

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

AEH 211

Department of Engineering and Physics

Bachelor of Science Honours Degree in Agricultural Engineering

Principles of Agricultural Machinery

3 hours (100 Marks)

Instructions:

NOV 2023

1. This paper contains 6 questions
2. Answer any **FOUR** questions, each of which carries 25 marks

Question 1

- a) Outline the different levels of mechanization based on the power source. [10 marks]
- b) Explain the effect of the following adjustments on a disc plough:
 - i. Vertical angle, [4 marks]
 - ii. Disc angle, and [4 marks]
 - iii. Distance between discs. [4 marks]
- c) Explain the need of additional weight on a disc plough. [3 marks]

Question 2

- a) Discuss the emerging innovative technologies that have potential for the advancement of farm machinery. [10 marks]
- b) Explain the following terms:
 - i. Primary Tillage, [3 marks]
 - ii. Secondary Tillage, [3 marks]
 - iii. Strip Tillage, [3 marks]
 - iv. Stubble mulch tillage, and [3 marks]
 - v. Combined Tillage. [3 marks]

Question 3

- a) Write down the term described by the following statements:
- i. Part of the mouldboard plough that helps counteract the side thrust exerted by the furrow. [2 marks]
 - ii. Part of the mouldboard plough that makes a horizontal cut. [2 marks]
 - iii. An implement used for breaking the plough pan. [2 marks]
 - iv. An accessory provided to remove the soil sticking on the plough. [2 marks]
 - v. An accessory shaped like a miniature plough which cuts a small ribbon of the soil and helps deflect standing trash. [2 marks]
- b) Briefly describe the following gang assemblies on disc harrows:
- i. Single acting, [5 marks]
 - ii. Double acting, and [5 marks]
 - iii. Offset. [5 marks]

Question 4

- a) State the part of the seed drill that performs the following functions:
- i. Holding the seed, [2 marks]
 - ii. Opening the furrow onto which the seed is placed, [2 marks]
 - iii. Metering the seed at the required interval, [2 marks]
 - iv. Placing the seed into the furrow, [2 marks]
 - v. Lightly compacting around the seed. [2 marks]
- b) Describe the static method of calibrating a planter. [15 marks]

Question 5

- a) Discuss the grain losses that occur during the field operations of a combine harvester. [12 marks]
- b) Name the part of the combine harvester that performs the following:
- i. Cutting a standing crop, [2 marks]
 - ii. Conveying and feeding the cut material, [3 marks]
 - iii. Threshing or removing seed from the pod, [3 marks]
 - iv. Separating the seed from the straw, and [2 marks]
 - v. Cleaning the chaff and other debris from the seed. [3 marks]

Question 6

- a) State the machine design considerations for root crop harvesting equipment. [5 marks]
- b) Figure 1 shows the crank and stroke of a reciprocating cutter bar knife of a mower. The information in Table 1 was collected from the cutter of the mower.

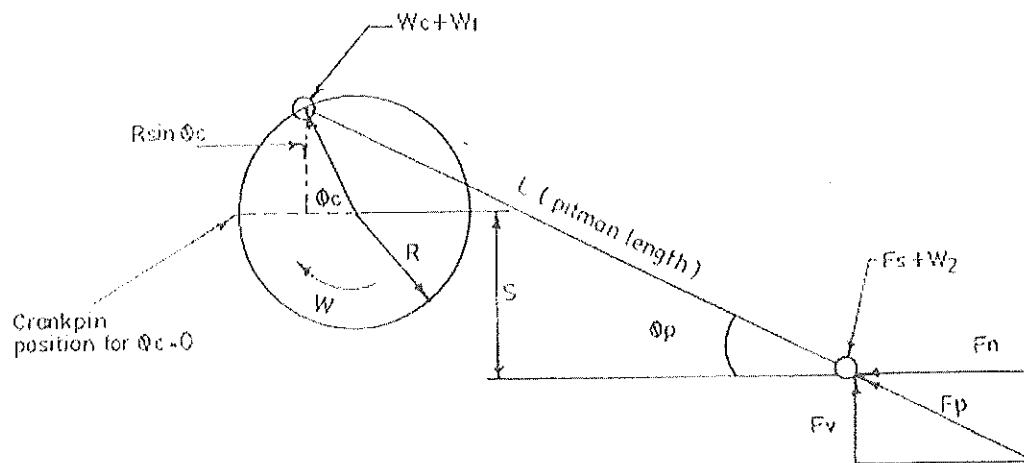


Figure 1: Crank and stroke mechanism

Table 1

Speed of crank	1000 rpm
Pitman length	1.06 m
Crank pin radius	38 mm
Mass of knife	4.4 kg
Mass of pitman	3.5 kg
Mass crank pin	0.35 kg
Center of gravity of pitman from knife end	0.48 m
Height of crankshaft center line above pivot connection between knife and pitman	240 mm

For the reciprocating cutter bar calculate:

- The horizontal inertial force at each end of stroke. [10 marks]
- Magnitude and direction of vertical reaction at each end of stroke. [10 marks]