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06EE45

# Fourth Semester B.E. Degree Examination, Dec.09/Jan.10
# Power Electronics

Time: 3 hrs. Max. Marks:100

**Note:1.** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
***2. Missing data may be suitably assumed.***



## Part – A

1 a. Give the circuit symbol, output characteristics and applications of various semiconductor devices. **(10 Marks)**

b. With the help of circuit and waveforms, explain the various types of power electronic converter circuits. **(10 Marks)**

2 a. With the help of necessary waveforms, explain the switching characteristics of a BJT. **(06 Marks)**

b. With the help of necessary waveforms, explain the switching characteristics of an IGBT. **(06 Marks)**

c. What is the necessity of base drive control? Explain the various methods of base drive control used for BJTs. **(08 Marks)**

3 a. Explain the two transistor analogy of a thyristor. **(06 Marks)**

b. Mention and explain the various methods of turn ON used for thyristors. **(08 Marks)**

c. The thyristor is gated with a pulse width of 40 μsec. The latching current of thyristor is 36 mA. For a load of 60 Ω and 2 H, will the thyristor get turned ON? If the answer is negative, how this problem can be overcome for the given load? Find the value of remedial parameter. Given $V_s = 300V$. **(06 Marks)**

4 a. What do you mean by commutation? Explain the method of self commutation with necessary circuit and waveforms. **(07 Marks)**

b. With necessary circuit and waveforms, explain the complementary commutation method. **(07 Marks)**

c. In the resonant pulse commutation circuit, the capacitance C = 30 μF and inductance L = 4 μH. The initial capacitor voltage is $V_0 = 200$ V. Determine the circuit turn-off time $t_{off}$ if the load $I_m$ is 50 A. **(06 Marks)**

## Part – B

5 a. With the help of circuit diagram and waveforms, explain the operation 1Q bidirectional voltage controller with R-L load. **(07 Marks)**

b. Explain the principle of ON-OFF control. Obtain an expression for rms voltage, rms current and p.f. for full wave AC voltage controller. **(07 Marks)**

c. A single phase half wave ac voltage controller has a resistive load of R = 10 Ω and the input voltage Vs = 120 V, f = 60 Hz, $\alpha = \frac{\pi}{2}$. Determine i) rms value of output voltage, ii) Input power factor iii) Average input current. **(06 Marks)**

6 a. For a single phase semi-converter with R-L load operating in continuous mode, i) Draw the circuit diagram, input and output waveforms ii) Derive an expression for average and rms output voltages. **(10 Marks)**

b. With the circuit diagram, explain the operation of three phase full converter for constant load current. If the input to this circuit is 3 phase, 50 Hz supply, determine the firing angle $\alpha$ for the SCRS to obtain an output average dc voltage of 50% of the maximum. If this output voltage is 270 V, calculate ac supply line-line rms voltage. **(10 Marks)**

7 a. What is chopper? Explain the operation of various types of chopper. **(08 Marks)**

b. With the help of circuit and waveforms, explain the operation of step up chopper. **(06 Marks)**

c. In the step down chopper $V_s = 230\,V$, load resistance is 10 Ω. Take a voltage drop of 2 V across chopper when it is ON. For a duty cycle of 0.4, calculate i) Average and rms values of output voltage. ii) Chopper efficiency. **(06 Marks)**

8 a. Explain the concept of sinusoidal modulation technique of voltage control in an inverter. **(06 Marks)**

b. What is the effect of harmonics? Explain harmonic reduction by transformer connection method. **(08 Marks)**

c. For the inverter circuit shown in figure,

i) Sketch to scale the waveforms of $V_0$, $i_0$, $i_{Q1}$, $i_{Q2}$, $i_1$ and $i_2$.

ii) Power delivered to load.

iii) State whether this circuit will require forced commutation. **(06 Marks)**

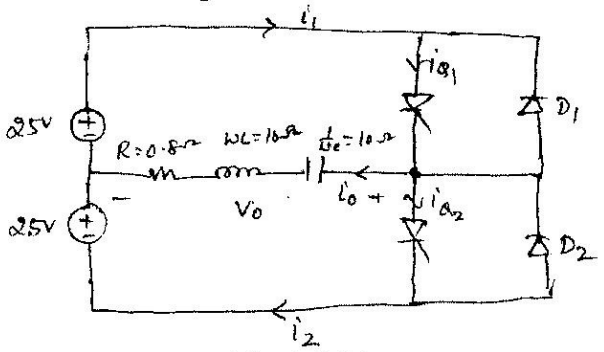


Fig. Q8 (c)

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