



Course Syllabus

EE114 Power Engineering-I

Course Details

Course Number: EE 114
Course Name: Power Engineering-I

Course Description

This is an introductory core course on power engineering. The course provides the building blocks for modern power systems, starting from the single phase household supply to three phase supply. The course introduces fundamental power system equipment like transformers, dc machines and induction machines. The course aims to provide practical insights into the working of these equipment along with modeling and analysis pertaining to them.

Learning Outcomes

The course should facilitate students to master the following

- Fundamentals of single/three phase circuit analysis (phasor analysis)
- Concepts of apparent, real and reactive powers as well as power factor
- Working principles and construction of single/three phase transformers, dc machines and induction machines
- Equivalent circuits for transformers, dc machines and induction motors
- Efficiency and regulation pertaining to these components

Course Contents

The course should facilitate students to master the following

- Single phase AC systems: introduction to real/reactive/apparent powers, power factor, introduction to phasors, phasor analysis and phasor diagram
- Three phase AC systems: analysis of balanced and unbalanced networks
- Review of magnetic circuits: inductance, mmf, reluctance, mutual inductance

- Transformers: single phase transformer (equivalent circuit, efficiency, OC/SC tests), auto transformer, three phase connections
- DC machines: equivalent circuit, separately excited machines
- Induction machines: rotating magnetic field, equivalent circuit, torque speed characteristics, efficiency, generator/motor action

Course Texts and Webpage

Text:	Electric Machinery Fundamentals, 5th Edition, Stephen Chapman McGraw Hill Inc. ISBN10: 0073529540 ISBN13: 9780073529547 Copyright: 2012
Text:	Fitzgerald & Kingsley's Electric Machinery, 7th Edition Stephen Umans, McGraw Hill Inc. ISBN10: 0073380466 ISBN13: 9780073380469 Copyright: 2014
Text:	Electric Circuits, 11th Edition
Text:	James W. Nilsson, Susan Riedel, (Emeritus) Iowa State University Pearson Copyright 2019
Text:	Electric Power Engineering Authors: Elgerd, Olle, van der Puije, Patrick Springer Copyright: 1998

Tentative Course Schedule

- AC Circuit Analysis [Suggested Duration: 3 weeks]
 - Single phase, Three phase (Balanced and Unbalanced)
 - Steady State Analysis, Phasor diagrams
 - Energy, apparent power, active power, reactive power and power factor
 - Maximum Power Transfer
 - Frequency Response
- Magnetic Circuit Analysis [Suggested Duration: 1 week]
 - Concept of reluctance
 - Permeance
 - MMF
 - Inductance
 - Mutual inductance and coupling
- Transformer [Suggested Duration: 3 weeks]
 - Construction of single and three phase (Shell and core)
 - Concept of magnetizing and leakage inductance

- Equivalent circuit (open and short circuit), efficiency and regulation
- Phase shifts- Three phase transformer
- Auto-transformer
- Electro-mechanical Energy Conversion [Suggested Duration: 1 week]
 - Force and Torque Calculations
 - Fundamental Laws
 - Concepts of Energy Balance, Coenergy
- DC Machine [Suggested Duration: 3 weeks]
 - Construction of Shunt and series, Magnetic circuits, electric circuits, commutators and armature mmf
 - Winding types
 - Speed Control
 - Transients in DC Machines
- Induction Machine [Suggested Duration: 3 weeks]
 - Construction- SCIM and WRIM
 - Rotating magnetic field
 - Equivalent circuit
 - Torque speed characteristics
 - Generator and motor action
 - Efficiency