



**THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY**  
**DEPARTMENT OF AGRICULTURE**  
**SEMESTER ONE FINAL EXAMINATION**  
**AG 413 PLANT BREEDING**  
**4<sup>th</sup> YEAR BSAG**  
**June, 2021**  
**TIME ALLOWED: 3 HOURS**

**INFORMATION FOR CANDIDATES:**

1. You have 10 minutes to read the paper. You must not begin writing during this time.
2. The examination paper has two parts:  
**Part A: Definition of terms.....10 Marks**  
**Part C: Short Answer Questions.....40 Marks**  
**Part B: Conceptual Questions.....50 Marks**  
**Total.....100 Marks**
3. Answers must be written in the book provided. No other written materials will be required.
4. Rulers, calculators and correction fluids are required in the examination room. **Mobile phones, Notes and Text books are NOT ALLOWED.**
5. Write your name and student number clearly on the front page of your answer book and examination attendance slip. **DO IT NOW.**
6. **Total marks = 100.**

## Part A. Definition of terms

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### **Question One** (10 Marks)

Define *any five (5)* of the following terms:

- |                         |                         |
|-------------------------|-------------------------|
| 1) Plant breeding       | 5) Protogyny            |
| 2) Bulbil               | 6) Protandry            |
| 3) Megasporogenesis     | 7) Self-incompatibility |
| 4) Double fertilization | 8) Allopolyploidy       |

## Part B. Short Answer Questions

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Answer all of the questions provided in this section.

### **Question Two** (3+ 3 = 6 Marks)

Discuss the difference between a test cross and a progeny test.

### **Question Three** (10 Marks)

- Discuss the difference between a Centre of Diversity and a Centre of Origin. (6 Marks)
- List any two of the Vavilov's Centres of Diversity, and two crops that are postulated to have originated there, respectively. (4 Marks)

### **Question Four** (2 + 1 + 1 + 2 = 6 Marks)

Discuss the differences between a hermaphrodite flower, a pistillate flower, staminate flower, and an inflorescence.

### **Question Five** (3+ 3 = 6 Marks)

Discuss two undesirable effects of plant breeding.

### **Question Six** (3+ 3 = 6 Marks)

- Discuss the difference between primary and secondary introduction,
- Give an example of a crop that has been introduced into PNG that fall into these categories of introductions.

**Question Seven** (3+ 3 = 6 Marks)

Discuss briefly the four main attributes of a “plant variety”, and state how it differs from a landrace.

**Part C. Conceptual Questions**

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Answer all of the questions provided in this section.

**Question Eight** (20 Marks)

- a) Discuss the three main objectives of polyploidy breeding. (6 Marks)
- b) What is *Gigas* effect? (2 Marks)
- c) Briefly explain, using an *example*, how *Gigas* effect can be manipulated to improve crop production. (4 + 8 = 12 Marks)

**Question Nine** (15 Marks)

Outline an *efficient* plant breeding method that involves hybridization you would use in breeding for either one of these scenarios:

- a) To improve seed size in winged bean (*Psophocarpus tetragonolobus*: Leguminosae) (10 Marks) or
- b) To improve corm yield in sweetpotato (*Ipomoea batatas*: Convolvulaceae). (10 Marks)
- c) Give your reasons as to why you chose this method as the most efficient. (5 Marks)

**Question Ten** (15 Marks)

Let us consider a hypothetical scenario where F<sub>1</sub> seeds were obtained from a cross between a tall (TT) male and dwarf (tt) female parent. The maternal parent is known to be apomictic. The seeds from this cross were planted out in a plot and observations were made on various plant traits.

- a) State the traits you would observe in the offspring population? (5 Marks)
- b) Explain the underlying basis of your observations. (10 Marks)



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END OF EXAM-