

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Power Electronics

Time: 3 hrs.

Max. Marks:100

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

PART - A

- 1 a. Explain power converter with block diagram. (10 Marks)
- b. What are the applications of power electronics listout. Explain in detail SMPS (Switch Mode Power Supply). (10 Marks)
- 2 a. Describe Turn on and Turn off characteristics of I.G.B.T. (10 Marks)
- b. The Beta (β) of bipolar transistor varies from 15 to 65. The load resistance $R_L = 10 \Omega$. DC supply voltage $V_{CC} = 120 \text{ V}$. The input voltage to the base circuit is $V_{BB} = 8 \text{ V}$. If $V_{CE(sat)} = 1.5 \text{ V}$ and $V_{BE(sat)} = 1.75 \text{ V}$. Calculate (i) The value of R_B will result in saturation with an over drive factor of 10. (ii) The forced β and (iii) Power loss (P_T) in the transistor. [Ref. Fig. Q2 (b)]. (10 Marks)

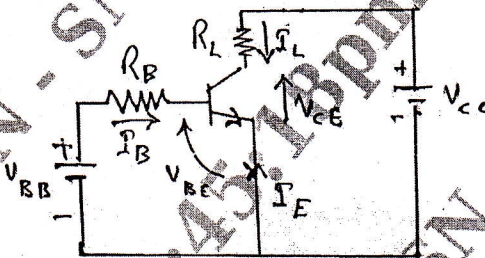


Fig. Q2 (b)

- 3 a. With neat sketch, explain two transistor model of an SCR and therefrom, obtain the condition for turn-on and turn-off of the device. (10 Marks)
- b. Explain the working principle of (i) R-firing circuit and (ii) R-C firing circuit. (10 Marks)
- 4 a. Define "Commutation". What are the methods of commutation? Explain complementary commutation. (10 Marks)
- b. In self commutation circuit shown in Fig. Q4 (b). $I_m = 12 \text{ A}$ and input voltage is $V = 120 \text{ V}$. The commutation time of the circuit is $60 \mu\text{s}$. The peak capacity current is twice the initial current, find the value of 'L' and 'C'. Assume that the capacitor is initially uncharged. (10 Marks)

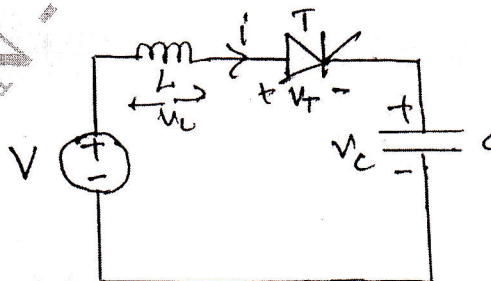


Fig. Q4 (b)

PART - B

- 5 a. Derive an expression for, (i) Average load voltage (ii) Average load current (iii) RMS load voltage for single phase half wave controlled converter with RL load. (10 Marks)
- b. 3 phase fully controlled converter charges a battery from a 3 phase supply of 230 V, 50 Hz. The battery EMF is 200 V and its internal resistance is 0.5 Ω . On account of inductance connected in series with the battery charging current is constant at 20 A. Calculate (i) Firing angle (ii) Supply power factor. (10 Marks)
- 6 a. Explain working principles of step-up chopper. What are the different control strategies employed in chopper. (10 Marks)
- b. A simple dc chopper is operating at a frequency of 2 kHz from a 96 V_{dc} source to supply a load resistance of 8 Ω load time constant is 6 ms. If the average load voltage is 57.6 V. Find T_{on} period of the chopper, the average load current. The magnitude of the ripple current and its RMS value. (10 Marks)
- 7 a. With necessary wave forms explain the working of a single phase bridge inverter. (10 Marks)
- b. With circuit diagram and wave form, explain working principle of single phase current source inverter. (10 Marks)
- 8 a. Explain with circuit diagram and wave form working of a single phase AC voltage controller with R-load. (10 Marks)
- b. A single phase full wave AC voltage controller operating from 230 V, 50 Hz AC supply controls. The power flow in a purely resistive load R that varies from 12 Ω to 23 Ω . If the maximum output power required is 2.3 kW. Determine the maximum values of RMS SCR current. (10 Marks)
