

CBCS SCHEME



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17EE53

Fifth Semester B.E. Degree Examination, Aug./Sept.2020 Power Electronics

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Discuss the Major Industrial applications of power electronic converter circuits. (04 Marks)
 - What is a free wheeling diode? Explain its working with circuit diagram, equivalent circuits and waveforms. (08 Marks)
 - With circuit diagram and waveforms explain single phase full wave rectifier with RL load. (08 Marks)

OR

- With the help of circuit diagram, input and output waveforms explain working of different types of power electronic converters. (08 Marks)
 - With circuit diagram and waveforms explain diode switched RL load with necessary equations. (08 Marks)
 - Discuss the peripheral effects of power electronics equipments. (04 Marks)

Module-2

- Explain the switching characteristics of MOSFET. (06 Marks)
 - For the transistor switch of Fig.Q.3(b) calculate forced beta β_{forced} of transistor. If the manufactures specified β is in the range 8 to 40 calculate the minimum overdrive factor and obtain the power loss P_T of the transistor. (08 Marks)

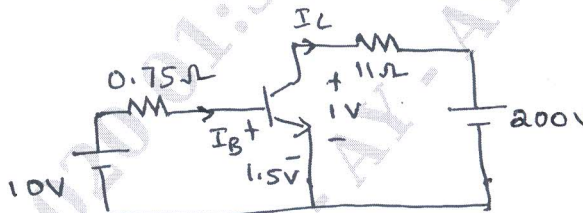


Fig.Q.3(b)

- With necessary waveforms explain output and transfer characteristics of IBGT. (06 Marks)

OR

- List and explain the switching limits of power BJT. (08 Marks)
 - With neat diagram explain different types of power MOSFETs. (06 Marks)
 - Discuss the needs and methods for providing isolation of gate/base circuit from power circuit with necessary circuit diagrams. (06 Marks)

Module-3

- Derive an expression for the anode current of thyristor with the help of two transistor analogy. (08 Marks)
 - Explain different methods of turning on of thyristor. (06 Marks)

- c. The SCR shown in Fig.Q.5(c), has a latching current of 20mA and is fired by the pulse of width 50μsec. Determine whether the SCR triggers or not and comment on the result. (06 Marks)

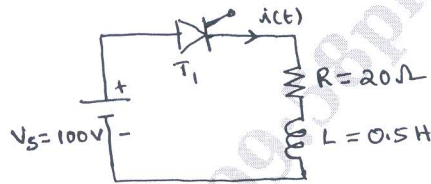


Fig.Q.5(c)

OR

- 6 a. Explain the V-I characteristics of SCR. Also define holding current and latching current. (06 Marks)
- b. With the circuit diagram and waveforms explain the working of UJT triggering technique of SCR. (07 Marks)
- c. Design the values of $\frac{di}{dt}$ inductor and RC snubber components for an SCR working in a 230V system. Given $\frac{di}{dt}$ rating is 90A/μsec and $\frac{dv}{dt}$ rating is 200V/μsec. Effective series resistance is 1.5Ω. Take damping factor as 0.6. (07 Marks)

Module-4

- 7 a. With the help of circuit diagram and waveforms explain the working of single full converter with R-L load. (10 Marks)
- b. With the circuit diagram and waveforms explain the operation of three phase dual converter. (10 Marks)

OR

- 8 a. Explain the working of single phase full wave AC voltage controller with resistive load. Draw relevant circuit diagram and waveforms. Derive an expression for rms output voltage. (10 Marks)
- b. A single phase full wave ac voltage controller has a resistive load of $R = 10\Omega$ and the input voltage is $V_s = 120V$ (rms), 60Hz. The delay angle of the thyristors are equal $\alpha_1 = \alpha_2 = \alpha = \pi/2$. Determine: i) The rms output voltage, V_0 ii) The input power factor and average and rms thyristor currents. (10 Marks)

Module-5

- 9 a. Classify the different types of choppers with circuit and quadrant diagrams, Explain the operation of four quadrant chopper. (10 Marks)
- b. A step down chopper has a resistive load of $R = 10\Omega$ and the input voltage is $V_s = 220V$. When the converter switch remains on, its voltage drop is $V_{ch} = 2V$ and the chopping frequency is $f = 1kHz$. If the duty cycle is 50%, determine:
- The average output voltage
 - The rms output voltage
 - The converter efficiency
 - The effective input resistance of the converter and
 - The rms value of the fundamental component of output harmonic voltage. (10 Marks)

OR

- 10 a. Explain the voltage control of single phase inverter using i) Single pulse width modulation ii) Multiple pulse width modulation. (07 Marks)
- b. Compare voltage source inverter and current source inverter. (06 Marks)
- c. With circuit diagram explain the operation of a single phase full bridge inverter supplying a resistive load. (07 Marks)

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