

(B)



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

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

COURSE CODE: REN 224

COURSE TITLE: OPERATIONS RESEARCH FOR TECHNOLOGISTS

DURATION: 2 HOURS

DATE: 11/2/2021

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.

This paper consists of 3 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

QUESTION 1 (30 marks)

- a. Define the following terms:
- i. Operations (1 mark)
 - ii. Research (1 mark)
 - iii. Operations research (2 marks)
 - iv. Nash equilibrium (1 mark)
- b. State any five (5) features of operations research. (5 marks)
- c. State any five (5) steps in the methodology of operations research. (5 marks)
- d. Define any five (5) Multi-criteria decision techniques. (5 marks)
- e. Describe any five (5) items representing games. (5 marks)
- f. State any five (5) assumptions of economic order quantity. (5 marks)

QUESTION 2 (20 marks)

A solar company makes wooden meter boxes and drier boxes. Each meter box requires 2 hours for carpentry work and 1 hour for painting. Each drier box requires 3 hours for carpentry work and 4 hours for painting. The company has a maximum of 60 hours of carpentry work and 40 hours of painting available each week and it makes a profit of Ksh. 15 per meter box and Ksh. 40 per drier box.

- 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. (5 marks)

QUESTION 3 (20 marks)

- a. State any five (5) steps in the process of simulation. (5 marks)
- b. Find the dual problem of the following primal problem: (5 marks)

$$\text{Maximize } 100X_1 + 80X_2$$

Subject to:

$$X_1 + X_2 \leq 500$$

$$5X_1 + 20X_2 \leq 650$$

$$10X_1 - 6X_2 \leq 300$$

$$X_1 \geq 0, X_2 \geq 0$$

- c. Table 1 shows the operating profit calculator in Ksh.

Sales	1,400
Selling price	99
Unit material cost	30
Unit production cost	14
Wages/benefits	40,000
Rent	5,000
Administrative costs	10,000

- i. Calculate the operating profit.

(4 marks)

- ii. What will be the profit if the sales increase to 1,500 and the unit production cost drops to 10 other factors remaining the same. (3 marks)
- iii. What will be the profit if the sales drop to 1,300 and the unit of material cost also drops to 20 other factors remaining the same? (3 marks)

QUESTION 4 (20 marks)

- a. State any five (5) functions of inventory. (5 marks)
- b. What do you do during decision making under conditions of risk using the following rules:
- i. Expected value rule. (1 mark)
 - ii. Mean-variance rule. (3 marks)
 - iii. Coefficient of variation rule. (1 mark)
- c. The table below shows the supply and demand in a transport problem.

	D ₁	D ₂	D ₃	SUPPLY
S ₁	15	30	20	50
S ₂	30	40	35	30
DEMAND	25	45	10	

- a. Draw the network flow. (4 marks)
- b. Develop the linear programming model. (6 marks)

QUESTION 5 (20 marks)

- a. State any four (4) advantages of Simulation. (4 marks)
- b. State any three (3) kinds of simulations. (3 marks)
- c. State any four (4) special purpose languages and programs in simulation. (4 marks)
- d. Find the total cost of a queuing system where the:
- cost of customer waiting time per time period = Ksh. 150
 - average number customers in system = 500
 - cost of servers per time period = Ksh. 800
 - number of servers = 5

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

Activity	Description	Immediate predecessor	Completion time (days)
A	Initial paperwork	-	3
B	Build body	A	3
C	Build frame	A	2
D	Finish body	B	3
E	Finish frame	C	7
F	Final paperwork	B, C	3
G	Mount body to frame	D, E	6
H	Install skirt on frame	C	2