

**ROYAL CIVIL SERVICE COMMISSION**  
**BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2013**  
**EXAMINATION CATEGORY: TECHNICAL**

**PAPER III: SUBJECT SPECIALIZATION PAPER for *BIO TECHNOLOGY***

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<b>Date</b>	: 14 October 2013
<b>Total Marks</b>	: 100
<b>Examination Time</b>	: 150 minutes (2.5 hours)
<b>Reading Time</b>	: 15 Minutes (prior to examination time)

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**GENERAL INSTRUCTIONS:**

1. Write your Roll Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided to check the number of pages of 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 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 two Case Studies. Choose only ONE case study and answer the questions under your choice.
4. 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 any or correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.
5. Begin each Section and Part in a fresh page of the Answer Booklet.
6. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
7. Use of any other paper including paper for rough work is not permitted.
8. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
9. This paper has **07** printed pages in all, 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 the correct answer chosen 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. **The average cell cycle span for a mammalian cell is?**
  - a. 48 hours
  - b. 24 hours
  - c. 12 hours
  - d. None of the above
  
2. **Who among the following coined the term Biotechnology?**
  - a. James Clarke
  - b. Karl Ereky
  - c. Paul Terasaky
  - d. Clarke and Sommer
  
3. **In a biotechnology laboratory, protoplasts are somatic cells from which \_\_\_\_\_ has been removed using enzymes**
  - a. Cell wall
  - b. Nucleus
  - c. Cell membrane
  - d. All of the above
  
4. **A selective herbicide, 2,4-D, is actually a form of**
  - a. Cytokinin
  - b. Gibberellins
  - c. Auxin
  - d. Ethylene
  
5. **Bacterial infections in humans can be treated with what?**
  - A. Antigen
  - B. Gene Therapy
  - C. Antibiotics
  - D. All of the above
  
6. **Penicillin is produced by**
  - a. anaerobic fermentation
  - b. aerobic fermentation

- c. aerobic fermentation followed by anaerobic fermentation
  - d. anaerobic fermentation followed by aerobic fermentation
- 7. Which tropical fruit crop has been successfully engineered to be protected against a lethal virus?**
- a. Passion fruit
  - b. Mango
  - c. Lychee
  - d. Papaya
- 8. Mycorrhizae are symbiotic associations between**
- a. Algae and fungi
  - b. Root and fungi
  - c. Bacteria and root
  - d. Bacteria and fungi
- 9. Organisms capable of converting  $N_2$  to  $NO_3$  are**
- a. Yeasts
  - b. Bacteria
  - c. Roundworms
  - d. Moulds
- 10. ----- is constitutional unit of proteins.**
- a. Gene
  - b. Allele
  - c. Amino Acids
  - d. Chromosomes
- 11. In 1996, Dolly the first mammalian clone was born, Dolly was a ?**
- a. Dog
  - b. Guinea Pig
  - c. Sheep
  - d. Goat
- 12. Triticale, the first man made cereal is an example of**
- a. Artificial Autopolyploidy
  - b. Man made crossing
  - c. Artificial evolution
  - d. Artificial Allopolyploidy
- 13. Which of the following is not a part of a human chromosome in any phase?**
- a. Centriole
  - b. Histone
  - c. Nucleosome
  - d. Centromere

- 14. The piece of equipment, that introduces DNA into cells via DNA-coated microprojectiles is known as**
- Laser
  - DNA probe
  - Gene gun
  - Inoculating needle
- 15. \_\_\_\_\_ is an example of a recalcitrant seed.**
- Rice
  - Potato
  - Cauliflower
  - None of above
- 16. Which of the agricultural challenges below cannot be solved with transgenic techniques?**
- Crops are damaged by frost
  - Crops are killed by a virus
  - Public concern about safety of synthetic pesticides
  - Consumer preference for organic vegetables
- 17. The binding between two amino acids is called?**
- Quantitative Trait Locus
  - DNA strand
  - Interlocus
  - Peptide Bond
- 18. Plants derived usually from anther culture for rapid production of homozygous lines in a breeding programme are**
- Diploids
  - Haploids
  - Polyploids
  - Autoploids
- 19. The enzyme-linked immunosorbent assay (ELISA) test was developed by?**
- Kary Mullis
  - Dennis E Bidwell and Alister Voller
  - Karl Ereky
  - Paul Terasaky
- 20. An animal that has gained new genetic information from the acquisition of foreign DNA, is considered as?**
- A chimera
  - A transgenic animal
  - A vector
  - An enzyme that links DNA molecules

