**1st SEM. 2011/2012**

## 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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## SECTION ONE: COMPULSORY

### QUESTION ONE

(a) The most common internal combustion engines that we use in farming are the two- and the four-stroke engines;
- i. briefly discuss the differences between a two-stroke and a four-stroke internal combustion engine, **(5 Marks)**
- ii. explain how the four engine cycle events take place in a four-stroke internal combustion engine, **(10 Marks)**
- iii. state the advantages of a two-stroke internal combustion engine. **(5 Marks)**

(b) State and explain **FOUR** characteristics that you would advise farmers to consider when selecting steers for draught work **(10 Marks).**

(c) To predict the power generated by a wind turbine, the following equation is used:

Power in watts (P) = ½ x $\rho$ x A x $v^3$

Where:

P = power in watts

$\rho$ = air density in kg/m³.

A = rotor swept area, exposed to the wind in m²

v = wind speed in m/s

Calculate:

**i)** The power (in kW) generated by a turbine with a diameter of 3 m that is spinning in wind of density of about 1.225 kg/m³ and a steady velocity of 46.8 km/h. Express your answer in 2 decimal places. **(5 Marks)**

**ii)** Make a comment about the changes in power if the wind velocity drops by 50%. **(5 marks)**

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### SECTION II: ANSWER ANY TWO QUESTIONS

**QUESTION TWO**

(a) Discuss the appropriateness of animal traction in comparison to tractors use on Swazi National Land (SNL).                    **(10 Marks).**

(b) Describe **THREE** ways of hitching implements onto a tractor    **(5 Marks)**

(c) Bio-fuels seem to be a practical solution to the looming energy crisis in the new millennium. Discuss the status of bio-fuels in Swaziland addressing the following issues:

      i.   current and potential usage,

     ii.   advantages of bio-fuels, and

   iii.   limitations of bio-fuels                    **(15 Marks)**

**QUESTION THREE**

(a) Using an illustrating diagram, outline the procedure for estimating the weight of an ox using linear measurements. Indicate the conditions that must be met in taking the measurements.                    **(10 Marks)**

(b) Differentiate compression ignition from spark ignition.    **(5 Marks)**

(c) Define and briefly discuss compression ratio of an engine.    **(5 Marks)**

(d) Discuss the key parameters that determine the quality of diesel and petrol fuels.
                    **(10 Marks)**

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## QUESTION FOUR

(a)    Briefly describe the features and functions of tractors that are classified as four-wheel-drive                                                                 **(5 Marks)**

(b) An oil can is inscribed **SAE10W40**. What is the interpretation of these letters and figures?                                                                            **(5 Marks)**

(c) Describe the operation of the engine timing system.                 **(5 marks)**

(d)  You are tasked to supervise a labourer digging a 100-metre long trench, a task that demands 750 watts of human power. The labourer is capable of digging 3 metres in an hour. The labourer works from 06:30 hours, takes a 30-minute tea break at 10:00 hours, a 1 hour lunch break between 13:00 and 14:00 hours and knocks off at 16:00 hours. How many days would it take the labourer to the complete the trench given that time to rest (TR) when carrying out tasks that demand power greater than maximum continuous output, is given by $TR = 60 \times (1 - \frac{300}{P})$ min/ *hour*

Where P      =      power required to carryout the task in watts

TR            =      Time to rest.

Clearly show all the steps you take to reach the answer.                  **(15 Marks).**

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