

Lecture-1

Date: 31.07.2017

- Introduction
- Why this course?
- Circuit Elements



Circuit Theory and Device (ECE215)

Instructor: Dr. Mohammad S. Hashmi

TAs: Dinesh Rano, Deepayan Banerjee, Antara Saxena, Sachin Yadav

Class Timings: Monday / Tuesday / Thursday (9:30 – 10:30)

Lab and Tute: Check TT for respective groups

Office Hours: Tuesday (16:00 – 17:00) & Wednesday (16:00 – 17:00)

TA Office Hours: TBA

Pre-requisites: Basic Electronics, Linear Algebra

Co-requisites: Signals and Systems, Differential Equations

Course URL:

Available at: <http://www.iitd.edu.in/~mshashmi/Teaching.html>

Course Focus:

Circuit Analysis and Synthesis

Course Objectives:

On the completion of this course students should

- be able to analyze and synthesize electrical circuits
- be able to find circuit response using Laplace and Fourier transform
- To be able to use standard SPICE tools for simple circuit analysis and synthesis
- Understand the fundamental working principles and physics of transistor devices

Lab Component:

- Introduction to SPICE Tools and MATLAB – by TAs
- Advanced Topics is mostly self learning – **may be assisted by the TAs**

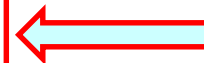
Evaluation:



- Assignments and Labs – 30% weightage
- [Pen & Paper + SPICE + MATLAB] based (all compulsory!)



- Class Tests (Surprise) – 20% weightage
- All Compulsory!



- Mid-Sem (25%)
- End-Sem (25%)

Attendance and Classroom Behavior:

- Attendance not mandatory (unless imposed by DOAA)
- Students will be responsible for any notes, announcements etc. made during the class
- Prompt arrival to the class is requested
- No eating, drinking, smoking allowed in the class

Text Book:

- Fundamental of Electric Circuits, *5th Edition*, by Alexander and Sadiku

Reference Book:

- Network Analysis and Synthesis, *3rd Edition*, **by** Franklin F. Kuo

Course Website:

<http://www.iitd.edu.in/~mshashmi/Teaching.html>

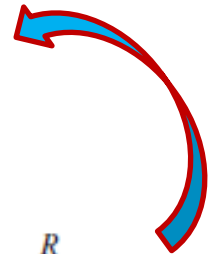
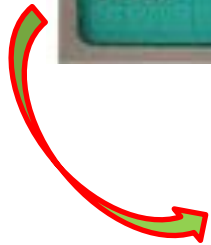
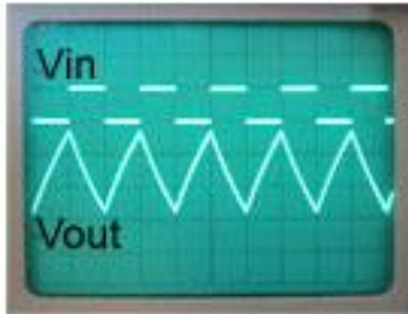
Info related to ECE215 can be found here

Important: We will have an assessment test

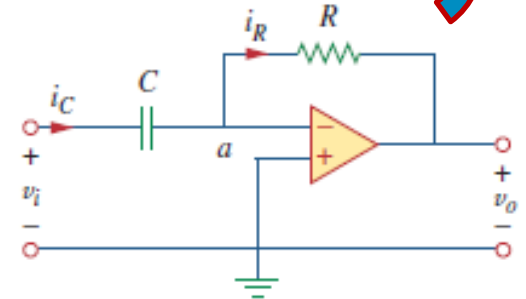
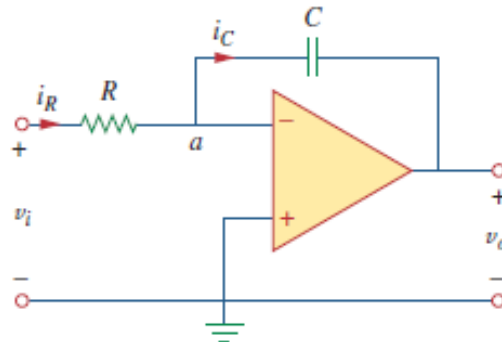
Why This Course?

