



USN

--	--	--	--	--	--	--	--	--	--

Seventh Semester B.E. Degree Examination, June/July 2023 Power Electronics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the different types of power electronics circuits with their input and output waveforms. Also mentions its application. (06 Marks)
- b. With transient modes of MOSFET, explain the switching characteristics. (06 Marks)
- c. Discuss the peripherals effects of power electronics converters. Also write the remedies. (04 Marks)

OR

- 2 a. Explain control characteristics of IGBT, SCR and MCT with help of waveforms and circuit diagram. (06 Marks)
- b. The bipolar transistor in Fig.Q.2(b) is specified to have β_F in the range of 8 to 40. The load resistance is $R_C = 11\Omega$ the dc supply voltage is $V_{CC} = 200V$ and input voltage to the base circuit is $V_B = 10V$. IF $V_{CE(sat)} = 1V$ and $V_{BE(sat)} = 1.5V$. Find: i) Value of R_B that result in saturation with an ODF of 5 ii) β_{forced} iii) Power loss in the transistor. (06 Marks)

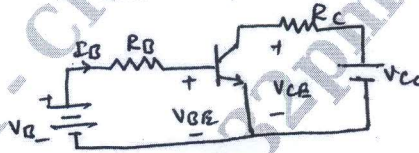


Fig.Q.2(b)

- c. Give the comparison between BJT and IGBT. (04 Marks)

Module-2

- 3 a. Draw the two transistor model of thyristor and derive an expression for anode current and explain why gate loses its control once SCR is turned ON. (06 Marks)
- b. Explain dynamic turn ON and turn OFF characteristics of SCR. (06 Marks)
- c. The latching current of a thyristor is 50mA. The duration of gate pulse is 50μsec. Will the thyristor get fired? Comment on the result. Refer Fig.3(c). (04 Marks)

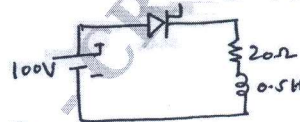


Fig.3(c)

OR

- 4 a. With neat circuit diagram and waveforms explain R_C Half wave SCR firing circuit. (06 Marks)
- b. Design the UJT triggering circuit of SCR. Given $V_{BB} = 20V$, $\eta = 0.6$, $I_P = 10\mu A$, $V_V = 2V$, $I_V = 10mA$. The frequency of oscillation is 100Hz. The triggering pulse width should be 50μS. Assume $C = 1\mu F$. (06 Marks)
- c. What is necessary condition for successful commutation of SCR. Compare between forced and natural commutation. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Explain the working of ON/OFF controller with help of waveform and derive expression for RMS output voltage. (06 Marks)
- b. A single phase half wave controlled rectifier is used to supply power of 10Ω load from 230V, 50Hz supply at firing angle 30° calculate:
- Average output voltage
 - Effective output voltage
 - Average load current. (06 Marks)
- c. What are advantages and drawbacks of circulating current mode at operation at a dual converter? (04 Marks)

OR

- 6 a. Explain the operation of 1ϕ full converter with neat circuit diagram and waveform for ripple free and continuous load current. Derive expression for average output voltage and RMS output voltage. (08 Marks)
- b. A single phase unidirectional AC voltage controller has a resistive load of $R = 10\Omega$ and input voltage is $V_s = 120V$, 60Hz. The delay angle of thyristor is $\alpha = \pi/2$. Determine:
- RMS value of output voltage
 - Input PF
 - Average input current. (08 Marks)

Module-4

- 7 a. Explain the principle of operation of step up chopper and derive output voltage expression. (06 Marks)
- b. Explain the working of buck regulator and derive the expression for average output voltage. (06 Marks)
- c. A step down DC chopper has a resistive load of $R = 15\Omega$ and input voltage of $V_{dc} = 200V$. When the chopper remain ON its voltage drop is 2.5V. The chopper frequency is 1kHz if the duty cycle is 50%. Determine:
- Average output voltage
 - RMS output voltage. (04 Marks)

OR

- 8 a. Briefly explain classification of chopper with circuit, waveform and quadrant diagram. (08 Marks)
- b. A boost regulator has an input voltage of $V_s = 5V$. The average output voltage $V_a = 15V$ and average load current $I_a = 0.5A$. The switching frequency is 25kHz. If $L = 150\mu H$ $C = 200\mu f$, determine: i) Duty cycle ii) Ripple current at inductor (ΔI) iii) The peak current of inductor iv) Ripple voltage of filter capacitor ΔV_c v) Critical values of L and C. (08 Marks)

CMRIT LIBRARY
BANGALORE - 560 037

Module-5

- 9 a. What do you mean by inverter? Explain the operation of single phase full bridge inverter with circuit and waveforms. Derive the rms output voltage. (08 Marks)
- b. Explain the working of DC link variable inverter. Also mention advantages and disadvantages. (08 Marks)

OR

- 10 a. Explain the working at transistorized current source inverter. (08 Marks)
- b. Give the comparison between voltage source inverter and current source inverter. (04 Marks)
- c. Write short note on solid-state relay. (04 Marks)

* * * * *