SWITCHED MODE AND RESONANT CONVERTERS FOR POWER SUPPLY DESIGN

Course Code: 19EE2206  
L    T    P    C  
3    0    0    3

Prerequisites: Power Electronics

Course Outcomes:
CO1: Explain the principles of operation of non-isolated and isolated hard-switched DC-DC converters (L2)
CO2: Illustrate various loss components in a switched mode converter and choice of switching frequency with a view towards design of such converters (L3)
CO3: Describe slope criteria for a stable circuit and describe the transfer functions and design error amplifiers in the feedback loop. (L2)
CO4: Analyze and Calculation of Inductors and Chokes for Buck and Boost Converters. (L4)
CO5: Analyze Resonant Converters and classify them. (L4)

Unit-I: FUNDAMENTALS OF SWITCHING REGULATORS  10 Lectures
Buck, Boost, Buck-Boost SMPS Topologies. Basic Operation- Waveforms - modes of operation - switching stresses - switching and conduction losses - optimum switching frequency - practical voltage, current and power limits - design relations - voltage mode control principles. (Abraham I Pressman)

Learning Outcomes:
1. Explain the principles of operation of non-isolated and isolated hard-switched DC-DC converters (L2)
2. Determine switching and conduction losses (L3)
3. Illustrate the design relations for switching regulators. (L3)

Unit-II: PUSH-PULL AND FORWARD CONVERTER TOPOLOGIES  10 Lectures

Learning Outcomes:
1. Illustrate various loss components in a switched mode converter and choice of switching frequency with a view towards design of converters (L3)
2. Describe Push-Pull and Forward Converter Topologies (L2)
3. Illustrate Continuous and Discontinuous modes operation waveforms. (L3)

Unit-III: FEEDBACK LOOP STABILIZATION  10 Lectures
Mechanism of Loop Oscillations – Gain Criteria for a stable circuit, Gain Slope Criteria for a stable circuit, Pulse Width Modulator gain, shaping the Error Amplifier Gain Vs frequency Characteristics. Error Amplifier Transfer Function, Poles and Zeros, Design Example-
Stabilizing a Forward converter feedback loop with a Type 2 Error amplifier, Trans-conductance Error Amplifiers, (Abraham I Pressman)

**Learning Outcomes:**
1. Describe the mechanism of Loop Oscillations. (L2)
2. Explain the Transfer Function of Error Amplifier in a feedback loop. (L2)
3. Illustrate Trans conductance Error Amplifiers. (L3)

**Unit-IV: INDUCTORS & CHOKES IN SWITCHED MODE POWER SUPPLIES**


**Learning Outcomes:**
1. Discuss the design of Inductors for SMPS (L2)
2. Select the value of Inductance with a design example. (L4)
3. Discuss the design of choke for buck and boost converter. (L2)

**Unit-V: RESONANT CONVERTERS**


**Learning Outcomes:**
1. Discuss about Resonant Converters. (L2)
2. Classify Resonant Converters. (L4)
3. Discuss about DC Resonant link Inverter. (L2)

**TEXT BOOK:**

**REFERENCE BOOKS:**