We talk about integration, differentiation, etc.?

Did you think about their realization ?

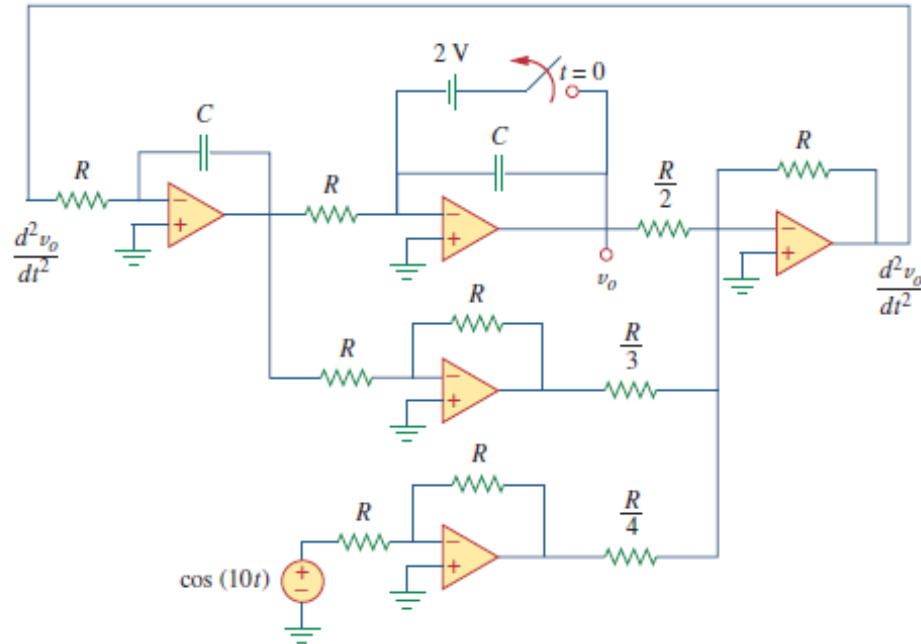


Simply: an inverting amplifier with a capacitor in the feedback loop



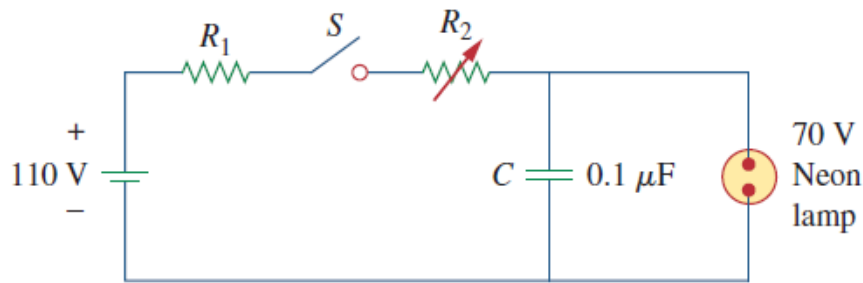
Why This Course?

How do you implement? $\frac{d^2 v_o}{dt^2} + 3 \frac{dv_o}{dt} + 2v_o = 4 \cos 10t$

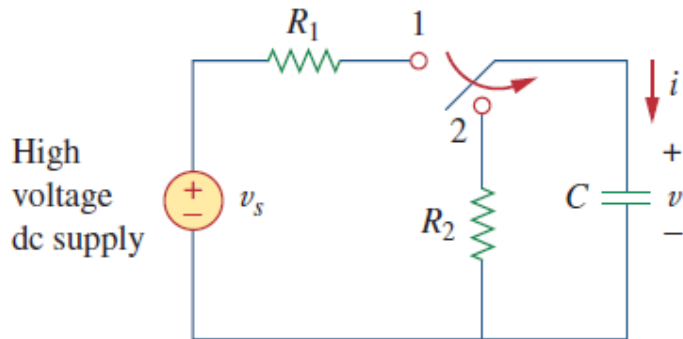


Why This Course?

