Course Title: Power System II
Course Code: EPEG 413
Credit Hours: 3

Course Description:
This course provides a broad understanding of the performance of modern power systems and the analysis and computation of large three phase systems.

Course Contents:

Unit 1: Introduction to Power System Analysis
Single and double subscript notation, Power in single-phase AC circuits; Complex power triangle, Direction of power flow; Voltage and current in balanced three phase circuits; Power in balanced three phase circuits; Per unit quantities, Circuit model of Synchronous machine, Park's Transformation, Equivalent circuit of transformer, p.u. impedance in 1-phase transformer circuit, p.u. impedance of 3-winding transformer, online diagram, advantages of p.u. computing

Unit 2: Load-Flow Solutions
Power flow problem using static equations, bus admittance matrix, Gauss-Seidel method, Newton - Raphson method Fast-decoupled method, Control of power into a network, Optimal load flow solution

Unit 3: Symmetrical Three Phase Faults
Impedance and reactance diagram, Transients in RL series circuits; Short - circuit currents and the reactances of synchronous machines; internal voltages of loaded machines under transient condition; Bus impedance matrix in fault calculations; Bus impedance matrix equivalent networks; Selection of circuit breakers

Unit 4: Symmetrical Components
Synthesis of asymmetrical phasors from their symmetrical components; Symmetrical components of asymmetrical phasors; Phase shift of symmetrical components in Y-Delta transformer banks; Power in terms of symmetrical components; Unsymmetrical series impedances, Sequence impedances and sequence networks; Sequence networks of unloaded generators, Sequence impedance -positive and negative sequence networks, Zero sequence networks

Unit 5: Unsymmetrical Faults
Unsymmetrical faults on power systems; Single line to ground fault on power system; Line to line fault on power system; Double line to ground fault on a power system; Interpretation of the interconnected sequence networks; Analysis of unsymmetrical faults using the bus impedance matrix; Fault through impedance

Unit 6: Power System Stability and Control
Stability problem, rotor dynamics and the swing equation; Power angle equation, steady state stability-small signal stability, Transient stability studies, Equal area criterion of stability, Factor affecting transient stability, Multi-machine stability studies, load frequency control, automatic

generation control, reactive power and voltage control, Supervisor Control And Data Acquisition (SCADA), Energy Management Systems (EMS)

References:

1. W. D. Stevenson, *Elements of Power System Analysis,* Tata Mc Graw Hill
2. Hadi Saadat, *Power System Analysis*, , McGraw-Hill
3. P. Kundur, *Power System Stability and Control*, McGraw-Hill

Evaluation:

In-Semester Evaluation: 50%
End-Semester Evaluation: 50%