



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
MSc IN INDUSTRIAL ENGINEERING & MANAGEMENT**

COURSE CODE: IEM 822

COURSE TITLE: OPERATIONS RESEARCH

DATE: 28-04-2022

TIME: 08:00-10:00

INSTRUCTIONS TO CANDIDATES

This paper contains five questions
Answer THREE (3) questions

TIME: 3 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over. ►

Question ONE

Four factories, A, B, C and D produce sugar and the capacity of each factory is given below: Factory A produces 10 tons of sugar and B produces 8 tons of sugar, C produces 5 tons of sugar and that of D is 6 tons of sugar. The sugar has demand in three markets X, Y and Z. The demand of market X is 7 tons, that of market Y is 12 tons and the demand of market Z is 4 tons. The following matrix gives the transportation cost of 1 ton of sugar from each factory to the destinations. Find the Optimal Solution for least cost transportation cost (20 Marks)

| Factories | Cost in Rs. Per ton (x 100) | | | Availability in tons |
|--------------|-----------------------------|----|---|----------------------|
| | Markets | | | |
| | X | Y | Z | |
| A | 4 | 3 | 2 | 10 |
| B | 5 | 6 | 1 | 8 |
| C | 6 | 4 | 3 | 5 |
| D | 3 | 5 | 4 | 6 |
| Requirements | 7 | 12 | 4 | |

Question Two

a) Describe the application of phases in OR using suitable examples (10 Marks)

b) A ship has three cargo holds, forward, aft and center. The capacity limits are:

Forward 2000 tons, 100,000 cubic meters

Center 3000 tons, 135,000 cubic meters

Aft 1500 tons, 30,000 cubic meters.

The following cargoes are offered, the ship owners may accept all or any part of each commodity:

| Commodity | Amount in tons | Volume per ton in m^3 | Profit per ton in Rs |
|-----------|----------------|-------------------------|----------------------|
| A | 6000 | 60 | 60 |
| B | 4000 | 50 | 80 |
| C | 2000 | 25 | 50 |

In order to preserve the trim of the ship the weight in each hold must be proportional to the capacity in tons.

i) How should the cargo be distributed so as to maximize profit? (5 Marks)

ii) Formulate this as linear programming problem (5 marks)

Question THREE

- a) Solve graphically the given linear programming problem. (Minimization Problem) (10 Marks)
- b) A company manufactures two products X and Y on two facilities A and B. The data collected by the analyst is presented in the form of inequalities. Find the optimal product mix for maximising the profit (10 Marks)
- Maximise $Z = 6x - 2y$ S.T Writing in the equation form: Maximise $Z = 6x - 2y$ S.T.
- $2x - 1y \leq 2$ $2x - 1y = 2$ $1x + 0y = 3$ and both x and y are ≥ 0
- $1x + 0y \leq 3$ and both x and y are ≥ 0

Question FOUR

In Operations Research (OR), we are concerned with how to choose optimal strategy under specified set of assumptions, including all available strategies and their associated payoffs.

- a) With examples discuss decision making based on purpose, nature and persons involved of OR (6 Marks)
- b) With examples, discuss decision making based on the degree of certainty (6 Marks)
- c) Illustrate the relationship among intuition, judgement, science, quantitative attitudes, practices, methods and models in OR decision making (8 Marks)

Question FIVE

- a) Discuss the application of models in OR based on different classifications (12 Marks)
- b) Discuss the importance of linear programming models in OR (8 Marks)

