

1st SEM.2009/2010



**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: NONE

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

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1st SEM.2009/2010

SECTION ONE: COMPULSORY

QUESTION ONE

- a) Briefly describe the potential application of wind energy in agriculture.
(5 Marks).
- b) A local Non-Governmental Organization (NGO) is seeking technical assistance in designing a wind-powered micro-irrigation system for a community garden project. The following data about the project site are provided:
- i. Average speed of prevailing wind = 10 m/s.
 - ii. Average wind density = 1.2 kg/m³.

The NGO has already ordered a wind turbine with blades measuring 150 mm in diameter.

Calculate the power that the turbine is likely to generate and recommend the water pump size for the project.
(10 Marks)

(Indicate your estimated efficiency of the system)

- c) Discuss the factors that contribute to reduced interest in using draught animal power in Swaziland. In your own opinion, what are the possible options of increasing use of draught animals in the country?
(10 Marks).
- d) If the needle of the engine temperature gauge points to red which is a sign of engine overheating, state five (5) fault finding checks that you will carry out on a tractor.
(15 Marks)

1st SEM.2009/2010

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- (a) Define rolling resistance. What are the factors that influence rolling resistance? **(10 Marks)**
- (b) With the aid of a sketch diagram, describe the diesel fuel system indicating pressure differences in the fuel lines **(10 Marks)**
- (b) Figure 1, below shows a belt driven air compressor. The motor pulley is 50 mm diameter and the pump pulley is 350 mm in diameter. Determine the belt length if the pulley centres are 750 mm apart. **(10 Marks)**

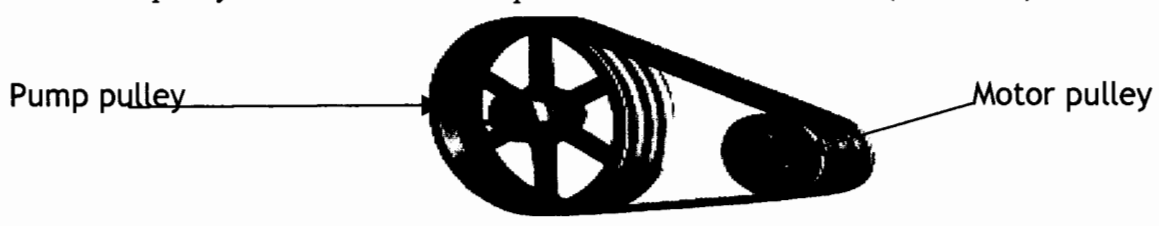


Figure 1. Air compressor belt drive.

QUESTION THREE

- (a) A stationary four-cylinder, four –stroke engine has a cylinder bore of 250 mm, a stroke of 500 mm, compression ratio of 16:1 and runs at 154 revolutions per minute.
 - (i) How many times does the engine fire (go on power stroke) in a minute?
 - (ii) Calculate the distance moved by the piston between the top dead centre (TDC) and the bottom dead centre (BDC) in a minute.
 - (iii) What is the piston speed in metres per second?
 - (iv) Calculate the displacement volume
 - (v) Calculate the clearance volume

(15 Marks)
- (b) State five (5) causes of excessive fuel consumption in engines. **(5 Marks)**
- (c)
 - i. The following inscription is written on a tractor tyre sidewall; **235/75 R 15 10 PR**. What does this information mean?
 - ii. Determine the section height of the tyre described in (i)
 - iii. Briefly describe the best practice for tyre storage on a farm.

(10 Marks)

QUESTION FOUR

(a) Give a narration of the preventive maintenance procedures that you would conduct before driving a tractor. Clearly indicate the remedial actions that you would take at each stage. **(20 marks)**

(b) Explain the need for ballasting on tractors, the forms it takes on conventional tractors and the operations in which the ballasting is important. List two factors that limit the level of ballasting. **(10 Marks)**