.1	1.2	1.5	1.6	2
13	1	1.1	1.3	1.5	1.8
11	0.9	1	1.2	1.3	1.6
7	0.7	0.8	1	1.2	1.4
2	0.5	0.7	0.8	1	1.1
<2	0.4	0.5	0.7	0.8	0.9

- (v) What is the calculated earning if the farmer was to sell all the fish at 800 grams considering that the farm gate price of fish is Nu. 100 per KG: (5 marks)
- (vi) Discuss the types of feeding techniques in aquaculture systems; carp culture, trout culture and multi trophic aquaculture systems. (15 marks)

CASE 2

Question 1

You are a Geog extension officer promoting a commercial farm with polyculture system of carp culture. Assume that the stocking density is 5 fish per meter sq. in a subtropical climate. The commercial farmer has a land with adequate water supply that can accommodate 50 x 20 meter pond.

- (a) Calculate the number of fish of each species that is recommended to be stocked in the pond if common carp was the lead species based on the given table on the next page. (10 marks)

Species Composition	Lead Species			
	Grass Carp	Common Carp	Silver Carp	Expected growth in 6 months (grams)
Grass Carp	35%	25%	20%	1000
Common Carp	25%	35%	25%	1000
Rohu	10%	10%	10%	250
Mirgal	5%	5%	5%	250
Silver Carp	20%	20%	35%	600
Catla	5%	5%	5%	600

- (b) If the input cost was calculated at Nu. 24000, and carp fetches Nu. 60/KG in the market, what is the projected net income of the farmer after six months? (5 marks)
- (c) It was found after the pond excavation that there was leaking of water at various points. What are the recommendations that you would suggest to rectify the condition, and justify the proposed recommendations? (5 marks)

Question 2

A fisheries entrepreneur requests you to design a trout rearing facility with capacity of 3,000 KG of rainbow trout per harvest.

- (a) Calculate the raceway size needed for the rearing facility, and provide the design layout with a labeled diagram. Assume that the standard depth of water for the facility is 1.2 meters deep and stocking density is 20 KG/ cubic meter. (10 marks)
- (b) List out some of the management techniques that would help the entrepreneur harvest good yield of trout from the farm.? (5 marks)
- (c) List out some of the management techniques that can be used to prevent escape of farm fish into native river systems and their establishment from hatchery perspective as well as from farmers' perspective. (5 marks)

Question 3

List out the core mandates and functions of the following agencies in Bhutan:

- (a) National Centre for Aquaculture (5 marks)
- (b) National Centre for Lake and Riverine Fisheries (5 marks)