

# University of Ruhuna - Faculty of Technology

Bachelor of Biosystems Technology Degree

Level I (Semester II) Examination

September, 2020

Course Unit: BST 1251 – Fundamental Genetics

Time Allowed: 1 hour

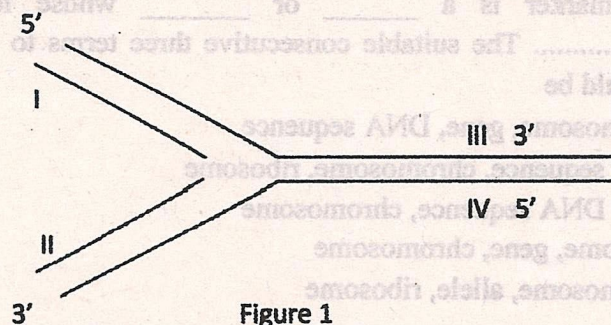
This question paper contains 06 pages.

## Part A – Multiple Choice Questions

Underline the most appropriate answer.

Answer all the questions.

1. The mechanism of DNA replication is studied in an E. coli replication fork.



Find the correct statement about the replication fork in figure 1?

- a) Strands I and II have base sequences that are identical to each other
- b) Strand III is a lagging strand template while strand IV is a leading strand template
- c) Strands I and III will be covalently bonded to each other when replication is completed
- d) Strands III and IV will be H-bonded to each other when replication is completed
- e) Strand I is elongating continuously while strand II is an Okazaki fragment

2. How many stop codons are there in the genetic code?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

3. In terms of DNA and RNA structure, what is a nucleotide?

- a) A nucleotide is a heterocyclic base binds with a molecule of sugar
- b) A nucleotide is a sugar molecule covalently bonded to a heterocyclic base
- c) A nucleotide is a sugar molecule bonded to phosphate group/s, a molecule of sugar and a heterocyclic base.
- d) A nucleotide is a heterocyclic base bonded to phosphate group/s
- e) A nucleotide is a heterocyclic base bonded to a sugar molecule

4. A genetic marker is a \_\_\_\_\_ or \_\_\_\_\_ whose location is defined on a ..... The suitable consecutive three terms to fill the three blanks in the sentence would be

- a) chromosome, gene, DNA sequence
- b) DNA sequence, chromosome, ribosome
- c) gene, DNA sequence, chromosome
- d) ribosome, gene, chromosome
- e) chromosome, allele, ribosome

5. Which is not a characteristic of an ideal population under the Hardy-Weinberg Principle?

- a) Few individuals
- b) Isolated from migration
- c) No mutation
- d) No selection
- e) Random mating

6. The mutation type causes by an addition or deletion of bases would be

- a) Point mutations
- b) Frame shift mutations
- c) Lethal mutations
- d) Germline mutations
- e) Spontaneous mutations

7. If 16% of the individuals in a population show a recessive trait, the allelic frequency for the dominant allele would be

- a) 4%
- b) 16%
- c) 84%
- d) 96%
- e) 99%

8. The formula important to predict the genotypic frequency of the next generation would be

- a)  $p + q = 1$
- b)  $X^2 = \sum [(o - e)^2 / e]$
- c)  $p^2 + 2pq + q^2 = 1$
- d)  $d = 0.5 \lambda / n * \sin(\theta)$
- e)  $e = mc^2$

9. The term refers the total aggregate alleles in a population would be

- a) the gene pool
- b) the allelic frequency
- c) the genotypic frequency
- d) the genetic structure
- e) none of these

10. If black fur(B) in guinea pigs is dominant over white fur(b), the probability of an offspring with the same phenotype as its parents in a cross between a homozygous black and a heterozygous black guinea pig would be

- a) 0%
- b) 25%
- c) 50%
- d) 75%
- e) 100%

(2 × 10 = 20 marks)

**Part B – Structured Essay**

Answer all questions in the given spaces.

01. Select the most appropriate genetic term from the given list for the given explanations in column A and write the answers in the blanks of column B.

(Gene, Genome, Alleles, Locus, Homozygous, Heterozygous, Dominant, Recessive, Genotype, Phenotype)

| No.   | A   | B |
|-------|---|---|
| i)    | The physical appearance of an organism  |   |
| ii)   | A unit of heredity; a section of DNA sequence encoding a single protein   |   |
| iii)  | An allele that is masked by a dominant allele; does not appear in the heterozygous condition, but appears only in homozygous condition    |   |
| iv)   | Two genes that occupy the same position on homologous chromosomes and that cover the same trait (like 'flavors' of a trait).              |   |
| v)    | The genetic makeup of an organisms  |   |
| vi)   | Having two different genes for a particular characteristic.   |   |
| vii)  | A fixed location on a strand of DNA where a gene or one of its alleles is located   |   |
| viii) | Having identical alleles (one from each parent) of a particular gene  |   |
| ix)   | The entire set of genes in an organism  |   |
| x)    | The allele of a gene that masks or suppresses the expression of an alternate allele; the trait even appears in the heterozygous condition |   |

(1 × 10 = 10 marks)

02. Write three (03) fundamental characteristics of genes.

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(2×3=6 marks)

03. Write Mendel's "Principle of Independent Assortment"?

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(4 marks)

04. Write three (03) post transcriptional modifications.

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(2 × 3 = 6 marks)

05. Suppose that the distance between the genes A-B = 12 cM, B-C = 7 cM and A-C = 5 cM. Show the relative positions of the genes.

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(2 marks)

06. Define the term "genetic recombination".

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(4 marks)

07. Name four (04) types of gene mutations.

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(2 × 4 = 8 marks)

**Part C – Essay Questions**

**Answer both questions.**

01) Briefly explain the applications of bioinformatics in different areas of biological sciences. (20 marks)

02) Briefly explain the DNA replication process. (20 marks)

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(2 x 3 = 6 marks)

03. Suppose that the distance between the genes A-B = 15 cM, B-C = 7 cM and A-C = 2 cM. Show the relative positions of the genes.

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(2 marks)

(4 marks)

07. Name four (04) types of gene mutations.

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(2 x 4 = 8 marks)