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 (NWCM)
  ○ 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	

Board Of Studies	Name	Signature
Chairman (HoD)	Gitanjali Phadnis	G.M.Phadnis

• Simpson's Three-Eight Rule	

Unit 4: Numerical Solution of Ordinary Differential Equation	**8**

• 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, Chapter 4: Sections 4.1, 4.2, 4.3
  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

Board Of Studies	Name	Signature
Chairman (HoD)	Gitanjali Phadnis	G. M. Phadnis

Board Of Studies	Name	Signature(In white cell)	
Chairman (HoD)	Gitanjali Phadnis	G.M.Phadnis 20/3/2021	
Faculty	Vrushali Paranjpe		20/3/2021
Subject Expert (Outside SPPU)	Dr. Machchhindra Gophane	20/3/21	
Subject Expert (Outside SPPU)	Dr. Prashant Malavadkar		20-03-2021
VC Nominee (SPPU)	Dr. Vinayak Joshi	20/3/21	
Industry Expert	Mr. Anup Manakeshwar		ManakeshwarAB 20-03-2021
Alumni	Ms. Jyoti Sharma	Jyoti 20/03/2021	

Board Of Studies	Name	Signature
Chairman (HoD)	Gitanjali Phadnis	G.M.Phadnis