UNIVERSITY OF ESWATINI

MAIN EXAMINATION PAPER

PROGRAMME: BSc AGRICULTURAL AND BIOSYSTEMS ENGINEERING 4

COURSE CODE: ABE410

TITLE OF PAPER: FARM MACHINERY MANAGEMENT

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

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SECTION 1: COMPULSORY QUESTION

QUESTION 1

a.   Discuss four (4) main reasons why farmers mechanise?   **[20 marks]**

b.   A farmer buys a 15 hp tiller that cost E140000. The economic life of the tiller is 10

years and it is expected to be used for 500 hours per year. Other assumptions are:

- Salvage value: 10%

- Interest: 10%

- Insurance & taxes: 1% of PP

- Housing: 1% of PP

- Fuel consumption: 1 litre per hour

- Fuel cost: E13/litre

- Lubrication consumption: 5% of fuel

- Repair and maintenance: 5-8%

- Labour: E20/hour

(i)   Using the straight line method for depreciation, determine the total fixed costs.

                                                                                [10 marks]

(ii)   Determine the total variable costs

                                                                                [10 marks]

SECTION II: ANSWER ANY TWO (2) QUESTIONS

QUESTION 2

a. With examples, define the following terms as used in the scheduling of crop harvesting:

   i. Delayed scheduling   [3 Marks]

   ii. Premature scheduling   [3 marks]

   iii. Balanced scheduling   [4 marks]

b. A 6 m width-of-cut self-propelled combine makes an average stop of 5 minutes every time its 2-t grain tank is to be unloaded. This stop includes the time for adjustments, lubrication, refuelling, and the operator's personal time. The gross yield of the field is 2.1 t/ha. Material losses are measured as 0.1 t/ha. The operating speed is 4.8 km/h. The time for turning on the headland at the end of the 400 m field is 20 s. The average actual width of cut is 0.95 of theoretical. Determine:

   i. Theoretical field capacity   [3 marks]

   ii. Effective or actual field capacity   [5 marks]

   iii. Field efficiency   [2 marks]

   iv. Percentage of time loss   [5 marks]

   v. Material efficiency   [5 marks]

QUESTION 3

a.   Discuss how timeliness of operation affect machine selection   **[15 marks]**

b.   What is the least-cost width for a spike tooth harrow used on 120 ha annually? Labour

cost = E80/hr, tractor fixed costs = E60/hr, speed of operation = 8 km/hr, field efficiency =

0.70, and the price of the harrow is E1000/m. Use a 10-year life and 10% interest.**[15 marks]**

QUESTION 4

a.   A single-tine sub-soiler is used at a speed of 5 km/hr and at a spacing of 2 m. From

field observations it is determined that 17% of the time is spent on turning at headlands and

refuelling the tractor. Determine the field capacity.   **[10 marks]**

b.   Discuss four (4) factors that should be considered when deciding on the size of

machinery required   **[20 marks]**

EQUATIONS

$$AC = \frac{(FC\%)P}{100} + \frac{cA}{Swe}[(R\&M)P + L + O + F + T]$$

$$FC = \frac{P-PS}{L} + \frac{P+PSI}{2} + 0.02P$$

$$AC = \frac{(FC\%)pw}{100} + \frac{cA}{Swe}[rmpw + L + ow + fw + T]$$

$$w = \sqrt{\frac{100cA}{(FC\%)pSe}(L+T)}$$

TABLE: VALUES FOR FIXED COST PERCENTAGE

Service life, yr	Values of FC%
1	100
2	53
3	37
4	29
5	25
6	22
7	20
8	18
9	17
10	16
11	15
12	14
15	13
20	12