ME 693 Electromechanics (3-0-0-6)

Prerequisites: Mechanical Vibrations, Basics of Electrical Machines, Solid Mechanics

Syllabus:

Introduction to electromagnetics: Maxwell's Equations, Magnetic Circuits and Induction, Principles of electromechanical energy conversion; Introduction to Rotating Machines: Types of electrical machines, generalized theory of electrical machines, Reference frame theory, space vector formulation; Unbalanced Magnetic Pull: definition, cause, effect and remedies, different winding scheme to reduce unbalanced magnetic pull; Magnetic Bearings: introduction, principles of magnetic suspension, mathematical modeling, hardware components which includes power amplifiers, sensors, actuators, controllers; Self-bearing machine: Basic principles, different methods of producing controllable force, introduction to self-bearing machine and control techniques; Finite element analysis of electromechanical devices: Solution of Laplace's and Poisson's equation, coupled circuit equation and field equation; Coupled rotordynamics combining electrical dynamics and mechanical dynamics: System fault analysis using electromechanical devices; Magnetostriction.

Texts/References:

- 1. Stephen J Chapman, Electric Machinery Fundamentals, McGraw Hills, Fifth Edition, 2011.
- 2. Gerhard Schweitzer, Eric Maslen, Magnetic Bearings: Theory, Design and Application to Rotating Machinery, Springer, 2009.
- 3. João Pedro A. Bastos, Nelson Sadowski, Electromagnetic Modelling by Finite Element Methods, Marcel Dekker, Inc., 2003.
- Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovcova, Design of Rotating Electrical Machines, Wiley, 2nd Edition, October 2013.
- 5. Daniel Fleisch, A Student's Guide to Maxwell's Equations, Cambridge, 2008.
- 6. A. Chiba, T. Fukao, M. Oshima, M. Takemoto, D. Dorrell, Magnetic Bearings and Bearingless Drives, Elsevier, 2005.
- 7. K. Hameyer and R. Belmans, Numerical modelling and Design of Electrical Machines and Devices, WIT press, 1999.
- 8. Peter P. Sylvaster and Ronald L. Ferrari, Finite Elements for Electrical Engineers, Cambridge University Press, 1996.
- 9. Michael I. Friswell, John E. T. Penny, Seamus D Garvey, Dynamics of Rotating Machines, Cambridge, First Edition, 2010.