**Approval: 10th Senate Meeting**

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| Course Name | : Applied Mathematical Programming |
| Course Number | : MA-515 |
| Credit | : 3-1-0-4 |
| Prerequisites | : None |
| Students intended for | : M.Sc /M.S./Ph.D. ./B.Tech 3rd & 4th year |
| Elective or core | : Core for M.Sc. in Applied Mathematics and Elective for other discipline |
| Semester | : Odd/Even |

**Preamble:**

This course is aimed to give understanding of fundamentals of linear and quadratic programming with emphasize on quantitative insight.

The course highlights the prevailing abilities of mathematical programming to problems like costs minimization, resource allocation, efficiency optimization and offering better solution in many other key areas in economics, science, engineering and industry by solving their respective decision making problems.

The course contents are intended to have flavor of both adequate theoretical basis of methods discussed and their applications with implementations for problems solving in industry.

**Expected Outcomes:**

After successful completion of the course students

1. Should be able to understand and make mathematical model the decision making problems.
2. Have adequate understanding of theatrical concepts governing the working of linear and quadratic programming.
3. Would be able to solve different types of linear and quadratic programming problems arising in various domains in industry

**Course Contents:**

Origin and types of Linear Program: Model formulation in Industrial Problems, Solution by Graphical Method. **[5]**

Theory and geometry of linear programs, Simplex Method, Big-M, Two Phase and Revised simplex method, complexity of simplex method, application to decision making. **[8]**

Duality theory and application, Economic interpretation of dual variables, Primal dual relationship and theorems, Dual simplex method, primal-dual method. **[7]**

Integer programming and Applications, Gomory's Algorithm and branch and bound methods. **[5]**

Transportation problems, Assignment problems, Application in various domains. **[5]**

Alternate approaches to solve LPP: ellipsoid method, Karmarkar's algorithm and application. **[5]**

Nonlinear programming, Lagrange multipliers, Farka's lemma, constraint qualification, KKT optimality conditions, sufficiency of KKT under convexity; Quadratic Programming, Wolfe method, Industrial Applications of QPP: Machine Learning, Finance etc. **[7]**

**Text Books:**


1. D. Bertsimas and J. N. Tsitsiklis, "Introduction to Linear Optimization", Athena Scientific (1997).
2. Robert J. Vanderbei, "Linear Programming: Foundations and Extensions", Springer, 4th ed. (2014).
3. G. V. Reklaitis, A. Ravindran, K. M. Ragsdell, "Engineering Optimization: Methods and Applications", Wiley (2006).
4. Mokhtar S. Bazaaraa, Hanif D. Shirali and M.C.Shetty, "Nonlinear Programming, Theory and Algorithms", John Wiley & Sons, New York (2004).


**References Books:**


1. Murty, Katta G., ed., "Case Studies in Operations Research: Applications of Optimal Decision Making". Vol. 212. Springer (2014).
2. Don T. Phillips, A. Ravindran, James J. Solberg, "Operations Research: Principles and Practice", John Wiley & Sons (1987).
3. S. S. Rao, "Engineering Optimization: Theory and Practice", 4th Edition, John Wiley & Sons (2009).