ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2016
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION PAPER FOR HORTICULTURE

Date:	2 October 2016
Total Marks:	100
Examination Time:	150 minutes (2.5 hours)
Reading Time:	15 minutes *(prior to examination time)*

GENERAL INSTRUCTIONS

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided to check the number of pages, printing error, clarify doubts and to read instructions in Question Paper. You are NOT permitted to write during this time.
3. This paper consists of **TWO Sections, namely Section A and Section B.**

   Section A has two parts: Part I - **30 Multiple Choice Questions.**
   Part II - **4 Short Answer Questions.**

   All questions under **Section A** are **COMPULSORY**.

   Section B consists of 2 case studies. Choose only **ONE** case study and answer the questions under 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 correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.
6. Begin each Section and Part in 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 are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
10. The Question 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 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Polymerase chain reaction is a laboratory technique used in molecular biology to
   a. make DNA bigger.
   b. make multiple copies of a segment of DNA.
   c. make cell undergo mitosis.
   d. make cell under meiosis.

2. Plants go through two primary kinds of cycles. One of these is the seasonal cycle in which plants respond to the environment such as through spring, summer, autumn and winter, or through wet-dry periods. What is it called?
   a. Ontogeny
   b. Phenology
   c. Competence
   d. Determinism

3. The scientific name of Quinoa is
   a. *Chenopodium album*
   b. *Chenopodium quinoa*
   c. *Brassica quinoa*
   d. *Amaranthus retroflexus*

4. The centre of origin of potato is
   a. South America
   b. North America
   c. Europe
   d. Asia

5. Huanglongbin (HLB) is caused by
   a. Virus
   b. Fungus
   c. Bacteria
   d. Nematodes

6. When did Bhutan join World Trade Organization?
   a. 1999
   b. 2008
   c. 2015
   d. Did not join yet

7. Some of the medicinal plants are collected from high altitude areas for making traditional medicines and they are
   a. *Aquilaria malaccensis, Piper mullesus & Terminalia chebula*
   b. *Aconitum orochryseum, Gentiana urnula & Meconopsis horridula*
   c. *Terminalia bellirica, Punica granatum & Phyllanthus emblica*
   d. *Cinnamomumbejolghota, Amomium subulatum & Zingiber officinale*

8. The most common nursery diseases of citrus which can cause potential economic losses are
   a. Anthracnose, Bacterial Canker & Crown Gall
   b. Bacterial Spot, Brown Rot & Leaf Spot
   c. Fire blight, Leaf blight & Scab
   d. HLB, CTV and Powdery mildew

9. A legal document enables exemption of sales taxes & import duties on farm machineries, sales taxes & customs duty on agricultural inputs, and income tax holiday of 10 years for commercial farming & related processing of products. Which legal document is it?
   a. Food Act of Bhutan 2005
   b. The Economic Development Policy of the Kingdom of Bhutan 2010
   c. The Seeds Act of Bhutan 2000
   d. Cooperatives Act of Bhutan 2001 (amended in 2009)

10. Plant growth regulators are well known to be involved in physiological processes governing growth and development of plants. Which growth regulator induces leaf and fruit abscission and also induces dormancy.
    a. Abscisic acid
    b. Auxins
    c. Gibberellins
    d. Cytokinins

11. Long day plants flower when the length of photoperiod is more than 14 hours. The example of long day plants are
    a. Sweet potato and chayote
    b. Tomato and pepper
    c. Beans and potato
    d. Radish and carrot

12. The availability of plant nutrients in the soil is affected by the soil reaction (soil pH). When the soil pH goes below 6.5, the following nutrients become unavailable:
    a. Phosphorus, magnesium, molybdenum and calcium
    b. Iron, manganese, boron and zinc
    c. Carbon, hydrogen, oxygen and nitrogen
    d. Potassium, sulphur, copper and chlorine

13. Nuclear polyhydrosis virus (NPV), a bio-control agent was found effective in controlling
    a. *Helicoverpa armigera*
    b. *Empoasca* species

c. *Meloidogyne* species
d. All of the above

14. Up until now, ___ essential elements have been identified
    a. 3
    b. 6
    c. 12
    d. 16

15. Which are the major constituents of organic compounds like carbohydrates and fats found in the plants and provide energy required for growth and development?
    a. Carbon, hydrogen & oxygen
    b. Nitrogen, phosphorus and potassium
    c. Calcium, magnesium and sulphur
    d. Iron, manganese and copper

16. The use of nitrification inhibitors is to
    a. decrease the nitrogen-use efficiency.
    b. increase the nitrogen-use efficiency.
    c. stop the release of nutrient from soil.
    d. no effect.

