

1<sup>st</sup> SEM.2013/2014



**UNIVERSITY OF SWAZILAND  
FINAL EXAMINATION PAPER**

***COURSE CODE:*            ABE 203**

***TITLE OF PAPER:*        FARM POWER**

***BSc. AGRICULTURAL & BIOSYSTEMS ENGINEERING  
YEAR 2***

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

**SPECIAL MATERIAL REQUIRED: CALCULATOR**

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

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GRANTED BY THE CHIEF INVIGILATOR**

SECTION ONE: COMPULSORY

QUESTION ONE

- (a) Describe the 4-stroke cycle of a petrol engine. **[10 Marks]**
- (b) Discuss the operational differences between a petrol engine and a diesel engine **[10 Marks]**
- (c) List the pros and cons of using belts to transmit power in agricultural machines **[10 Marks]**

- (d) The effective length of a drive belt between two pulleys is given by the equation :

$$L = 2C + \frac{(D - d)^2}{4C} + \pi \frac{(D + d)}{2}$$

Define the symbols used in the equation

**[5 Marks]**

- (e) Determine the belt length required to transmit power from a 50 mm diameter pulley to a 350 mm diameter pulley. The pulleys centres are 750 mm apart. **[5 Marks]**

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**SECTION II: ANSWER ANY TWO QUESTIONS**

**QUESTION TWO**

- (a) With the aid of a neat labeled sketch, describe the engine water cooling system. **[10 Marks]**
- (b) Discuss human related causes of farm machinery accidents. **[10 Marks]**
- (c) Your local member of parliament advocates use of animal traction instead of tractors on Swazi Nation Land (SNL). You have been requested to assist him compile facts in preparation for the on-coming debate in the August House. Discuss **five (5)** key points that you would suggest to him. **[10 Marks]**

**QUESTION THREE**

- (a) Describe the step by step procedure you would use to jump-start a tractor with a dead battery. **[10 Marks]**
- (b) 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 **[14 Marks]**
- (c) A Massey Ferguson 1035 diesel tractor has 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 is 2000 revolutions per minute (RPM). Calculate
- (i) Engine capacity in  $\text{cm}^3$
  - (ii) Clearance volume in  $\text{cm}^3$ ,
  - (iii) Piston displacement in  $\text{cm}^3$ ,
  - (iv) Displacement volume in litres, and
  - (v) Piston speed in m/minute
  - (vi) Stroke-bore ratio. **[6 Marks]**

#### QUESTION FOUR

a) Briefly describe the functions of the following internal engine components;

- (i) piston rings
- (ii) connecting rod
- (iii) rocker arm
- (iv) gudgeon pin
- (v) inlet valve

**[10 Marks]**

b) Give a detailed description of the preventive maintenance that you would conduct on a dry element air intake and exhaust system. Clearly indicate the remedial actions that you would take at each stage.

**[20 marks]**