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Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
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. Define power electronics? Mention any six applications and advantages of power electronic controllers. (08 Marks)
- b. Explain I-V Characteristics and switching characteristics of a power diode? (08 Marks)

OR

- 2 a. Explain with neat circuit and waveforms, operation of single phase full wave diode rectifier with R-L load? (08 Marks)
- b. Explain the following with respect to power electronic systems. (08 Marks)
 - (i) Peripheral effects of static power converter system.
 - (ii) Freewheeling diodes.
 - (iii) Reverse recovery characteristics of power diodes.

Module-2

- 3 a. For the transistor switch in Fig.Q3(a), calculate
 - (i) Forced beta, β_f of transistor.
 - (ii) If the manufacturer specified β in the range 8 to 40, calculate the minimum Overdrive Factor (ODF).
 - (iii) Obtain the power loss ' P_T ' of the transistor.

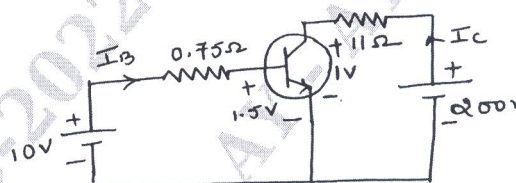


Fig.Q3(a)

- b. Explain various methods of base drive control in BJT. (08 Marks)

OR

- 4 a. What is an IGBT? Explain its switching characteristics? What are its advantages over BJT and MOSFET? (08 Marks)
- b. Explain the needs and methods for providing isolation of gate/base circuits form power circuits in power electronic system with necessary diagrams. (08 Marks)

Module-3

- 5 a. Explain two-transistor model of the thyristor. (08 Marks)

- b. Define holding current and latching current of a thyristor? The thyristor is gated with a pulse width of 40 μ sec. The latching current of thyristor is 36 mA (36×10^{-3} A). For a load of 60 Ω and 2H, will the thyristor gets turned ON? If not, how it can be overcome for the given load? Find its value? Refer to Fig.Q5(b). (08 Marks)

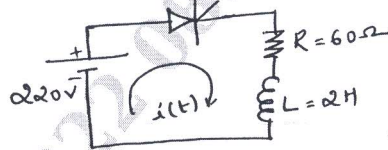


Fig.Q5(b)

OR

- 6 a. Explain R-firing and RC full wave firing circuits for a thyristor? (08 Marks)
 b. A UJT is used to trigger the thyristor whose minimum gate triggering voltage is 6.2V. The UJT rating are:
 $\eta = 0.66$, $I_p = 0.5$ mA (0.5×10^{-3} A), $I_v = 3$ mA (3×10^{-3} A), $R_{B1} + R_{B2} = 5$ k Ω , leakage current = 3.2 mA (3.2×10^{-3} A). $V_p = 14$ V, $V_v = 1$ V. Oscillator frequency is 2 kHz and capacitor $C = 0.04$ μ F. Design the complete circuit (Assume $V_D = 0.8$ volts) (08 Marks)

Module-4

- 7 a. Explain the operation of single phase full wave controlled rectifier drawing the waveforms across – supply voltage output voltage and current, across SCR's T_1 and T_2 and supply current for a R-L load in continuous load current operation? Derive the expressions for average output voltage and RMS output voltage for the same circuit? (08 Marks)
 b. Explain the operation of single phase dual converter? Mention the advantages and disadvantages of circulating current mode of operation. (08 Marks)

OR

- 8 a. A single phase full wave ac voltage controller supplies a resistive load of $R = 10\Omega$, from an input voltage $V_s = 200$ V, 60 hz. The delay angles of the thyristors are equal, $\alpha_1 = \alpha_2 = \pi/2$. Determine (i) The RMS output voltage
 (ii) The Input power factor.
 (iii) Average current of thyristors
 (iv) RMS current of thyristors. (08 Marks)
 b. Explain the operation of single phase AC voltage controller with inductive load? Derive the expression for RMS output voltage for discontinuous load current. (08 Marks)

Module-5

- 9 a. Explain the continuous and discontinuous load current mode of operations of a step down chopper with R-L load? (08 Marks)
 b. Explain class 'C' and class 'D' chopper classifications with quadrant operations. (08 Marks)

OR

- 10 a. Explain the operation of single phase transistorized current source inverter? Mention any four comparison between voltage source inverter and current source inverter. (08 Marks)
 b. Explain the operation of single phase full bridge inverter for a resistive load? Derive the expression for the RMS value of square wave output voltage. (08 Marks)
