Mahindra University Hyderabad

École Centrale School of Engineering

Minor-I Exam

Program: B. Tech. **Branch: CM** **Year: II** **Semester: IV**

Subject: Optimization Techniques (MA2210) SE23UCAM020

Date: 28/02/2025 **Start Time: 10:00 AM**

Time Duration: 1.5 Hours **Max. Marks: 25**

Instructions:

1) There are 4 questions, all of which are compulsory.
2) Justify your answer wherever required. Guesswork will not be considered in evaluation.
3) Use of non-programmable scientific calculator is allowed. However, sharing calculators during exams is strictly prohibited.

Course outcomes (COs)

CO 1: Formulate and classify optimization problems, including identifying design vectors and constraints.

CO 2: Apply classical optimization techniques to find optimal solutions to single and multivariable problems.

CO 3: Solve linear programming problems and comprehend their real-world applications.

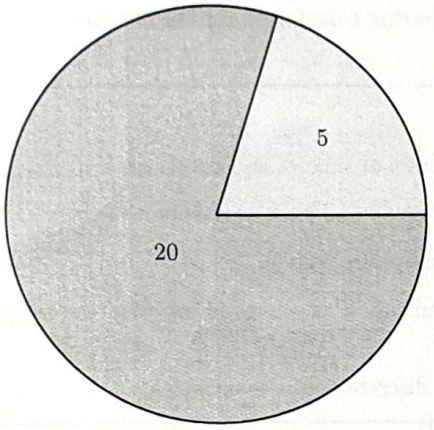
CO 4: Solve transportation problems using different methods and understand their relevance in logistics and supply chain management.

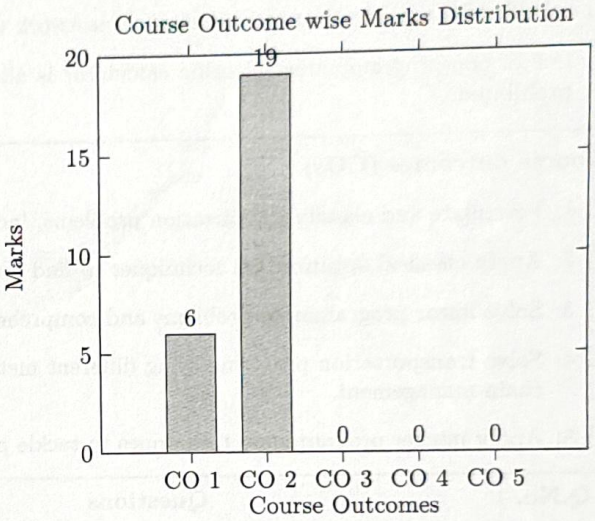
CO 5: Apply integer programming techniques to tackle problems involving discrete decision variables.

Q.No.	Questions	Marks	CO	BL	PO	PI Code
1	A small furniture workshop produces chairs, tables, and benches. The production of these items requires both raw materials and labor, which are available in limited quantities. Each chair uses 2 units of material and takes 3 hours to build, providing a profit of Rs. 40. Each table uses 3 units of material and takes 5 hours to build, providing a profit of Rs. 70. Each bench uses 4 units of material and takes 4 hours to build, providing a profit of Rs. 90. The workshop has a total of 50 units of material and 60 hours of labor available for production. Due to storage limitations, they cannot produce more than 5 benches. How many chairs, tables, and benches should the workshop produce to maximize their profit while staying within the material and labor limits? Give the mathematical formulation of this optimization problem.	6	CO1	L3	PO2	2.1.1
2	Find the minimum of the function $f(x) = x^3 - 2x + 10$, using Newton-Raphson method with initial guess $x^{(1)} = 1$ and $\varepsilon = 0.001$.	6	CO2	L3	PO1	1.1.1

Q.No.	Questions	Marks	CO	BL	PO	PI Code
3	a) State the necessary condition of a single variable function to have a relative minimum. (2) b) State the sufficient condition for a single variable optimization function to have a extreme point. (3)	5	CO2	L1	PO1	1.2.1
4	Find the solution of the given problem using the Lagrange Multiplier method: Maximize $f(X) = 2x_1 + x_2 + 10$ Subject to: $g(X) = x_1 + 2x_2^2 = 3$	8	CO2	L3	PO1	1.1.1

Bloom's Level wise Marks Distribution





BL – Bloom's Taxonomy Levels:
1 – Remembering, 2 – Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 – Creating
CO – Course Outcomes
PO – Program Outcomes
PI Code – Performance Indicator Code

End of exam