INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2022**
Programme	:	Diploma In Electrical and Electronics Engineering (DEEI)
Course	:	**EEE2112:** Introduction to Power Electronics and Drivers
Date of Examination	:	6 August 2022(Saturday)
Time	:	12:00noon – 3:00pm Reading Time : Nil
Duration	:	3 Hours

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Material permitted : Programmable Scientific Calculator

Materials provided : Nil

Examiner(s) : Khadijah Kamarulazizi

Chief Moderator : Richard Lai

*This paper consists of **6** printed pages, including the cover page*

INTI INTERNATIONAL COLLEGE PENANG
DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (DEEI)
EEE2112: INTRODUCTION TO POWER ELECTRONICS AND DRIVERS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2022 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°. [15]

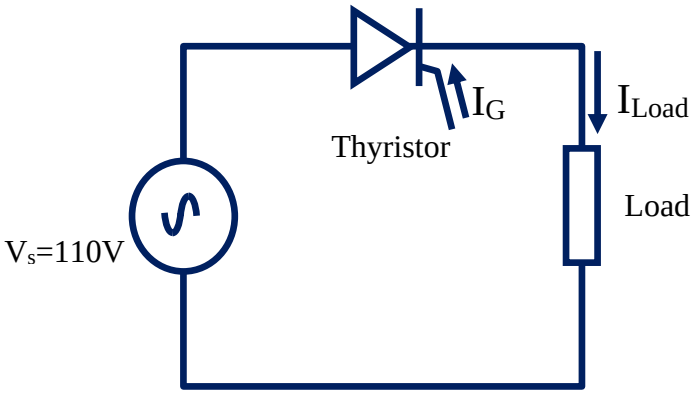

Figure Q1(a)

(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 and current 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]

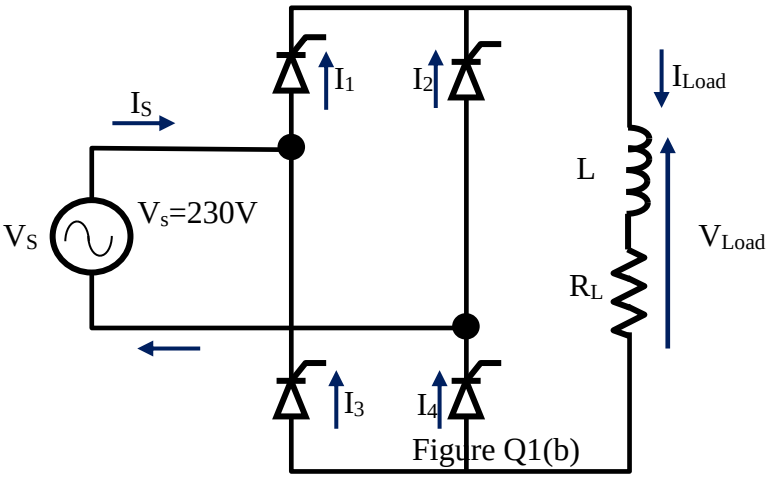

Figure Q1(b)

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 of 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:

(i) The total harmonic distortion THD. [3]

(ii) The distortion factor DF up to 7^{th} harmonics. [8]

(iii) The harmonic factor and distortion factor of the 3^{rd} harmonic only. [5]

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

(v) The peak current at the load. [2]

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

(vii) The switching frequency for each switching element is 100 Hz, find the frequency of the square wave generated by inverter if each MOSFET switch at 100hz [1]

(viii) 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: $\alpha 1 = \alpha 2 = 90°$.

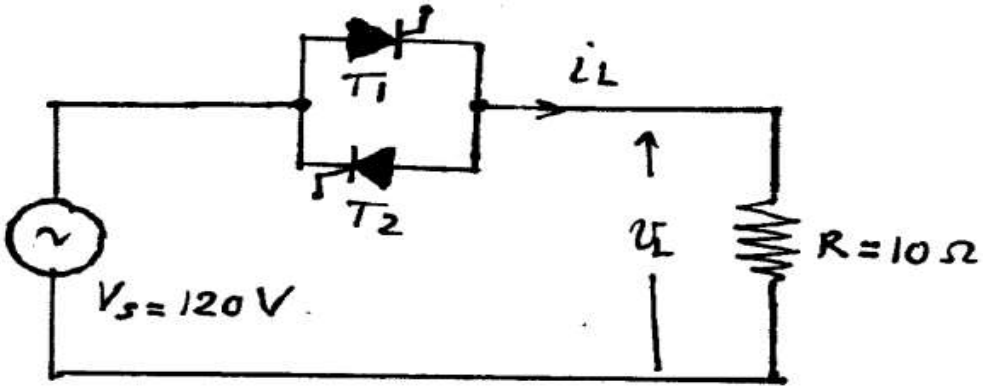

Figure Q4

(a) (i) Sketch (draw and label) the output waveform at V_L and derive the $V_{Lr.m.s.}$ [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—

E2112(F) /April2022 Alan Wong