

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)

- 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° , 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 μ sec. 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 10 μ s 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 $R_c = 40 \Omega$ and $C = 0.08 \mu F$. 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.

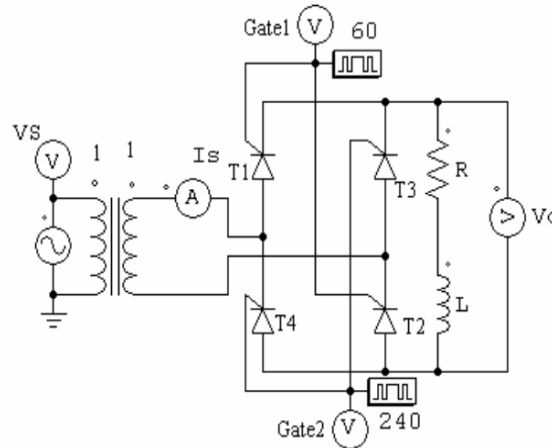
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UNIT – II

- 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 0.5Ω . 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:



- The delay angle α .
- The efficiency.
- Ripple factor.
- The peak inverse voltage (PIV) of the thyristor.
- 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 $R = 5 \Omega$, $L = 5 \text{ mH}$, 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 $R = 3 \Omega$ and dc input voltage $E_{dc} = 50 \text{ V}$, calculate:

- RMS output voltage at fundamental frequency.
- The output power.
- 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.
