B.Tech III Year I Semester (R13) Supplementary Examinations June 2016
POWER ELECTRONICS
(Electrical & Electronics Engineering)

Time: 3 hours   Max. Marks: 70

PART - A
(Compulsory Question)
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1   Answer the following: (10 X 02 = 20 Marks)

(a)   Explain the significance of latching and holding currents of a thyristor.

(b)   What are the steps to be employed to prevent the difficulties of parallel working of thyristors?

(c)   Draw the circuit of single phase thyristor phase controlled half wave converter.

(d)   Draw single phase centre tap full wave converter circuit.

(e)   From chopper circuit operation view point, why working at low chopper frequency is preferred?

(f)   Define duty ratio of chopper.

(g)   What are the main application areas of inverters?

(h)   What are the advantages of forced commutation in inverters?

(i)   Draw the waveform of single phase at voltage controller with purely inductive loads for $\alpha > \frac{\pi}{2}$.

(j)   What are the step up and step down cycloconverters?

PART - B
(Answer all five units, 5 X 10 = 50 Marks)
UNIT - I

2   (a)   Mention the important ratings of the thyristors along with their significance.

(b)   Calculate the required parameters for snubber circuit to provide reliable $\frac{dv}{dt}$ protection to a thyristor used in a single phase fully controlled bridge. Input voltage to bridge is single phase, 230 V, 50 Hz A.C and the source inductance is 150 μH. The thyristor has a maximum $\frac{dv}{dt}$ capacity of $50\ V/\mu$ sec.

OR

3   (a)   Explain the turn on characteristics of the thyristor.

(b)   If the latching current of thyristor in series with a purely inductive load of 0.1 H and d.c voltage source of 100 V is 4 mA, determine the minimum width of the firing pulse required to properly turn-on the thyristor.

UNIT – II

4   (a)   Explain the operation of three phase six pulse bridge converter feeding a resistive load, with neat waveforms.

(b)   A single phase bridge converter feeds an R-L load having a resistance of 5.5 ohms and an inductance of a very large value causing perfect smoothing. The converter is fed from a 400 V, 50 Hz single phase supply. For a firing angle of $\alpha = 75°$, determine: (i) The average value of output current. (ii) The rms value of output current. (iii) The average and rms thyristor currents. (iv) The power factor or the ac source.

OR

5   (a)   Explain the operation of six pulse bridge converter feeding RLE load, with neat waveforms.

(b)   A 3 pulse converter operates into an R-L load having an additional dc voltage of 240 V. The load resistance is $1.5\ \Omega$ and the inductance is large enough to provide ripple free current. The converter has a firing angle of $135°$. Determine the following: (i) The dc load voltage. (ii) The average value of dc current. (iii) The thyristor peak inverse voltage of thyristor. The converter transformer has a secondary voltage of 220 V at 50 Hz.

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UNIT - III

6 (a) Explain the operation of step down chopper with back e.m.f load.

(b) A step down chopper is supplying a resistive load of $10\,\Omega$ from an ideal d.c source of 220 V. When the chopper switch remains on, its voltage drop is 2 V and the chopper frequency is 1000 Hz. If the chopper duty cycle is maintained at 0.5, calculate: (i) The average and rms value of load voltage. (ii) The chopper efficiency.

OR

7 (a) Draw and explain the operation of step up chopper circuit.

(b) An ideal single quadrant chopper operating in first quadrant is supplied with power form an ideal battery source of terminal voltage 220 V. The load voltage waveform consists of rectangular pulses of duration 1 m sec in over all chopper time period of 3 m sec. Calculate the average and rms values of the load voltage and the voltage ripple factor.

UNIT - IV

8 (a) Draw the auxiliary commutated single phase half bridge inverter circuit.

(b) A single phase half bridge inverter feeds a resistive load of R = 7.2 ohms. The dc voltage of the inverter $v_s = 200\,V$. Determine: (i) RMS value of the fundamental component of the voltage at the output. (ii) Output power. (iii) Average and peak currents of the thyristor. (iv) Peak inverse voltage. (v) Total harmonic distortion. (vi) Distortion factor. (vii) Harmonic factor and distortion factor of lowest order harmonic.

OR

9 (a) Draw the auxiliary commutated single phase full bridge inverter circuit.

(b) A single phase full bridge inverter feeds a single phase load comprising a resistance of 10 ohms and an inductance of 50 mH. The inverter is supplied form 250 V d.c source. Determine the load current at first 2 intervals. The frequency of the output is 50 Hz.

UNIT - V

10 (a) Explain the operation of single phase ac voltage controller with resistive load. Derive an expression for its form factor.

(b) Load voltage in a single phase resistive circuit is controlled by symmetrical phase angle triggering of a pair of inverse parallel connected thyristors. The load circuit resistance is $10\,\Omega$, if the supply voltage is given by v = 170 sin(314t) and the firing delay angle of thyristors is equal and maintained at $\alpha = \frac{\pi}{2}$, determine: (i) The rms value of load voltage and load current.

(ii) The input power factor.

(iii) The average and the rms current of thyristors.

OR

11 (a) Draw the general layout and ideal waveforms of cycloconverter.

(b) Draw and explain the principle of operation of bridge configuration of single phase cycloconverter.

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