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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**MAKEUP EXAMINATION JULY-2024**

**Semester**: VI

**Course Code**: ECE 3016

**Course Name**: Electronic Controlled Converter

**Program:** B. Tech.

**Date**: 10-07-2024

**Time**: 1.30 PM – 4.30 PM

**Max Marks**: 100

**Weightage**: 50%

**Instructions:**

1. *Read the question properly and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. Scientific and Non-programmable calculators are permitted.

**Part A**

**Answer any Five Questions. [Memory Recall Questions] (5Qx2M=10)**

**Q.NO.1.** When converting AC power to controlled DC power, the full-wave controlled rectifier circuit is utilized to increase efficiency to a level comparable to that of a half-wave controlled rectifier. Is it possible to have a controlled output in the full-wave controlled rectifier circuit by connecting a sufficiently big capacitor across the resistive load?

[2M] (C.O.NO. 2) [Bloom’s level-L1]

**Q.NO.2.** By adjusting the duty cycle (K) between 0 and 1, the Buck converter or step-down chopper circuit converts a fixed DC voltage to a variable DC voltage. Could you recommend a good way to calculate the effective input resistance of the chopper in terms of K while taking into account the practical (voltage across the switch at ON is Vch) chopper? [2M] (C.O.NO. 3) [Bloom’s level-L1]

**Q.NO.3.** Let's look at an example where a step-up chopper circuit or Boost converter with an input voltage of Vs is linked across the output of a DC motor with a back emf of Eb. Name the prerequisite that must be met in order for Boost to function.

[2M] (C.O.NO. 3) [Bloom’s level-L1]

**Q.NO.4.** An example of a power electronic converter is an inverter, which changes fixed DC power into variable AC power. Why are GTO devices not favored over MOSFETs or IGBTs in the circuit of a complete bridge voltage source inverter?

[2M] (C.O.NO. 4) [Bloom’s level-L2]

**Q.NO.5.** If the output voltage across the output of the full-bridge inverter is square wave, it is operated in square wave mode. What is the rms value of the basic component accessible at the inverter's output if the battery voltage is 24 volts?

[2M] (C.O.NO. 4) [Bloom’s level-L2]

**Q.NO.6.** Using a single triac device or two SCRs coupled back to back, the single phase bidirectional AC voltage controller can regulate power flow in both the positive and negative half cycles. Could you recommend the bare minimum of SCRs and diodes required to operate the bidirectional AC power flow control system?

[2M] (C.O.NO. 5) [Bloom’s level-L3]

**Q.NO.7.** The lack of a common cathode is a disadvantage of a single phase bidirectional AC voltage controller with two SCRs linked in an anti-parallel topology. How can a common cathode be achieved without the need of a triac device?

[2M] (C.O.NO. 5) [Bloom’s level-L3]

**Part B**

**Answer any Two Questions. [Thought Provoking Questions] (2Qx15M=30)**

**Q.NO.8.** You can rotate a DC motor in four different modes with a class-E chopper: forward (first quadrant), forward regenerative breaking (second quadrant), reverse (third quadrant), and reverse regenerative breaking (fourth quadrant). This is based on theoretical knowledge. Could you describe the process by which the class-E chopper can be utilized to achieve the functionality of the class-C chopper (a bidirectional DC/DC converter) with the required equivalent circuit and related waveforms? [15M] (C.O.NO. 3) [Bloom’s level-L2]

**Q.NO.9.** Complementary switching pulses are required to turn on Q3 and Q4 switches, and switching pulses with a 50% duty cycle are required to run a single phase full bridge inverter in square wave mode. The basic component's rms value is highest and it contains all of the hormones if you get a square wave at the inverter's output. To improve the inverter's harmonic profile, design a suitable system for producing single pulse width modulated switching pulses that will switch the inverter while removing some harmonics. For multiple pulse width modulation, can you write an equation for the rms output voltage?

[15M] (C.O.NO. 4) [Bloom’s level-L2]

**Q.NO.10.** To manage power in both directions, the single phase bidirectional AC voltage controller circuit consists of two SCRs linked in an anti-parallel topology. Draw the input, output, and current waveforms for a resistive load while taking into account an appropriate firing angle if you were to replace any one SCR with a diode. [15M] (C.O.NO. 5) [Bloom’s level-L2]

**Part C**

**Answer any Three Questions. [Problem Solving Questions] (3Qx20M=60)**

**Q.NO.11.** If the average output voltage is 25% of the highest feasible average output voltage, find the firing angle (a), average output current (b), and average output voltage (c) of a single phase half wave regulated rectifier that is powered by a 120V, 60 Hz supply with a resistive load of R = 10 ohm. Average output voltage (e) rms output voltage (d) rms output current

[20M] (C.O.NO. 2) [Bloom’s level-L3]

**Q.NO.18.** The input voltage and output voltage of a step-up chopper are 100V and 120V, respectively. if the chopper's non-conducting time is 100μs. Determine the pulse width. If the pulse width is split into two equal segments in order to operate at a constant frequency. Determine the output voltage that has changed.

[20M] (C.O.NO. 3) [Bloom’s level-L3]

**Q.NO.19.** The input voltage of the single phase full wave AC voltage controller is Vs = 120V, 50 Hz, and it has a resistive load of R = 3 ohm. Determine the following: (a) rms output voltage (b) input power factor (c) average current of T1 thyristor (d) rms current of T1 thyristor. The delay angles of the thyristors T1 and T2 are equal to alpha1 = alpha 2 = alpha = pi/3. [20M] (C.O.NO. 4) [Bloom’s level-L3]

**Q.NO.20.** Determine (a) the rms output voltage (b) the rms value of the fundamental component (c) output power (d) the average current of each device (e) the peak device current (f) and the reverse blocking voltage of each device for a single phase full bridge inverter with a resistive load of R = 2.5 ohm and dc input voltage Vs = 24V.

[20M] (C.O.NO. 5) [Bloom’s level-L3]