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10EC73

Seventh Semester B.E. Degree Examination, June/July 2019

Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

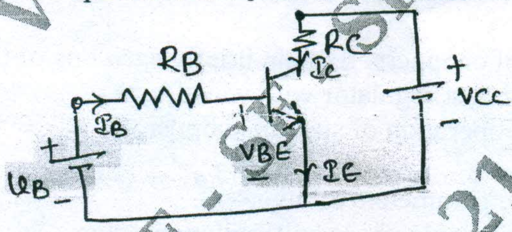
1 a. Explain five types of power electronic converter circuits briefly. Also indicate two applications of each type. **(10 Marks)**

b. Give symbol, and characteristic features of the following devices:
i) RCT ii) GTO iii) Triac iv) SCR v) IGBT **(10 Marks)**

2 a. Give the comparison between BJT, MOSFET and IGBT. **(06 Marks)**

b. What is the necessity of base drive control in a power transistor? Explain antisaturation control. **(08 Marks)**

c. For a transistor switch shown in Fig.Q2(c):
i) Calculate the forced beta, β_f of transistor.
ii) If the manufacturers specified β is in the range of 8 to 40, calculate the minimum overdrive factor (ODF)
iii) Obtain power loss P_T in the transistor.



$V_B = 10V$, $R_B = 0.75\Omega$
$V_{BE(sat)} = 1.5V$
$R_C = 11\Omega$, $V_{CC} = 200\ V$
$V_{CE(sat)} = 1V$

Fig.Q2(c) **(06 Marks)**

3 a. Draw the two transistor model of a thyristor and derive an expression for the anode current in terms of the common base current gain α_1 and α_2 of the transistors. **(09 Marks)**

b. What is the need for protection of thyristor? Explain how thyristors are protected against high $\frac{di}{dt}$. **(06 Marks)**

c. Explain different methods to turn on a thyristor. **(05 Marks)**

4 a. What will be the average power in the load for the circuit shown in Fig.Q4(a), when $\alpha = \frac{\pi}{4}$. Assume SCR to be ideal. Supply voltage is 330 sin 314t. Also calculate the RMS power and the rectification efficient.

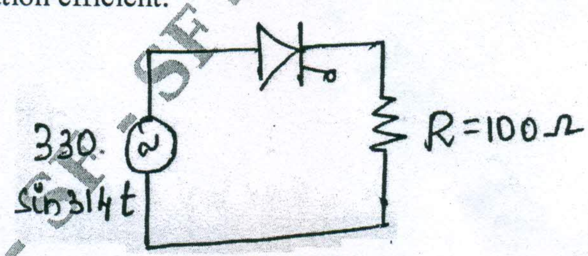


Fig.Q4(a) **(06 Marks)**

b. With a neat circuit diagram and waveforms, explain the working of a single phase full controlled bridge converter feeding highly inductive load. Derive the expression for the average output voltage and rms output voltage. **(10 Marks)**

c. Compare full controlled and semi-controlled rectifiers. **(04 Marks)**

PART – B

5 a. With a neat circuit diagram and waveforms, explain complementary commutation. **(10 Marks)**

b. In the resonant pulse commutation circuit, the supply voltage is is $V_S = 200$ V, load current $I_o = 150$ A, the commutation inductance $L = 4\mu H$ and commutation capacitance $C = 20\ \mu F$. Determine the peak resonant reversing current of thyristor T_3 and turn OFF time t_{OFF} for T_1. Assume $V_O = V_S$. **(10 Marks)**

6 a. With relevant circuit and waveform, explain the principle of single phase fullwave AC voltage controller with resistive load. Derive expression for RMS output voltage. **(10 Marks)**

b. A single phase FW ac voltage controller working on ON-OFF control has supply voltage of 230 V RMS, 50 Hz and load is 50 Ω. The controller is ON for 30 cycles and OFF for 40 cycles. Calculate:
   i) ON or OFF time interval
   ii) RMS output voltage
   iii) Input power factor
   iv) Average and RMS thyristor current **(06 Marks)**

c. Compare ON-OFF controller and phase controller. **(04 Marks)**

7 a. Give the classification of choppers. Explain briefly each one of them. **(10 Marks)**

b. Explain the working of boost regulator with waveforms. **(06 Marks)**

c. Explain the principle of operation of step up chopper. **(04 Marks)**

8 a. Explain the performance parameters of inverters. **(06 Marks)**

b. Explain the operations of single phase half bridge inverter. **(08 Marks)**

c. Explain the working of variable DC link inverter. **(06 Marks)**

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