**ROYAL CIVIL SERVICE COMISSION**

**BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2014**

**EXAMINATION CATEGORY: TECHNICAL**

**PAPER III: SUBJECT SPECIALIZATION PAPER for: *BIOTECHNOLOGY***

Date : 12 October 2014

Total Marks : 100

Examination Time : 150 minutes (2.5 hours)

Reading Time : 15 Minutes (prior to examination time)

GENERAL INSTRUCTIONS:

1. Write your Roll Number Clearly 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 NOTpermitted to write during this time.
3. This paper consists of TWO SECTIONS, namely section A and Section B:
   * **Section A** has two parts: Part 1- 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.

1. 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.
2. Begin each Section and Part in a fresh page of the answer booklet.
3. You are not permitted to tear off any sheet (s) of the Answer Booklet as well as the Question Paper.
4. Use of any other paper including paper for rough work is not permitted.
5. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
6. This paper has **08 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 cell theory was first proposed by?
2. Alec Jeffreys
3. Schleiden and Schwann
4. Lious Pasteur
5. Dennis E Bidwell and AlisterVoller
6. The deliberate modifications of an organism's genetic information by directly changing its nucleic acid content is a subject matter of;
   1. Genetic engineering
   2. Population genetics
   3. DNA Sequencing
   4. Molecular breeding
7. Which one of the following is an example of a Somatic cell?
   1. Collenchyma
   2. Parenchyma
   3. Egg and sperm
   4. Lipids
8. The most extensively used nutrient medium is the MS medium which was developed by ?
9. Fischer and Miller
10. Kogl and Skoog
11. Murashige and Skoog
12. Darwin and Hooke
13. A bacterial cell wall is made of up of ………………
14. Cellulose
15. Peptidoglycan
16. Chitin
17. Lignin
18. Which of the following is not a part of a human chromosome in any phase?
19. Centriole
20. Histone
21. Nucleosome
22. Centromere
23. Agrobacterium based gene transfer is efficient…………
24. With both monocots and dicots
25. With majority monocots and few dicots
26. Only with dicots
27. Only with monocots
28. In a biotechnology laboratory a Laminar Air Flow hood (LAF) is essential equipment. The function of LAF is:
29. Create a sterile environment to protect tissue culture from contamination and protect operator from other potential risks
30. Protect the Lab technician from UV radiations only
31. Only make to make a virus free environment
32. All of the above
33. The type of microscope used for visualizing cell cultures in situ is known as…………………
34. Electron microscope
35. Transmission electron microscope
36. [Scanning electron microscope](http://en.wikipedia.org/wiki/Scanning_electron_microscope)
37. Inverted microscope
38. ……………was the microorganism whose genome was first sequenced.
    1. Bacilliusthruengenis
    2. E.coli
    3. Haemophilus influenza
    4. P. Pastoris
39. ………………involves the storing of cells at very low temperature.
40. Adherent cell cultures
41. Cryopreservation
42. Polymerase Chain Reaction
43. Suspension cultures
44. The cross linkage of antigens by antibodies is known as
45. Complement fixation
46. Agglutination
47. A cross reaction
48. All of the above
49. In human the B cells and T cells are matured in the……………….
50. Bone marrow and thymus respectively
51. Lymph nodes and spleen respectively
52. Bursa and thymus respectively
53. None of these
54. ……………………was the first drug to be produced by mammalian cell culture.
55. t-PA protein
56. Tissue plasminogen activator
57. C[hymosin](http://en.wikipedia.org/wiki/Chymosin)
58. Insulin
59. Which of one of the following organism is considered a Natural Genetic Engineer of plants?
60. Streptomyces ramosus
61. Bacillus thuringiensis
62. Agrobacterium tumefaciens
63. [Bacillus anthracis](http://en.wikipedia.org/wiki/Bacillus_anthracis),
64. The first inter-genetic somatic hybrids between potato and tomatoes are known as:
    1. Bt. Pomatoes
    2. Pharma tomato
    3. Pomatoes
    4. Clone
65. A very common mutualistic, symbiotic relationship between a fungus and the roots of a plant is:
66. Lichen
67. Mycorrhizal
68. Ascomycete
69. Basidiomycete
70. Which cell-based plant technology involves the combining of two cells without cell walls from different species?
71. Clonal propagation
72. Cybridization
73. Protoplast fusion
74. Mutant selection
75. A ……………is the basic physical and functional unit of heredity.
76. Chromosome
77. DNA
78. RNA
79. Gene
80. Dolly, the first mammal was cloned using a cloning technique where the nucleus from an unfertilized egg was removed and replaced with the nucleus from a somatic cell. The cloning techniques is known as;
    1. Somatic Cell Nuclear Transfer
    2. Nanotechnology
    3. DNA Sequencing
    4. Parasexual Hybridization
81. The term “Genome” was coined by H. Winkler in the year;
82. 1962
83. 1920
84. 1996
85. 1990
86. Which one of the following is not a cloning vector?
87. Plasmid
88. Cosmids
89. Histone
90. All of above
91. Which one of the following is not a direct gene transfer technique?
92. Particle Gun
93. Electroporation
94. Microinjection
95. DNA Profiling
96. The genetic variations in individuals are caused due to ……………………… which occurs both in the coding and non-coding regions of the genome.
97. Single Nucleotide Polymorphisms or SNPs
98. Chromosomal Alteration
99. Incomplete Dominance
100. Haploid and Diploid
101. The name of the first genes available for genetic engineering of crop plants

