AFRICA UNIVERSITY

(A United Methodist-Related Institution)
INVESTING IN AFRICA'S FUTURE

FACULTY OF EDUCATION

FIRST SESSION 2011 MAIN EXAMINATION QUESTION PAPER

COURSE CODE	AAE 101
COURSE TITLE	Introduction to Agricultural Engineering
GROUP	B Ed, BSc Ed (Block release)
EXAMINER	Mr. W. Zendera
DATE	December, 2011
DURATION	3 Hours
INSTRUCTIONS	1. Answer any **five** questions 2. The number of marks for each question is given in brackets 3. Write legibly

Question 1

a) List the areas of expertise of an agricultural engineer. **(5)**

b) Describe the four ways of changing over to a new system during the implementation stage of the system development process. **(8)**

c) Write down the recommended:

I. Slope

II. Depth of channel

III. Width of channel

IV. Channel spacing

V. Maximum contour channel length

For a standard contour channel for highly erodible soils with a slope of 2%. **(5)**

d) Calculate the power requirement (kW) for an irrigation pump that will deliver 87 m^3/hr at a head of 50 m assuming that the pump efficiency is 75%. **(2)**

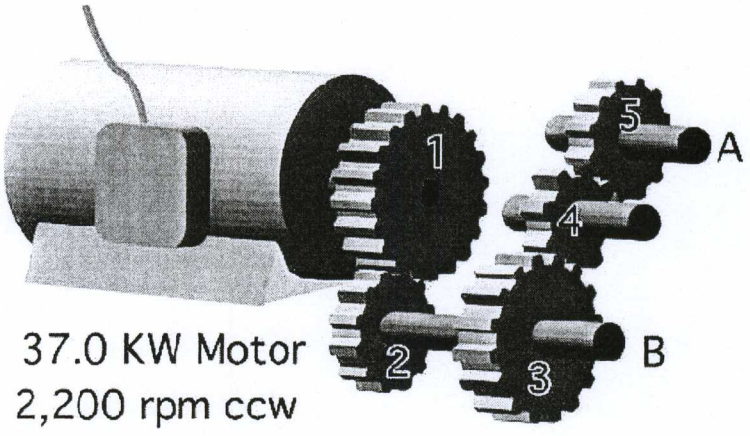
Question 2

(a) With the aid of a diagram show how you would change the direction of rotation on:

I. A sprocket and chain assembly **(2)**

II. A belt and pulley assembly **(2)**

(b)



Gear	Number of teeth
1	24
2	12
3	16
4	8
5	12

Figure 1

I. State the direction of rotation of gear 2, 3, 4 and 5. **(4)**

II. Calculate the speed of shaft A and B in figure 1? **(4)**

III. Calculate the torque available in shaft A and B. **(4)**

IV. Predict the power available at shaft B. **(4)**

Question 3

(a) Briefly describe the events associated with the movement of the piston in a four stroke engine. **(10)**

(b) A six cylinder engine has a bore of 70mm and a stroke of 80mm. If the clearance volume of the cylinder is 42 000 mm^3, calculate:

I. The compression ratio of the engine **(4)**

II. The capacity of the engine in litres. **(6)**

(1 litre = 10^6 mm^3)

Question 4

(a) Define the following

I. brake power **(2)**

II. engine power **(2)**

III. PTO power **(2)**

IV. Drawbar power **(2)**

(b) A 100 mm diameter hydraulic cylinder when the system pressure is set at 26 000 Kpa, the flow rate is 0.015 m^3/min and the control valve is activated for 15 sec. Determine the:

I. Maximum force possible **(4)**

II. Amount of extension **(4)**

III. Rate of extension (m/min) **(4)**

Question 5

(a) Determine the size of nozzles (L/min) required for applying a chemical at the rate of 185 L/ha when the nozzle spacing is 0.4545 m and the sprayer will be traveling at a velocity of 4.0 km/hr. **(10)**

(b) How much water (kg) must be removed from 1.2 metric tons (t) of grain to lower the moisture from 14.5 to 11.0%DB? **(10)**

Question 6

1 (a) briefly describe the following

I. A steady state process **(2)**

II. An unsteady state process **(2)**

III. A continuous process **(2)**

IV. A batch process **(2)**

(b) Skim milk is prepared by the removal of some of the fat from whole milk. This skim milk is found to contain 90.5% water, 3.5% protein, 5.1% carbohydrate, 0.1% fat and 0.8% ash. If the original milk contained 4.5% fat, calculate its composition assuming that fat only was removed to make the skim milk and that there are no losses in processing. **(12)**