



Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025

Power Electronics

15EC73

Max. Marks: 80

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

Module-1

- 1 a. Give symbol, characteristic features of the following devices :
i) GTO ii) TRIAC iii) MOSFET. (06 Marks)
- b. Explain different types of power electronic circuits with their input and output waveforms. (06 Marks)
- c. Explain peripheral effects of power converter system. (04 Marks)

OR

- 2 a. Compare power MOSFET and bipolar junction transistor. (04 Marks)
- b. Draw the switching model of MOSFET and explain its switching characteristics with neat figure. (06 Marks)
- c. Explain output and transfer characteristics of IGBT. (06 Marks)

Module-2

- 3 a. The SCR shown in Fig.Q3(a) has latching current of 40mA and is triggered by the pulse width of 50 μ sec. Determine whether the SCR turn ON or not.

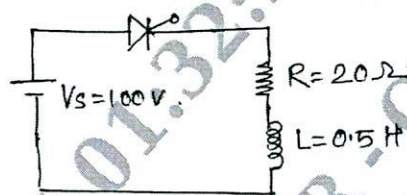


Fig.Q3(a)

- b. With the two transistor analogy of thyristor obtain the equation for anode current. (06 Marks)
- c. Explain the operation of a full wave RC triggering circuit with waveforms. (06 Marks)

OR

- 4 a. Explain class B LC communication with necessary circuit diagram, waveforms and equations. (08 Marks)
- b. A UJT is used to trigger the thyristor whose minimum gate triggering voltage is 6.2V. The UJT ratings are : $\eta = 0.66$, $I_p = 0.5\text{mA}$, $I_v = 3\text{mA}$, $R_{B_1} + R_{B_2} = 5\text{k}\Omega$, leakage current = 3.2mA, $V_p = 14\text{V}$ and $V_v = 1\text{V}$. Oscillator frequency is 2KHz and capacitor $c = 0.04 \mu\text{F}$. Design the complete circuits. (08 Marks)

Module-3

- 5 a. With a circuit diagram and waveforms, explain the working of a single phase full converter with a highly inductive load. Derive an expression for the average output voltage and rms output voltage. (08 Marks)
- b. With a neat diagram and waveforms, explain the principle of single phase dual converter. (06 Marks)
- c. Explain the role played by the free-wheeling diode in converters with R-L load. (02 Marks)

OR

- 6 a. Explain the principle of ON - OFF control, with the help of waveforms and derive an expression for rms output voltage. (06 Marks)
- b. An AC voltage controller has a resistive load of $R = 10$ and the rms input voltage is 120V, 60Hz. The thyristor switch is ON for $n = 25$ cycles and is OFF for $m = 75$ cycles. Determine
i) rms output voltage ii) the input power factor iii) the average and rms current of thyristor. (04 Marks)
- c. Explain the operation of a single phase bidirectional controller with resistive load. Derive an expression for rms output voltage. (06 Marks)

Module-4

- 7 a. Explain the working of step-down choppers with necessary circuit diagram and waveforms. Derive the equation for $V_{O(av)}$ and V_{ORMS} . (06 Marks)
- b. Give the classification of chopper. Explain briefly each one of them. (10 Marks)

OR

- 8 a. With the help of circuit diagram and waveforms, explain the operation of step-up chopper. (06 Marks)
- b. With a neat circuit diagram and wave forms explain the working principle of Buck regulator. Derive the expression for peak to peak ripple voltage of the capacitor, present across the load. (10 Marks)

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Module-5

- 9 a. Explain the operation of single phase half bridge inverter with R - load. Derive the expression for rms output voltage. (08 Marks)
- b. Explain the performance parameters of inverters. (08 Marks)

OR

- 10 a. Explain the working of variable dc - link inverter. (08 Marks)
- b. With a circuit diagram and waveforms, explain the working of a single phase full wave switch. Also derive an expression for average current and rms current of each thyristor. (08 Marks)
