Code: 13A02503

R13

B.Tech III Year I Semester (R13) Regular Examinations December 2015

POWER ELECTRONICS

(Electrical and 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) What is difference between a Non-Punch through and Punch through IGBT?

(b) What is the significance of turn-off gain of a GTO?

(c) What is the purpose of inter-phase reactor in a three-phase line commutated converter?

(d) A single phase full converter has a source voltage 230 V, 50 Hz. If the firing angle of the converter is 60^0, what is its input power factor?

(e) Input to the step up chopper is 200 V. The output required is 600 V. If the conducting time of thyristor is 200 μsec. Compute chopping frequency.

(f) What is the basic difference between time ratio control and current limit control of a chopper?

(g) Why feedback diodes are used in bridge inverters?

(h) A single phase half bridge inverter has dc input voltage 48 V. What is RMS value of output voltage?

(i) The gate-cathode characteristics of a TRIAC are given by $v_g = 2 + 5i_g$. A triggering pulse train with an amplitude of 10 V, ON period 10μs is applied to the gate through 10 Ω resistor. Calculate peak gate power.

(j) In which type of cycloconverters forced commutation is employed? Also give cycloconverter applications.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Using two-transistor analogy, explain different turn on methods of SCR.

OR

3 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 Ω and C = 0.08 μF. The leakage currents for four thyristors are 21 mA, 25 mA, 18 mA and 16 mA respectively. Determine voltage across each SCR in the off-state and the discharge current of each capacitor at the time of turn-on.

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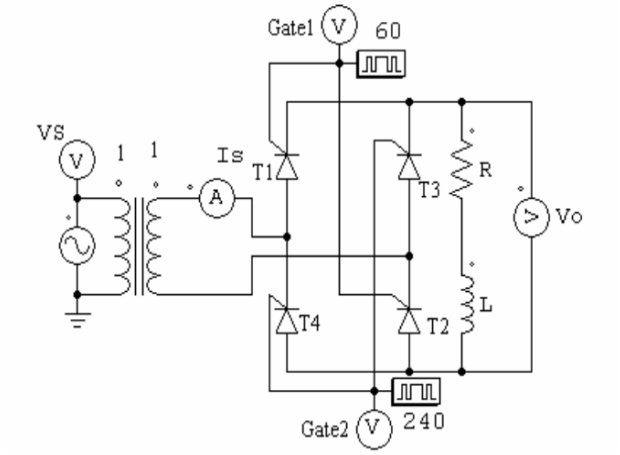
UNIT – II

4 A 3-phase full converter charges a battery from a three phase supply of 230 V, 50 Hz. The battery emf is 200 V and its internal resistance is 0.5 Ω. On account of inductance connected in series with the battery, charging current is constant at 20 A. Compute the firing angle delay and the supply power factor.

OR

5 The rectifier shown below has pure DC load current of 50 A and, $V_s = 220 \sin 314t$ and unity transformer ratio. if it is required to obtain an average output voltage of 70% of the maximum possible output voltage, calculate:



(a) The delay angle α.
(b) The efficiency.
(c) Ripple factor.
(d) The peak inverse voltage (PIV) of the thyristor.
(e) input displacement factor.

UNIT – III

6 A step down chopper feeding on RL load with input dc voltage of 200 V, with a load of R = 5 Ω, L = 5 mH, switching frequency of 1 kHz and duty ratio of 0.5. Calculate: (i) Maximum and minimum values of load current. (ii) Average value of load current. (iii) RMS load current. (iv) Effective input resistance as seen by source. (v) RMS chopper current.

OR

7 With a neat circuit diagram and necessary waveforms, describe different modes of operation of a voltage commutated chopper.

UNIT – IV

8 Explain the operation of a Series inverter with necessary circuit and waveforms.

OR

9 Single phase half bridge inverter has a resistive load of R = 3 Ω and dc input voltage E_{dc} = 50 V, calculate:
(a) RMS output voltage at fundamental frequency.
(b) The output power.
(c) Average and peak current of each thyristor.

UNIT – V

10 With neat sketches explain different modes of operation of TRIAC.

OR

11 Describe the operation of a single phase bridge type cycloconverter with necessary circuit and waveforms.

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