EC42

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NEW SCHEME

Fourth Semester B.E. Degree Examination, July 2007
EC / TE / EE / IT / ML / BM
Power Electronics

Time: 3 hrs.] [Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. Mention and explain the different types of power electronic converter systems. Draw their output / input characteristics. **(08 Marks)**

b. What are the peripheral effects of power converter system? **(04 Marks)**

c. What is the need of a base drive control in a power transistor? Explain proportional and anti saturation control. **(08 Marks)**

2 a. With the necessary waveforms explain the switching characteristics of a power transistor. **(07 Marks)**

b. Give the comparison between SCR, MOSFET and IGBT. **(06 Marks)**

c. With the necessary sketches, explain the switching characteristics of an IGBT. **(07 Marks)**

3 a. Sketch the static V-I characteristics of an SCR and then explain
i) Latching current.
ii) Holding current.
iii) Break over voltage. **(08 Marks)**

b. Explain the various methods of turn-on of an SCR and mention the advantages of gate triggering. **(08 Marks)**

c. The thyristor is gated with a pulse width of 40 μsec. The latching current of thyristor is 36 mA. For a load of 60 Ω and 2H, will the thyristor get turned ON? If not, how it can be overcome for the given load? Find its value. **(04 Marks)**

4 a. What do you mean by commutation? Explain briefly the different types of commutation. **(08 Marks)**

b. With necessary circuit and waveforms, explain complementary commutation scheme. **(08 Marks)**

c. The resonant pulse commutation circuit has a capacitance C = 30 μF and L = 4 μH. The initial capacitor voltage is V_0 = 200 V. Determine the circuit turn OFF time for the load current I_m = 250 A. **(04 Marks)**

5 a. What are the advantages of freewheeling diode? Explain the principle of operation of a single phase HWR feeding an RL load. Draw the necessary sketches. **(08 Marks)**

b. With the necessary circuit and waveforms, explain the operation of three-phase full converter. **(08 Marks)**

c. A single phase rectifier for 10 kW rating is required. Thyristor of current rating 50 A are to be used. Find the rated voltage of thyristor using a safety factor of 2, if the rectifier is
i) Full wave using centre tapped transformer.
ii) Full wave bridge rectifier.
Assume RL load. **(04 Marks)**

6 a. Classify the choppers and explain the different types and chopper circuits. **(08 Marks)**

b. Obtain an expression for the output voltage for a step-up chopper. Explain how duty cycle is controlled. **(08 Marks)**

c. A dc chopper has an input voltage of 200 V and a load of 8 Ω resistance. The voltage drop across thyristor is 2 V and the chopper frequency is 800 Hz. The duty cycle $\alpha = 0.4$. Find

i) Average output voltage.
ii) Rms output voltage.
iii) Chopper efficiency. **(04 Marks)**

7 a. With necessary circuit and waveforms, explain the operation and fullwave a.c. voltage controller feeding an RL load. **(08 Marks)**

b. Explain the various methods of gating an SCR. State why short duration pulses are insufficient for an ac voltage controller feeding an RL load. **(06 Marks)**

c. A single phase half wave ac voltage controller has an input voltage of 150 V and a load resistance of 8 Ω. The firing angle of thyristor is 60° in each positive half cycle. Find

i) Average output voltage.
ii) RMS output voltage.
iii) Power output.
iv) Power input
v) Average input current over one cycle **(06 Marks)**

8 a. What do you mean by Inverters? Explain the operation of single phase full bridge inverter. Draw the load current waveforms for R, RL and RLC loads. **(08 Marks)**

b. With necessary circuit and waveforms, explain the operation of three phase bridge inverter with 180° mode of operation. **(08 Marks)**

c. Explain how harmonics can be reduced by transformer connections. **(04 Marks)**

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