How do you design delay circuits?



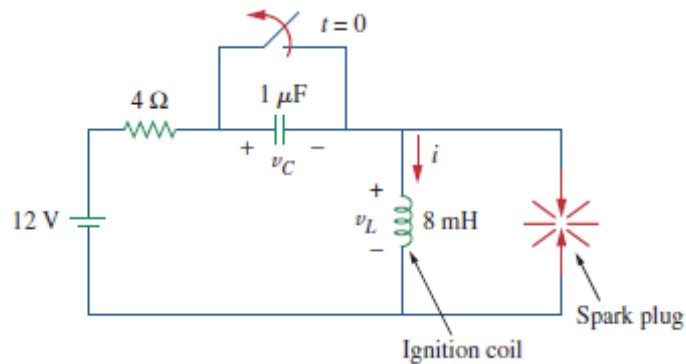
How about photo flash units?



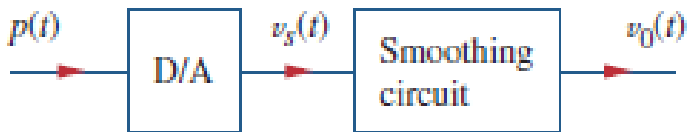
You learn these things through analysis of first-order circuits

Why This Course?

How about automobile ignition system?



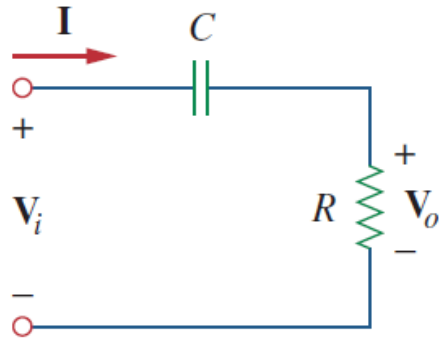
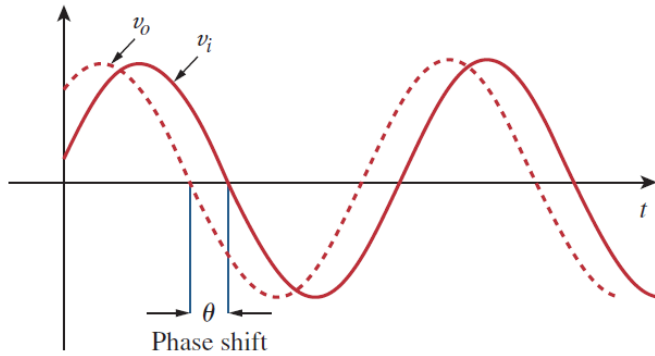
Smoothing circuit in Digital Communication System?



You learn these things through analysis of second-order circuits

Why This Course?

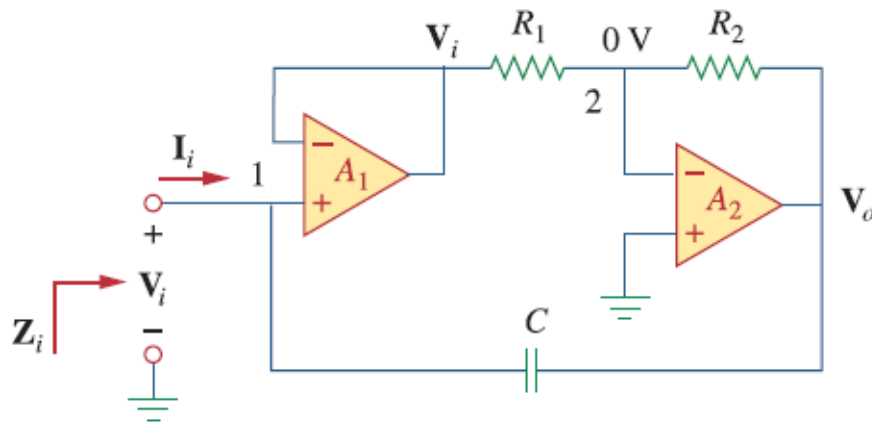
Phase shifter?



