INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EEE2112: Introduction to Power Electronics & Drives**
Date of Examination	:	5 December 2021 (Sunday)
Time	:	2.00pm – 5.00pm Reading Time : Nil
Duration	:	3 Hours

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Nil

Examiner(s)	:	**Alan Wong Kam Mun**
Chief Moderator	:	Richard Lai

*This paper consists of **4** printed pages, including the cover page*

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)

EEE2112: INTRODUCTION TO POWER ELECTRONICS AND DRIVERS
FINAL ALTERNATIVE ASSESSMENT: AUGUST 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.
Important notice: Computer software are NOT allowed in this exam except software to access the Question Paper and to submit the Answer Script. Answers are expected to be hand-written and required graph are to be manually plotted. Copy/paste and computer plotted graph will get zero marks.

Question 1

a. A single-phase 110 V, 500 W load is connected to single-phase 110 V, 50 Hz supply through a SCR as shown in Figure Q1(a). Find the RMS power delivered to the load for a SCR firing angle delays of 45^{o}. [15]

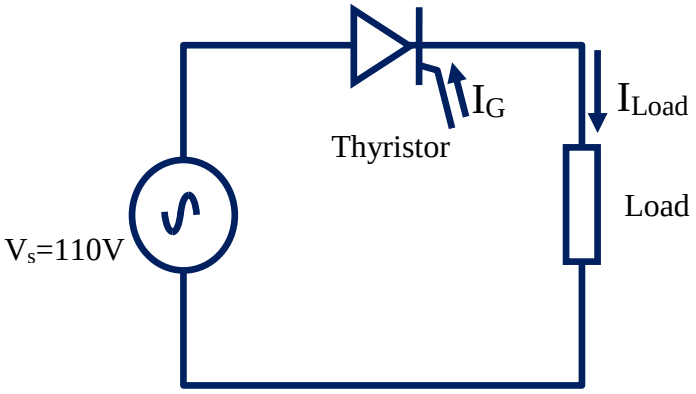

Figure Q1(a)

b. A single-phase bridge controlled rectifier as shown in Figure Q1(b), fed with single phase 230 V 50 Hz ac supply is used to control the dc supply. Assume the load consists of resistance R_L= 10 Ω and L is very large (infinite).

(i) Find the average output voltage given that the firing angle of the SCR is 30° and 210°.

[6]

(ii) Sketch the load voltage if freewheeling diode connected across the load.

[4]

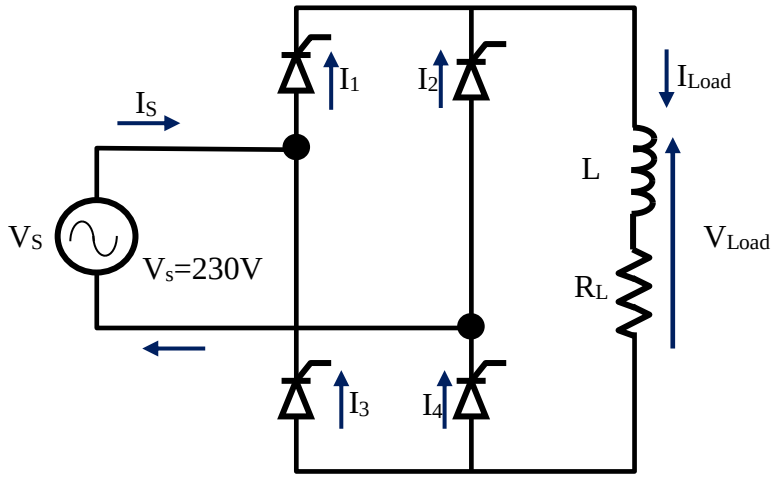

Figure Q1(b)

Question 2

A dc step-down converter connect to 48 V battery produces an output voltage of 18 V across a 10 Ω resistive load with output voltage ripple less than 0.5 percent. Assume ideal components characteristic with the inductance 25% larger than the minimum value and switching frequency is 40 kHz, find:

(i) The duty ratio. [2]

(ii) The value of the inductor. [4]

(iii) The value of the capacitor. [4]

(iv) The peak current and peak voltage at the inductor and capacitor respectively. [5]

(v) The rms current rating for the inductor. [3]

(vi) The voltage and current rating of the capacitor and inductor respectively. Assume 100% safely margin. [4]

(vii) The voltage and current rating of the switching device. Assume 100% safely margin. [3]

Question 3

A single phase full-bridge inverter has a resistive load of R= 3 Ω and the DC input voltage Vdc= 24 V. The switching elements used are power MOSFET. Find :

a) The total harmonic distortion THD. [3]

b) The distortion factor DF. [8]

c) The harmonic factor and distortion factor of the 3rd harmonic only. [5]

d) The real output power at the resistive load. [2]

e) The peak current at the load. [2]

f) The average current at each switching element. [2]

g) The switching frequency for each switching element is 100 Hz, what is the frequency of the square wave generated. [1]

h) The new output power at the resistive load when an ideal 100 Hz low pass filter is connected to the inverter output. [2]

Question 4

A single phase full-wave AC chopper is shown in Figure Q4 below has a resistive load R = 10 Ω and the input voltage is Vs = 120 Vrms, 50 Hz. The firing angles of thyristor T1 and T2 are equal: $\alpha 1 = \alpha 2 = 90°$.

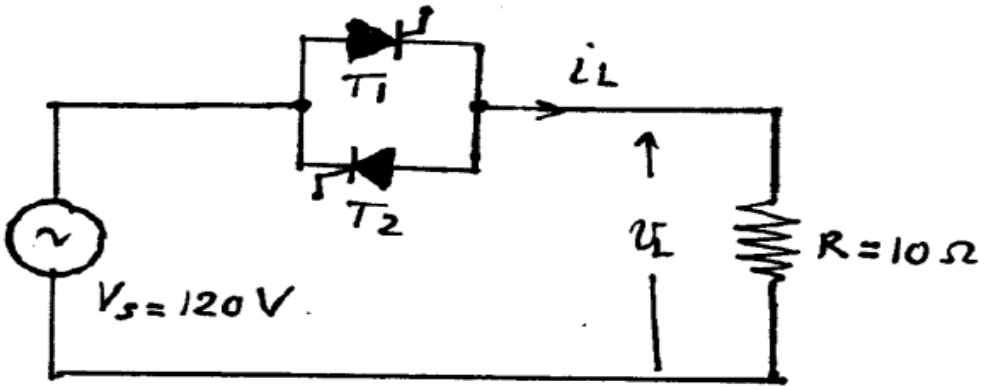

Figure Q4

a) (i) Sketch (draw and label) the output waveform at V_L. [5]

(ii) Find the rms output voltage $V_{Lrms.}$ [4]

b) Find the input power factor. [8]

c) Find the average and rms values of the thyristor current. [8]

~THE END~