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 being 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.