University of Management & Technology
School of Science & Technology
Department of Electrical Engineering

EE 340 Electrical Machines

Lecture Schedule	See EE Timetable on website	**Semester**	Fall 2013
Pre-requisite	None	**Credit Hours**	3+1
Instructor(s)	Asif Hussain[1] Nauman Ahmad[2] Muhammad Haris[3] Tabraiz Ahmad Alvi[4]	**Contact**	asif.hussain@umt.edu.pk [1] nauman.ahmad@umt.edu.pk[2] muhammad.haris@umt.edu.pk[3] tabraz.alvi@umt.edu.pk[4]
Office		**Office Hours**	See office window
Teaching Assistant	None	**Contact**	N/A
Office	N/A	**Office Hours**	N/A

Course Description	This is an undergraduate level course.. The course will cover; Magnetic field and the reluctance of magnetic materials and air. Voltage-current characteristics and voltage regulation of generator. Torque speed characteristics and speed regulation of DC motors. Various techniques for starting, speed control, reversing and braking. Remedial measures of main problems occurring in DC machines. Generalized concepts of electromechanical energy conversion. To introduce the fundamentals of ac machine. Detailed operating principles of ac machines including induction motor, synchronous motors, alternators and Transformers have been included to develop thorough understanding of construction, characteristics, operation and proper application of ac machines being used in industries.
Expected Outcomes	In accordance with HEC curriculum outcomes a, b, d, e, f, g, h & i, at the end of the course students will become familiar with: ▪ Understanding of electromechanical energy conversion ▪ Basic concepts of rotating machines ▪ Concepts of transformer principle ▪ DC machine principle and operations ▪ Concepts involved in AC machines
Books	**Textbook:** ▪ Electrical Machines, Drives and Power Systems by Theodore Wildi, 6th Edition **Reference Books:** ▪ Electric Machinery Fundamentals by Stephen J. Chapman, Latest Edition[1] ▪ Electric Machinery by Fitzgerald, Kingsley and Umans, Latest Edition[2]

Grading Policy	Details and timings for the assessment of this module are as follows: **Theory Part:** **Exam (Weightage)** — **Duration** — **Type** MidTerm Exam (25%) — 60 minutes — Subjective Final Exam (50%) — 120-150 minutes — Subjective Quiz (at least 5 per semester) (15%) — 10-15 min each — Objective + Subjective Assignment (at least 5 per semester) (10%) — Take home — Subjective

Course Schedule and Lecture Plan

Lecture	Topics	Textbook (TB) / Reference (Ref) Readings(RB)
1 – 3	**Fundamentals of Electricity, Magnetism and Circuits:**	Ch#01 of RB[1]
4 – 9	**Transformer:** Principle of operation of a transformer, Operation of transformer at no-load and under load condition, Impedance ratio, Shifting impedance from secondary to primary and vice versa, Principle of operation and equivalent circuit of practical transformer, Polarity tests, Losses and transformer rating, No load saturation curve, Construction of power transformer, Cooling methods, Simplifying the equivalent circuit of transformer, Voltage regulation, Phasor diagram of transformer, Instrument transformer, Basics of three phase transformer	Ch#02 of RB[1]
10 – 12	**Direct Current Generators:** Operating principle of DC generator, Difference between AC and DC generator, Neutral Zones, Generator under no-load and under-load condition, Armature reaction, Operating principle of Separately excited, shunt and compound generators, Equivalent circuit of generator, Load characteristics, Mechanical losses, Electrical losses, Losses as a function of load, Efficiency curve. Temperature rise	Ch#04[4.0-4.22] of TB
13 – 14	**Direct Current Motors:** Counter-electromotive force, Acceleration of the motor, Mechanical power and torque, Speed of rotation, Armature speed control, Field speed control, Operating principle and application of Shunt, Series and Compound motors, Stopping and dynamic braking of motor, Armature reaction and Commutation	Ch#05 of TB

Mid Term Exam (8th Week)		
17 – 20	**Three-Phase Induction Machines:** Principal components, Principle of operation, The rotating field, Direction of rotation, Starting characteristics of a squirrel cage motor, Concept of rotor-slip, Motor under load, Active power flow, Torque versus speed curve, Effect of rotor resistance	Ch#13[13.0-13.16] of TB
21 – 22	**Equivalent Circuit of the Induction Motor:** The wound rotor induction motor, Power relationship, Phasor diagram of induction motor, Equivalent circuit and power calculations	Ch#15 of TB
23 – 26	**Synchronous Generators:** Operating principle of synchronous generators, Main features of rotor and stator, Field and brushless excitation, No-load saturation curve, Equivalent circuit of synchronous generator, Concept of infinite bus, Active power delivered by the synchronous generator, Transient reactance, Power transfer between two sources	Ch#16 of TB
27 – 30	**Synchronous Motors:** Construction, Starting of synchronous motor, Pull-in torque, Synchronous motor under load, Power and torque, , Power factor rating, V-curves	Ch#17[17.0-17.12] of TB
31 – 32	**Single Phase Machines**	Ch#18 & 19
Final Term Exam (Comprehensive)		