1019
Exam.Code:0936
Sub. Code: 6990
B.E. (Electrical and Electronics Engineering)
Sixth Semester
EE-606: Power Electronics

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt _five_ questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Assume any missing data.

x-x-x

Q. I.

1. Plot the dynamic characteristics of SCR during turn-on process.

2. Why is there a resistor in series with a capacitor in a snubber circuit?

3. Give the circuit for a chopper which operates in all four quadrants.

4. What is the need of commutation circuits in power electronics circuits?

5. What is the role of freewheeling diodes in converter circuit? (5x2=10)

PART-A

Q.II a) Describe how two series connected SCRs are subjected to unequal voltage distribution during their dynamic conditions. Drive an expression for capacitances C used in the dynamic equalizing circuit for n series connected SCRs. (5)

b) Explain class B commutation and determine the turn-off time foe main SCR for a load of R=1.5 Ω. A circuit employing class-B commutation circuit has C=50 μF, L=20μH, V_s = 200 V and initial voltage across capacitor is 200 V. (5)

Q.III. a) How can an SCR be turned-on? Explain the two-transistor model of an SCR and hence explain the concept of gate triggering as used for firing an SCR. (4)

b) Draw an UJT relaxation oscillator circuit and discuss how amplitude of output voltage pulse is estimated during these oscillations.

A relaxation oscillator is to be designed to generate 2kHz output. V_{DC}=10V, η= 0.6, I_p=0.5mA. Neglect the discharge time for calculation of frequency. Find the values of various components of the circuit. (3, 3)

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Q.IV a) Why does an SCR need protection from high $\frac{di}{dt}$ and $\frac{dv}{dt}$ ratings. Give a complete protection scheme for SCR from over voltage and above two phenomena. (5)

b) Explain the commutation process of an SCR? Hence explain the class E commutation scheme with the help of neat circuit and different modes of operation. (5)

PART-B

Q.V. a) A step up chopper has input voltage of 220 V and output voltage of 660 V. If the off time of the chopper is 100µs, compute the pulse width of the output voltage. In case the pulse width is reduced by 50%, find the new output voltage. (5)

b) Discuss the working of a 3-phase fully controlled bridge converter feeding RL load. Draw wave shapes of input voltage, firing pulses and output voltage for $\alpha = 45°$. Show the effect of freewheeling diode as well. (5)

Q.VI. a) What is a buck-boost converter? What are its applications? Explain its working and draw a neat circuit diagram of the converter. (5)

b) Discuss the conditions governing the design of commutating components of a Load commutated chopper and obtain the expression for these parameters in terms of source voltage, load current, circuit turn-off time etc. Hence, explain the working of the chopper with neat current and voltage sketches (5)

Q.VII. a) With the help of neat circuit and waveforms explain the working of Morgan chopper. Hence compare this chopper circuit with other chopper circuits. (5)

b) A 230 V dc motor runs at 800 rpm at no load. The motor is fed by a step down chopper having 230 V dc input. If the chopper is operated at $\alpha = 0.7$, the motor current is 25 A and armature resistance is 0.5Ω, find the speed of the motor. (5)

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