SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. Semester V

Subject Name: **Engineering Optimization** **Subject Code: BTAS10501**

Type of course: HSM

Prerequisite: Linear Algebra

Rationale: This kind of course is required to provide strong foundation for students in operations research modelling and essential tools for optimization. Such expertiseis needed for engineering students who do not have an industrial engineering background but would like to learn about modelling and optimization concepts and likely to use these methods in their research and projects.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
2	1	0	3	60	25	15	-	-	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hr.	Module % Weightage
1.	**Introduction to Optimization** Mathematical formulation, Classification of optimization problems,formulation of optimization problem for Engineering applications	3	10
2.	**Classical Optimization Techniques** Single variable optimization, Functions of Single and Two Variables Convexity and Concavity of Functions of One/ Two Variables , Constrained and unconstrained multivariable optimization, optimization of Functions of Multiple Variables: Unconstrained Optimization Direct substitution method, Lagrange's method of multipliers ,Optimization of Functions of Multiple Variables subjectto Equality Constraints, Karush Kuhn-Tucker Conditions	12	20

3.	**Linear Programming** Linear programming problem- graphical method (two variable) simplex method, Two Phases of the Simplex Method. **Integer programming Problem** General integer programming Problem, Branch and bound Method,	7	15
4.	**Transportation models and its Variants:** Transportation problems: Mathematical model, Concept of Unimodularity, Methods to find initial feasible solution (NWCM, matrix minima, Vogel's approximation), Methods to find optimal solutions (MODI, Stepping stone), Degeneracy in transportation problem, Unbalanced Transportation problem, Maximization in transportation problem Assignment problems: Introduction and Mathematical model, Hungarian Methods to find solution, Degeneracy in assignment problem, Unbalanced assignment problem, Infeasible assignment problems, Maximization in assignment problem	10	20
5.	**Non-linear Programming:** Introduction, Elimination Method: Unrestricted Search, haustive search, Interval-halving method, Fibonacci method.	6	15
6.	**Project management Optimization techniques** PERT, CPM **,** Multi-objective Optimization	7	20

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	25	35	20	10	00

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and detailslike ISBN	Year of publication	Edition
1.	Engineering optimization Theory and Practice	S.S.Rao	New Age International	2010	3rd
2.	An Introduction To Optimization	E. K. P. Chong S. H. Zak	Wiley India Pvt.	2010	2nd

3.	Introduction to Optimum Design	Jasbir S.Arora	McGraw Hill	1989	Latest
4.	Optimization for Engineering Design Algorithms and Examples	Kalyanmoy Deb	Prentice Hall	1998	3rd
5.	Practical Optimization	R. Fletcher	John Wiley	2010	2nd
6.	Operations Research: AnIntroduction	Hamdy A.Taha	Pearson	2010	Latest

Course Outcomes:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Formulate real-life engineering problems, using mathematical modelling techniques.	10
CO-2	Apply classical optimisation techniques to solve application problems.	20
CO-3	Solve real life optimization problems using Linear programming and transportation model techniques	35
CO-4	Apply nonlinear optimisation techniques to solve optimization problems	15
CO-5	Use concepts of multi-objective optimization and project management techniques for problem solving	20

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	-	-	2	2	2	1
CO3	3	2	2	2	2	2	-	-	2	2	2	2
CO4	3	2	2	2	2	-	-	-	2	2	2	2
CO5	2	2	-	2	2	-	1	2	2	2	2	2

List of Open Source/learning website:

NPTEL http://nptel.ac.in/courses/105108127/ - Optimization Methods
NPTEL- https://nptel.ac.in/courses/112106134 - Fundamentals of Operations Research
University of Washington - http://www.math.washington.edu/~rtr/fundamentals.pdf
University of Hamilton - http://www.hamilton.ie/ollie/Downloads/Opt.pdf
MIT open courses http://ocw.mit.edu/courses/sloan-school-of-management/15-093j-optimization-methods-fall-2009/lecture-notes/
NPTEL- 106108056 http://textofvideo.nptel.iitm.ac.in/video.php?courseId=106108056&p=1