

Synopsis and Reading List for CP2 : Circuit Theory

The purpose of the course is to provide an elementary introduction to linear circuit theory. The lectures will fully cover the syllabus and will assume very little previous knowledge of the subject. Loosely, I plan to distribute the material as follows:-

Lecture 1 : Basics. Voltage, current and resistance. Ohms Law. Power. AC and DC.

Lecture 2 : Kirchoff's Laws. Mesh currents. Resistors in series and parallel. The potential divider. Earths. Power transfer.

Lecture 3 : Principal of superposition. Voltage sources and current sources. Input and output resistance. Thevenin and Norton theorems.

Lecture 4 : Capacitance. Energy stored in a capacitor. Capacitors in series and parallel. RC circuit and time constants. RC integration and differentiation. Filter circuits.

Lecture 5 : Inductance. Mutual inductance and self inductance. Energy stored in an inductor. LR circuit.

Lecture 6 : Response of capacitors and inductors to steady AC. Power factors and RMS. Phase shifts.

Lecture 7 : Transients in series and parallel LCR circuits. Ringing. Overdamped, underdamped and critically damped solutions.

Lecture 8 : Examples.

Lecture 9 : Review of complex numbers. Application of complex numbers to AC theory.

Lecture 10 : Complex impedance for R, C and L. AC response of LCR circuit. Resonance.

Lecture 11 : Bandwidth. Q-value. LCR parallel circuit.

Lecture 12 : Examples of LCR circuits. Bridge circuits, the Wien bridge.

Lecture 13 : Summary of the course and more examples.

Recommended Books

You will find all the material you need for the Prelims Circuit Theory syllabus in self-contained chapters of books on general electronics or electromagnetism.

The first two listed below contain all you need to know. Of these, Bugg is an excellent book which is marginally the better buy for the course.

1) **'Electronics Circuits, Amplifiers and Gates.' : D.V. Bugg**

Adam Hilger (Paperback ~ £17.00)

Chapters 1 to 6 and chapter 14 exclusively cover the material required for the Prelims Electronics and Circuit Theory Course. An excellent book.

2) **'Basic Electronics for Scientists.' : J. Brophy**

McGraw Hill (Paperback ~ £18.00).

Chapters 1, 2 and 5 exclusively cover the material required for the course.

You may also find useful :-

'Electromagnetism - Principles and Applications.' : Lorrain and Corson

Freeman (Paperback ~ £24.00).

This book is highly recommended for the Prelims Electromagnetism Course. Four chapters (Chapters 5, 16, 17 and 18 in Edition 1 and Chapters 5, 15, 16 and 18 in Edition 2) are also relevant to the Prelims Electronics and Circuit Theory Course.