

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ELECTRICAL ENGINEERING (07) POWER SYSTEM MANAGEMENT & OPTIMIZATION SUBJECT CODE: 2720717 SEMESTER: II

**Type of course:** Engineering

**Prerequisite:** Basic concepts and principles of Power Systems Analysis.

**Rationale:** This course addresses unified and unique mathematical treatment of various optimization techniques for Power Systems Engineers. It covers the theory and applications of NLP, LPP and other strategies for solving optimization problem. Examples and applications like minimization of losses, Unit commitment and active and reactive power dispatch related to power systems operation and control will be covered.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

### Content:

Sr. No.	Content	Total Hrs	% Weightage
<b>1</b>	<b>Introduction</b> Optimal problem formulation, Design variables, Constraints, Objective function, Variable bounds, Optimization algorithms.	<b>02</b>	<b>05</b>
<b>2</b>	<b>Linear Programming</b> Formulation of LPP, Graphical method, Simplex method, The use of artificial variables, Big-M method, Sensitivity analysis and duality theory	<b>06</b>	<b>10</b>
<b>3</b>	<b>Non linear Programming I</b> Single-Variable optimization algorithms, Optimality criteria, Exhaustive search method, Bounding phase method, Region-Elimination methods, Interval halving method, Fibonacci search method, Golden Section search method, Point-Estimation method, Successive quadratic estimation method, Gradient based methods, Newton-Raphson method, Bisection method, Secant method, Cubic search method	<b>10</b>	<b>20</b>
<b>4</b>	<b>Non linear Programming II</b> Multivariable optimization algorithms, optimality criteria, Direct search methods, Hooke and Jeeve's method, Powell's conjugate direction method, Simplex method, Indirect search (descent) method, Cauchy's (steepest descent) method, Conjugate gradient (Fletcher-Reeves) method, Newton's method,	<b>06</b>	<b>15</b>
<b>5</b>	<b>Non linear Programming III</b> Multivariable constrained optimization algorithms; Generalized reduced gradient method, Gradient projection method, Box-Complex algorithm, Kuhn-Tucker conditions, and Penalty function methods	<b>08</b>	<b>15</b>

<b>6</b>	<b>Economic Load Dispatch of Thermal Generating Units</b> Introduction, generator operating cost economic dispatch problem on busbar, optimal generator scheduling, economic dispatch using NR method, Optimal power flow based on Newton's method, Optimal power flow based on gradient method,	<b>08</b>	20
<b>7</b>	<b>Multiobjective Generation Scheduling</b> Introduction, state of art, weighting method, min max optimum, Epsilon constraint method, Reactive power optimization and management	<b>06</b>	15

### Reference Books:

1. POWER SYSTEM OPTIMIZATION by KOTHARI, D. P., DHILLON, J. S., Second Edition, PHI
2. Engineering Optimization: Theory and Practice, Singiresu S. Rao, New Age International.
3. Optimization for Engineering Design by Kalyanmoy Deb PHI publication
4. Linear Programming in single and multiobjective systems by James P Ignizio, Prentice Hall.
5. OPERATIONS RESEARCH AN INTRODUCTION By Hamdy A TAHA Prentice Hall of India
6. Students are encouraged to read various research papers of peer reviewed journals for application related topics

### Course Outcome:

After learning the course the students should be able to:

1. Learn the unified and exact mathematical basis as well as the general principles of optimization techniques
2. Understand detailed theoretical and practical aspects of application of optimization techniques
3. Formulate deterministic mathematical programs and solutions for Power System applications
4. Determine the operating condition of the power systems, in which optimization of some system variable are obtained

### List of Experiments and Open Ended Problems:

Students may use other softwares such as C, C++ etc in lieu of MATLAB

### Major Equipment:

Computers.

### List of Open Source Software/learning website:

MATLAB Software. C, C++, SCILAB

NPTEL courses related to power system analysis and Optimization

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry

portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.