EECS 312 - Electronics Circuits I (Spring 2018)

Material in Exam I:

Chapter 4 –Diodes (4.1, 4.2, 4.3, 4.4, 4.5, 4.6)

Ideal diodes:

Difference between linear devices and nonlinear devices,

Ideal diode model (equivalent circuit),

Forward bias, reverse bias,

Ideal diode circuit analysis

Circuit analysis steps: assume an operation state, enforce the condition (forward: short, reverse: open), analyze circuit, check the assumption.

Real junction diode fundamentals:

Three operation regions: forward bias, reverse bias and break down.

Junction diode terminal characteristics and *I-V* equation: meaning of all the parameters in the equation

Circuit analysis using diode equation (to find exact solutions)

Equivalent circuit for a junction diode: (approximations)

Ideal diode model

Constant voltage drop model (CVD)

Piece-wise linear model (PWL)

Circuit analysis using diode models: steps of circuit analysis, circuit with multiple diodes.

Small-signal analysis:

A small AC signal is superimposed on a large-signal DC

Diode small-signal equivalent resistance (depends on DC operation point)

Steps of small-signal circuit analysis: (1) DC analysis, (2) find small-signal resistance, (3) replace diode with small-signal PWL model for the diode(s), (4) draw small-signal equivalent circuit, and (5) circuit analysis to find small-signal input-output relation

Zener diodes:

Zener diode equivalent circuit models: CVD and PWL. Pay attention to polarities.

Shunt regulator: is a circuit to stabilize the output voltage.

Shunt regulator design concerns and performance definitions such as *line regulation* and *load regulation*

Rectifier circuits:

Rectifier circuit configuration: step-down transformer, rectifier, low-pass filter, voltage regulator

Half-wave rectifier

Full-wave rectifier

Bridge rectifier

Basic circuit configurations, operation principles, and their comparison

Average voltage calculation and pick-inverse-voltage (PIV).

Note: the waveform does not have to be sine wave; it can be square wave, triangle wave, etc.

Peak rectifier and precision rectifier: understand basic concepts

Limiting circuits:

It is another important application of diodes. Used to protect circuits from been damaged.

Transfer function (input-output relation) of a circuit: How to find the transfer function of a diode circuit. For a diode one only needs to consider forward and reverse biasing conditions, but for a Zener diode one has to consider forward, reverse and breakdown conditions.

Steps to find input-output relation of a diode based circuit (including limiting circuit).
Solve circuit problems quickly.