

## Questions on 1<sup>st</sup> half of course

Jan 2011

Q1 (d) Sketch the circuit of a series linear regulator which generates a 5V, 1A output from a 12V dc. supply. Making the usual assumptions calculate the efficiency of the linear regulator. (10 Marks)

August 2011

Q1 (c)

i) Sketch a simplified equivalent circuit model of a n-channel IGBT and briefly explain how it works. (6 Marks)

ii) Give one advantage and one disadvantage of an IGBT compared to a MOSFET. (4 Marks)

**Q1(d)**

A simple linear regulator is required to provide an 8 V / 5 A output from a 12V dc supply.

i) Sketch a circuit diagram of the linear regulator. (5 Marks)

ii) Making the usual assumptions calculate the losses in the 8 V regulator described above

(5 Marks)

Jan 2012

**Q1 (c)**

A fast recovery rectifier is stated to have a reverse recovery time of 1  $\mu$ s and the stored charge is 500 nC according to its datasheet. Answer the questions below in relation to this diode.

i) Sketch the typical current waveform of this diode as it goes from forward bias (conduction) to reverse bias (blocking).

(4 Marks)

ii) Calculate the peak reverse recovery current ( $I_{RR}$ ) for this diode.

( 3 Marks)

iii) Would you recommend this diode for use in a converter with a switching frequency of 200kHz? Explain your answer.

(3 Marks)

**Q1 (d)**

i) Sketch the circuit of a switch mode step down dc to dc regulator (Buck converter)

**(6 Marks)**

ii) Calculate the on time of the switch ( $t_{on}$ ) in a switch mode step down regulator that produces a 12V output from a 24V supply. The switching frequency  $f_{switch}$  is 20kHz.

**(4 Marks)**

**August 2012**

**Q1 (c)**

(c)

(i) Sketch a simplified equivalent circuit model of a n-channel IGBT and briefly explain how it works.

**(6 marks)**

(ii) Give one advantage and one disadvantage of an IGBT compared to a MOSFET.

**(4 marks)**

**Q2 (d)**

(b) A simple linear regulator is required to provide a 12V, 1 Amp output from an unregulated 20V dc supply.

i) Sketch a circuit diagram of the linear regulator

**(5 marks)**

ii) Making the usual assumptions calculate the power loss in the linear regulator.

**(5 marks)**

iii) Sketch the circuit of a switching regulator that could step 20V down to 12V in a more efficient manner than the linear power supply described above.

**(5 marks)**

Jan 2013

Q1 d)

(d) (i) Sketch the circuit of a series linear regulator.

**(6 marks)**

(ii) Would you recommend a series linear regulator to provide a 24 V, 10 A output from an unregulated 120V DC supply? Explain why/why not.

**(2 marks)**

(iii) Would you recommend a series linear regulator to provide a stable 10V, 1Amp output from a 12V DC supply? Explain why / why not?

**(2 marks)**

August 2013

Q1

(c) Draw the silicon structure of a thyristor (SCR) and show how it suggests a two transistor equivalent circuit. Use the two transistor equivalent circuit to briefly explain how a thyristor works.

**(10 Marks)**

(d) A fast recovery rectifier is stated to have a reverse recovery time of 500 ns and the stored charge is 450 nC according to its datasheet. Answer the questions below in relation to this diode.

i) Sketch the typical current waveform of a diode as it goes from forward bias (conduction) to reverse bias (blocking).

**(3 Marks)**

ii) Calculate the peak reverse recovery current ( $I_{RR}$ ) for this diode.

**( 3 Marks)**

iii) Briefly discuss two potential difficulties caused by diode reverse recovery.

**(4 Marks)**

Q2 (b)

(b) i) Sketch the circuit of a switch mode step down dc to dc regulator (Buck converter)

**(6 Marks)**

ii) Calculate the on time of the switch ( $t_{on}$ ) in a switch mode step down regulator that produces an 8V output from a 24V supply. The switching frequency  $f_{switch}$  is 33.3 kHz.

**(4 Marks)**

iii) What are the main advantages and main disadvantages of switch mode buck converters in comparison to linear regulators?

**(5 Marks)**