ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2011
EXAMINATION CATEGORY: <u>TECHNICAL</u>

<u>PAPER III: SUBJECT SPECIALIZATION PAPER FOR: FISHERY SCIENCE</u>

Date: October 30, 2011

Maximum Time:-150 mins.

Maximum Marks: - 100

INSTRUCTIONS:

1. Under the provision of the Technical Graduates Common Examination Procedures of the Royal Civil Service Commission, candidates shall write his/her **Roll No** (Registration Numbers) only on the Questions and Answers Booklet in the space provided.
2. Use either **Blue or Black ink pen or ball pen** for written part and **H.B. Pencils** for sketches and drawings.
3. No other particulars which would indicate the candidate's identity shall be written on either of question or answer booklet. Any candidates found guilty of writing his particulars and making identification marks shall be *disqualified from the consideration for future employment*.
4. This book is the property of Royal Civil Service Commission and shall not be taken away from the examination hall. This book consists of **12 pages** including the coverage page and no page shall be removed or torn.
5. No other materials are permitted in the examination hall besides your Registration (Admission) Card, pens, pencils and eraser. **NO-PROGRAMMABLE CALCULATORS.**
6. Candidates are required to produce the **ADMIT CARD** (Registration) as and when demanded.
7. First 10 minutes is being provided to check the number of pages, printing errors, clarify doubts and to read the instructions. **NOT PERMITTED TO WRITE**.
8. This booklet consists of two sections namely – **SECTION A** and **SECTION B**.
9. **SECTION A** consists of two (2) parts. **Part I** consists of 30 questions carrying one (1) mark and is compulsory. Tick or circle the options clearly as instructed. **Part II** consists of three (3) questions carrying a total of 20 marks and is also compulsory. Follow the instructions.
10. **SECTION B** consists of two **CASE** related questions. Choose only **ONE.** Each case study carries 50 marks, which are split into 3 to 6 sub questions with marks being valued upon the question's expected value.
11. The written answers, the ticked or circled options should be neat and clear. All the diagrams should also be clean and clear (SECTION B).

12. Once the examination starts, you are not allowed to ask or borrow any materials from the other candidates.
13. You are requested to close the question and answer booklet and to sit quietly if you completed the paper before the stipulated time.

SECTION A

SECTION A CONSISTS OF TWO (2) PARTS

Part 1: Tick or circle clearly the correct answer(s) from the options provided (30 marks). Each question carries 1 mark only.

1) Aquaculture is a three thousand year old practice started by the:
   a) Mesopotamian
   b) Egyptian and the Chinese
   c) Harrapan
   d) Minoan
   e) Mayan

2) Fish that migrate within freshwater system are called:
   a) Anadromous
   b) Oceanodromous
   c) Catadromous
   d) Potamodromous
   e) Amphidromous

3) Vertical migrations undertaken by organisms living in the pelagic zone in 24 hour cycle in response to ecological gradients are called:
   a) Photic Migrations
   b) Pelagic Migrations
   c) Diel Migrations
   d) Daily Migrations
   e) Thermal Migrations

4) Practice in which the by-products (wastes) from one species are recycled to become inputs (fertilizers, food) for another is called:
   a) Carp Culture
   b) Integrated Multi Trophic Aquaculture
   c) Mariculture
   d) Polyculture
   e) Symbiotic Culture

5) Growth of shrimp farming most importantly has led to:
   a) Destruction of farmlands

b) Decrease in fin-fish farming
c) Destruction of mangrove forest
d) Decrease in available freshwater
e) Pollution of rivers

6) The stage at which fish cannot be transported or propagated is:
   a) Soft egg stage
   b) Double shelled egg stage
   c) Eyed ova stage
   d) Morula and Blastula stage
   e) Fingerling stage

7) Brood fish must be tranquilized before transport to:
   a) Reduce food consumption
   b) Keep them fresh
   c) Prevent water spillage
   d) Prevent injury
   e) Increase fertility

8) A water body can be classified into different zones depending on the depth. In the figure below, Zone A represents:

