EGERTON UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2008/2009

THIRD YEAR EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL ENGINEERING

AGEN 332: INTRODUCTION TO FARM POWER

STREAM: 2006 B. SC. AGEN **TIME**: 2 Hours

DAY/TIME: Monday, 3.00 – 5.00 p.m. **DATE**: 4/05/09

INSTRUCTIONS:

1. This paper consists of **FIVE** questions.
2. Answer any **FOUR** questions.
3. All questions carry equal marks.
4. Marks for each question are shown in brackets.
5. You should have a calculator for this examination.

QUESTION 1

(a) State **THREE** functions of engine lubricating oil in a tractor engine. **(3 marks)**

(b) What do you understand by the following terms as applied to engine lubricating oil?

(i) Viscosity

(ii) Viscosity index **(2 marks)**

(c) Name **FOUR** additives in engine lubricating oil and for each one state the reason(s) for their use. **(4 marks)**

(d) What are the sources of contaminants of engine lubricating oil? How do these contaminants reach the crankcase oil? **(8 marks)**

(e) Where are the following engine lubricating oil systems to be found?

(i) Splash lubrication

(ii) Force- feed lubrication **(2 marks)**

(f) Sketch a labeled block diagram of a force-feed lubrication system in an engine. **(6 marks)**

QUESTION 2

(a) State the difference between:

(i) A spark ignition engine and a compression ignition engine **(4 marks)**

(ii) A four-stroke cycle spark ignition engine and a two-stroke cycle spark ignition engine. **(2 marks)**

(b) With the aid of a sketch(es), describe the principle of operation of a four-stroke cycle compression ignition engine. **(8 marks)**

(c) Explain the following terms as applied to internal combustion engines:

(i) Swept/displacement volume

(ii) Clearance volume

(iii) Compression ratio **(6 marks)**

(d) A four-stroke cycle spark ignition engine has a bore of 10 cm and a stroke of 12.5 cm. If the compression ratio of this engine is 7 : 1, calculate:

(i) Piston displacement **(2 marks)**

(ii) Clearance volume **(2 marks)**

(iii) Engine capacity **(1 mark)**

QUESTION 3

(a) What problems could possibly arise when a tractor engine is ran either "TOO HOT" or "TOO COLD"? **(5 marks)**

(b) State the major working parts of the air cooling system of an engine. What is the function of each of those parts? **(3 marks)**

(c) Sketch the water cooling system of a tractor engine and state the function of its major working parts. **(8 marks)**

(d) A tractor engine is overheating. List FOUR probable causes of this problem and state the remedy for each of those causes of the problem. **(4 marks)**

(e) (i) List THREE factors that are important in the selection/design of an engine water cooling system. **(3 marks)**

(ii) A tractor develops 85 kW. If the temperature drop through the radiator is 6°C, determine the quantity of water to be circulated through the cooling system.
Assume:
(i) The engine rejects approximately 0.58 kW for each kW of output
(ii) A flow of 0.16 l/(s-kW_r) where kW_r is heat flow through radiator **(2 marks)**

QUESTION 4

(a) (i) With the aid of a sketch, describe the principle of operation of a simple clutch. **(7 marks)**
(ii) Why are tractors fitted with dual clutches? **(2 marks)**

(b) In a four-speed gearbox, the constant mesh gears have 20 and 35 teeth respectively. The second main shaft gear has 30 teeth and the meshing layshaft (countershaft) gear has 25 teeth. Calculate the velocity ratio when the second gear is engaged. Sketch the power flow in this transmission. **(6 marks)**

(c) What is the function of the following on a tractor?
(i) Differential
(ii) Differential lock
(iii) Final drive **(6 marks)**

(d) With the aid of a sketch, show the main working parts of a front wheel tractor steering system. **(4 marks)**

QUESTION 5

(a) Why is air cleaning system necessary in an agricultural tractor engine? **(2 marks)**

(b) With the aid of a sketch, describe
(i) The fuel system of a compression ignition engine **(9 marks)**
(ii) The principle of operation of a basic carburetor **(8 marks)**

(c) The fuel filter of tractor engine requires replacement. Describe how this exercise is carried out and the tractor made ready for work. **(6 marks)**

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