



**UNIVERSITY OF SWAZILAND  
FINAL EXAMINATION PAPER**

**PROGRAMME: BSC AGRIC ECON. AGBMGT. II  
BSC AGRIC EDUC. II  
BSC AGRIC AGRON. II  
BSC ANL SC. II  
BSC HORT. II  
BSC LWM. II**

**COURSE CODE: LUM 205 (NEW PROGRAMME)**

**TITLE OF PAPER: FARM MECHANISATION**

**TIME ALLOWED: TWO (2) HOURS**

**SPECIAL MATERIAL REQUIRED: NONE**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO  
OTHER QUESTIONS.**

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN  
GRANTED BY THE CHIEF INVIGILATOR**

## QUESTION 1

- a) Discuss the advantages and disadvantages of the use of mould board ploughs as opposed to disc ploughs in Southern Africa. [15 marks]

- b) A farm with an arable area of 120 ha is to be put to production in the following manner. 60 ha is to be used for the production of rainfed maize, 30 ha used for producing silage and irrigated pasture, and the remainder used for natural grazing. The farmer involved requires that you determine the size of the machinery complement required for the production of the maize operation given the following data:

- A) The maize must be planted by November 1 of each year and ploughing can only be done in the months of September and October.  
 B) During each of the ploughing months approximately 10 days of the 30 days available in each month are unworkable due to rain.  
 C) Land preparation shall consist of mouldboard ploughing followed by single pass discing using a heavy tandem disc harrow. Average soil strength at the time of ploughing is estimated to be  $75 \text{ kN/m}^2$ , ploughing depth is to be 30 cm, whilst the draught force per unit width of the disc harrow is 2 kN/m. Field efficiency levels of 80% are estimated for both categories of equipment/

Given the information, determine:

- (i) The size of the tractor (i.e. minimum power output –assuming a reserve power requirement of 10% of peak implement demand);

[13 marks]

- (ii) The number of bottoms required by the plough (assuming only 45 cm cut bottoms are available);

[6 marks]

- (iii) The width of the disc harrow required for this operation.

[6 marks]

Assume: 
$$\frac{\text{Ploughing width}}{\text{Harrowing width}} = \frac{1}{10}$$

**QUESTION 2**

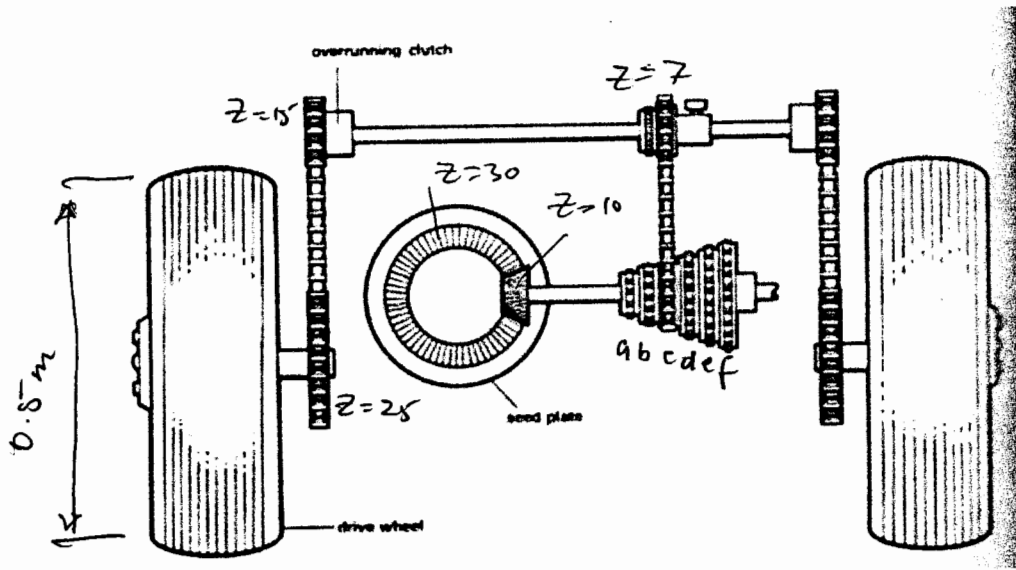
- a) Explain the purpose of leaving headland in a ploughing operation using a tractor?  
[7 marks]
- b) What are the different methods of ploughing land? Describe one with the help of a sketch.  
[10 marks]
- c) There are 15 discs in a disc harrow spaced at 25 cm. The average overlap in operation is about 30 cm between successive pass when it operates at 7 kph. If the total turning loss amounts to 30% of the total time engaged in harrowing, determine the field efficiency of the machine in that particular operation.  
[13 marks]