200 m	Zone A
	Zone B
1000 m	
	Zone C
3000 m	
	Zone D
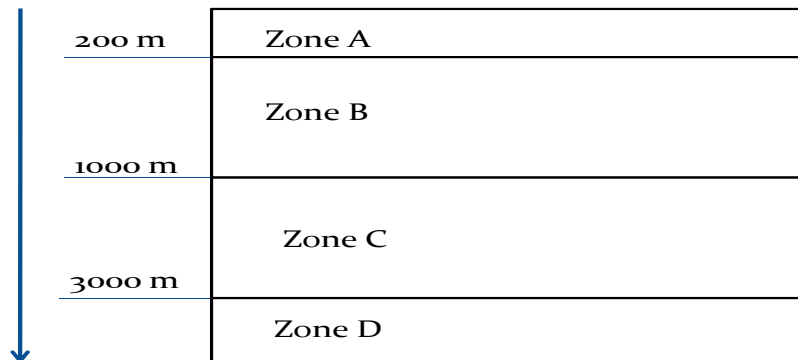
   a) Mesopelagic Zone
   b) Epipelagic Zone
   c) Abyssopelagic Zone
   d) Bathypelagic Zone
   e) Aphotic Zone

9) Maximum fish species occur in the:
   a) Mesopelagic Zone
   b) Aphotic Zone
   c) Abyssopelagic Zone
   d) Epipelagic Zone
   e) Bathypelagic Zone

10) Which chemical is not used as anesthetics in fish?
   a) MS-222 or Tricaine Methanosulfonate
   b) Benzocaine
   c) Formalin
   d) Clove Oil
   e) Carbon dioxide

11) Which of the following is a non-chemical method to induce anesthesia in fish?
   a) Reduced feeding
   b) Hypothermia
   c) Heating
   d) Bleeding
   e) Fin clipping

12) Which is the only approved anesthetic with zero withdrawal time for transport of "food fish" by the United States Food and Drug Administration?
   a) 2-Phenoxyethanol
   b) Carbon dioxide
   c) MS-222
   d) Clove Oil
   e) Metomidate

13) Which of the following is the causative agent for Bacterial Gill Disease (BGD) in fish?
   a) *Aeromonas salmonicida*
   b) *Flavobacterium branchiophilum*
   c) *Gyrodactylus*
   d) *Trichodina*
   e) *Ichthyopthirius*

14) Fin Rot and Furunculosis in fish is caused by:
   a) *Chilodonella*
   b) *Ichtyobodo*
   c) *Aeromonas salmonicida*
   d) *Saprolegnia*
   e) *Coleps sp.*

15) The purpose of specially made grass mats or kakabans is to:
   a) Provide resting spots for fish

b) Dry fish during processing
c) Lay fish food for drying
d) Enable fish to deposit their eggs
e) Lay fish during anesthesia

16) Dubisch ponds are special:
   a) Rearing ponds for broodstock
   b) Rearing ponds for fingerlings
   c) Spawning ponds
   d) Nursing ponds for wonded or sick ponds
   e) Feeding ponds

17) The process of using hormones in the propagation of fish is called:
   a) Dip treatment
   b) Stripping
   c) Hypophysation
   d) Natural spawning
   e) Suturing

18) The scientific name for Grass Carp is:
   a) *Hypophthalmichthys molitrix*
   b) *Aristichthys nobilis*
   c) *Ctenopharyngodon idella*
   d) *Cyprinus carpio*
   e) *Salmo trutta*

19) Which one of the following does not fall under Chinese Major Carps or Indian Major Carps ?
   a) *Catla catla*
   b) *Aristichthys nobilis*
   c) *Labeo rohita*
   d) *Cyprinus carpio*
   e) *Cirrhinus mrigala*

20) As per Petr (1999) the total length of major rivers in Bhutan stands at:
   a) 1500 KM
   b) 1020 KM
   c) 7200 KM
   d) 500 KM
   e) 1500 KM

21) The biggest potential impact facing Bhutan's river are:
   a) Industrial pollution

b) Water extraction for irrigation
c) Hydropower dams
d) Sewage effluents
e) Pollution from chemical fertilizers

22) *Tor puititora* is commonly known as:
    a) Brown Trout
    b) Snow Trout
    c) Katle
    d) Golden Mahseer
    e) Himalayan Trout

23) Number of exotic fish species legally introduced into Bhutan for aquaculture and for river stocking stands at:
    a) 5
    b) 6
    c) 7
    d) 9
    e) 10

24) Which of the following is not a national or international quality standard for fishery products:
    a) Codex Standards
    b) US FDA Standards
    c) EU Norms
    d) Bureau of Indian Standards
    e) Hazard Analysis Critical Control Points (HACCP)

25) Growth Rate Potential in fish is determined by:
    a) Oxygen availability
    b) Feed quantity
    c) Feed Quality
    d) Water Osmoregularity
    e) Genetic makeup