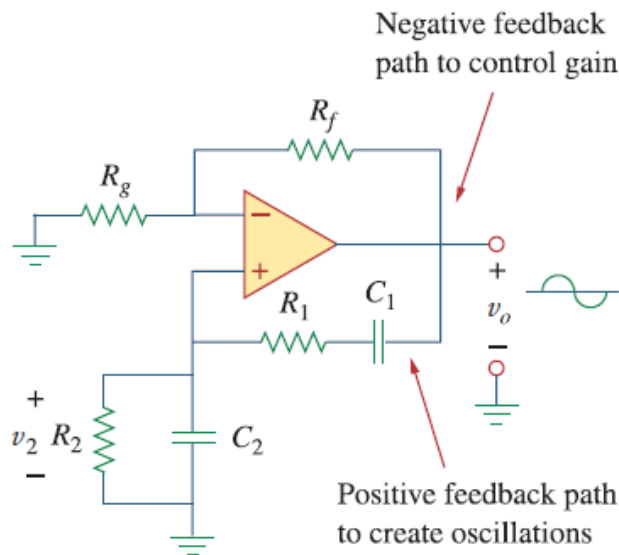
You learn these things through analysis of AC circuits

Why This Course?

How about capacitance multiplier for synthesis of high value capacitance?



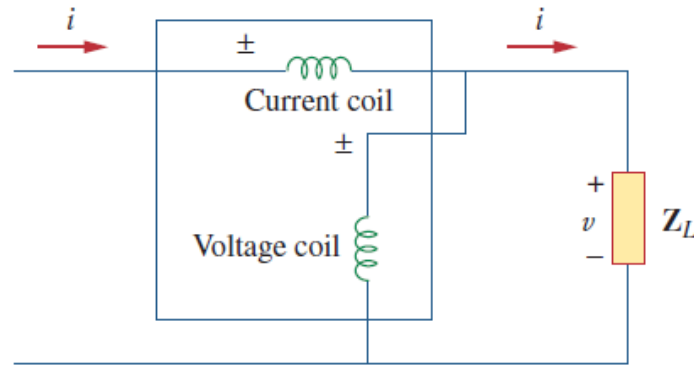
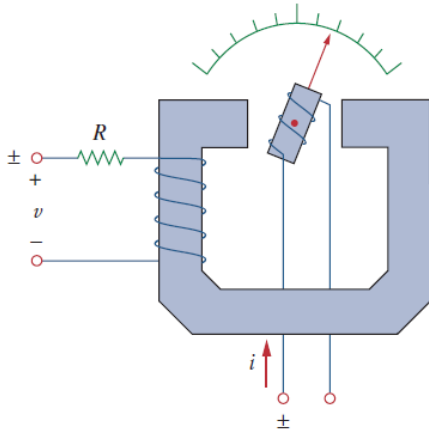
DC is produced by batteries but how about AC?



You learn these things through sinusoidal steady state analysis of circuits

Why This Course?

How to measure power? Using watt meter??

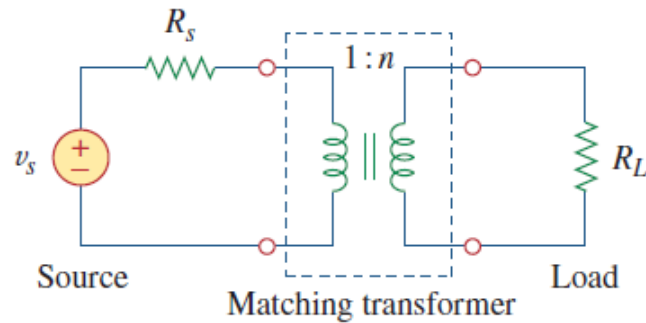
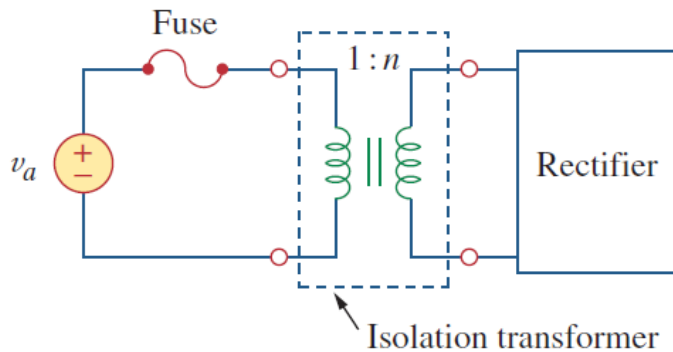


