

Total number of printed pages – 7

B. Tech
CPEE 5306

Fifth Semester Examination – 2007

POWER ELECTRONICS

Full Marks – 70

Time : 3 Hours

IWL

*Answer Question No. 1 which is compulsory
and any **five** from the rest.*

*The figures in the right-hand margin
indicate marks.*

1. Answer the following questions : 2×10
- (i) How many regions of operation is there for BJTs ? Briefly explain them.

P.T.O.

- (ii) What are the advantages of GTO over an SCR ?
- (iii) What is Displacement factor ?
- (iv) Input power factor is better in Half controlled rectifier or full controlled rectifier ? Explain briefly the reason.
- (v) Write the advantages of circulating current scheme operation of Dual converter.
- (vi) What are the applications of cycloconverter ?
- (vii) A single-phase one pulse controlled circuit has resistance and counter e.m.f load and $400 \sin 314 t$ as the source voltage. For a load counter e.m.f of 200 V, what is the range of firing angle control ?

(viii) In a current source inverter, if frequency of output voltage is f Hz, then what is the frequency of voltage input to the current source inverter ?

(ix) A single phase full bridge Voltage source Inverter has inductor L as the load. For a constant source voltage, what is the shape of the current through the inductor ?

(x) Draw the chopper configuration which is used for motoring action.

2. (a) Draw and explain the output characteristics of n-channel enhancement mode MOSFET. 5

(b) Draw and explain the switching behaviour of an SCR. 5

3. (a) Derive the expressions for average output voltage, RMS supply current, displacement angle, supply power factor, displacement factor in case of a single phase half controlled rectifier. Assume the load current to be continuous and ripple free.

5

(b) A highly inductive load, such that load current can be assumed constant, is to be supplied from a 230 V, 50 Hz, single phase supply by a fully controlled and a half-controlled bridges. Compare the average load voltage provided by each bridge at firing angles of 30° and 90° .

Neglect device voltage drop. 5

4. Explain the operation of a three-phase fully controlled bridge converter with resistive load.

Describe details in the following modes of operation with associated waveforms,

- (i) Discontinuous conduction mode,
- (ii) Continuous conduction mode. Derive the expression for average voltage. 10

5. (a) Draw the circuit of a four quadrant chopper and explain its operation. 5

(b) Describe a Morgan Chopper with associated voltage and current waveforms. Enumerate the demerits of Morgan Chopper compared to Jones Chopper.

5

6. Describe modified McMurray half-bridge inverter with appropriate voltage and current waveforms. For this circuit, find an expression that gives the circuit turn-off time for the main thyristor in terms of load, current, peak capacitance current, etc. Discuss how commutating circuit components can be designed on the basis of minimum commutation energy ? 10

7. (a) Draw and explain the general block-diagram of a thyristor trigger circuit. 3

(b) Draw RC half-wave trigger circuit for one SCR and discuss the function of the various components used. Describe with the help of waveforms how the output voltage is controlled by varying the resistance ? 7

8. Write short notes on : 2×5

(i) Circuit for forced commutation

(ii) Single phase Mid Point cycloconverter.

IWL