1st SEM.2008/2009



## UNIVERSITY OF SWAZILAND
### FINAL EXAMINATION PAPER

*COURSE CODE*: LUM 203

TITLE OF PAPER: - FARM POWER

BSC. LAND AND WATER MANAGEMENT YEAR 2

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: SCIENTIFIC CALCULATOR

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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## SECTION ONE: COMPULSORY

**QUESTION ONE**

(a) Define the following terms as they apply in internal combustion engines;
(i)    Cylinder bore
(ii)   Stroke
(iii)  Compression ratio
(iv)   Clearance volume
(v)    Piston displacement
(vi)   Displacement volume
(vii)  Piston speed                                    (7 Marks)

(b) A Massey Ferguson 1035 diesel tractor runs on a three cylinder, four stroke internal combustion engine. The cylinder bore is 88.9 mm, the stroke is 127 mm, compression ratio is 16.5: 1 and engine speed at rated power is 2000 revolutions per minute (rpm).

Calculate:
(i)    Clearance volume,
(ii)   Piston displacement,
(iii)  Displacement volume, and
(iv)   Piston speed                                   (10 Marks)

(c) Give a brief description of how you would differentiate the following types of tractors by their external features:
      (i)  A two-wheel drive from a four-wheel drive
      (ii) A "true" four-wheel drive from an auxiliary four-wheel drive.
                                                     (4 Marks)

(d) Name **THREE** animal species used for draught work and indicate the type of work each species is most suited for.                    (9 Marks)

(e) In most southern African countries, the peak demand period for ploughing amongst smallholder farmers who rely on draft animals coincides with the dry period when the animals are in their worst body condition. Discuss this statement and make three recommendations to overcome the challenge.    (10 Marks)

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## SECTION II: ANSWER ANY TWO QUESTIONS

### QUESTION TWO

(a) A farmer approaches you for advice on how to jump-start a tractor. Draft a simple jump-starting procedure which you will leave with the farmer for future reference. Explain why some of the steps have got to be done in the way you present them. (15 Marks)

(b) Name and explain **FIVE** conformation characteristics that are considered in draught animal selection. (15 Marks)

### QUESTION THREE

(a) Define firing order as it applies in internal combustion engines. (2 Marks)

(b) The design of a crankshaft for an in-line six cylinder engine is as shown in the Figure 1 below.
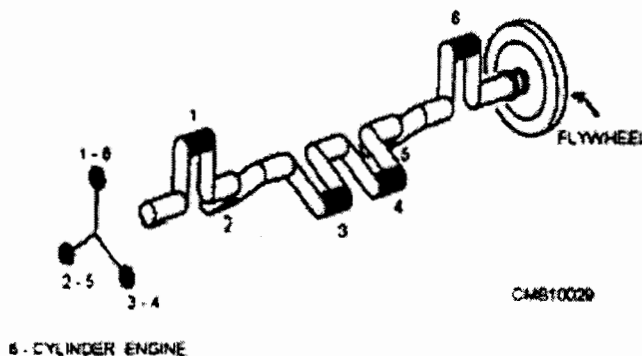


Figure 1—Crankshaft design for an in-line six cylinder engine

Work out **two** firing orders that are possible with this design. Indicate the condition(s) that must be observed in the design. (8 Marks)

(c) The following information is inscribed on a tractor tyre; **16.9-34 10 PR.** What information does this inscription present to you? (5 Marks)

(d) Explain what wheel slip is in respect to off road vehicles and state two reasons why the levels of wheel slip should be limited during a ploughing operation. (10 Marks)

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(e)  Figure 2, below, shows a simple V-belt-drive system that is commonly encountered on farms. The pitch diameter of the driver pulley is 100 mm and that of the driven pulley is 200 mm. Given that the centres of the pulleys are 250 mm apart, determine the length (L) of the belt.                    (5 Marks)
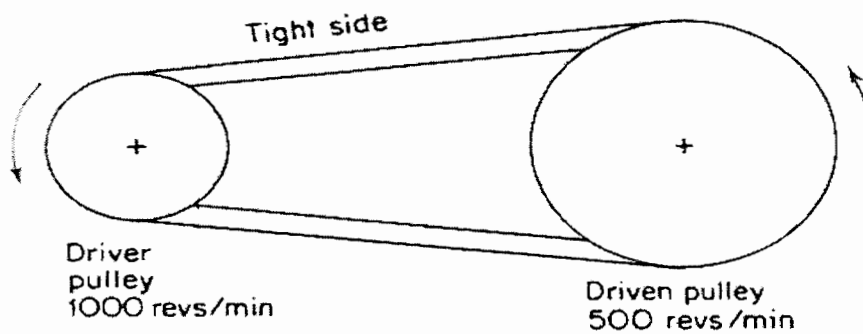


Figure 2. Simple V-belt drive system.

**QUESTION FOUR**

(a) You have discovered that the temperature gauge needle of your tractor points to red (or similar sign of overheating). What remedial action would you take to restore the correct operating temperature of your tractor          (10 Marks)

(b) Explain the need for ballasting on tractors, the forms it takes on conventional tractors and the operations in which ballasting is important.        (5 Marks)

(c) Define ergonomics and discuss its importance in operator productivity.
(10 Marks)

(d) A farmer's son has got a capability to continuously carryout tasks that require power output of a maximum of 300 watts (W). The farmer assigns his son to do a job that requires 600 W power output. How would you advise the son to handle this task?                                 (5 Marks)

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