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(*Knowledge for Development*)

# KIBABII UNIVERSITY

## UNIVERSITY EXAMINATIONS
## 2016/2017 ACADEMIC YEAR

## FIRST YEAR 2ND SEMESTER
## SPECIAL/SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF AGRICULTURE AND BIOTECHNOLOGY AGRICULTURE EDUCATION AND EXTENSION & AGRICULTURE ECONOMICS AND REOURCE MANAGEMENT

**COURSE CODE:** SAB 140
**COURSE TITLE:** FARM POWER AND MACHINERIES

**DATE:** 21ST SEPT. 2015 **TIME:** 11:30 AM – 1:30 PM

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INSTRUCTIONS TO CANDIDATES

Answer Question ONE and any other TWO.

TIME: 2 Hours

This paper consists of 4 printed pages. Please Turn Over

**QUESTION ONE (Compulsory) – (30 Marks)**

a) Define:

(i) Primary tillage **(1 Mark)**

(ii) Secondary tillage **(1 Mark)**

b) Draw and label a diagram of a Disc plough **(4 Marks)**

c) Explain two conditions under which Disc ploughs are used **(2 Marks)**

d) What are the four major functions of a Spike-tooth harrow? **(2 Marks)**

e) Identify a condition under which Subsoilers are used **(1 Mark)**

f) Use sketches to differentiate between the following disc harrows:

(i) A single-action harrow **(2 Marks)**

(ii) A tandem harrow **(2 Marks)**

g) Explain three factors that affect the application rate of manure **(3 Marks)**

h) State four reasons for calibrating a Boom Sprayer **(2 Marks)**

i) Define the following terms with reference to an Internal Combustion Engine (ICE):

(i) Piston stroke **(1 Mark)**

(ii) Firing order **(1 Mark)**

j) State and explain any four design developments that have been made on an ICE to improve its efficiency **(2 Marks)**

k) Draw and label the major components of a power transmission system in a farm tractor **(3 Marks)**

l) State three main functions of a Differential in the power transmission system of a tractor **(3 Marks)**

**QUESTION TWO (20 Marks)**

a) Define the following terms:

(i) Theoretical Field Capacity **(2 Marks)**

(ii) Scheduling Capacity **(2 Marks)**

b) A Farm Manager of a Company needs assistance in selecting the sizes and the number of disc ploughs. Each tractor uses one disc plough. The following information is also availed to you: farm size is 2210 hectares; soil type is clay loam with a soil resistance of 8.5N/cm$^2$; prefered plough width is 1.5m; plough depth is 20cm; ploughing speed is 6kph; Ploughing period is June and July: working 5 days in a week utilizing 8 hours per day; and ploughing field efficiency is 68%.

Recommend to the Farm Manager the:

(i) Appropriate Scheduling Capacity **(4 Marks)**

(ii) Number of tractors required to complete ploughing in time **(4 Marks)**

(iii)Drawbar power (in kW) that each tractor must develop to pull the plough **(4 Marks)**

(iv)Indicated power (in HP) of each tractor if the power losses through rolling resistance, wheel slip and transmission are 5%, 15%, and 8% respectively. **(4 Marks)**

**QUESTION THREE (20 Marks)**

a) Outline the procedure used in the field to calibrate a Grain Drill **(6 Marks)**

b) During calibration, a Grain Drill is found to discharge 50g of seed per 10 wheel revolutions per drill. The Grain Drill has 22 drills with an average spacing of 18cm. The recommended sowing rate is 160kg/ha. The wheel has a radius of 215mm.

(i) Does this drill sow at the recommended rate? **(8 Marks)**

(ii) If not, what is the discrepancy? **(2 Marks)**

(iii)Name two causes for the discrepancy in the sowing rate **(4 Marks)**

**QUESTION FOUR (20 Marks)**

a) Give a brief account of three major harvesting processes that a Combine Harvester does **(6 Marks)**

b) A wheat harvesting operation comprises of two self-propelled combine harvesters (C1, C2); four trucks (T1, T2, T3, T4) to transport the wheat grain from the field to the farm store; and one unloader (U) to off-load the trucks at the storage site. A combine harvester takes 11 minutes to fill its tank with clean harvested grain. A truck takes 1 minute to align itself to the combine harvester, and another 2 minutes to be loaded with grain. The truck takes 14 minutes to travel to the unloader, and another 1 minute to align to the unloader for the off-loading exercise which takes 9 minutes for every truck. The truck takes 12 minutes to travel from the unloader to the combine harvester.

Use the above information to determine the following for every machine:

(i) Active time **(2 Marks)**

(ii) Support time **(2 Marks)**

(iii)Idle time **(2 Marks)**

c) Draw and label a Cycle Diagram to show the inter-relationships of the farm machinery operations in (b) above **(8 Marks)**

**QUESTION FIVE (20 Marks)**

a) Use well-labelled diagrams to explain the principles of working of a 4-stroke Internal Combustion Engine propelled by diesel **(9 Marks)**

b) What are the three main functions of a Differential in the power transmission system of a tractor? **(3 Marks)**

c) What are the purposes of the following systems on the farm tractor?

(i) Cooling system **(2 Marks)**

(ii) Fuel system **(2 Marks)**

d) If you are on an agricultural farm and you notice the features listed below on tractor, state two major causes of every feature:

(i) Blue smoke from an engine **(2 Marks)**

(ii) Excessive fuel consumption **(2 Marks)**

(iii)Engine overheating **(2 Marks)**