How do we calculate electricity consumption cost?

You learn these things through AC power analysis

Why This Course?

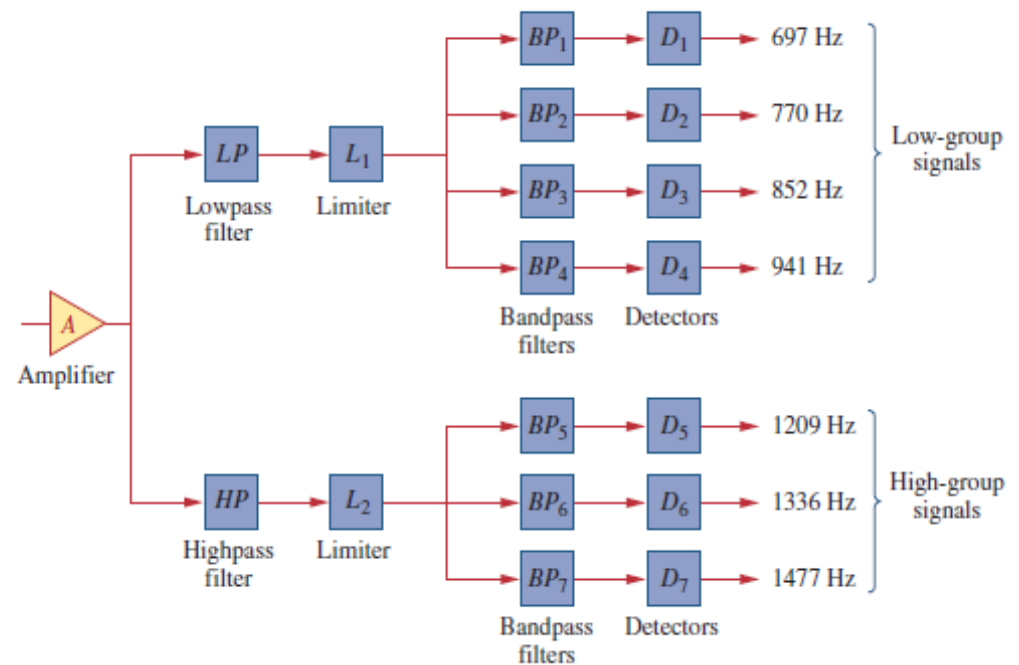
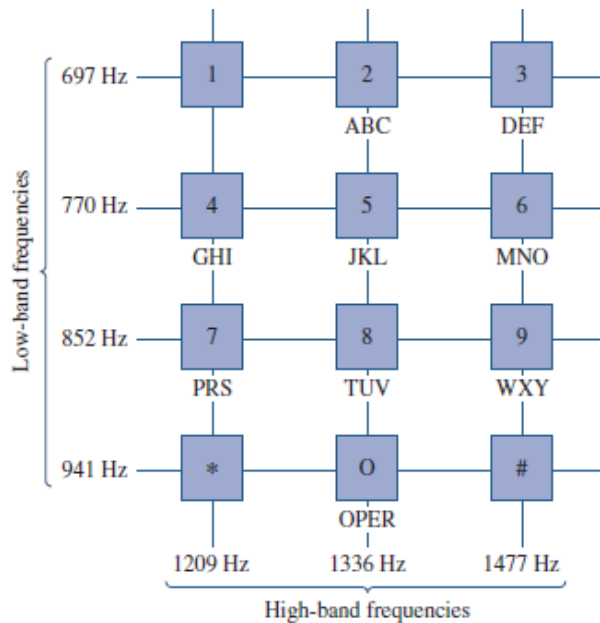
Transformer?? Applications in diverse domains!!!



