



**UNIVERSITY OF SWAZILAND  
SUPPLEMENTARY EXAMINATION PAPER**

**PROGRAMME: BSC LWM. II**

**COURSE CODE: LUM 203**

**TITLE OF PAPER: FARM POWER (NEW PROGRAMME)**

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

**SPECIAL MATERIAL REQUIRED: NONE**

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

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GRANTED BY THE CHIEF INVIGILATOR**

**SECTION I      COMPULSORY****QUESTION 1**

- a) Name the four basic parts of an internal combustion engine and their functions in the engine.

[8 marks]

- b) Distinguish between an internal combustion engine and an external combustion engine.

[4 marks]

- c) The data in Table 1 was extracted from the sales pamphlet of a tractor dealer in Matsapha.

Calculate:

- i) the total piston displacement;
- ii) the clearance volume per cylinder;
- iii) compare the engine capacity with total piston displacement.

[16 marks]

Table 1.      Engine Data

Bore	98.4 mm
Stroke	127.0 mm
Number of cylinders	4
Engine Capacity	3.86 l

- d) What factors have led to diesel engines being preferred to petrol engines as a source of power for agricultural tractors?

[12 marks]

**SECTION II**

**ANSWER ANY TWO QUESTIONS**

**QUESTION 2**

- a) Draw a picture of a bull showing the girth and length measurements. Using the diagram, explain the procedure to determine the weight of the bull. Stipulate the necessary conditions that must be observed to reduce errors of measurement. [15 marks]
- b) Calculate the weight a two year old steer with a girth of 165 cm and a length of 149 cm. Basing on its weight, would you recommend the steer for draught work? [10 marks]
- c) List the desirable characteristics one should consider in choosing a bovine for draught purposes. [5 marks]

**QUESTION 3**

- a) There are possibilities of refuelling a tractor either in the morning before going out to work or in the evening after work. Which time would you recommend to a farmer to refuel his/her tractor? Give reasons for your answer. [10 marks]
- b) Figure 1 over the page shows the components of drive train of a tractor power transmission system. Table 1 shows the transmission data from the technical specifications of the operator's manual for the components in figure 1.

Calculate

- i. the speed of the rear driven wheels, in revolutions per minute, if the engine is running at 1500 rpm and gear number 4 has been selected. [10 marks]

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Calculate

- i. the speed of the rear driven wheels, in revolutions per minute, if the engine is running at 1500 rpm and gear number 4 has been selected. [10 marks]

- ii. the forward speed of the tractor in km/h, if the tractor is fitted with 16.9/14 – 30 tyres and assuming that there is no slip on the ground and the aspect ratio is 80%.

[10 marks]

Table 1  
drive train of a tractor.

: Gear Ratio for the

Drive Component	Gear Ratio
Gearbox	
Gear 1	8.0:1
Gear 2	7.0:1
Gear 3	6.0:1
Gear 4	5.0:1
Gear 5	4.0:1
Gear 6	3.0:1
Gear 7	2.0:1
Gear 8	1.0:1
Differential	8.0:1
Final Drive	5.0:1

