



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

DIRECTORATE OF TVET

SECOND YEAR FIRST TERM EXAMINATION FOR

CERTIFICATE IN BUILDING TECHNOLOGY

CERTIFICATE IN MECHANICAL ENGINEERING

MATHEMATICS II.

DATE: 21/7/2022

TIME: 11.30-2.30 PM

INSTRUCTIONS

Answer all questions.

1. Using the substitution method solve the networks given below

$$2I_1 + 4I_2 + 3I_3 = 4$$

$$-4I_1 - 2I_2 + I_3 = 2$$

$$3I_1 + 5I_2 + 2I_3 = -1$$

(10 marks)

2. Given the matrices $A = \begin{bmatrix} -2 & 1 & 2 \\ 0 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 & 1 \\ 1 & 1 & 1 \\ 3 & 1 & -1 \end{bmatrix}$

a) Determine $(A + B)^T$ (5 marks)

b) Determine $(B - A)^T$ (5 marks)

3. Given the vectors $A = 10i + j + 2k$, $B = 2i + 3j + 4k$ and $C = 5i + 2j + 3k$

Determine

a) $A \bullet (B \times C)$ (4 marks)

b) $A \times B$ (4 marks)

4. a) A bag contains 7 black, 5 green and 5 red marbles. Three marbles are picked at random at a time with replacement.
- Represent this information in a tree diagram
 - Determine the probability of picking
 - All red marbles
 - Two green and one red in that order (12 marks)
- b) Thirty students in a class taking mechanical engineering and building technology had their heights recorded as follows:
- 120 127 125 125 128 127
 104 100 108 116 103 116
 112 110 121 101 152 126
 151 128 102 150 142 150
 112 133 140 128 152 140
- make a frequency table starting with class interval of 100-109
 - find the mean height of the class (8 marks)
5. a) The table below represents the failing strength of 100 concrete cubes tested in a laboratory

class	frequency
3.8-4.0	12
4.1-4.3	10
4.4-4.6	16
4.7-4.9	20
5.0-5.2	18
5.3-5.5	14
5.6-5.8	6
5.9-6.1	4

Determine:

- Modal class
- The mean failing strength
- The standard deviation (10 marks)

- b) four trade partners from Europe, Japan, USA and South Africa contributed 2,000 sterling pounds (£), 5,000 US(\$), 100,000 Japanese yen and 20,000 south African rand respectively. they converted all the currencies into Kenyan shillings and paid custom duty of 30% on goods they bought at ksh50,000. calculate the cash balance in US(\$)
dollars they have using the exchange rates table given. (8 marks)

Currency	Kenyan shillings
1 sterling £	140.9997
1 US \$	90.7031
100JPY	75.3598
1SA Rand	7.8066

6. a) given the matrices

$$A = \begin{bmatrix} 13 & 7 \\ -6 & 4 \end{bmatrix}, B = \begin{bmatrix} 9 & 8 \\ 12 & 10 \end{bmatrix} \text{ and } C = \begin{bmatrix} 11 & -7 \\ -8 & 5 \end{bmatrix}$$

Find

i. $3A + B - C$

ii. AC

iii. AC^{-1}

(9 marks)

- b) use the results obtained in (iii) above to solve

$$87x - 56y = -50$$

$$62y - 98x = 52$$

(5 marks)

- c) A mason used three bags of lime and 2 bags of cement in day one and 5 bags of lime and 3 bags of cement in day two during plastering. If the cost of lime and cement in day was ksh3050 and in day two was ksh4,800. Use the matrix method to find the cost of lime and cement. (6 marks)

7. a) Given that vector $\vec{A} = A_1i + A_2j + A_3k$ and $\vec{B} = B_1i + B_2j + B_3k$ show that

$$\vec{A} \bullet \vec{B} = A_1B_1 + A_2B_2 + A_3B_3$$

(4 marks)

- b) Given vectors:

$$A = 3i + 2j$$

$$B = 8i + 5j$$

Find the magnitude of the directional vector $3\vec{A} + \vec{B}$

(6 marks)