for pest resistance was:

1. Jumping genes
2. Cry genes
3. Guanine
4. Vir genes
5. Rennet is a complex enzyme produced in the stomach of ruminant mammals and is used for making cheese . The key component of a Rennet is:
6. Protease
7. Casein
8. Chymosin
9. Lipase
10. Which one of the following is not a molecular marker?
11. Restriction Fragment Length Polymorphism (RFLP)
12. Isozyme
13. Randomly Amplified Polymorphic DNA (RAPD)
14. Taq Polymerase
15. Which breeding method uses a chemical to strip the cell wall of plant cells of two sexually incompatible species?
16. Mass Selection
17. Protoplast Fusion
18. Transformation
19. Micro-injection
20. A common procedure in [microbiology](http://en.wikipedia.org/wiki/Microbiology) and [cytology](http://en.wikipedia.org/wiki/Cell_biology) used to separate certain Subcellular components is:
21. Electrophoresis
22. Autoradiography
23. Chromatography
24. Differential Centrifugation
25. In genetic engineering, a chimera is……………………….
26. An enzyme that links DNA molecules
27. A virus that infects bacteria
28. A plasmid that contains foreign DNA
29. A fungi

**PART II: Short Answer Questions (20 Marks)**

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

1. What is a PCR technology? Describe the steps involved. What are its applications?
2. What is a Cloning Vector? Why are they necessary? **Name different types of Cloning Vectors ?**

3. What is a Genetic Marker?

4. What is direct gene transfer? What are the methods of direct gene transfer?

**SECTION B**

**Case Study**

**Choose either Case 1 or Case 2 from this Section. Each case carries 50 marks. Marks for each sub-section are indicated in the brackets.**

**CASE 1**

**Biotechnology is still a fairly new area in Bhutan. The government is looking ahead to exploit the application of biotech techniques in different sectors. In this context answer the following questions**.

1. What is biotechnology? (10)
2. **What is agricultural biotechnology? (10)**
3. **Write a short note on the application of modern biotechnology and the sector that can exploit and benefit from modern biotech technologies in Bhutan? (10)**
4. How can agricultural biotechnologies be used to enhance the conservation of genetic resources? (10)
5. Name the international agreement or protocol on biosafety and write a short note on it? (10)

**CASE 2**

**You have been appointed as a Biotechnologist in the National Seed Center, Paro, Ministry of Agriculture and Forests after passing your civil service exams. In this context answer the following questions:**

1. Recommend 10 basic and most important cell culture equipments for setting up a cell culture laboratory at the National Seed Center, Paro to immediately start the work.(10)
2. **What is Cell Culture? Define different types of cell cultures? (10)**
3. Electrophoresis is widely used in biotechnology laboratory. What is electrophoresis? Define. (10)
4. What are the different types of electrophoresis? (10)
5. What are the applications of electrophoresis? (10)