Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET A

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2024

Semester : Semester V - 2021
Course Code : ECE3016
Course Name : Electronic Controlled Converters
Program : B.Tech.

Date : 10-JAN-2024
Time : 9:30AM - 12:30 PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **5 X 2M = 10M**

1. The source and load will both experience harmonic injection if a power electronic converter is utilized to convert energy from one form to another. Filters on both the input and output sides are one potential way to get rid of these harmonics. Nevertheless, the converter's weight, delay, and cost all go up when these filters are included. Could you offer a different approach to get rid of these harmonics without making the converter heavier, more expensive, or require more time to complete?

(CO1) [Knowledge]

2. In full-wave controlled rectifier with resistive load, the average output voltage is given by the equation $V_{oav} = \frac{V_m}{\pi}(1 + \cos\alpha)$ what is the average output voltage equation if you replace all the SCRs by power diodes?

(CO2) [Knowledge]

3. The Buck converter or step-down chopper circuit converts a fixed DC voltage to a variable DC voltage, by adjusting the duty cycle (K) between 0 and 1. Could you recommend a good way to calculate the chopper's effective input resistance in terms of K while taking into account the practical (voltage across the switch when it is ON is Vch) chopper?

(CO3) [Knowledge]

4. An inverter is a kind of power electronic converter that changes constant DC power into variable AC power. Can you mention the function of the diode connected across each IGBT in the full bridge voltage source inverter circuit

(CO4) [Knowledge]

5. Using a single triac device or two SCRs connecting 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 minimum number of SCRs and diodes required to operate the bidirectional AC power flow controller?

(CO5) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **5 X 10M = 50M**

6. In the circuit of Fully controlled AC to DC converter, what if you replace any one SCR by a diode? Draw the circuit diagram and output voltage waveform in synchronization with input voltage and gate pulse. Derive the equation for average output voltage?

(CO2) [Comprehension]

7. According to theory, a Class-A chopper can be operated in first quadrant for rotating a dc motor in forward direction and a Class-B chopper can be operated in the second quadrant for rotating a dc motor in forward regenerative breaking. Could you describe how the Class-C chopper can be utilised to achieve Bidirectional DC/DC converter with the circuit diagram and related waveforms?

(CO3) [Comprehension]

8. The step-down chopper has an input voltage of Vs = 24V, a resistive load of R = 10 ohm, a voltage drop of Vch = 1.5V when the chopper is turned on, and a chopping frequency of f = 1kHz. Should the duty cycle be 60% Find the following: (a) effective input resistance; (b) rms output voltage; (c) chopper efficiency; and (d) average output voltage.

(CO3) [Comprehension]

9. In order to run a single phase full bridge inverter in square wave mode, 50% duty cycle switching pulses are required to activate the diagonal switches (Q1 and Q2), and complementary switching pulses are required to activate the Q3 and Q4 switches. The fundamental component of rms value is highest when the inverter output produces a square wave, but it contains all of the harmonics. Create a suitable plan for producing multiple pulse width modulated switching pulses to turn on the inverter. This will allow you to remove some harmonics and enhance the inverter's harmonic profile. Write an expression for the multiple pulse width modulation's rms output voltage.

(CO4) [Comprehension]

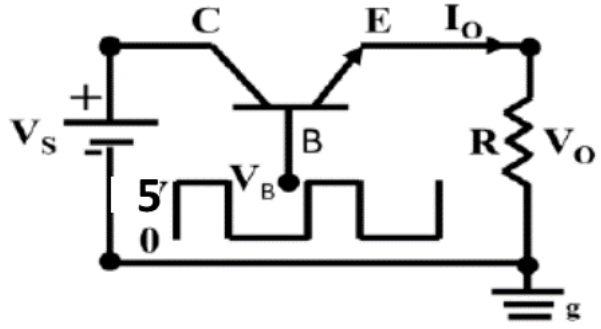
10. To manage power in both directions, the single phase bidirectional AC voltage controller circuit consists of two SCRs linked in an anti-parallel topology. Sketch the input, output, and current waveforms for a resistive load while taking into account an appropriate firing angle if you were to replace any one SCR with a diode?

(CO5) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **2 X 20M = 40M**

11. For the transistor based chopper circuit shown in figure a dc supply of 12V is applied and the transistor is switched by applying periodic base pulses of voltage varying between 0 to 5V. The chopper frequency is 100Hz, duty cycle is 30% and load resistance of 5Ω. Sketch the load voltage with reference to the input base pulses and calculate (i) Average output voltage (ii) Average load current



(CO3,CO2) [Application]

12. For a single phase full bridge inverter with a resistive load of R = 8 ohm and dc input voltage Vs = 36V. 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.

(CO4,CO5) [Application]