Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023

Semester : Semester VI - 2020
Course Code : ECE3016
Course Name : Sem VI - ECE3016 - Electronic Controlled Converters
Program : ECE

Date : 16-JUN-2023
Time : 9.30AM - 12.30PM
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 2 = 10M)**

1. Let us assume that Power Electronic Converter during the process of converting one form of energy into other form injects third harmonics into the source as well as load. One of the possible solution to eliminate third harmonics is the use of filters at input side as well as at the output side. But the addition of these filters increases the cost, delay and weight of the converter. Can you suggest alternate solution to eliminate these third harmonics without increasing the cost, delay and weight of the Converter?

(CO1) [Knowledge]

2. Let us consider a case where DC motor that has a back emf of Eb is connected across the output of a Boost converter or step-up chopper circuit that has an input voltage of Vs. Mention the condition that needs to be satisfied to achieve Boost Operation?

(CO3) [Knowledge]

3. The single phase bidirectional AC voltage controller is used to control power flow both in positive half cycle and in negative half cycle by using two Silicon Controlled Rectifiers(SCRs) connected back to back or by using single triac device. Can you suggest minimum number of SCRs and diodes needed to achieve bidirectional AC power flow control operation?

(CO5) [Knowledge]

4. The Full-Wave Controlled Rectifier circuit is used to improve the efficiency on par with half-wave controlled rectifier during the process of converting AC power to controlled DC power. Is it possible to obtain controlled output, if you connect a capacitor of sufficiently large value across the resistive load in the circuit of full-wave controlled rectifier?

(CO2) [Knowledge]

5. If the Full-Bridge Inverter is operated in square wave mode to obtain square wave output voltage across the output. If the battery voltage of the inverter is 24V, then what is the rms value of the fundamental component available at the output of the inverter?

(CO4) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **(2 X 15 = 30M)**

6. In single phase fully controlled rectifier, the firing angles for both the thyristor pairs are assumed to be equal. A large value of L will result in a continuous steady current in the load. A small value of inductor L will produce a discontinuous load current. To operate the above converter in rectification mode and in inversion mode the firing angle should be between 0 to less than 90 degrees (for rectification mode) and greater than 90 degrees to 180 degrees (for inversion mode). Assuming suitable firing angle sketch output voltage and output current waveforms for rectification mode and for inversion mode.

(CO3) [Comprehension]

7. To operate single phase full bridge inverter in square wave mode the switching pulses to turn-on diagonal switches (Q1 and Q2) should be with 50% duty cycle and complementary switching pulses are essential to turn-on Q3 and Q4 switches. If you obtain square wave at the output of inverter, the rms value of the fundamental component is highest but it has all the hormonics. Sketch the appropriate scheme to generate single pulse width modulated switching pulses to switch the inverter, so that certain harmonics could be eliminated to improve the harmonic profile of the inverter. Write your comments on rms output voltage for single Pulse Width Modulation, multiple Pulse Width Modulation and sinusoidal Pulse Width Modulation?

(CO4) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(3 X 20 = 60M)**

8. A single phase full bridge inverter has a resistive load of R = 2.4 ohm, and dc input voltage Vs = 48V, determine (a) RMS output voltage (b) RMS value of the fundamental component (c) Output power (d) Average current of each device (e) Peak device current (f) Reverse blocking voltage of each device.

(CO5) [Application]

9. A single phase full wave controlled rectifier is operated from 220V, 50 Hz supply and the resistive load is R = 20 Ω, If the firing angle is 25 degrees, calculate the (a) Average output voltage (b) RMS output voltage (c) Normalized output voltage (d) Efficiency (e) Form factor (f) Ripple factor.

(CO3) [Application]

10. The step-down chopper has a resistive load of R = 10 ohm and the input voltage Vs = 220V, when the chopper is ON its voltage drop is Vch = 2V, and the chopping frequency is f = 1kHz. If the duty cycle is 50% determine (a) average Output voltage (b) RMS output voltage (c) Chopper efficiency (d) Effective input resistance.

(CO4) [Application]