UNIVERSITY OF FORT HARE

INTRODUCTION TO AGRICULTURAL ENGINEERING AGG221

SUPPLEMENTARY EXAMINATIONS

FEBRUARY 2019

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Time: 3 hours

Subject: AGG221

Marks: 100

This paper consists of 3 pages including the cover page

Internal Examiners

R Moyo

INSTRUCTIONS
Answer ALL Questions

1. a. A hammer mill is required to operate at 1025 rpm. The electric motor that will provide power for the hammer mill runs at 1440 rpm. The hammer mill has a Vee belt pulley with a diameter of 225 mm. Calculate the diameter pulley required for the electric motor. (10)
   b. Gross mass of a vehicle is 2170 kg, and the tare mass is 1190 kg. Calculate how many bags of cement the vehicle can carry if the cement is 50kg per bag. (10)

2. a. The relative density of milk is 1.06. The specific gravity of water is 1000kg/m^3. A dairy has 65 cows producing an average of 24 kg of milk per cow per day. Calculate the volume tank (L) required to hold two days' production of milk. (10)

   b. List the items on tractor that must be checked every morning. (7)

   c. Which of two hydraulic levers should be used to control the working depth of fully mounted disc harrow while it is being used for secondary tillage? (3)

3. A machine will be used to plant soyabeans and apply fertiliser in the rows. The desired final population of soyabeans is 200 000 plants per hectare. The seed is certified to 80 % germination. Emergence losses are estimated to be 8 %. The crop will be planted in 45 cm rows, and the planter units are driven by wheels that have a circumference of 1500 mm. Calculate the number of seeds that need to be dropped for 3 turns of the wheel when calibrating the machine. (20)

4. A farmer wishes to plant 65 ha of maize with a 4 row conservation agriculture planter that also applies fertiliser, and 44kW tractor. The crop spacing is 0.75 m. The same tractor will be used to spray herbicide with a 600 litre boom sprayer which has 22 nozzles at 500 mm spacing. The cost of both operators together is R21.00/h. Calculate the total cost for both operations. (20)

Table 1: Typical soil drafts when soil is easily workable (speeds for tractors)

Implement	**Power rating**	**Draft (kN/m effective width)**			**Typical Speed (km/h)**
		Sandy soil	**Loam soil**	**Clay soil**	
Plough	High	5	10	16	3-4
Planter	Low	0.75kN/row	1.25kN	1.75kN/row	5-7
Boom sprayer	Low				6-8

Table 2. Field Efficiencies for different machinery activities (tractor operated)

Activity	Field Efficiency (%)
Primary and secondary tillage	80
Planting of row crops (seed only)	60
Planting and fertilising row crops	50
Spraying with boom sprayer	55

Table 3. Tractor costs per hour of operation for different size tractors

Tractor (kW)	Power rating Of implement	Cost of operating tractor (R/h)		
		1000h/yr use	500h/yr use	250h/yr use
44	High	141.3	221.18	345.15
	Medium	145.0	209.03	333.00
	Low	135.5	199.58	323.55

Table 4. Implement costs per hour of operation (tractor drawn)

Implement Type	Cost per hour (R/h)
Plough, 3 furrow mould board	15.5
Disc harrow, 2 m mounted	78.47
Disc harrow, 2.3m trailed	196.64
Planter, 2 row	74.46
Planter, 4 row	169.95
Planter, 4 row, conservation agriculture	257.70
Boom sprayer, 400l tank, 6-10m boom	40.33
Boom sprayer, 600l tank, 8-12m boom	52.26

5. a. With aid of diagram, explain how a VIP toilet is different to a normal toilet. Explain why this type of toilet should be encouraged. (10)

   b. You measure the distance between two points X and Y on a map with a ruler and the distance 43 mm. The map scale is 1: 25 000. What distance is there between X and Y on the ground? (4)

   c. Calculate the % slope from point A to B which are 74 mm apart on a map with a scale of 1: 20000. Point A is on contour level 1694 above sea level. Point B is midway between contours 1708 and 1709 (6)

END OF EXAMINATION