EE 211 Section 1
Course Objectives – Chapters 4 and 5

Chapter 4

1. Be able to define an active device.
2. Be able to define a dependent source.
3. Be able to define the four types of linear dependent sources:
   (a) Current-Controlled Voltage Source
   (b) Voltage-Controlled Voltage Source
   (c) Current-Controlled Current Source
   (d) Voltage-Controlled Current Source
4. Be able to define the following terms:
   (a) Transresistance r
   (b) Voltage gain μ
   (c) Current gain β
   (d) Transconductance g
5. Be able to define feedback, and to identify circuits where feedback is present.
6. Be able to analyze circuits with dependent sources:
   (a) Circuit Reduction
   (b) Source Transformations
   (c) Superposition
   (d) Node-voltage Analysis
   (e) Mesh-current Analysis
7. Be able to define the input resistance and output resistance of a circuit.
8. Be able to determine the input resistance and output resistance of a circuit.
9. Be able to draw the dependent-source model of an op amp.

10. Be able to identify when negative feedback is present in an op amp circuit.
11. Be able to use the ideal model of the op amp ($v_P = v_N$ and $i_P = i_N = 0$ when negative feedback is present, and the op amp is not saturated) to solve circuits with op amps.
12. Be able to determine whether an op amp is in the linear mode or the saturation mode.
13. Be able to use node-voltage analysis to analyze op amp circuits.
14. Be able to recognize and determine the gain of the five op-amp building-block circuits:
    (a) Inverting Amplifier
    (b) Non-inverting Amplifier
    (c) Follower
    (d) Summing Op-Amp Circuit
    (e) Difference Amplifier
15. Be able to determine the gain of an op amp circuit designed with the standard building blocks.
16. Be able to design an op-amp circuit with a desired input-output relationship with the standard op-amp building blocks.

Chapter 5

1. Be able to sketch the following basic waveforms:
    (a) Unit Step Function $u(t)$
    (b) Impulse Function $\delta(t)$
    (c) Ramp Function $r(t)$
    (d) Exponential Waveform $[V_A e^{-t/T_C}]u(t)$
    (e) Sinusoidal Waveform $V_A \cos[2\pi t/T_0 + \phi]$
2. Be able to integrate and differentiate the basic waveforms.

3. Be able to calculate and sketch linear combinations of the basic waveforms.

4. For exponential waveforms be able to:

   (a) Define the amplitude V_A and the time constant T_C

   (b) Given any two of the following quantities, be able to determine the others:

      i. Amplitude V_A

      ii. Time Constant T_C

      iii. Value at one time $v(t_1)$

      iv. Value at a second time $v(t_2)$

5. For sinusoidal waveforms be able to:

   (a) Define Amplitude, Period, Frequency, Phase

   (b) Be able to convert between frequency in Hertz and frequency in radians/sec.

   (c) From the equation of a sinusoid be able to determine Amplitude, Period, Frequency, Phase

   (d) Be able to convert between the cosine phase-description of sinusoids ($V_A \cos[2\pi t/T_0 + \phi]$) and the Fourier form ($a \cos[2\pi t/T_0) + b \sin(2\pi t/T_0)$).

6. Be able to combine the three basic waveforms (step, sinusoidal, exponential) into composite waveforms. In particular be able to identify and use:

   (a) The exponential rise waveform $v(t) = V_A[1 - e^{-t/TC}]u(t)$

   (b) The decaying sinusoid $v(t) = V_A[e^{-t/T_C} \sin \omega_0 t]u(t)$

   (c) The double exponential $v(t) = V_A(e^{-t/T1} - e^{t/T_2})u(t)$