Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**

PEE5I101

5th Semester Regular / Back Examination 2018-19

POWER ELECTRONICS

BRANCH : ELECTRICAL

Time : 3 Hours

Max Marks : 100

Q.CODE : E300

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 **Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Why circuit turn-off time is usually greater than thyristor turn off time ?

b) What do you mean by latching current and holding current of a thyristor in operation.

c) What is the electrical analogue of heat transfer from a power semiconductor device ?

d) Can a power device be protected by a fuse? Justify.

e) Single-phase converters are avoided in high performance applications. Why?

f) What do you mean by AC link chopper? Draw the block diagram.

g) The input voltage of a chopper is 220V, load voltage is 150V and the chopping frequency is 4Hz. Find the ON and OFF period of the thyristor in each cycle.

h) What is the purpose of a converter in dc drives?

i) How is the delay angle of one converter related to the delay angle of the other converter in a dual-converter system?

j) What are the methods to vary the inverter output voltage? Write down some applications of inverter?

Part- II

Q2 **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Discuss the need of Snubber circuit and a series inductor for athyristor? Explain with clear circuit diagram.

b) Explain the cosine waveform is used for designing a firing circuit?

c) Enumerate the control circuit design for a two-quadrant chopper circuit.

d) Derive the average output DC voltage for a single-phase controlled-bridge converter with both continuous and discontinuous current mode operations with relevant waveform.

e) Derive the expression for the average output voltage for a three phase, 3-pulse and three phase, 6-pulse diode rectifier using cosine form.

f) Ripple current is minimized by either increasing the chopper frequency or including an inductance in series with the armature of the dc motor. Discuss the merits and demerits of each alternative.

g) What are the advantages of pulse width modulation? Describe the technique of technique of single pulse-width modulation with the expression for modulation index.

h) How is SCR different from GTO? What are the merits and demerits of GTO?

i) Draw and explain the current-voltage characteristic of a GTO thyristor switch and how it differs from an ordinary three wire thyristor switch ?

j) Draw the circuit and explain the modified single phase series inverter with advantages and disadvantages.

k) Draw the waveform of source voltage, source current, load voltage and load current of single phase full controlled converter for discontinuous load current with R-L load.

l) What is cycloconverter? Explain the working of a single phase centre-tap cycloconverter with a simple diagram. Draw the input wave of frequency f and output wave of frequency f/4 for a resistive load.

Part-III

Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Draw and explain the dynamic characteristic of thyristor during turn on and turn-off process. Draw the relevant circuit for this characteristic. **(10)**

b) Find the protective elements of snubber circuit for protection of $\frac{di}{dt}$ and $\frac{dv}{dt}$ **(6)**

Q4 **a)** Explain the operation with associated waveforms of a three-phase half wave controlled rectifier for a highly inductive load. Derive the expression for average and rms output voltage. **(10)**

b) A three phase half wave controlled converter is operated from a three-phase Y-connected 208V,60Hz supply and the load resistance is R = 10 ohm. If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, Calculate : (i) the delay angle α (ii) the rectification efficiency. **(6)**

Q5 **a)** Draw and explain for three phase voltage source bridge type of inverter operating under 180^0 mode. **(10)**

b) A first-quadrant dc-to-dc chopper feeds an inductive load of 10 Ω resistance, 50mH inductance, and back emf of 55V dc, from a 340V dc source. If the chopper is operated at 200Hz with a 25% on-state duty cycle, determine, with and without (rotor standstill, *E* = 0) the back emf : **(6)**

i) the load average and rms voltages;
ii) the rms ripple voltage, hence ripple factor;
iii) the maximum and minimum output current, hence the peak-to-peak output ripple in the current;
iv) the average load output current.

Q6 **a)** Draw the circuit diagram at different mode of operation for the single phase parallel inverter and explain the working with output voltage waveform. **(10)**

b) Discuss the working function of a SMPS with block diagram. **(6)**