

NEW SCHEME

Fourth Semester B.E. Degree Examination, July 2006
EC/EE/IT/TC/ML/BM

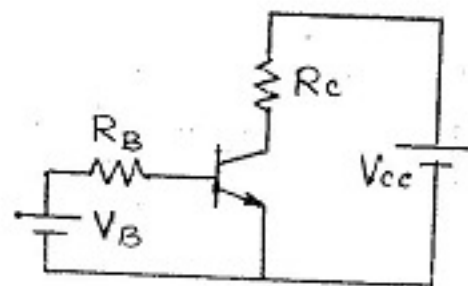
Power Electronics

Time: 3 hrs.]

[Max. Marks:100

Note: I. Answer any FIVE full questions.

1.
 - a. What are the advantages of static power converters? Mention the peripheral (terminal) effects of such static power converters. (06 Marks)
 - b. Mention at least four power electronic circuits; indicate their inputs and outputs with one application of each type. (06 Marks)
 - c. Draw the input and output characteristics of four of the following devices: i) BJT ii) MOSFET iii) IGBT iv) SCR v) UJT. (08 Marks)
2.
 - a. Compare BJT, MOSFET and SCR with reference to power switching applications. (06 Marks)
 - b. Draw the switching model and switching wave-forms of a power MOSFET. Define the different switching times. (06 Marks)
 - c. A power BJT is connected as a switch as in fig.2(c) with the following data:



$V_{CC}=100V$, $V_B=8V$,
 $V_{CE(sat)}=2.5V$,
 $V_{BE(sat)}=1.75V$
 β of the transistor is varied from 10 to 60.

Fig.2(c)

Calculate: i) the value of R_B that will result in saturation with an over drive factor of 20. ii) the forced β . iii) power loss in the transistor. (08 Marks)

3.
 - a. Using two transistor model, explain the turn-on mechanism of a SCR. Derive an expression for anode current in terms of transistor parameters. (08 Marks)
 - b. Explain the need for dv/dt and di/dt protection for SCR. A SCR circuit has the following data: supply voltage = 200 V, dv/dt rating = $100 V/\mu s$, di/dt rating = $50 A/\mu s$. Calculate the Snubber circuit elements using approximate expressions. (08 Marks)
 - c. With a circuit diagram and waveforms explain RC – triggering circuit. (04 Marks)
4.
 - a. What are the conditions to be satisfied for successful commutation of a thyristor? With voltage and current wave forms, discuss the process of commutation. (06 Marks)
 - b. With the help of a circuit diagram and waveforms explain the operation of resonant pulse commutation. (08 Marks)
 - c. For the complementary commutation circuit shown in fig.4(c). Calculate the values of C to provide circuit turn off time of 20 micro-sec. (06 Marks)

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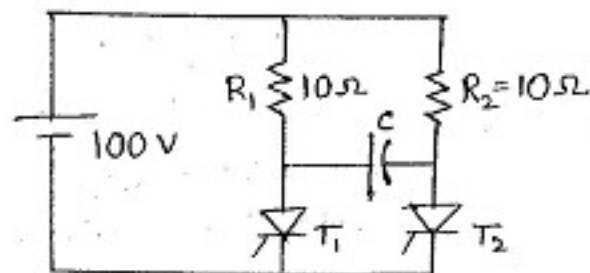


Fig.4(c)

- 5 a. Explain with a circuit diagram and waveforms the working of a single phase control type AC voltage controller connected to resistive load. Derive the relationship between rms output voltage and rms input voltage. (08 Marks)
- b. Why short duration gate pulses are not suited for triggering thyristors in full wave a.c. voltage controllers feeding inductive loads. (04 Marks)
- c. A single phase full wave a.c. voltage controller shown in fig.5(c) has a resistive load of 5 Ohm with input voltage of 120 V, 50 Hz. The delay angles $\alpha_1 = \alpha_2 = \frac{2\pi}{3}$.

Determine : i) rms output voltage ii) average current through the thyristors. iii) rms current through the thyristors iv) input P.F. (08 Marks)

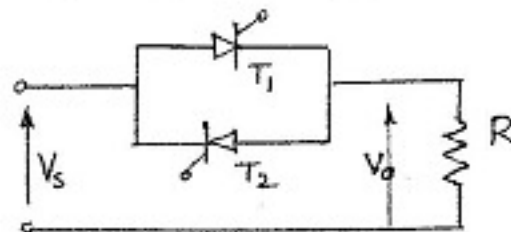


Fig.5(c)

- 6 a. Explain the working of a single phase full converter feeding highly inductive load. Derive an expression for average output voltage. (08 Marks)
- b. What is a free Wheeling Diode? What are the advantages of free Wheeling Diode in rectifier circuits feeding inductive load? (04 Marks)
- c. A single phase dual converter is feeding RL load, the thyristors are triggered with a delay angle of 60 degrees. Sketch the waveforms of input voltage, and output voltage of both the converters. Mention any two advantages of circulating current mode of operation of dual converter. (08 Marks)
- 7 a. Explain how DC choppers are classified, with reference to load voltage and load current. (08 Marks)
- b. With the help of a circuit diagram and waveforms explain the working of a DC chopper. Derive an expression for:
i) Output voltage ii) Output power (12 Marks)
- 8 a. With circuit diagram and waveforms explain the operation of a single phase bridge inverter feeding resistive load. If additional diodes are connected across the switches, what are their functions? (08 Marks)
- b. Briefly explain how output is controlled in single phase bridge inverter. (04 Marks)
- c. With a circuit diagram explain the working of a single phase current source inverter. (08 Marks)