

**3 HOURS (100 Marks)**

**INSTRUCTION: Answer any FOUR questions. Each question carries 25 marks**

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1. Explain the following concepts in animal genetics highlighting their implications in animal breeding;

- NOV 2024
- a) Pleiotropy. [5 marks]
  - b) Penetrance. [5 marks]
  - c) Variable expressivity. [5 marks]
  - d) Incomplete penetrance. [5 marks]
  - e) Phenocopies. [5 marks]

2.

- a) State the **five** assumptions of the Hardy-Weinberg law. [5 marks]
- b) Discuss how violations of these assumptions can lead to deviations from genetic equilibrium. [5 marks]
- c) Using the Hardy-Weinberg equation, calculate the expected genotypic frequencies in a population with two alleles (a and A) at a locus, given that the frequency of allele A is 0.6. Show your calculations. [15 marks]

3.

- a) Define the following correlation terms;
  - i. Genetic correlation. [3 marks]
  - ii. Environmental correlation. [3 marks]
  - iii. Phenotypic correlation. [3 marks]

b) Discuss how these correlations influence the response to selection in animal breeding.

[10 marks]

c) Provide examples of traits with positive and negative correlations and explain their implications for breeding objectives.

[6 marks]

4. Discuss the potential synergies and challenges of combining different selection approaches.

[25 marks]

5.

a) Describe the process of marker-assisted selection and explain how molecular markers are used to assist in the selection of desired traits.

[15 marks]

b) Discuss the limitations or challenges associated with marker-assisted selection and how they can be overcome.

[10 marks]

6.

a) Discuss the importance of record keeping and data analysis in a breeding program.

[10 marks]

b) Describe the challenges and future prospects of breeding programs in the face of climate change and emerging diseases.

[15 marks]

**END OF PAPER**