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MEPE-301(B)

M.E./M.Tech., III Semester

Examination, December 2017

Power Electronics Supply System and Design

(Elective-I)

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Discuss the different performance parameters of power electronics supplies. 7
   b) What are the Techniques used for performance measurement in power electronics supply design. 7

2. a) A flyback converter is operating in a complete demagnetization mode. Derive the voltage transfer ratio V_o/V_d in terms of the load resistance R, switching frequency f_s, transformer inductance L_m and duty ratio D. 7
   b) A switch mode power supply is to be designed with the following specifications : V_d=48V±10%, V_o=5 V (regulated), f_s= 100kHz, P_{load} is 15-50W, A forward converter operating in continuous conduction mode with a demagnetizing winding (N_3=N_1) is chosen. Assume all components to be ideal except for the presence of transformer magnetization inductance. 7

   i) Calculate N_2/N_1 if this turns ratio is desired to be as small as possible
   ii) Calculate the minimum value of the filter inductance

3. a) Explain space vector modulation used in inverters. Write the important features of the same. 7
   b) Describe briefly the 180° conduction mode of operation of a three phase inverter with star connected resistive load. 7

4. a) Discuss any one method of harmonic control in AC chopper. 7
   b) What are the control strategies for the regulation of output voltage in ac voltage controller? 7

5. a) What is the circuit configuration of a three-level ZVS-PWM converter? What are its advantages? Explain the operation. 7
   b) In a buck ZCS-QR converter, the input voltage is 70 to 100V dc. The required output voltage is 24V dc at a load current of 2A to 10A. 7

   Calculate the following:

   i) The peak transistor current
   ii) The peak voltage at the resonant capacitor
   iii) The conversion frequency range to maintain the output voltage constant at 24V for the entire range of supply voltage and load current , for both half wave and full wave mode of operation. The resonant frequency is 3MHz.

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6. a) Write down the differences and similarities between ZCT and ZVT converters. 7

   b) Differentiate between symmetrical and asymmetrical waveform pattern. Discuss how it helps in designing AC Chopper. 7

7. a) In a Cuk converter operating at 50kHz, $L_1 = L_2 = 1$ mH and $C_1 = 5$mF. The output capacitor is sufficiently large to yield an essentially constant output voltage. Here $V_d = 10$ V and the output V_o is regulated to be constant at 5V. It is supplying 5W to a load. Assume ideal components.

   Calculate the percentage errors in assuming a constant voltage across C_1 or in assuming constant currents i_{L1} and i_{L2}. 7

   b) Write down the procedure of dc inductor design. 7

8. a) Write down the advantages and disadvantages of VSI and CSI. 7

   b) Discuss different modulation techniques used in operating inverters. Write down the advantages and disadvantages of the discussed techniques. 7

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