



**Instructions to candidates**

Duration: 03 hours

Number of questions: 05 essay questions

Answer all questions

Mark allocation: 100 (All questions carry equal mark)

1.

a. How can you synthesis a DNA sequence form m-RNA sequence?

(5 mark)

b. A group of scientists at "Gene Tech" institution have isolated and sequenced a specific gene ( $DT_1$ ) of a particular marine plant. They have identified that "GCT" sequence of that gene represents introns. A part of the anti-sense strand of that gene is as follows:

5' ACTGCTTTAGGGCTCTAGCTGCAAAGTCAGCT 3'

i. Write the sense strand

(5 mark)

ii. What is the possible m-RNA strand?

(5 mark)

c. Briefly explain how RNA duplex is formed (use suitable diagrams)

(5 mark)

2. Following description is based on coat colour of mice.

a. Normal wild type coat colour is agouti, a grayish pattern is formed by alternating bands of pigment on each hair. Agouti is dominant to black (non agouti) hair, which is caused by a recessive mutation, (a). Thus (A) results in agouti, while (aa) yields black coat colour. When it is homozygous, a recessive mutation, (b), at a separate locus, eliminates pigmentation altogether, yielding albino mice (bb), regardless of the genotype at the other locus.

A cross is made between albino mice and black colour mice and F1 Phenotypic ratios are as follows.

1/4 agouti, 1/4 black, 1/2 albino

Note: gene A represents the coat colour of mice.

i. What is the genetic basis of this incident?

(2 mark)

ii. Find the genotypes of F1 generation (mention all the steps)

(5 mark)

b. A group of scientists wanted to design an experiment related to the inheritance of body colour of mammals. Therefore, the black colour mouse of F1 generation was crossed with agouti mouse. Find the possible genotypic ratio of this cross.

(3 mark)

c. Certain genetic abnormality expresses by having x- linked dominant allele.

Abnormal woman get married to a man who is not abnormal and from that marriage they got two offspring. The first offspring is a female who is not expressing abnormal condition. That normal female get married to a abnormal man and their first abnormal female offspring get married to a abnormal man and they got two female offspring both having abnormal condition.

i. Draw the pedigree and find the genotypes

(8 mark)

ii. What is the probability of having a normal male offspring in the progeny three?

(2 mark)

3. Tea is a major cash crop in Sri Lanka that is mainly propagated by vegetative means. Creation of genetic variation through sexual reproduction is difficult. We also know that, tea is an introduced crop and there are no wild relatives in Sri Lanka. Supposed that you want to incorporate drought resistant qualities to existing tea cultivar TRI 2015. Unfortunately, a previous study revealed that there are no drought resistant tea cultivars at present in Sri Lanka.

a. Suggest a suitable breeding method to artificially induce genetic variation in TRI 2015.

(5 mark)

b. Explain the stepwise procedure for the breeding method you named in 3a above.  
(15 mark)

4.

a. State five (5) centres of origin of world crops and give two (2) example crops for each of the centre.

(10 mark)

b. Why is the importance of studying centres of origin of world crops? (5 mark)

c. What are the important plant traits in early crop domestication? Your answer should include at least five important traits.

(5 mark)

5.

a. What do you mean by "hybrid vigor"? (5 mark)

b. Describe the procedure for producing hybrid seeds using two superior corn varieties as parents. (Your answer should include all the steps in the breeding program).

(10 mark)

c. What would happen to hybrid vigor, if you use open-pollinated seeds (F<sub>2</sub>) of a hybrid corn cultivation, to establish the next generation?

(5 mark)

