**University of Management and Technology**

**Course Outline**

Course code: **EE317** Course title: **Power System Fundamentals**

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| Program | BSEE |
| Credit Hours | 3 |
| Duration | One Semester |
| Prerequisites | EE 212 Electrical Network Analysis |
| Resource Person | Dr. Adnan Haider1  Farah Sarwar2 |
| Counseling Timing  (Office # 401/6 ) | Tuesday & Thursday (10:00 – 13:00)  Wednesday & Friday (10:00 – 12:00) |
| Contact | Ext: 3679  Farah.sarwar@umt.edu.pk |

**Chairman/Director signature………………………………….**

**Dean’s signature…………………………… Date………………………………………….**

**Learning Objective:**

This introductory course will deal with the basic concepts involved in power systems, structure of modern power system, study of the conventional and nonconventional sources of electrical energy, calculation of transmission line parameters: inductance of single conductor, inductance of single and three phase lines, capacitance of single and three phase lines, mechanical design of transmission line, transmission line models, Underground cables, Effect of Lightning Phenomenon on Transmission Lines, and Limiting Factors at EHV and UHV.

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:

* Power generating stations
* Multiple factors involved in distribution systems
* Basic concepts of single phase and three phase system
* Power transmission system
* Electrical Design of Transmission Line
* Electrical Parameters of Transmission Lines
* Short, medium and Long Transmission Lines and their response to applied current and voltage
* Lighting effect on Overhead Transmission Lines
* Mechanical Design of Transmission Line and Components

**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.

**Marks Evaluation Marks in percentage**

Quizzes & Assignments 25

Midterm 25

Final exam 50

Total 100

**Recommended Text Books:**

* Principles of Power Systems by V.K. Mehta, Rohit Mehta [1]
* Power System Analysis by John J. Gringer, William D. Stevenson, Jr. [2]

**Reference Books:**

* Electrical Power Transmission System Engineering (Analysis and Design) by Turan Gonen[1]
* Electrical Power Distribution & Transmission by L.M. Faulken berry& W. Coffer [2]
* Power System Analysis by Hadi Saadat, 4th Edition [3]

**Calendar of Course contents to be covered during semester**

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| **Lecture** | **Topics** | **Textbook (TB) /**  **Reference Readings(RB)** |
| **02** | **Introduction**  Importance of Electrical Energy, Generation, Sources of Energy, Comparison of Energy Sources, Units of Energy, Relationship among Energy units, Efficiency, Advantages of liquid Fuel over Solid Fuel and vice versa | Ch # 1 of TB[1] |
| **04** | **Generating Stations**  Steam Power Stations, Hydroelectric Power Stations, Diesel Power Stations, Nuclear Power Stations, Gas Turbine Power Plants, Comparison of different Power Plants | Ch # 2 of TB[1] |
| **03** | **Variable Load on Power Stations**  Structure of Electric Power System, Load Curves, important Terms and Factors, Units Generated per Annum, Load Duration curves, Typical Loads, Typical Demand and Diversity Factors, Methods of meeting the Loads, Interconnected Grid System. | Ch # 3 of TB[1] |
| **01** | **Transmission System Planning**  Introduction, Aging Transmission System, Benefits of Transmission System, Power Pools, Transmission Planning, Traditional Techniques | Chap # 01 of RB[1] |
| **01** | **Basic Concepts**  Per-Unit Quantities, Changing the Base of Per-Unit Quantities | Ch # 1 of TB[2] |
| **03** | **Series Impedance of Transmission Lines**  Types of Conductors, Resistance, Tabulated Resistance Values, Inductance of Conductor Due to Internal Flux, Flux Linkages of Two Points External to an Isolated Conductor, Inductance of a Single-Phase Two Wire Line, Flux Linkages of One Conductor in a Group, Inductance of Composite Conductor Lines, The Use of Tables, Inductance of Three-Phase Lines with Equilateral Spacing, | Ch # 4 of TB[2] |
| **Mid Term Exam** | | |
| **02** | **Series Impedance of Transmission Lines**  Inductance of Three-Phase Lines with Unsymmetrical Spacing, Inductance Calculations for Bundled Conductors | Ch # 4 of TB[2] |
| **02** | **Capacitance of Transmission Lines**  Capacitance of a three-phase Line with Unsymmetrical Spacing, Capacitance Calculations for Bundled Conductors, Parallel Circuit Three Phase Lines | Ch # 5 of TB[2] |
| **02** | **Current and Voltage Relations of a Transmission Line**  Representation of Lines, The Short Transmission Line, The Medium Length Line, The Long Transmission Line: Solution to the Differential Equations, The Long Transmission Line: Interpretation of the Equations | Ch # 6 of TB[2] |
| **02** | **Current and Voltage Relations of a Transmission Line**  The Long Transmission Line: Hyperbolic Form of the Equations, The Equivalent Circuit of a Long Line, Power Flow through a Transmission Line, Reactive Compensation of Transmission Lines, Transmission Line Transients, Transient Analysis: Reflections, Direct Current Transmission | Ch # 6 of TB[2] |
| **02** | **Mechanical Design of Overhead Lines**  Main Components of Overhead Lines, Line Supports, Insulators, Types of Insulators, Potential Distribution over Suspension Insulator String, | Chap # 08 of TB[1] |
| **02** | **Mechanical Design of Overhead Lines**  String Efficiency, Methods of Improving String Efficiency, Important Points, Sag in Overhead Lines, Sag Calculations, Some Mechanical Principles | Chap # 08 of TB[1] |
| **End Term Exam (Comprehensive)** | | |