17. Soils having low pH, low cation exchange capacity, low status of base especially Ca, Mg and K along with toxicity of Al and Mn. What soil type is this?
    a. Alkali soils
    b. Acid soils
    c. Saline soils
    d. None of the above

18. _____ are considered to be the most efficient and effective pollinators of apple trees.
    a. Birds
    b. Butterflies & moths
    c. Beetles
    d. Honeybees

19. Presence of a chemical inhibitor is responsible for dormancy in seeds of most temperate fruits such as apple, pear, peach, etc. What chemical inhibitor is it?
    a. Abscisic acid
    b. Gibberillic acid
    c. Ethrel
    d. Benzyle adenine

20. The national flower of Bhutan is _____.
    a. *Meconopsis horridula*
    b. *Magnolia campbellii*
    c. *Rhododendron hodgsonii*
    d. *Phaius flavus*

21. Pumice is a kind of growing media having
    a. Volcanic origin
    b. Organic origin
    c. Aquatic origin
    d. Swamp origin

22. The most popular apple variety in Bhutan is
    a. Red Delicious
    b. Royal Delicious
    c. Golden Delicious
    d. Lobo

23. The scientific name for shiitake mushroom is
    a. *Agaricus bisporus*
    b. *Pleurotus ostreatus*
    c. *Lentinula edodes*
    d. *Volvariella volvacea*

24. Ripening transforms a physically mature but inedible plant organ into a visually attractive taste and smell sensation. Ripening can be achieved by
    a. application of ethylene.
    b. increasing CO_2 concentration.
    c. storing at low temperature.
    d. skin coating with wax.

25. One of the most common permitted food preservative is
    a. Magnesium sulphate
    b. Sodium benzoate
    c. Calcium chloride
    d. Boric acid

26. The most easiest method of propagating tulips, daffodils and narcissus is through
    a. Cuttings
    b. Seeds
    c. Bulbs
    d. Rhizomes

27. The purpose of the "pad and fan" system commonly used in the greenhouses is to
    a. reduce air temperature.
    b. reduce relative humidity.

c. increase air temperature.
d. supply more carbon dioxide.

28. TSS (Total Soluble Solids) level can be measured by using a simple instrument called
    a. Penetrometer
    b. Chlorophyll Meter
    c. Spectrophotometer
    d. Refractometer

29. One vitamin deficiency is a major public health concern in lower income countries and is the leading cause of preventable childhood blindness & night blindness. Which one is it?
    a. Vitamin A deficiency
    b. Vitamin B deficiency
    c. Vitamin C deficiency
    d. Vitamin E deficiency

30. A trap crop is a plant that attracts agricultural creatures usually insects, away from nearby crops. An example of a trap crop is
    a. Cotton
    b. Marigold
    c. Rose
    d. Soybeans

PART II – Short Answer Type Questions (20 Marks)

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

1. What do you understand by day neutral, long-day and short-day plants? What are the advantages of growing day neutral plants? Please name some of the day neutral plants.

2. There are several systems of classifying the diverse vegetable crops grown throughout the world. What are they?

3. The overall ‘quality’ of a seed lot is composed of several different aspects, each of which can be separately defined and determined. What are they?

4. Please describe different types of fruit trees planting systems? Which one is the most suitable planting system in Bhutan? Justify your statement.

SECTION B

Case Study

Choose either Case 1 or Case 2 from this Section. Each Case carries 50 marks.

Case 1

The primary mandate of Department of Agriculture is to enhance crop production towards improving food and nutrition security, reducing poverty and increasing household income. However, crop production is far less than what is required. For example, vegetable self-sufficiency stands at 86% and rice self-sufficiency stands at 45%. We need to enhance production further in order to make Bhutan self-sufficient in food production and also to improve the household income and nutritional status of Bhutanese people. Your write-up should cover the following key questions:

a) What are the key interventions that need to be implemented to make Bhutan self-sufficient in food production? (20 marks)

b) What do you understand by the term "plant breeding"? How can plant breeding play a role in increasing Bhutan's food self-sufficiency target? (15 marks)

c) What is food fortification? Should Bhutan go for food fortification in order to improve our food and nutrition security? If so, which food/crop should we fortify? (15 marks)

Case 2

Propagation is an art of multiplication of plants. The fruit plants are propagated both by sexual or asexual methods. In sexual method, the plants are raised from seeds whereas in asexual method, the plants are raised from a vegetative part. Both the methods have their own advantages and disadvantages. Please write an essay on propagation covering the following topics:

a) Advantages and disadvantages of sexual & asexual methods of propagation (10 marks)

b) Different vegetative methods of propagation? (20 marks)

c) The most common method of propagating the following fruits and nuts? (10 marks)

i. Apple
ii. Mandarin
iii. Arecanut

d) Micro-propagation and it advantages and disadvantages. (10 marks)

*****TASHI DELEK*****