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Total No. of Pages : 02

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M.Tech EPD&T (Sem.–1)

DESIGNING WITH POWER DEVICES

Subject Code : MTEP-102-18

Paper ID : [75228]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. (a) Differentiate between the constructional features of a GTO and a Thyristor. Explain the turn off mechanism of a GTO.
   (b) Draw the output i-v characteristics of a MOSFET and explain it in terms of the operating principle of the device.
2. (a) What do you understand by "dynamic latch up" of an IGBT? How can it be prevented?
   (b) What steps are taken in the cell structure design of an IGBT to minimize the "tail current'' during turn off operation?
3. (a) Discuss the various steps in design of a power for pulse width modulated convertor.
   (b) Discuss core material, insulating material and wires selection is done in case of pulse transformers?
4. (a) For a 20-kHz, 100-W half-bridge power supply having an output of 5 V dc at 20 A, calculate the output inductor *L* using a ferrite core . (b) An IGBT can be constructed from a BJT and a MOSFET. Draw this using symbols. State one advantage of using an IGBT instead of a BJT and one advantage of using an IGBT instead of a MOSFET.
5. Figure 1 shows a buck converter. The input voltage to the converter is U1 = 20 V. The average output voltage U2 is 5 V while delivering a load of 2 A. The power-switches are assumed to be ideal during conduction and blocking states (0 V during conduction and 0 A in blocking). The converter is operated at a switching frequency of 100 kHz. The equivalent series resistance (ESR) of the capacitor is given as R_c = 5 mΩ and the capacitance C = 100 μF.

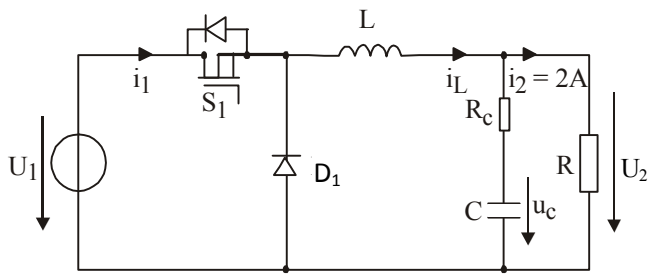

Fig.1

Find the following :

(a) The DC value of the input current

(b) Evaluate the inductance L to limit the ripple current of i_1 to ± 20%.

(c) For what value of the inductance L, does the converter operate at the boundary between continuous and discontinuous conduction modes?

(d) Sketch the current through the capacitor C

(e) Sketch Uc

6.

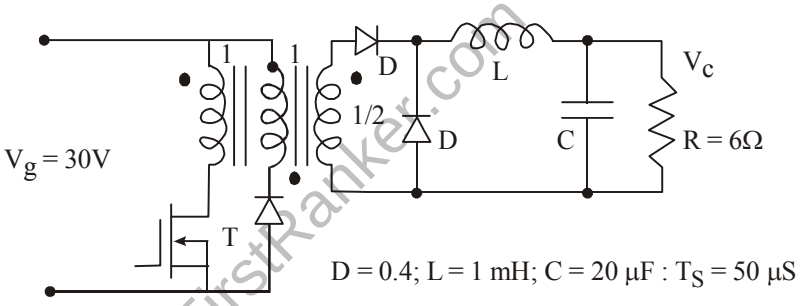

Fig. 2

Figure shows a forward converter operating at a duty ratio of 0.4. Assume the components to be ideal. Sketch the following waveforms under steady state.

(A) Inductor current. (B) Secondary current

(C) Primary current. (D) Output voltage.

7. Discuss how PWM control is used in power supplies. Describe any discrete component based PWM control unit.

8. Write short note on the following

(a) Line preferred UPS system

(b) Reliability of UPS system