EE/SG/20042023/ENDEXAM

Name:.....
Roll No:.....

DEPARTMENT OF ELECTRCAL ENGINEERING
National Institute of Technology Calicut

WINTER SEMESTER APRIL 2023

EE6302D ADVANCED POWER ELECTRONIC CIRCUITS

Time: Three Hours

Total Marks: 50

*Answer **all** questions*

I. For a series inverter, $V=300V$, $R = 3\Omega$, $L=40\ \mu H$, $C= 5\ \mu F$ and the output frequency $f_0 = 8kHz$. Determine

a). the minimum time provided for turn off of devices.

b). peak values of thyristor voltage and current

c). Plot the waveforms for load voltage, source current and capacitor voltage.

What change in design is required when there is chance for the variation of load resistance between $2\ \Omega$ and $4\ \Omega$. What are the limitations associated with this inverter. Draw the modified configuration to rectify them. (12marks)

II What are the problems associated with switching converters? Explain the causes behind these issues and schemes used to solve them.

Consider an ZCS buck converter with the following parameters.
$V_{in} = 25V$, $I_0 = 1A$, $L = 3\ \mu H$ *and* $C= 0.02\mu F$. Describe and sketch the following parameters.

(a) Current through the switch
(b) Capacitor voltage
(c) Voltage across and current through the filter inductance

Obtain the peak current rating of the switch. (10marks)

III A 3 phase motor load requires input currents of $i_a=15\ sin\ (100\pi t)$, $i_b=15\ sin\ (100\pi t-2\pi/3)$ and $i_c=15\ sin\ (100\pi t+2\pi/3)$ from a $20A$ current source. Draw the circuit diagram and indicate all possible states of the inverter. Draw the vector diagram and show the reference phasor at 2ms. Calculate the dwell times. Derive the expressions used. What are the necessary conditions to be satisfied for the PWM control of current source inverters? (10marks)

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$L = \frac{R}{8f_s}$

IV. A single phase induction motor is connected to utility lines through a half bridge inverter circuits. Explain how regenerative mode of operation can be achieved. (7marks)

V. Give all possible switching combinations to realize a single phase 5level flying capacitor type inverter. If R-L load is used, sketch load voltage and current waveforms and indicate the devices conducting in each interval. (6marks)

V. What is power factor? What are the causes of poor power factor and its effects due to power electronic circuits?
Obtain the pf when the current and voltage waveforms associated with a circuit are as given below. (5marks)