You learn these things through analysis of magnetically coupled circuits

Why This Course?

Touch tone telephone??



Requires understanding of frequency behavior of circuits

Similarly other aspects of this course has also important ramifications on advanced learning. So pay attention!

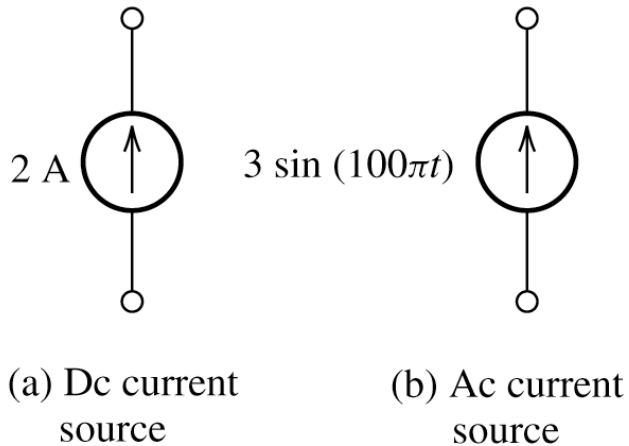
Q: I see! This course has lot many interesting usefulness but what about the useless mathematical analysis?



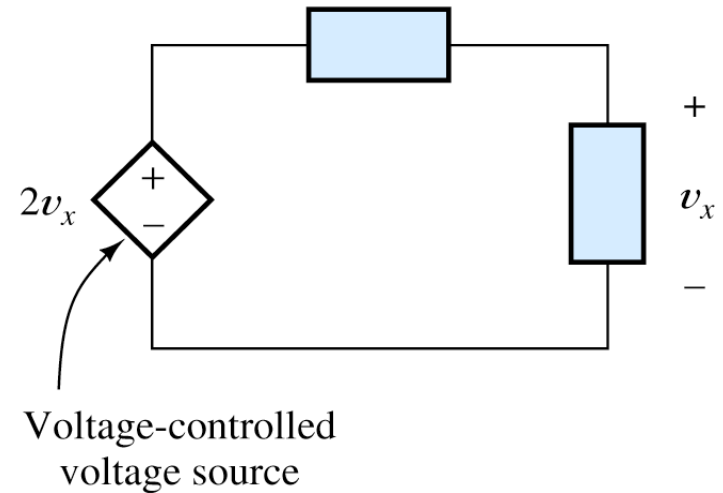
A: well, there is no free lunch!

Circuit Elements

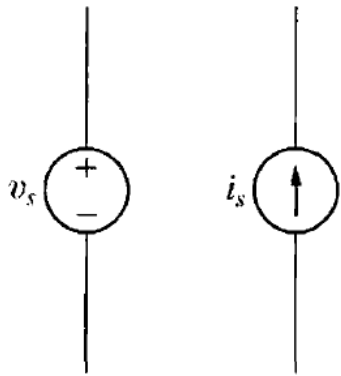
There are six ideal basic circuit elements: voltage sources, current sources, resistors, inductors, capacitors, memristors



Independent Current Sources



Ideal current and voltage Sources



- An **ideal voltage source** is a circuit element that maintains a prescribed voltage across its terminals regardless of the current flowing in those terminals.
- An **ideal current source** is a circuit element that maintains a prescribed current through its terminals regardless of the voltage across those terminals.

Remarks

- an ideal voltage source provides a steady voltage \rightarrow even if the current in the element changes \rightarrow impossible to specify the current in an ideal voltage source.
- Likewise, it is impossible to determine the voltage across ideal current source.
- We have sacrificed our ability to relate voltage and current in a practical source for the simplicity of using ideal sources in circuit analysis.



Dependent Sources