THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF AGRICULTURE -2ND YEAR DEGREE

FIRST SEMESTER EXAMINATIONS -2020

AG212 – AGRICULTURAL MECHANIZATION

WEDNESDAY, 24TH JUNE 2020– 12:40 P.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. Answer all questions.
3. Use only ink.
4. 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.

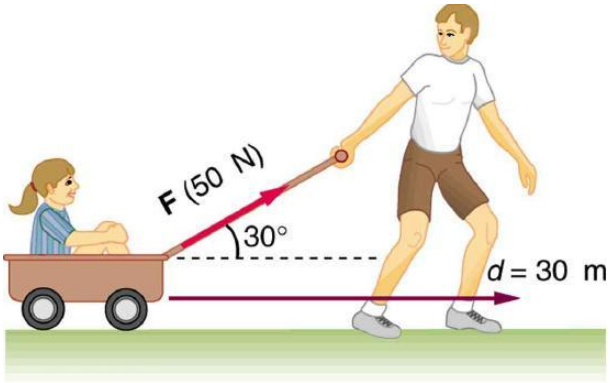
PART A SHORT AND DESCRIPTIVE ANSWERS

Question 1 (2+4+4+6 = 16 Marks)

(a) What is Agriculture Mechanization?
(b) Give four reasons why there is a need for farm mechanization.
(c) Prime movers are devices that convert thermal, potential or kinetic energy into mechanical work. List two prime movers that are involved in the energy conversion in agricultural mechanization, and explain how each does that.
(d) State three (3) different sources of farm power and explain each.

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

a) Define the term 'work' in physics, state its formula and the units by which it could be expressed.
b) Explain how work is related to Power.
c) Select a simple machine and write about how its mechanical advantage is achieved, stating clearly how distance and effort change in the input as well as output .
d) How much work is done by the boy pulling his sister 30.0 m in a wagon as shown in Figure? Assume no friction acts on the wagon.



e) Explain with diagrams the 'Pascal's Principle'.

Question 3 (4+6+2+3= 15 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) There are 4 - stroke and 2 - stroke engines. Briefly explain each stage in a 4 –stroke **Diesel Engine** with diagrams for each stage.
c) List and explain two (2) main differences between diesel and petrol engine.
d) Describe the purpose of hydraulic system in a farm tractor.

Question 4 (4+2+4= 10 Marks)

(a) State four tillage objectives and explain each.
(b) Describe the function of a disc harrow and a condition for its use.
(c) Determine how much fuel a farmer needs to plough a field of 20 ha. He uses a 50 kW tractor with a three-furrow 400 mm cut plough and the soil is of the sand-loam type. From the list of field capacities, it can be found that a three-furrow plough requires 40 kW and it should be able to plough 5 ha/day. The field efficiency, N = 83 %. The available(PTO power) kW $= 50 \times 0.8 = 40$ kW. The specific fuel consumption $= 0.31\ \mathrm{l.kW^{-1}.h^{-1}}$(*0.31 litres of fuel per kilowatt per hour*)

Question 5 (4+3+3+3=13 Marks)

(a) State the 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/cm^2. The space between furrow openers is 10 cm and time loss in turning is 10%.*(Be careful of unit conversions)*.

(d) 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 5 (2+2+3+2= 9 Marks)

a) State two conditions where a brittle material is not applicable.
b) Define brittleness and ductility in metals.
c) Explain why Structural steel in bridges and in high storey buildings has the characteristics it possesses, indicating a metal property that structural steel possess and one that it does not possess.
d) 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 6 (2+3+3+3 = 11 Marks)

a) Define 'Post Harvest Handling'.
b) Describe three (3) main elements of the post-harvest system.
c) State and explain three (3) objectives/reasons of applying post-harvest technology to harvest fruits and vegetables.
d) List and describe three (3) main causes of fruits and vegetables post-harvest losses.

PART B - MULTIPLE CHOICE (10 Marks)

Select the preference that best suits the statement.

1. Cast iron is an engineering material which is
(a) low in cost and has good casting characteristics
(b) high compressive strength and wear resistance
(c) excellent machine ability and a brittle material
(d) All of the above

2. Conditions for use of ductile material include
(a) compressive loads (b) Tensile and shock loads
(c) Heavy loads (d) All of the above

3. The factors that should be considered when selecting a material include;
(a) Density, shape and size, and thermal conductivity
(b) Suitability, cost and availability
(c)Tough, corrosion resistant, and Machinability
(d) All of the above

4. An agricultural machine that cuts, threshes, and cleans a grain crop in one operation
(a) Baler (b) Rake
(c) Combine (d) Cultivator

5. Machine used for planting precisely and accurately
(a) Cultivator (b) Plow
(c) Planter (d) Rake

6. 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

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

(a) Plow (b) Spreader
(c) Cultivator (c) Planter

8. A 8-row automatic transplanter operates at a forward speed of 0.25 m/sec. If seedling spacing along the row is 0.25 m and row to row spacing is 0.75 m, the required feed rate of the seedlings into the transplanter is

(a) 100 seedlings per minute (b) 130 seedlings per minute
(c) 240 seedlings per minute (d) 480 seedlings per minute

9. The penetration of a tandem disc harrow can be increased by

(a) Increasing tilt angle (b) Increasing disc angle
(c) Increasing disc diameter (d) All of the above

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

(a) Plasticity (b) Ductility
(c) Drawability (d) Elasticity

End of Exams