

1. What is ESR? [3%] How does it affect the electrical characteristics of a capacitor? [7%]
  
2. Compare the differences of conduction mechanisms between a MOSFET and a BJT. [10%]
  
3. (a) Draw a circuit topology without transformer which can convert AC 110V into DC 400V with the power rating of 4kW. [15%] (b) Explain the operational principle of the proposed circuit to show that it can achieve the requirement. [15%]
  
4. (a) Sketch the voltage and current waveforms of the main components in a Buck converter operated in CCM. [10%] (b) Derive the voltage transfer ratio, maximum voltage and current ratings of its switch and diode. [15%]
  
5. Describe the switching mechanisms of four soft-switching methods (ZVS, ZCS, near ZVS, near ZCS) and explain their influence on switching losses and parasitic components. [25%]