Course Description

Course Title	***Power System Planning***		
Prerequisites	***Power System Analysis I and II***	**Credits**	**3**
Objectives	This course aims to explore the theoretical and practical knowledge on the expansion planning of modern power systems. Students learn the fundamentals of electric load forecasting, economic evaluations of power systems, fundamentals of convex optimization in power system planning, generation expansion planning, transmission and substation expansion planning, composite generation and transmission planning and volt-var planning. It is assumed that students are familiar with power system analysis and operation basics.		
Syllabus	***Introduction:*** Introduction to generation, transmission and distribution of electrical energy, power system elements, power system structure, power system studies and time sclaes, planning types, planning horizons, planning sequences. ***Planning Criteria:*** Introduction, system adequacy and security, planning purposes, planning standards, reliability assessment. ***Economic Evaluation of Power Systems:*** Introduction, definitions of terms, time value of money, present worth method , annual cost method, rate of return method. ***Fundamentals of Optimization:*** Introductions to convex optimization, constrained and unconstrained optimization, KKT optimality conditions, types of optimization programming problems, solution methods, optimization using standard solvers in GAMS. ***Load Forecasting:*** Introduction, time horizons of load forecasting, long term forecasting, extrapolation of trend curves, Box-Jenkins forecasting methods, multivariate forecasting methods, stepwise regression, econometric and end-use methods, combination method, ***Generation Exp. Planning:*** Introduction to generation expansion problem(GEP), technical input-output characteristics of generating units, GEP modeling, objective functions and constraints of GEP optimization problem, solution methods, solution of GEP in GAMS and WASP software. ***Transmission Exp. Planning:*** Introduction to transmission expansion problem(TEP), technical characteristics of transmission lines, TEP modeling, objective functions and constraints of TEP optimization problem, TEP and GEP composite planning, solution methods, modeling and solution of GEP in GAMS. ***Reactive Power Planning***: Introduction to voltage and reactive power control, static and dynamic reactive power resources, modeling of volt-var planning problem, objective functions and constraints of volt-var optimization problem, composite TEP and volt-var planning. ***Planning Under under Uncertainty:*** Sources of uncertainties in power system planning, uncertainty modeling techniques, decision making under uncertainty.		
Comments	Students must be familiar with optimization and power system analysis software. Expansion planning of large scale power systems using standard solvers in GAMS and other commercial planning software such as WASP or PLEXOS is a major part of this course.		
References	1. Modern Power System Planning, X. Wang, J. R. Mc Donald, Mc Graw Hill, 1994. 2. Electric Power System Planning: Issues, Algorithms and Solutions, Hossein Seifi, Mohammad Sadegh Sepasian, Springer, 2011. 3. Convex Optimization– S. Boyd and L. Vandenberghe , Cambridge University Press, 2004. 4. Electric Power Planning for Regulated and Deregulated Markets A. Mazer, John Wiley, 2007.		