

First Semester M. E. (Electrical and Elect.) Examination

ADVANCED POWER ELECTRONICS

Paper - 1 EEEME 2

P. Pages : 4

Time : Three Hours]

[Max. Marks : 80

- Note :** (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and Separate answer-book must be used for Section A and B in Pharmacy and Cosmetic Tech.
- (2) All question carry equal marks.
- (3) Answer **Three** questions from Section A and **Three** questions from Section B.
- (4) Due credit will be given to neatness and adequate dimensions.
- (5) Assume suitable data wherever necessary.
- (6) Illustrate your answer wherever necessary with the help of neat sketches.
- (7) Use pen of Blue/Black ink/refill only for writing the answer book.

SECTION A

I. (A) Justify the following statements :—

- (i) Power MOSFET is operated at high enough gate source voltage to minimize the conduction losses.
- (ii) Parallel operation of MOSFETS can be done more easily as compared to thyristors.
- (iii) Antiparallel diode is connected across MOSFET.
- (iv) Operating frequency of power MOSFET is higher than that of a power BJT.

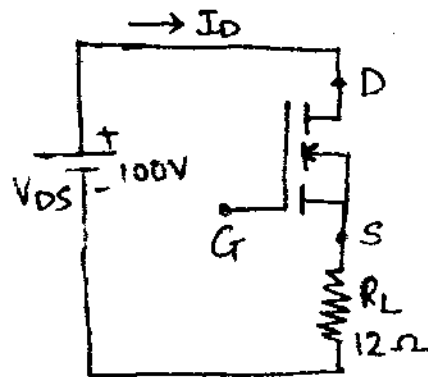
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(B) For the circuit shown in figure below determine :

- (a) Power loss in the on-state.
- (b) Power loss during the turn on interval. MOSFET parameters are : $t_r = 2\mu s$,
 $R_{DS(on)} = 0.2\Omega$

Duty cycle $D = 0.7$

$f = 30 \text{ kHz}$



7

OR

2. Draw a neat structural diagram of GTO. Explain briefly the switching behaviour of a GTO with the help of appropriate voltage and current waveforms. Derive the expression for turn off gain of GTO. Also discuss on the magnitude of this parameter for reliable turn off of GTO. 14

3. With the help of neat circuit diagram and relevant waveforms explain the operation of continuous mode flyback converters. Also, derive the expression for voltage transfer ratio in terms of transformer turns ratio and duty ratio. 13

OR

4. (A) What are the disadvantages of linear regulators ? How are they overcome in switching regulators ? What is continuous and discontinuous mode of switching regulator. 6

(B) The input voltage of Cuk converter is $V_s = 15\text{V}$. The duty cycle $k = 0.4$ and the switching frequency $= 25\text{kHz}$. The filter inductance $L_2 = 350\mu\text{H}$ and filter capacitor $C_2 = 220\mu\text{F}$. The energy transferred capacitance is $C_1 = 400\mu\text{F}$ and inductance $L_1 = 250\mu\text{H}$. The average load current is $I_a = 1.25\text{A}$. Determine:

- (a) The avg o/p voltage V_a .
- (b) The avg i/p current I_s .

- (c) The peak to peak inductor current L_1 , ΔI_1 .
 - (d) The (p top) ripple voltage of capacitance C_1 , ΔV_{C_1} .
 - (e) The peak to peak inductor current L_2 , ΔI_2 .
 - (f) The (p to p) ripple voltage of capacitance C_2 , ΔV_{C_2} .
 - (g) Peak current of transistor I_p .
 - (h) Find critical values L_1 , C_1 , L_2 and C_2 . 7
5. (A) Explain hysteresis loss, eddy current loss and skin effect limitations with reference to magnetic materials. 6
- (B) Explain the electrical characteristics of transformer needed to be considered while its design. Also state the effect of rise in temperature on transformer. 7

OR

6. (A) Discuss the inductor design constraints. 5
- (B) Explain the single pass transformer design procedure step by step by giving its flowchart. 8

SECTION B

7. Explain the operation of bridge inverter with 120° conduction mode with the help of schematic circuit diagram and waveforms. What are the problems associated with this type of conduction mode? Give its comparison with other two modes of conduction. Also determine for 120° mode. :
- (i) rms value of load current.
 - (ii) rms value of thyristor current.
 - (iii) Load power, if the three phase bridge inverter delivers power to a resistive load from a 450 V dc source. Load is of 10Ω per phase and star connected. 14

OR

8. (A) Give the circuit analysis of current source Inverter with resistive Load. 7

- (B) State the need for reduction of harmonics in inverters. Enlist the various methods for reduction of harmonics in inverter output. Explain any one of them. 7

9. (A) Explain with neat sketch the blanking times for bridge circuits. 7
(B) Explain any one thyristor drive circuits with neat diagram. 6

OR

10. (A) Explain with neat diagram the DC coupled drive circuits with unpolar output. 7
(B) Explain open emitter BJT drive circuit with neat diagram. 6
11. (A) Explain the working of 3 phase bidirectional delta connected controllers. Also draw the various waveforms for $\alpha = 120^\circ$. 8
(B) Why is the power factor of semiconverter better than that of full converter? 5

OR

12. Explain three phase half wave controllers. Draw the various waveforms for $\alpha = 60^\circ$ and $\alpha = 120^\circ$. Show that the expression for rms output phase voltage depends on the range of delay angles. 13

