EMBU UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

SECOND SEMESTER EXAMINATION 2013/2014

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF

OF BACHELOR OF SCIENCE IN AGRICULTURE, BACHELOR OF SCIENCE IN HORTICULTURE AND BACHEOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION

AEB 201A: POWER SYSTEMS AND MACHINERY FOR AGRICULTURE

DATE: APRIL 10, 2014 **TIME: 2.00 - 4.00PM**

INSTRUCTIONS:

Answer Question ONE and ANY other Two

QUESTION ONE

a.) i.) Discuss **FIVE** major sources of power on a mechanized farm.

(5marks)

ii) Explain **FIVE** reasons for mechanizing agriculture.

(5marks)

b) i.) With the aid of diagrams, explain the operation of a four stroke-cycle **diesel** engine.

(4marks)

ii) Explain **FIVE** major functions of engine lubricating oil as it circulates within the engine.

(5 marks)

ii) Give **FOUR** advantages of power transmission by belts as compared to power transmission by gears, chain and sprockets.

(4 marks)

d.) The draught of one bottom of a 6-bottom, 41cm mouldboard plough when ploughing 18cm deep at a tractor speed of 6km per hour was 4kN. Calculate the following for this plough:

i.) The total draught required to pull it. (1 mark)

ii.) The specific draught in Newtons per square centimeter. (2 marks)

iii.) The actual power required to overcome the draught of the plough. (2 marks)

iv.) The working rate for this plough in hectares per hour, if the field efficiency is 75%. (2 marks)

QUESTION TWO

a.) i.) Define the term "velocity ratio" as applied in power transmission between shafts.

(1mark).

ii.) A dynamo is belt-driven at 3600 revolutions per minute from a crankshaft pulley of 14cm diameter, revolving at 3000 revolutions per minute. Determine the linear speed of the belt in metres per minute and the diameter of the dynamo pulley. (6 marks)

b) i.) With clearly labeled diagrams, distinguish between a mouldboard plough bottom and a disc plough bottom.

(4 marks)

ii.) State three (3) conditions where a disc plough would be preferred over a mouldboard plough in seedbed preparation.

(3marks)

c.) With aid of diagrams, explain the operation of the following types of disc harrows:

i.) Single-acting disc harrow.

(2 marks)

ii.) Tandem disc harrow.

(2 marks)

iii.) Offset disc harrow.

(2 marks)

QUESTION THREE

a) A maize farmer is using a precision row crop planter with the following specifications for the maize planting unit:

i.) Diameter of the press wheel = 63cm

ii.) Number of teeth on the sprocket attached to the press wheel = 24 teeth

iii.) Number of teeth on the seed plate shaft sprocket = 10 teeth

iv.) The seed plate shaft drives the seed plate through a set of bevel gears. The gear attached to the seed plate shaft has 20 teeth while the gear attached to the seed plate has 64 teeth.

v.) The seed plate has 16 cells.

vi.) The sprocket on the press wheel is connected to the sprocket on the seed plate shaft directly by a chain.

vii.) Spacing between the maize rows = 90 cm

b) Sketch the drive train for seed plate (name all components) (3 marks)

i.) Calculate the seed spacing within the row.

(4 marks)

ii.) Calculate the plant population per hectare if there was a 95% germination.

(3 marks)

c.) State **FOUR** mechanical functions that a seed planter is required to perform. (4 marks)

i.) Define the term calibration as applied in material dispensing machines such as Planters and chemical sprayers. (2marks)

d.) Define the following terminologies as used in the study and operation of agricultural field machines.

i.) Theoretical field capacity. (2 marks)

ii.) Effective field capacity (2 marks)

QUESTION FOUR

a.) A four cylinder, four stroke cycle engine has a compression ratio of 9.5 to 1 when using a clearance volume of 55 cubic centimetres. Calculate the following for this engine:

i.) The piston displacement in cubic centimetres. (5 marks)

ii.) The bore of the engine cylinder when the stroke is 78 millimetres. (5 marks)

b.) i.) Describe **FOUR** major functions of tyres on a vehicle/tractor. (2 marks)

ii.) Explain two types of abnormal tyre wear and mention the causes of each type of wear. (2 marks)

c.) Define the following terms as applied to a vehicle/tractor.

i.) Tractor ballasting. (2 marks)

ii.) Weight transfer (2 marks)

iii.) Wheelslip (2 marks)

QUESTION FIVE

a.) With aid of a diagram, explain the operation of the tractor drawn chemical sprayer (boom sprayer). (5marks)

b i.) Name the principal units of a precision chop forage harvester and explain the function of each unit. (5 marks)

ii.) List and explain four types of seed losses in a combine harvester. (4 marks)

c) A wheat farmer is using a combine harvester that has a header of 5 metres width to harvest his wheat .The combine harvester moves at a speed of 1.5 metres per second and in one minute 400 kilograms of materials enters the header. Of this amount 180 kilograms enters the grain thanks and the remaining 220 kilograms of materials is discharged through the combine on to the field. Determine the following for this combine harvester:

i.) Field capacity in hectares per hour (2 marks)

ii.) Material capacity in tons per hour (2 marks)

iii.) Throughput capacity in tons per hour (2 marks)

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