PEE6J002 GENERALIZED THEORY OF ELECTRICAL MACHINES (3-1-0)

Module – 1: **[10 hours]**

University portion (80%):

Theory of electromechanical energy conversion: Magnetically Coupled Circuits, Electromechanical Energy Conversion, Elementary ac Machines. (Ch-1.1,1.2,1.3,1.4)

Distributed windings in ac machinery: Describing Distributed Windings, Winding Functions, Air-Gap Magneto motive Force, Rotating MMF, Flux Linkage and Inductance, Resistance, Voltage and Flux Linkage Equations for Distributed Winding Machines.(Ch-2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8)

Reference-frame theory: Equations of Transformation, Change of Variables, Stationary Circuit Variables Transformed to the Arbitrary Reference Frame, Commonly Used Reference Frames, Transformation of a Balanced Set, Balanced Steady-State Phasor Relationships, Balanced Steady-State Voltage Equations.
(Ch-3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8)

Institute portion (20%):

Variables Observed from Several Frames of Reference, Transformation between Reference Frames, Specialty Transformations, Space-Phasor Notation(Ch-3.9,3.10,3.11,3.12) Or Related topics as decided by the concerned faculty teaching the subject

Module – 2: **[10 hours]**

University portion: (80%)

Permanent-magnet AC machines: Voltage and Torque Equations in Machine Variables, Voltage and Torque Equations in Rotor, Reference-Frame Variables, Analysis of Steady-State Operation, Brushless dc Motor, Phase Shifting of Applied Voltages of a Permanent-Magnet ac Machine, Control of Stator Currents.
(Ch-4.1,4.2,4.3,4.4,4.5,4.6,4.7)

Synchronous Machines: Voltage Equations in Machine Variables, Torque Equation in Machine Variables, Stator Voltage Equations in Arbitrary Reference-Frame Variables, Voltage Equations in Rotor Reference-Frame Variables, Torque Equations in Substitute Variables, Rotor Angle and Angle Between Rotors(Ch-5.1,5.2,5.3,5.4,5.5,5.6,5.7)

Institute portion (20%):

Per Unit System, Analysis of Steady-State Operation, Stator Currents Positive Out of Machine, Synchronous Generator Operation, Computer Simulation.(Ch-5.8,5.9,5.10,5.11) Or Related topics as decided by the concerned faculty teaching the subject

Module – 3: **[10 hours]**

University portion: (80%)

Symmetrical Induction Machines: Voltage Equations in Machine Variables, Torque Equation in Machine Variables, Equations of Transformation for Rotor Circuits, Voltage Equations in Arbitrary Reference-Frame Variables, Torque Equation in Arbitrary Reference-Frame Variables, Commonly Used Reference Frames, Per Unit System, Analysis of Steady-State Operation, Free Acceleration Characteristics, Free Acceleration Characteristics Viewed from Various Reference Frames.(Ch-6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8,6.9,6.10,6.11)

Institute portion (20%):

Dynamic Performance During Sudden Changes in Load Torque , Dynamic Performance During a Three-Phase Fault at the Machine Terminals, Computer Simulation in the Arbitrary Reference Frame(Ch-6.12,6.13,6.14) Or Related topics as decided by the concerned faculty teaching the subject

Module – 4: **[10 hours]**

University portion: (80%)

Machine Equations in operational impedances and time constants: Park's Equations in Operational Form, Operational Impedances and G(p) for a Synchronous Machine with Four Rotor Windings, Standard Synchronous Machine Reactances, Standard Synchronous Machine Time Constants, Derived Synchronous Machine Time Constants, Parameters from Short-Circuit Characteristics, Parameters from Frequency-Response Characteristics(Ch-7.1,7.2,7.3,7.4,7.5,7.6,7.7,7.8)

Alternative forms of machine equations: Machine Equations to Be Linearized, Linearization of Machine Equations, Small-Displacement Stability: Eigen values, Eigen values of Typical Induction Machines, Eigen values of Typical Synchronous Machines, Neglecting Electric Transients of Stator Voltage Equations, Induction Machine Performance Predicted with Stator Electric Transients Neglected(Ch-8.1,8.2,8.3,8.4,8.5,8.6,8.7,8.8)

Institute portion (20%):

Synchronous Machine Performance Predicted with Stator Electric Transients Neglected, Detailed Voltage Behind Reactance Model, Reduced Order Voltage Behind Reactance Model (Ch-8.9,8.10,8.11) Or Related topics as decided by the concerned faculty teaching the subject

Text Book:

1. Analysis of Electric Machinery and Drive Systems, 3rd Edition, by Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven Pekarek (Chapter 1- Chapter 8)

Reference:

1. Generalized Machine Theory by P.S Bimbhra