AC – 28/03/2025
Item No. – 6.2 (N) (5b) Sem. IV

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	**IV**
Title of Paper	**Credits 2**
I) Optimization Technique-II	**2 credit**
From the Academic Year	**2025-26**

Semester- IV
Open Elective-III
Name of the Course: Optimization Technique-II

Sr. No.	Heading	Particulars
1	**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:** **Production Planning and Scheduling:** Network analysis, also known as network optimization, focuses on understanding and optimizing relationships between interconnected elements. Analyzing how resources (such as data, goods, or people) flow through networks (e.g., transportation, communication, supply chains). Identifying the most critical activities in a project schedule to minimize delays. These models can also help organizations to determine the best order of production for various products. These techniques help in finding cost-effective solutions for network design and operation. 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.	
2	**Vertical:**	Open Elective
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Theory (2 Credit)** **Total No of Theory Hours : 30** **Total Marks : 50** **Course Objectives (CO):** (List the course objectives) 1. Introducing students to Network Analysis, Critical Path Methods applicable to business contexts. 2. To learn mathematical formulation and solution of real-life situations using Decision Theory 3. To Explain the methods to Plan and Schedule Projects 4. To understand and learn Sequencing of Jobs in Business Models 5. To learn how to Solve Game Theory Problems 6. To learn the application of Optimization Techniques in Real Life Problems 7. To develop students' critical thinking and problem-solving abilities through the application of statistical methods in real-world business scenarios.	
8	**Course Outcomes (OC):** (List the course outcomes) 1. Understanding of fundamental optimization techniques and methods applicable to business analysis. 2. Identifying the most critical activities in a project schedule to minimize delays. 3. Learning to find cost-effective solutions for network design and operation. 4. Learning how to ensure timely completion of projects or tasks. 5. Understanding Decision theory frameworks for making rational choices under uncertainty.	

	6. Identifying the best course of action given available information and potential outcomes under a real life situation. 7. Maximizing expected utility (benefits) while considering risks and preferences. 8. Learning how to Sequence Jobs and Evaluate Total Elapsed Time 9. Applying Game Theory to find out an optimal solution for a given situation. 10. Applying Skills in communicating statistical findings effectively to stakeholders. 11. Competence in applying statistical methods to solve real-world business Problems.

Module 1:	**Network Analysis:**	**15 hrs**
1.1	**<u>Critical Path Method (CPM)</u>** Concepts: Activity, Event, Network Diagram, Merge Event, Burst Event, Concurrent and Burst Activity, Construction of a Network Diagram. Node Relationship and Precedence Relationship. Principles of Constructing Network Diagram. Use of Dummy Activity Numerical Consisting of Maximum Ten (10) Activities. Critical Path, Sub-critical Path, Critical and Non-critical Activities, Project Completion Time. Forward Pass and Backward Pass Methods. Calculation of EST, EFT, LST, LFT, Head Event Slack, Tail Event Slack, Total Float, Free Float, Independent Float and Interfering Float	**5**
1.2	**<u>Project Crashing</u>** Meaning of Project Crashing. Concepts: Normal Time, Normal Cost, Crash Time, Crash Cost of Activities, Cost Slope of an Activity. Costs involved in Project Crashing: Direct, Indirect, Penalty and Total Costs. Time – Cost Trade off in Project Crashing. Optimal (Minimum) Project Cost and Optimal Project Completion Time. Process of Project Crashing. Numerical Consisting of Maximum Ten (10) Activities. Numerical based on Maximum Four (04) Iterations of Crashing	**5**
1.3	**<u>Program Evaluation and Review Technique (PERT)</u>** Three Time Estimates of PERT: Optimistic Time (a), Most Likely Time (m) and Pessimistic Time (b). Expected Time (te) of an Activity Using Three Time Estimates. Difference between CPM and PERT. Numerical Consisting of Maximum Ten (10) Activities. Construction of PERT Network using te values of all Activities. Mean (Expected) Project Completion Time.	**5**

	Standard Deviation and Variance of Activities. Project Variance and Project Standard Deviation. Simple Questions related to PERT Technique.	
Module 2:	**Decision Theory, Inventory control and Queuing theory.**	**15 hrs**
2.1	**<u>Decision Theory</u>** Decision Environments – Risk & Uncertainty, Payoff Table, Regret Table Decision Making under Uncertainty Maximin & Maximax Criteria, Minimax Regret Criterion Laplace Criterion, Hurwitz Criterion Decision Making Under Risk Expected Monetary Value Criterion, Expected Opportunity Loss (E.O.L), Decision Tree Analysis	**5**
2.2	Inventory Management: Introduction to Inventory control problem, Type of Inventory, Different cost in Inventory Problem, Selective control techniques b) Techniques of Inventory models: EOQ with known demand, uniform demand, problem of EOQ with shortages, Inventory model with stochastic demand, Buffer stock, price discounts, back order inventory models	**5**
2.3	Queuing theory: Introduction of Queuing theory, Elements of a Queuing model. b) Pure birth and death model, specialized poison queues, single server models: (M/M/1):(GD/∞/∞), M/M/1:(GD/M/∞), Multiserver models.	**5**

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.

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