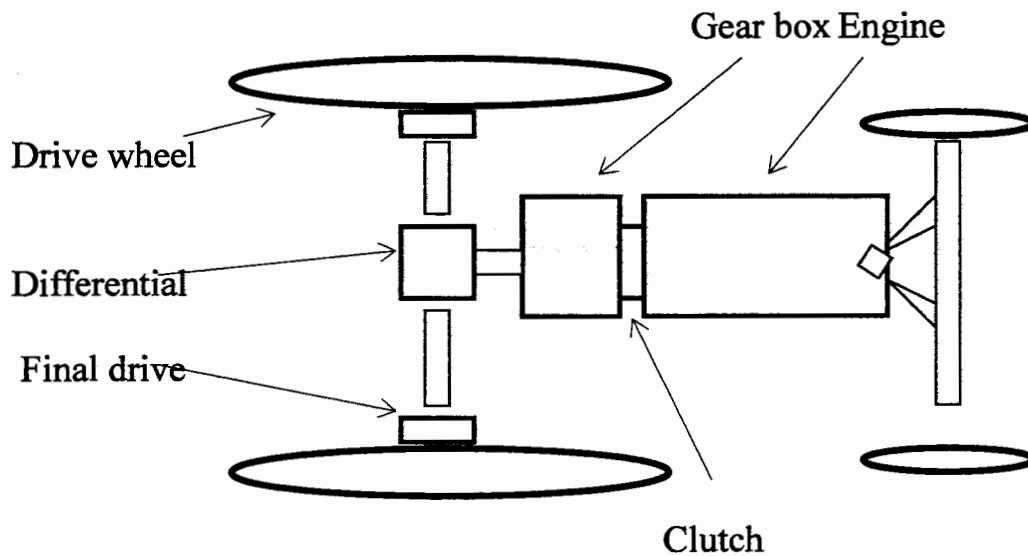


Figure 1 The drive train of a tractor power transmission.

## QUESTION 4

a) Tractors are mostly utilised on soft ground as compared to road vehicles. What is the effect of tractor weight on the following:

(i) Rolling resistance of the wheel? [4 marks]

(ii) Slip of the wheel on the ground? [4 marks]

(iii) For each of (i) and (ii) above explain how the effect is manipulated to enable the tyre to effectively provide sufficient traction for the tractor. [12 marks]

b) Figure 2 shows a tractor and an implement in operation. Calculate the weight transfer on to the rear wheels due to a drawbar pull of 600 N. [10 marks]

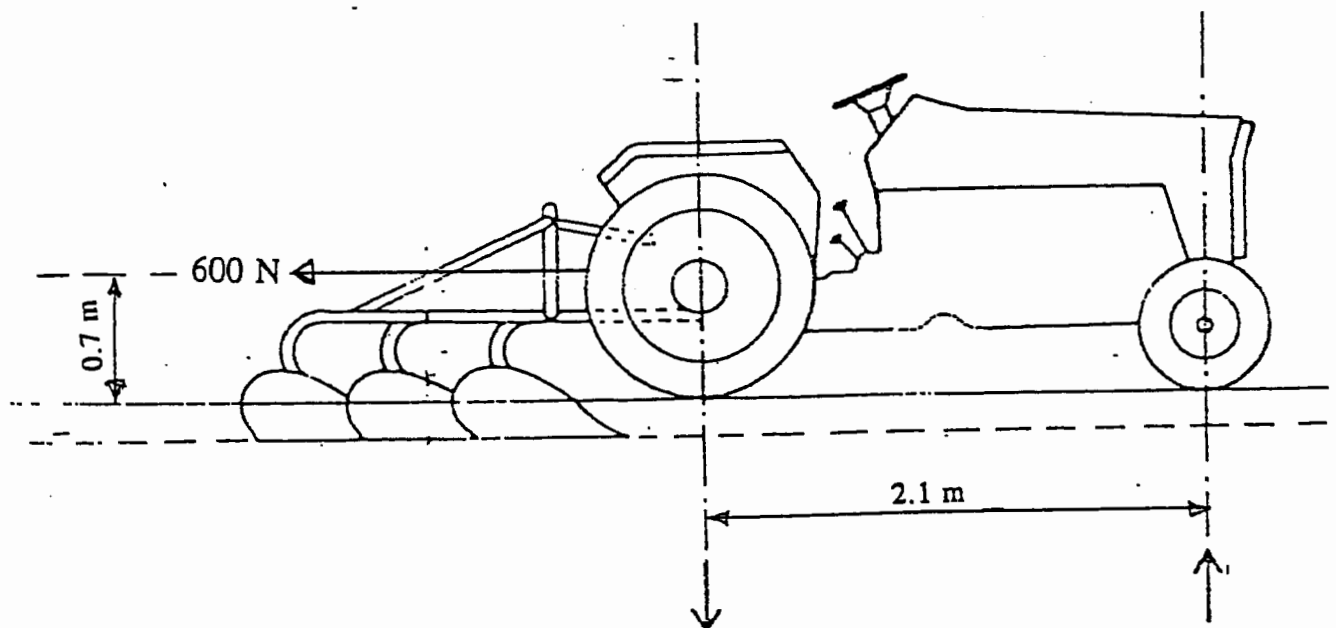


Figure 2. Weight transfer on a tractor due to drawbar pull