THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF AGRICULTURE -2ND YEAR DEGREE

FIRST SEMESTER EXAMINATIONS -2021

AG212 – AGRICULTURAL MECHANIZATION

WEDNESDAY, 16TH JUNE 2021– 8:20 A.M.

TIME ALLOWED: **3 HOURS**

TOTAL MARKS: 100

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read the paper. You must not begin writing during this time.

2. There are three (3) parts to this exam and 23 questions altogether. Part A contains questions with parts (a), (b), (c), etc.

3. Answer all questions.

4. Use only ink.

5. Start each question on a new page and show all your calculations in the answer book provided. No other material will be accepted.

5. Write on one side of the page only and keep the margins clear.

6. Write your NAME and Student NUMBER clearly on the front page. **Do it now**.

7. Calculators are permitted in the examination. Note and textbooks are not allowed.

8. Marks for each of the question are given within parenthesis at the end of each question.

9. Switch your mobile phone **OFF**.

PART A SHORT AND DESCRIPTIVE ANSWERS WITH CALCULATIONS

Question 1 (2+4+6 = 12 Marks)

(a) What is Agricultural Mechanization?

(b) State two (2) advantages and two (2) disadvantages of agricultural mechanization.

(c) State three (3) different sources of farm power and explain how each can be used.

Question 2 (3+2+4+4+3 = 16 Marks)

(a) (i) Explain how work is related to power , and **(ii)** state the units of work and power clearly

(b) Define Tractor and state two main uses of the tractor.

(c) Explain two main differences between a wheeled tractor and a crawler tractor.

(d) Define 'Draft force' and state its units of measure?

(e) Explain with diagrams the 'Pascal's Principle' demonstrating how it has been used as an advantage.

Question 3 (4+4+4= 12 Marks)

(a) An energy converter converts one form of energy to another. Explain how an Internal combustion engine is an energy converter and between what different forms of energy does it operate?

(b) Describe two (2) main differences between petrol and diesel engines.

(c) (i) Define PTO, and **(ii)** Differentiate between PTO Power and Tractor power.

Question 4 (4+2 = 6 Marks)

(a) List **(i)** Two primary tillage objectives, and **(ii)** Secondary tillage objectives

(b) State the possible conditions affecting the decision of a farmer to select a mould board plough over the other types of ploughs, to plough a certain land area.

Question 5 (2+2+3+3 = 10 Marks)

A three-bottom 1 m plough would be required to plough a 21 ha field. The plough should be able to plough 3 ha/day. A 40 kW tractor is required for the job. The field efficiency, N= 75 %. Take 8 hours of work in a day. The specific fuel consumption rate is *0.31 litres of fuel per kilowatt per hour (l/kWh).* Calculate:

(a) Total width of plough
(b) The speed of plough in m/hr
(c) With the theoretical field capacity (TFC) given as 3 ha/day, calculate the effective field capacity in ha per hour.
(d) The total amount of fuel consumed in ploughing 21 ha of field.

Question 6 (4+4+4+3=15 Marks)

(a) State four (4) requirements of perfect sowing.

(b) Calculate the time required for sowing 1.2 hectares of land by a five furrow seed drill working at 11.5 cm deep. The speed of seed drill is 3 km/hr and pressure exerted by the soil on the seed drill is 0.42 kg/cm2. The space between furrow openers is 10 cm and time loss in turning is 10%. *(Be careful of unit conversions)*.

(c) The following observations are recorded while calibrating the seed drill.

Number of furrows = 10

Spacing between the furrows = 20 cm

Diameter of the ground wheel = 1.5 m

Speed of rotation of ground wheel = 500

Weight of seed collected = 20 kg

Calculate the seed rate. (Be careful of unit conversions).

(d) Maximum yield of maize is obtained with a population of 40,000 plants per hectare. The rows are 100 cm apart and an average emergence is 90% expected. What would be seed spacing? *(Be careful of unit conversions)*.

Question 7 (2+3= 5 Marks)

(a) Define brittleness and ductility in metals.

(b) Explain why surface coating of farming equipment or machinery is necessary and that farm equipment need to be clean and dry and stored in proper shelter.

Question 8 (2+3+2 = 7 Marks)

(a) Define the ‘Post Harvest Handling’ process.

(b) Describe three (3) main elements of the post-harvest system.

(c) List and describe two (2) causes of fruits and vegetables post-harvest losses.

PART B - MULTIPLE CHOICE (11 Marks)

Select the preference that best suits the statement.

9. Conditions for use of ductile material include

(a) Compressive loads

(b) Tensile and shock loads

(c) Heavy loads

(d) All of the above

10. Material selection normally takes note of factors such as;

(a) Density, shape and size, and thermal conductivity

(b) Suitability, cost and availability

(c)Tough, corrosion resistant, and Machinability

(d) All of the above

11. An agricultural machine that cuts, threshes, and cleans a grain crop in one operation

(a) Baler (b) Rake

(c) Combine (d) Cultivator

12. Machine used for planting precisely and accurately

(a) Cultivator (b) Plow

(c) Planter (d) Rake

13. A large farming implement with one or more blades fixed in a frame, drawn by a tractor or by animals and used for cutting furrows in the soil and turning it over, especially to prepare for the planting of seeds.

(a) Tractor (b) Plow

(c) Rake (d) Cultivator

14. A mechanical implement for breaking up the soil and uprooting weeds.

(a) Plow (b) Spreader

(c) Cultivator (c) Planter

15. A 10-row automatic transplanter operates at a forward speed of 0.5 m/sec. If seedling spacing along the row is 0.5 m and row to row spacing is 0.75 m, the required feed rate of the seedlings into the transplanter is; **(3 Marks)**

(a) 500 seedlings per minute (b) 600 seedlings per minute

(c) 240 seedlings per minute (d) 480 seedlings per minute

16. Disc ploughs are used on;

(a) wet and swampy soil (b) Hard dry soil

(c) Already ploughed soil (d) All of the above

17. The property of a material which allows it to be drawn into a smaller section when pulled is called

(a) Plasticity (b) Ductility

(c) Drawability (d) Elasticity

PART C – TRUE/FALSE (6 Marks)

Fill in the blanks with the appropriate term 'True' or 'False'.

18. Identifying one's 'priority critical field operation' is the first step in estimating tractor power needs. _____

19. Clutch is a device, used to connect and disconnect the tractor engine from the transmission gears and drive wheels._____

20. A necessity for having clutch in a tractor is to allow for changing of gears._____

21. Differential and Final drive are not part of the power transmission system of the tractor._____

22. Storage unit, metering mechanism and carrying frame are some of the essential components of the fertilizer application equipment._____

23. Grain/food drying is about food technology and not part of Post Harvesting process._____

End of Examinations