

CHUKA



UNIVERSITY

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**UNIVERSITY EXAMINATIONS**

**SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF  
BACHELOR OF SCIENCE IN AGRICULTURE, BACHELOR OF SCIENCE IN  
AGRICULTURAL EDUCATION**

**AGEN 131: BASIC FARM POWER SOURCE AND UTILIZATION**

**STREAMS: BSC (AGRIC)Y2S1, BSC (AGED) YISI**

**TIME: 2 HOURS**

**DAY/DATE: MONDAY 03/12/2018**

**11.30 AM – 1.30PM**

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**INSTRUCTIONS:**

- **This paper contains seven questions**
- **Answer ALL Questions in Section A and any other Two in Section B**

**SECTION A (30 MARKS)**

**QUESTION ONE**

- (a) Discuss three most important functions of engine lubricating oil. [6 marks]
- (b) Describe two main functions of tyres on a vehicle /tractor. [4 marks]

**QUESTION TWO**

- (a) A diesel engine has a bore and a stroke of 100 mm and 140 mm respectively. The clearance volume of this engine is  $60 \text{ cm}^3$ . Calculate the compression ratio of this engine. [6 marks]
- (b) With the aid of a diagram, name the basic parts of an internal combustion petrol engine. [4 marks]

**QUESTION THREE**

(a) Explain the purpose of the friction clutch in power transmission on a tractor/vehicle. [2 marks]

(b) With the aid of diagrams, show the basic clutch action and name the parts. [4 marks]

**QUESTION FOUR**

Discuss two methods of improving traction on a farm tractor. [4 marks]

**SECTION B (40 MARKS): ANSWER TWO QUESTIONS**

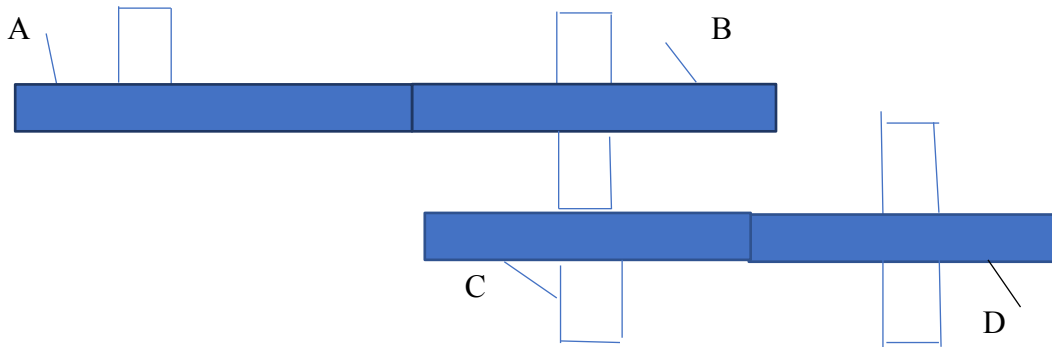
**QUESTION FIVE (20 MARKS)**

(a) Define the following terms related to a farm tractor:

- (i) Wheel track [2 marks]
- (ii) Wheel slip [2 marks]
- (iii) Load (weight) transfer [2 marks]
- (iv) Coefficient of traction [2 marks]

(b) Gear systems are used to transmit rotary motion and power from one shaft to another. Define velocity ratio as applied to gear systems. [3 marks]

(c) A double reduction set of gearing system is shown in the figure as given. Gear wheel A is the driver gear, gear wheels B and C are fixed to the same shaft and gear wheel D is the final gear in the train. The number of teeth on each wheel are: A= 20 teeth, B = 50teeth, C =40 teeth and D = 30 teeth.



Compound gear train  
 A = 20 teeth  
 B = 50 teeth  
 C = 40 teeth  
 D = 30 teeth

(i) Determine the velocity ratio of the gear system [3 marks]

(ii) Calculate the speed of gear wheel D when gear A rotates at 2800 revolutions per minute. [3

marks]

(c) Differentiate between spur gear and helical gear. [3 marks]

**QUESTION SIX**

(a) Discuss five factors considered in designing modern tractors. [10 marks]

(b) A gearbox is driven in second gear, where the constant mesh gears on the clutch shaft and the counter shaft have 16 and 38 teeth respectively. The second gear on the main shaft has 32 teeth and meshes with the counter shaft gear having 14 teeth. Determine the following for this gearbox.

(i) The second gear ratio. [4 marks]

(ii) The propeller shaft speed for an engine speed of 3600 rpm [4 marks]

(c) Define the term “Preventive maintenance” on a tractor / vehicle. [2 marks]

**QUESTION SEVEN**

(a) Discuss three factors to consider when matching a tractor and an implement. [6 marks]

(b) A four bottom, 40cm moldboard plough operates in medium to heavy soil surface conditions considered as firm. The plough experiences a soil resistance that requires 30 kW drawbar power per meter width. Determine the total drawbar power required to pull this plough in the given soil. [6 marks]

(c) Define the following terms:

(i) Tractive efficiency [3 marks]

(ii) Coefficient of rolling resistance [3 marks]

(iii) Tractor ballasting [2 marks]