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Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, May 2015
(2013 Scheme)
13.405 : POWER ELECTRONICS (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. What is the function and types of snubber circuits ?
2. Draw the thermal equivalent circuit of an SCR.
3. What is the need of commutation in thyristor circuits ?
4. State the advantages of using pulse transformers in triggering semiconductor devices.
5. What are the features that the firing circuits for thyristors should possess ?
6. What are the merits of IGBT over MOSFET ?
7. Why is power factor of semi-converter better than full converter ?
8. What is the major drawback of 3-pulse converter ?
9. What are the various control strategies for varying duty cycle of a chopper ?
10. Calculate the output frequency of a series inverter with the following parameters :

    T_{off} = 0.2 ms, Time period of oscillation = 0.377 ms.

PART – B

Answer **any one full** question from **each** Module. **Each** question carries **20** marks.

Module – 1

11. a) Describe the two-transistor model of a thyristor. Using this model, describe in detail any one mechanism of turning on a thyristor. **10**

    b) Discuss how a thyristor may be subjected to internal and external overvoltages. Describe the method adopted for suppressing such over voltages in thyristor systems. **10**

OR

12. a) With a circuit diagram and appropriate waveforms, describe the resonant-pulse commutation used for thyristors. **10**

    b) A string of four series-connected thyristors is provided with static and dynamic equalizing circuits. This string has to withstand an off-state voltage of 10 kV. The static equalizing resistance is 25000 Ω and the dynamic equalizing circuit has $R_c = 40\ \Omega$ and $C = 0.08\ \mu F$. The leakage currents for four thyristors are 21 mA, 25 mA, 18 mA and 16 mA respectively. Determine the voltage across each SCR in the off-state and the discharge current of each capacitor at the time of turn-on. **10**

Module – 2

13. a) Why pulse-train gating is preferred over pulse gating ? Explain with relevant circuit and waveforms, the pulse-train gating of SCRs. **10**

    b) Describe the resistance firing circuit used for triggering SCRs. Is it possible to get a firing angle greater than 90° with resistance firing ? Illustrate your answer with appropriate waveforms. **10**

OR

14. a) Describe the trigger circuit for a TRIAC using a DIAC. **10**

    b) Explain the operation and static V-I characteristics of GTO. **10**

Module – 3

15. a) Explain briefly continuous and discontinuous modes of operation of single phase AC-DC converter. 10

    b) A single phase full converter has a RLE load (R = 1.5 Ω , L = 4.5 mH, E = 10 V). Compute the average value of load current and load voltage at $\alpha = 30^\circ$ and draw the necessary waveforms. 10

OR

16. a) With relevant circuit diagram and waveforms, explain the principle of operation of 3-phase fully controlled converter with RL load. 10

    b) Describe the effect of source inductance on the performance of a single phase full converter. 10

Module – 4

17. a) Draw the circuit diagram of a step up chopper and describe the principle of operation with the associated output current waveform. Also derive the formula for the output voltage. 10

    b) With neat sketch and relevant waveforms, explain the various modes of operation of Buck-Boost converter. 10

OR

18. Describe the principle of working of a 3-phase full bridge inverter with an appropriate circuit diagram. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for 180 degree and its resistive load is star connected. 20
