

FACULTY OF ENGINEERING

B.E. 3/4 (EEE/Inst.) I Sem. (Main) Examination, December 2011
POWER ELECTRONICS

Time: 3 Hours]

[Max. Marks: 75

Note : Answer all questions of Part A. Answer five questions from Part B.

PART – A

(25 Marks)

1. List out the different types of power diodes. 2
2. Compare power BJT_s with power MOSFET. 3
3. Explain UJT-triggering mechanism in SCR circuits. 3
4. Mention the applications of cyclo converters. 2
5. Describe the basic principle of operation of ETO. 3
6. Draw the output voltage waveform of a 1-phase half wave controlled converter with RL-load. 2
7. Why is the power factor of a semi-converter better than that of full converter ? 3
8. What are the two modes of operation of a dual converter ? 2
9. What is the time ratio control ? 2
10. What is the principle of operation of 1-phase inverters ? Draw the circuit arrangement for such an inverter. 3

PART – B

(50 Marks)

11. a) Draw and explain V-I characteristics of SCR. 5
b) With the help of neat structural diagram and suitable waveforms. Explain the operation of IGBT. 5
12. a) Bring out the advantages and limitations of power MOSFETs when compared to other power semiconductor devices. 5
b) Discuss the protection mechanism used in SCRs. 5
13. Explain the operation of a fully controlled thyristor bridge converter as a rectifier as well as a line commutated inverter with relevant wave forms. 10

14. a) Explain the operation of 3-phase, half wave controlled converter with resistive load, and inductive load. Sketch the associated waveforms. 6
- b) Calculate the average output voltage of a 3-phase half controlled bridge operating with a triggering angle of $\pi/2$ and connected to 3-phase a.c. supply of 400 V and 50 Hz. The load current is assumed to be continuous. 4
15. a) Explain the operation of a 1-phase to 1-phase cycloconverter feeding R-load. 5
- b) A 1-phase ac voltage controller is connected to a resistive load of 10Ω . The input a.c. voltage is 230 V at 50 Hz. Estimate the rms load voltage rms load current and power input for a delay angle of 90° . 5
16. a) With the help of circuit diagram, explain the working of step-up/step-down chopper. 5
- b) A buck-boost converter is operated from a 24 V battery and supplies an average load current of 2 A. Its switching frequency is 50 kHz. Neglecting diode and switch drop, determine : 5
- i) Range of duty-cycle variation required to maintain the output voltage at 15 V, given that the battery voltage ranges from 26 V in the fully charged state to 21 V in the discharged state.
- ii) The peak to peak choke ripple current for the nominal supply voltage, given that the choke value is $500\ \mu\text{H}$.
17. a) Explain the operation of a 3-phase bridge inverter with necessary waveforms bringing out the necessity of return current diodes in such inverters. 6
- b) How is the output voltage and frequency of a PWM inverter varied ? 4