Course Code EE- 861	Credit Hours (Th-Pr) 3.0-0	**Alternating Current Electrical Machines and Drives (Elective)**	Contact Hrs/Week (Th-Pr) 3.0-0	Total Contact Hrs (Th-Pr) 45-0

Course Description:

1. Electric motors constitute majority of the load on electrical grid. Consequently, the energy efficiency of the power system is directly affected by the machines' efficiency of operation. Quite often these machines are operated by supplying power directly from the mains with no control except a minimal on-off control. Typically, the constant speed operation of a machine suffers from the efficiency loss under varying load conditions because the machine's efficiency varies with its load at constant speed of operation. Such inefficient operation of the electric machines results in an increase in source power requirement for both real and reactive power from the grid. Moreover, this inefficiency in electromechanical conversion causes heat dissipation which reduces the life span of the machine system. Thus an energy conservation initiative requires a system to process the power supplied to or from the machine to achieve the desired control over its speed for optimum efficiency. The system may also yield the benefit of soft start that reduces the power spikes during turn-on and turn-off, thus delivering an impact on reducing the peak power demand on the grid. Such a system comprises of power electronics converters driven by feedback control systems – collectively known as Electric Drives. The course on Electric Drives builds on its pre-requisite course of Electrical Machines. However, in contrast with its pre-requisite, this course is more oriented towards the dynamic modeling for control system design of electric machines rather than their mathematical analysis. It introduces generic building modules which are used to create dynamic models of electric machines. The machine theory is developed based on the generalized unified approach emphasizing similarities between different machines. The modeling involves space vector theory to develop the mathematics for the spatial orientation of machine quantities. Power Electronics Converters and their Modulation is also investigated. Finally, some basic electric drives are studied. This course thoroughly employs simulations in Simulink/SimPowerSystem

Eligibility Criteria:

2. B.E (Electrical Engineering)

Recommended Books:

S. No.	Title	Author(s)	Assigned Code	Remarks
1.	Fundamentals of Electrical Drives by André Veltman, Duco W. J. Pulle and Rik W. De Doncker	André Veltman, Duco W. J. Pulle and Rik W. De Doncker	A	Text
2.	Advanced Electrical Drives by André Veltman, Duco W. J. Pulle and Rik W. De Doncker	André Veltman, Duco W. J. Pulle and Rik W. De Doncker	P	Text
3.	Fundamentals of Power Electronics	Robert W. Erickson	R	Reference
4.	Electric Machinery Fundamentals	Chapman	S	Reference

Course Objectives:

3. Primary objective is to develop a sound understanding in the students regarding the dynamic modeling for control system design of electric machines.

Learning outcome:

4. A student who has met the objectives of the course will be able to perform detailed analyses on the modelling and operation of AC machines and drives.

Topics Covered:

S.No	Topics	Text Book
a.	• Significance and Overview of Electric Drives • Generic Building Blocks for Modeling • Magnetic Principles & Magnetic Circuits	A
b.	• Symbolic & Generic Models of Magnetic Circuits	A & P

	• The Ideal Transformer (ITF) Concept • Steady-State Analysis	
c.	• Three and Two Inductance Models • Mutual and Self Inductance Based Models	A,P & R
d.	• 3-phase Circuits – Modeling Y-Connected Circuits • Modeling Delta-Connected Circuits • Application of Space Vectors for 3-phase Circuit Analysis	A
e.	• Real & Reactive Power in 1-phase and 3-phase Systems	A
f.	• Space Vectors based Transformer Model • Phasor Analysis • Ideal Rotating Transformer (IRTF) Concept	A,P & S
g.	•	A
h.	• Synchronous Machines – Configuration and Principles • Symbolic and Generic Models • Steady-State Characteristics	A
i.	• Induction Machines – Configuration and Principles • Symbolic and Generic Models • Steady-State Characteristics	A,P & S
j.	• DC Machines – Configuration and Principles Lecture 32: Symbolic and Generic Models • Steady-State Characteristics	A
k.	• Fundamentals of Power Electronics Converters • Steady-State Analysis • Converter Topologies	A
l.	• Modulation for Power Electronics Converters • 1-phase Converters	A,P & S
m.	• 3-phase Converters	A
n.	• Lecture 43: Basic Unipolar Electric Drive • Lecture 44: Basic Bipolar Electric Drive	A