- 21. The International Agreement on biosafety is known as the .....**
- Convention on biological diversity
  - Kyoto Protocol
  - Codex
  - Cartagena Protocol
- 22. The DNA profiling technique was first reported in 1984 by Sir Alec Jeffreys at .....**
- Leicester University in England
  - Cornwell University in USA
  - The University of New England
  - Tokyo University in Japan
- 23. Which of the following is an essential amino acid?**
- Tryptophan
  - Methionine
  - Lysine
  - All of the above
- 24. The sugar in RNA is \_\_\_\_\_ and the sugar in DNA is \_\_\_\_\_**
- Deoxyribose, Ribose
  - Ribose, Deoxyribose
  - Ribose, Phosphate
  - Ribose, Uracil
- 25. \_\_\_\_\_ is an analytical method applied for the separation and characterization of proteins, nucleic acids and subcellular-sized particles like viruses and small organelles.**
- Chemotherapy
  - Dialysis
  - Electrophoresis
  - Sterilization
- 26. Hemophilia is genetic disorder which is inherited from the parents by**
- Only male offspring
  - Only female offspring
  - Both male and female offspring
  - None of the above
- 27. Which one of the following is an example of a mutagen?**
- Chlorophyll
  - Nitrous acid
  - Codon
  - Ribonucleic acid

28. A cell medium contains
- Macronutrients
  - Micronutrients
  - Growth hormones
  - All of the above
29. One of the biggest advantages of the micro-propagation, a technique of rapid vegetative propagation is that it
- Produces genetically identical progenies
  - Produces healthy progenies
  - Rapidly produces genetically identical progenies from single cells.
  - None of the above
30. Syngenta, a popular Biotech Seed Company is based in.....
- Denmark
  - Germany
  - Switzerland
  - USA

**PART – II : Short Answer Questions (20 marks)**

**Answer ALL the questions. Each question carries 5 marks.**

- Question 1. What are GMOs? Give at least two examples?
- Question 2. What is ELISA? What are its different uses? Name two sectors that are using ELISA in Bhutan?
- Question 3. What is DNA Profiling?
- Question 4. What is Pasteurization? Name the scientist who developed this technique.

## 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

The Ministry of Agriculture and Forests accords a high priority on conservation of genetic resources of the country for the benefit of future generations. The National Biodiversity Center (NBC) is the apex institution mandated for conservation of all genetic resources. Biotechnology techniques can offer many benefits to the work of the NBC. In the context of biodiversity conservation efforts, answer the following questions.

- A. What is genetic erosion and name different factors contributing to genetic erosion in Bhutan? (10 marks)
- B. What is a Gene Bank? (10 marks)
- C. Define the following terms. Are these technologies used in Bhutan? Explain (20 marks)
  - i. Cryopreservation
  - ii. Micropropagation
  - iii. Polymerase Chain Reaction (PCR)
  - iv. Bioinformatics
- D. Will the introduction of GM crops in Bhutan exacerbate genetic erosion? (10 marks)

#### CASE 2

Attaining food self sufficiency, food and nutritional security is the primary objective of the Ministry of Agriculture and Forests. However, due to limited arable land and low productivity of crops together with several production constraints, the attainment of this objective has been a very big challenge. Introduction of GM technology, and GM food and crops could be a potential option to address the problems. In this context answer the following questions:

- A. Why are GM crops/foods produced? What are its potential advantages and disadvantages under the Bhutanese agriculture? (10 marks)
- B. Explain the Cartagena Protocol on Biosafety. Name the agency responsible for biosafety in Bhutan? What measures should the Agency adopt to enhance Biosafety in Bhutan from the perspective of GM food/crops? (20 marks)
- C. What is *Bacillus thuringiensis*? Name three crops that have used Bt. Genes? (10 marks)
- D. What does GURT stand for? Explain. (10 marks)