



**Mathematics Paper II**  
**Operations Research**

Semester: IV

Credits: 2

Subject Code: BS42104

Lectures: 36

**Course Outcomes:**

**At the end of this course, the learner will be able to:**

- Develop the skills of mathematical analysis: Formulation, Deduction, Proof and a clear perception of mathematical ideas and tools.
- Illustrate the applications of Operations Research and formulate a linear programming problem and apply appropriate method to solve it.
- Illustrate and analyze the managerial problems in the industry and use the resources (Machines, Materials, Staff etc.) more effectively.
- Build and solve Transportation problem and Assignment problem using suitable method.
- Compare the initial solutions of Transportation problems obtained by different methods and obtain the optimality of the solution.
- Solve the Sequencing problem by identifying the type of the problem and obtain the optimal sequence.

**Unit 1: Modeling With Linear Programming**

**4**

- Introduction to Operations Research
- Scope of Operations Research
- Mathematical Formulation of L.P.P.
- Graphical Method

**Unit 2: Simplex Method**

**10**

- Theory of Linear Programming, Slack and surplus variables, Standard form of LPP
- Some important definitions, Assumptions in LPP, Limitations of Linear programming, Applications of Linear programming, Advantages of Linear programming Techniques
- Simplex method, Big- M Method
- Special cases in LPP: Alternative Solution, Unbounded Solution, Infeasible Solution

**Unit 3: Duality and Simplex**

**6**

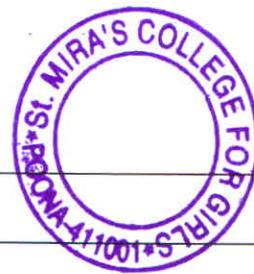
- Duality in Linear Programming
- Primal to dual conversion, Examples.

**Unit 4: Transportation Problems and its Variants**

**10**

- Introduction, Tabular representation
- Methods of IBFS
  - North-West Corner Method (NWC)
  - Matrix-Minima Method or Least Cost Entry Method (LCEM)
  - Vogel's Approximation Method (VAM)
- The Optimality Test of Transportation Model (MODI method only)
- Special Cases in Transportation Problems
  - Unbalanced Transportation Problems

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- Simpson's Three-Eight Rule

#### Unit 4: Numerical Solution of Ordinary Differential Equation

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- Euler's Method
- Euler's Modified Method
- Runge-Kutta Methods
  - Runge-Kutta Method of order Two
  - Runge-Kutta Method of order Four
  - Convergence of Runge Kutta Method

No. of Lectures = 36 + 12 (Contact Hours) = 48 (Total)

#### Recommended Text Books:

- A. K. Jaiswal and Anju Khandelwal, *A Textbook of Computer Based Numerical and Statistical Techniques*, New Age International Publishers, Year : January 2009  
**Unit 1:** Chapter 2: Sections 2.1, 2.5, 2.7  
**Unit 2:** Chapter 3: Sections 3.1, 3.2, 3.4, 3.5, **Unit 3:** Chapter 6: Sections 6.1, 6.3, 6.4, 6.5, 6.6, 6.7  
**Unit 4:** Chapter 7: Sections 7.1, 7.4, 7.5, 7.6

#### Reference Books:

- E. Balgurusamy, *Numerical Methods*, Tata McGraw-Hill Publishing Company Limited, 1999
- H.C. Saxena, *Finite differences and Numerical Analysis*, S. Chand and Company, 1 December 2010
- Jain, Iyengar, Jain, *Numerical Methods*, New Age International Publishers, Third Edition - 1 January 2020.
- K.E. Atkinson, *An Introduction to Numerical Analysis*, Wiley Publications, 26 September 2008
- S.S. Sastry, *Introductory Methods of Numerical Analysis*, 3rd edition, Prentice Hall of India, 1999

#### Websites:

- [http://mathforcollege.com/nm/topics/textbook\\_index.html](http://mathforcollege.com/nm/topics/textbook_index.html)

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St. Mira's College for Girls, Pune  
(SY B.SC(CS) 2021-2024)

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Chairman (HoD)	Gitanjali Phadnis	<i>G.M.Phadnis 20/3/2021</i>
Faculty	Vrushali Paranjpe	<i>Vrushali 20/3/2021</i>
Subject Expert (Outside SPPU)	Dr. Machchhindra Gophane	<i>MG 20/3/21</i>
Subject Expert (Outside SPPU)	Dr. Prashant Malavadkar	<i>Prashant 20-03-2021</i>
VC Nominee (SPPU)	Dr. Vinayak Joshi	<i>Vinay 20/3/21</i>
Industry Expert	Mr. Anup Manakeshwar	<i>Anup 20-03-2021</i>
Alumni	Ms. Jyoti Sharma	<i>Jyoti 20/03/2021</i>

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