Department of Electrical Engineering
School of Engineering
University of Management and Technology

Course Outline

Course code: EE406 Course Title: Power System Analysis and Design

Semester: Fall 2016

Program	BSEE
Credit Hours	3+1
Duration	One Semester
Prerequisites	EE317: Power System Fundamentals
Resource Person	Fahad Usman Khan Nouman Ahmad Jameel Ahmed
Counseling Timing (Office 501, 510)	See office window
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Chairman/Director signature…….

Dean's signature…… Date…….

Learning Objective:

This course has been designed to introduce the importance of analyzing various aspects of power system. It covers power flow studies and fault analysis of both symmetrical and unsymmetrical faults in power networks. This forms the basis for power system operation, control and protection. The course strongly supports expected outcomes a, b, d and i of the HEC Electrical Engineering Curriculum. Upon completion of this course, students will become familiar with:

- Per Unit Systems
- One Line Diagram of the Network
- Impedance Diagram
- Admittance Diagram
- Admittance Matrix Ybus
- Impedance Matrix Zbus
- Network Calculations using Ybus and Zbus
- Power Flow Solutions
- Symmetrical Faults
- Symmetrical Components
- Sequence Components
- Unsymmetrical Faults
- Swing Equation

Learning Methodology:

Lectures, Interactive, Participative, and industrial Visits

Grade Evaluation Criteria

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

Assessment	**Marks in percentage**
Quizzes & Assignments	25
Mid Term	25
Final exam	50
Total	100

Recommended Text Book:

[1] Power System Analysis by John J. Grainger & William D. Stevenson, Jr. 1994

Reference Books:

[2] Power System Analysis Third Edition, by Hadi Saadat 2011

[3] Power System Analysis and Design 5th ed by J. Duncan Glover and Thomas Overbye, Jan 7, 2011

[4] Power Systems Analysis (2nd Edition) by Arthur R. Bergen and Vijay Vittal Aug 16, 1999

Tentative Course Topics

No of Lectures	Topics	Textbook (TB) / Reference Readings(RR)
1 lecture	**Basic Concepts and Introduction** Per Unit Quantities, Changing the Base of Power Unit Quantities, The Single Line or One Line Diagram, Impedance and Reactance Diagrams, Node Equations,	Ch # 1 of TB[1]
4 lectures	**The Admittance Model and Network Calculations** Branch and Node Admittances, Mutually Coupled Branches in Ybus, An Equivalent Admittance Network, Modification of Ybus, The Network Incidence Matrix and Ybus, Method of Successive Elimination, Node Elimination (Kron Reduction), Triangular Factorization, Sparsity and Near Optimal Ordering	Chap # 07 of TB[1]
4 lectures	**The Impedance Model and Network Calculations** Bus Admittance and Impedance Matrices, Thevinin's Theorem and Zbus, Modification of an Existing Zbus, Direct Determination of Zbus, Calculations of Zbus Elements from Ybus, Power Invariant Transformations, Mutually Coupled Branches in Zbus	Chap # 08 of TB[1]
5 lectures	**Power Flow Solutions** The Power Flow Problem, Gauss-Seidal Method, Newton-Raphson Method, Newton Raphson Power Flow Solution, Power Flow Studies in System Design and Operation, Decoupled Power Flow Method	Chap # 09 of TB[1]
	Mid Term Exam	
4 lectures	**Symmetrical Faults** Transients in RL Series Circuits,	Chap # 10 of TB[1]

	Internal Voltages of Loaded Machines under Fault Conditions, Fault Calculations Using Zbus, Fault Calculations Using Zbus Equivalent Circuits, Selection of Circuit Breakers	
4 lectures	**Unsymmetrical Faults** Unsymmetrical Faults on Power Systems, Single Line-Ground Faults, Line to Line Faults, Double Line to Ground Faults, Open Conductor Faults	Chap # 12 of TB[1]
4 lectures	**Zbus Methods in Contingency Analysis** Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis by dc Model, System Reduction for Contingency and Fault Studies	Chap # 14 of TB[1]
2 lectures	**Power System Stability** Stability Problem, Rotor Dynamics and Swing Equation, Further Considerations of the Swing Equation, The Power-Angle Equation, Equal-Area Criterion of Stability, Multimachine Stability Studies: Classical Representation! Step-by-Step Solution of the Swing Curve	Chap # 16 of TB[1]
End Term Exam (Comprehensive)		