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**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE
ENERGY AND BIO FUELS TECHNOLOGY**

COURSE CODE: REN 224

COURSE TITLE: OPERATIONS RESEARCH

DURATION: 2 HOURS

DATE: 19/04/2023

TIME: 2:00-4:00PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

SECTION A: COMPULSORY

QUESTION ONE (30 MARKS)

(a) With the aid of sketches, describe the following terms as they are applied in Programme Evaluation and Review Technique:

(i) Dummy activity

(ii) Parallel activity

(6 marks)

(b) Highlight the following terms applied in Inventory control:

(i) Direct inventory

(ii) Indirect inventory

(iii) Purchased parts inventory

(6 marks)

(c) (i) Highlight FOUR applications of a Markov process

(ii) Explain the term "mixed strategy" as it is applied in Game Theory

(6 marks)

(d) Highlight the THREE queue disciplines and THREE Customer behaviour as they are applied in queuing system.

(6 marks)

(e) Using graphs, determine the feasible region for each of the following constraints given that $x_1, x_2 \geq 0$

(i) $-3x_1 + x_2 \geq 6$

(ii) $-x_1 + x_2 \geq 0$

(6 marks)

SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 MARKS)

(i) Define the term "Operation's Research"

(ii) Highlight FIVE applications of Operation's Research in a manufacturing concern.

(iii) Explain FOUR limitations of 2(i).

(iv) Explain the term “unbounded solution space” and highlight its manifestation.

QUESTION THREE (20 MARKS)

(i) Antonees company transports truckloads of maize from three Farms to four Depots. The supplies and demands are shown in Table 1. The unit cost in shillings is indicated at the Northwest corner of each box. Determine the minimum cost of transport between the Farms and the Depots using the North-west corner method.

Table 1

		DEPOT				supply
		1	2	3	4	
FARM	1	10	2	20	11	15
	2	12	7	9	20	
	3	4	14	16	18	10
Demand	5	15	15	15		

(ii) The owner of Kenor petrol station is studying the effect on his business from a new petrol station, Sherr petrol station that has been opened on the same route. Currently the market share is 80% and 20% between Kenor and Sherr petrol stations respectively. Analysis over the last week has indicated the following probabilities for customers switching from one petrol station to the other. Determine the expected market share for Kenor and Sherr after another TWO weeks have past.

FROM		TO	
		KENOR	SHERR
KENOR	0.75	0.25	
SHERR	0.55	0.45	

(20 marks)

QUESTION FOUR (20 MARKS)

With the aid of a graphical method determine Mavin's mixed strategy from the game between Mavin and Nekesa shown in Table 2.

TABLE 2

		NEKESA'S STRATEGIES			
		A	B	C	D
MAVIN'S STRATEGIES	1	4	3	1	3
	2	0	5	2	1

QUESTION FIVE (20 MARKS)

(i) Construct the network using the information in Table 3:

Table3

ACTIVITY	IMMEDIATE PREDECESSOR
A	-----
B	A
C	A
D	A
E	D
F	D
G	E
H	F,G
I	C,H
J	B

(ii) A certain transport company receives an average of four customers per hour in the booking bay. Determine the probability that THREE customers will arrive between 9.00pm-10.00pm.