26) Allowable Growth Rate in fish is not determined by:
    a) Water temperature
    b) Subclinical Respiratory Disease
    c) Water Osmoregularity
    d) Genetic makeup
    e) Feed

27) Increased feed in an aquaculture system does not lead to:

a) Increased nitrate
b) Decrease dissolved oxygen
c) Increased ammonia
d) Increased carbon dioxide
e) Decreased suspended solids

28) Standard Environmental Temperature (SET) is defined as the temperature below which every one degree drop in temperature will lead to 8.5% drop in metabolic rate of fish. The SET for cold water fish is:
   a) 6 °C
   b) 10 °C
   c) 15 °C
   d) 30 °C
   e) 21 °C

29) "Piping" is the term used when fish is observed at the surface of the water, gulping freshwater and running it through the gills. This is an indication of:
   a) Eutrophic water conditions
   b) Affinity of fish towards light
   c) Osmoregulation activity among fish
   d) Exploring the water for food
   e) Mating behavior

30) Which of the following is not considered a part of aquaculture production system?
   a) Capture fisheries
   b) Fish farms
   c) Aquatic plants like sea weed
   d) Ornamental fishes
   e) Shrimp farms

Part 2: Answers should be brief and to the point. (20 marks)

Provide answers on additional answer sheets.

Q 1: Define any three of the following terms (2 marks x 3):

    a. Aquaculture
    b. Limnology
    c. Capture Fisheries
    d. Recreational Fisheries

Q 2: Write short notes on any three of the following (3 marks x 3):

    a. Fishing gears
    b. Importance of fish processing
    c. Artificial breeding of common carp
    d. Liming of fish ponds
    e. Weed control in water bodies
    f. Thermal stratification in a water body

Q3: If you are a fisheries officer, what changes would you bring forward to improve domestic fish production in Bhutan? How will you bring about these changes? (5 marks)

SECTION B (50 marks)
From the given two case studies, choose ONE CASE and attempt all the questions under the relevant case.

CASE 1:

You are conducting a sampling to estimate fish population in a farmers' pond to suggest management improvements to the farmer. The sampling time was set at 2 hours with 10 cast net throws per hour. During the first sampling, you caught, marked and released 196 fish. A second sampling using the same technique was conducted after a week and resulted in catching 81 fish among which 9 were observed with marks.

    (i)   What is the catch per unit effort (CPUE) for first sampling and second sampling? (5 marks)

(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	17.8	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	21.8	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	49.8
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	64.8
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)

    a. The pond water temperature is 9.5⁰C.

    b.   The average weight of each fish is 200 grams.

    c. Use the answer in (ii) as the number of fishes

    d. Feeding Chart as below:

All values are in percent of body weight to be fed each day.					
Temperature in Degrees Celsius					
Nos. of Fish/KG	**3-5 ºC**	**5-7 ºC**	**7-9 ºC**	**9-10 ºC**	**11-12 ºC**
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 400 grams considering that the farm gate price of fish is Nu. 60 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 II

(i)   You are a fisheries officer promoting polyculture system of carp culture with stocking density of 4 fish per meter sq. in a rural area. A farmer has a land with water supply that can accommodate 20 x 30 meter pond.

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

Species	Percentage Composition for Grass Carp as lead species	Expected growth in 6 months (grams)
Grass Carp	35	1000
Common Carp	25	800
Rohu	10	250
Mirgal	5	250
Silver Carp	20	1000
Catla	5	1000

(b) If the input cost was negligible and carp fetches Nu. 150/KG in the market, what is the projected income of the farmer after six months? (5 marks)

(c) What are the recommended management measures that you would instruct the farmer to perform for good growth of carp in his pond? (5 marks)

(ii)   You are asked to design a trout rearing facility with a rearing capacity of 30,000 KG of rainbow trout per harvest.

(a) Calculate the minimum tank/raceway/pond size needed for the fish rearing facility. Assume that the standard depth of water for the facility is 1.5 meters deep and stocking density for trout is 20 KG/ cubic meter. (10 marks)

(b) What management recommendations would you instruct the farmer to perform for good growth of trout in his farm? (5 marks)

(c) Briefly state the potential dangers to the environment on rearing rainbow trout in Bhutan. (5 marks)

(iii) Carp culture is referred to as warm water fish culture and trout culture as cold water fish culture in Bhutan.

(a) List out some differences between the two systems. (5 marks)

(b) List out some similarities between the two systems. (5 marks)