EEE218 ELECTRIC CIRCUITS

Credits: 10

Course Description including Aims

This module introduces the concepts and analytical tools for interpreting and predicting the behaviour of combinations of passive circuit elements, resistance, capacitance and inductance driven by ideal voltage and/or current sources which may be ac or dc sources. The last few lectures will introduce the basics of electromechanical energy conversion. The ideas involved are important not only from the point of view of modelling the behaviour of real electronic circuits but also because many complicated processes in medicine, science and engineering are modelled by electric circuit analogies.

The aims are

1 outline the behaviour of the basic R, L and C elements in circuits with ac and dc voltages applied

2 define and illustrate the various circuit laws and theorems used to analyse circuits

3 introduce and demonstrate the use of the mathematical concepts (complex numbers) that aid the solving of ac circuit problems.

4 show how forces on a current carrying conductor in a magnetic field can be used to convert electrical into mechanical energy.

5 introduce students to basic electronic engineering measurement equipment and its practical application.

Outline Syllabus

Circuits and Circuit Elements : Concept of a circuit, *V-I* relationships for *R*, *L* and *C*. Series and parallel combinations of elements. Voltage and current sources. Stored energy, power dissipation. **Circuit Laws and Theorems**: Kirchoff's Laws, Superposition theorem, Thevenin, Norton theorems, loop analysis. **Time Varying Signals**: The sinusoid, amplitude, phase, frequency. Response of *L*, *C R* to ac. Phase relationships. **ac Circuits** : Phasor representation. Complex number notation. Analysis of ac circuits. Impedance, admittance, resonance. Power factor and power factor correction. **Transient Response** : First order *R L* and *R C* response. Stored energy. Time constants. **Electric Machines**: Force on a current carrying wire in a magnetic field, equivalent circuit and torque speed relationship of dc machines, torque speed relationship for induction, synchronous and stepper motors.

Time Allocation

24 lectures, 12 problem solving classes and two afternoons of laboratory work in the first semester.

Recommended Previous Courses

normal entry requirements

Assessment

2 hour examination, answer three questions out of four; two labs. The exam forms 80% of the module mark and the labs form the remaining 20%.

Recommended Books

Hughes, E.*	*Electrical Technology (8^{th} ed.)*	Longman-Pearson
Smith R.J. & Dorf R.C.	*Circuits, Devices and Systems (5^{th} ed.)*	Wiley
Roadstrum W.H & Wolaver D.H.	*Electrotechnology (2^{nd} ed.)*	Wiley
Paul C.R., Naser S.A. & Unnewehr L.E.	*Introduction to Electrical Engineering (2^{nd} ed.)*	McGraw-Hill
Fraser C.R & Milne J.	*Integrated Electronic and Electrical Engineering for Mechanical Engineers*	McGraw-Hill
Say, M.G.	*Electrotechnology*	Newnes-Butterworth
Rizzonni, G	*Principles & Applications of Electrical Engineering (2^{nd} ed.)*	McGraw Hill

Objectives

At the end of the course, successful students will be able to :-

1 deduce the response of R, L and C to a given standard current or voltage stimulus.

2 evaluate by using several different methods of analysis the currents and voltages in a network driven by dc and/or ac sources.

3 recognise situations where the use of particular circuit theorems will simplify the route to a solution.

4 construct phasor diagrams for combinations of series and parallel circuits.

5 manipulate complex currents and impedances.

6 calculate the transient response of simple first order circuits.

7 draw the torque-speed characteristics of dc and induction machines and make simple estimates of torque and speed for given drive conditions.

8 use oscilloscopes, multimeters and oscillators to make measurements on circuits.