

As Per NEP 2020

University of Mumbai



Syllabus for Basket of OE Vertical 3	
Faculty of Science	
Board of Studies in Statistics	
UG Second Year Programme	
Semester	III
Title of Paper	Credits 2
I) Optimization Techniques-I	2 credit
From the Academic Year	2025-26

Semester-III

Optimization Technique-I

Description the course:**Including but not limited to:**

Introduction: Optimization Technique is a field of study that involves using mathematical models, algorithms, and analytical methods to optimize decision-making processes. In business, Optimization Technique is applied to improve supply chain management, production processes, inventory management, risk management, and more. As a sub-field of Applied Operations Research, it has a very interesting position alongside other fields as Data Science and Machine Learning. The program has some unique features like applying analytical methods to help make better management decisions. Operations Research (OR), commonly known as OR, is a scientific study that involves using mathematical and statistical techniques to solve complex business problems. Its scope is vast in the present business landscape, and it plays a crucial role in decision-making and problem-solving across various industries.

Application, and Demand:**Linear Programming Problems (LPP)**

LPP can be used in various fields like Production planning, Manufacturing, transportation, sports, share market, engineering, machine learning etc.

Transportation and Logistics

Optimization Techniques can be used to optimize transportation and logistics, which includes determining the best routes for transportation, minimizing travel times, and maximizing the use of transportation resources.

Healthcare

Optimization Techniques can be used to optimize healthcare operations, including scheduling appointments, managing patient flow, and improving hospital capacity planning. O.R. models can also be used to optimize medical treatments and patient care.

Finance

Optimization Techniques can be used to optimize financial operations, including asset allocation, risk management, and portfolio optimization. O.R. models can also be used to forecast financial markets and predict future trends.

Job Prospects:

Optimization analyst provides accurate, timely and relevant inputs to stakeholders through complex data analysis, using statistical methodologies and tools. They are in high demand across various job roles such as Data Analyst, Business Analyst, Operations Manager, Risk Analyst, Statistician, Management Consultant,

Connection with Other Courses:

Optimization Techniques relates to other courses like Commerce, Applied Economics, Accounting & Finance, Mathematics, Computer Science, Business Management, and Medical Science And Technology.

Additional Areas : Optimization Techniques has a wide range of applications and can be used to solve complex real-world problems. By using mathematical modeling and optimization techniques, organizations can make better decisions and improve their operations.

Vertical:	Open Elective
Type:	Theory
Credits:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
Hours Allotted:	30 Hours
Marks Allotted:	50 Marks

Theory (2 Credit)

Total No of Theory Hours: 30

Total Marks : 50

Course Objectives (CO): (List the course objectives)

1. Introducing students to optimization techniques using Linear and non-linear programming.
2. To learn mathematical formulation and solution of real-life situations using Linear programming problems.
3. To understand and learn assignment and transportation problems in Business Models.
4. To learn the application of Optimization Techniques in Real Life Problems.
5. To develop students' critical thinking and problem-solving abilities through the application of statistical methods in real-world business scenarios.

Course Outcomes (OC): (List the course outcomes)

1. Understanding of fundamental optimization techniques and methods applicable to business / industrial analysis.
2. Learning to maxima/ minima problems into optimization techniques.
3. Learn the efficient computational procedures to solve optimization problems.

Module 1:	Network Analysis:	15 hrs
1.1	Introduction To Operation Research (OR) and Linear Programming Problems (LPP): Operation Research- Definition, Characteristics of OR, Application of OR, Limitation of OR Introduction of LPP, Formulation of LPP (Up to 3 Variables), Sketching of Graphs of Linear Equation and Linear Inequality, Solution of LP Problems using graphical method up to two variables.	07
1.2	Linear Programming Problems: Simplex Method: Concept of a slack variable, a surplus variable, artificial variable, L.P. problem in canonical form and standard form. Definition of a solution, a feasible and infeasible solution, basic variable and non-basic variable, a basic feasible solution, a	08

	degenerate and a non-degenerate solution, an optimal solution Maximization Type Problems. (Only Max. Z). No Minimization problems. Numerical on Degeneracy in Maximization Simplex Problems. Two or Three Decision Variables and Maximum Three Constraints Problem. (Up to Maximum Two Iterations) All Constraints to be “less than or equal to” Constraints. (“Greater than or Equal to” Constraints are not included.) Big-M method, modified objective function, modifications and applications of simplex method to L.P.P., criterion for no solution.	
Module 2:	Assignment and Transportation Problems	15 hrs
2.1	Assignment Problem: Statement of an assignment problem Maximization and Minimization Type Problems. Balanced and unbalanced assignment problem Relation with T.P. Optimal solution of an assignment problem using Hungarian method.	07
2.2	Transportation problem: Transportation problem (T. P.), statement of T. P., Maximization and Minimization Type Problems., balanced and unbalance T. P. Methods of obtaining initial basic feasible (IBF) solution of T.P. (i) North West corner rule (ii) Method of matrix minima (least cost method), (iii) Vogel's approximation (VAM). MODI method of obtaining Optimal solution of T. P, uniqueness and non- uniqueness of optimal solutions, degenerate solution.	08

9	Reference Books 1. Kanti Swarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons 2. J K Sharma, (1989): Mathematical Models in Operations Research, Tata McGraw Hill Publishing Company Ltd. 3. S.D.Sharma : Operations Research; Theory, Methods and applications,15th Edition ,Reprint, Kedarnath 4. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India. 5. J.K.Sharma , (2001), Quantitative Techniques For Managerial Decisions: MacMillan India Ltd. 6. Vohra N. D.(2006) : Quantitative Techniques in Management, Third edition, McGraw Hill Companies. 7. Maurice Sasieni, Arthur Yaspan and Lawrence Friedman, (1959): Operations Research: Methods and Problems, John Wiley & Sons. 8. Schaum Series book in O.R. Richard Broson. Tata Mcgraw Hill Publishing Company Ltd.
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Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/ Viva Quizzes, Class Tests, Presentation, Project, Assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. All questions are Compulsory.

Theory Question Paper Pattern:

Q 1	Attempt any one question out of two questions (Module I and II)	Max. marks: 10
Q 2	Attempt any two questions out of three questions (Module I)	Max. marks: 10
Q 3	Attempt any two questions out of three questions (Module II)	Max. marks: 10

Sd/-

**Sign of the BOS Chairman
Dr. Santosh Gite
Board of Studies in
Statistics**

Sd/-

**Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology**

Sd/-

**Sign of the
Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology**