KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
Special/supplementary EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWBLE ENERGY AND BIOFUELS TECHNOLOGY

COURSE CODE: REN 224

COURSE TITLE: OPERATIONS RESEARCH FOR TECHNOLOGISTS

DURATION: 2 HOURS

DATE: 20/1/2022   **TIME: 11-1PM**

<u>**INSTRUCTIONS TO CANDIDATES**</u>
- 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.

This paper consists of **3** printed pages. Please Turn Over ▶

QUESTION 1 (30 marks)

a. Define the following terms:
  i. Optimal solution (1 mark)
  ii. Team (1 mark)
  iii. Model (1 mark)
  iv. Operations research technique (1 marks)
  v. Systems approach (1 mark)
b. State any five (5) functions of inventory. (5 marks)
c. State any five (5) advantages of Simulation. (5 marks)
d. State any five (5) special purpose languages and programs in simulation. (5 marks)
e. What do you do during decision making under conditions of uncertainty using the following rules:
  i. Maximax rule. (1 mark)
  ii. Maximin rule. (1 marks)
  iii. Minimax regret rule. (1 mark)
  iv. Equal probability rule. (1 mark)
f. Find the dual problem of the following primal problem: (6 marks)
  Maximize $150X_1 + 100X_2$
  Subject to:
$$2X_1 + X_2 \leq 550$$
$$8X_1 + 15X_2 \leq 600$$
$$12X_1 - 8X_2 \leq 400$$
$$X_1 \geq 0, X_2 \geq 0$$

QUESTION 2 (20 marks)

a. State any five (5) Multi-criteria decision techniques. (5 marks)
b. State any five (5) assumptions economic order quantity. (5 marks)
c. The Table shows the operating profit calculator in Ksh.

Sales	1,500
Selling price	100
Unit material cost	20
Unit production cost	16
Wages/benefits	30,000
Rent	6,000
Administrative costs	15,000

  i. Calculate the operating profit. (4 marks)
  ii. What will be the profit if the sales increase to 1,800 and the unit production cost drops to 12 other factors remaining the same. (3 marks)
  iii. What will be the profit if the sales drop to 1,200 and the unit of material cost also drops to 18 other factors remaining the same? (3 marks)

QUESTION 3 (20 marks)

a. State any five (5) steps in the methodology of operations research. (5 marks)
b. State any five (5) items representing games. (5 marks)
c. Find the total cost of a queuing system where the: (4 marks)

- cost of customer waiting time per time period = Ksh. 200
- average number customers in system = 800
- cost of servers per time period = Ksh. 1000
- number of servers = 6

d. The table shows activities and description of a project. Draw the PERT project network. (6 marks)

Activity	Immediate predecessor	Completion time (days)
A	-	6
B	-	5
C	A	2
D	A	3
E	A	7
F	B, C	4
G	B, C	6
H	E, F	2
I	E,F	8
J	D, H	3
K	G, I	5

QUESTION 4 (20 marks)

A Biofuel company produces biodiesel and bioethanol. Production of biodiesel requires 8 kg of maize and 1 kg of millet. Production of bioethanol requires 12 kg of maize and 2 kg of millet. The company has a maximum of 2400 kg of maize and 400 kg of millet available each week and it makes a profit of Ksh. 50 per litre of biodiesel and Ksh. 70 per litre of bioethanol.

a. Put the information in a tabular form. (5 marks)
b. Give the objective function, conditions and constraints. (4 marks)
c. Draw a graph of conditions and constraints to show the feasible region. (6 marks)
d. Find the maximum profit made by the company by testing corner points. (5marks)

QUESTION 5 (20 marks)

a. State any five (5) features of operations research. (5 marks)
b. State any five (5) steps in the process of simulation. (5 marks)
c. The table below shows the supply and demand in a transport problem.

	D_1	D_2	D_3	SUPPLY
S_1	30	25	15	60
S_2	20	30	40	50
DEMAND	35	55	50	

    i. Draw the network flow. (4 marks)
    ii. Develop the linear programming model. (6 marks)