**QUESTION 3**

- a) Discuss the measures that can be taken to reduce spray drift when using conventional boom sprayers.  
[10 marks]
- b) Determine the nozzle flow rate of a sprayer that will travel at 8 kph and has a nozzle spacing of 50 cm on a 18 m boom given that the desired application rate is 280l/ha.  
[12 marks]
- c) Compare and contrast the use of ULV (Ultra Low Volume) sprayers to conventional knapsack sprayers in small scale agriculture  
[8 marks]

**QUESTION 4**

- a) Explain the concept of minimum tillage as compared to zero tillage in semi-arid regions. [8 marks]
- b) Given the planter layout shown in figure 1, and assuming the use of a 16 cell seed plate, determine the average seed spacing achieved when:
- (i) the ten tooth sprocket is driving; [7 marks]
  - (ii) the 18 tooth sprocket is driving. [7 marks]
  - (iii) Also determine the plant population achieved in (i) and (ii) assuming a row spacing of 90 cm. [8 marks]



$a = 8$   
 $b = 10$   
 $c = 15$   
 $d = 18$   
 $e = 20$   
 $f = 25$

Figure 1 Planter

## Range in Typical Field Efficiencies and Implement Operating Speeds

Operation	Equipment	Field Efficiencies, %	Operating Speeds km/hr [mi/hr]
Tillage	moldboard plow	88-74	5-9 [3.1-5.6]
	disk harrow	90-77	6-10 [3.7-6.2]
	spring-tooth or spike-tooth harrow	83-65	6-12 [3.7-7.5]
	field cultivator, chisel plow	90-75	6-9 [3.7-5.6]
Cultivation	row crop cultivator	90-68	3-9 [1.9-5.6]
	rotary hoe	88-80	9-20 [5.6-12.4]
Seeding	row planter with fertilizer	78-55	7-10 [4.3-6.2]
	grain drill with fertilizer	80-65	5-10 [3.0-6.2]
	broadcaster	70-65	7-10 [4.3-6.2]
	potato planter	80-55	9-12 [5.6-7.5]
Harvesting	mower-conditioner	95-80	5-9 [3.0-5.6]
	rake	89-62	6-9 [3.7-5.6]
	baler, rectangular	80-65	5-10 [3.0-6.2]
	baler, round	50-40	5-19 [3.0-12.0]
	forage harvester, shear bar	76-50	6-10 [3.7-6.2]
	combine	90-63	3-8 [1.9-5.0]
	corn picker	70-55	3-6 [1.9-3.7]
	windrower, swather	85-75	6-10 [3.7-6.2]
	potato harvester	90-50	3-6 [1.9-3.7]
	cotton, spindle picker	90-65	3-5 [1.9-3.1]
Miscellaneous	sprayer	80-55	7-10 [4.3-6.2]
	anhydrous ammonia applicator	65-55	6-9 [3.7-5.6]
	rotary stalk chopper, mower	85-65	6-10 [3.7-6.2]
	fertilizer spreader	90-60	6-10 [3.7-6.2]

Source:

Donnell Hunt:

*Farm Power and Machinery Management, 8th edition*