

**Complete, fold and seal
(see note 2 below)**

SURNAME: Ibrahim

FORENAME(S): Mohammed

Zereshan

Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

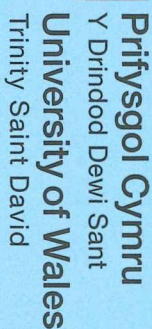
A

B

List the numbers of the questions you have attempted	Office Use
1 A	27
4	
5 B2	30
6	
7 B3	25
8	
9	
2	
3	
Total	82%

1	Student Number	2224559
2	Title of Examination Paper	Electronics 2
3	Module Code	SEEE 5000
4	Date and Time of Examination	7/5/24
5	Examination Venue	Corey Scr Gart Grading
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholiwr nall ai amwybyddu sgrïpt annarlennadwy, neu drefnu lidd gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Declirwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwngo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllwr/gwylwyr.
8. Rhaid dyrchwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

**Llenwch, plygwch a seilwch
(gweler nodyn 2 isod)**

CYFENW:

ENW(AU) CYNTAF: _____

1	Rhif Myfyrwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

[illegible]

(See the other side for English version)

1.

$$a) 20 \log(2205) = 46.85 \text{ dB} \quad \checkmark \quad 2$$

$$b) 20 \log(2000) = 66.02 \text{ dB}$$

$$\frac{20 \log(25005)}{10} = 67.96 \text{ dB} \quad 1$$

2.

x

3.

x

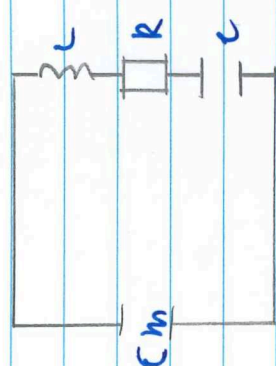
4.

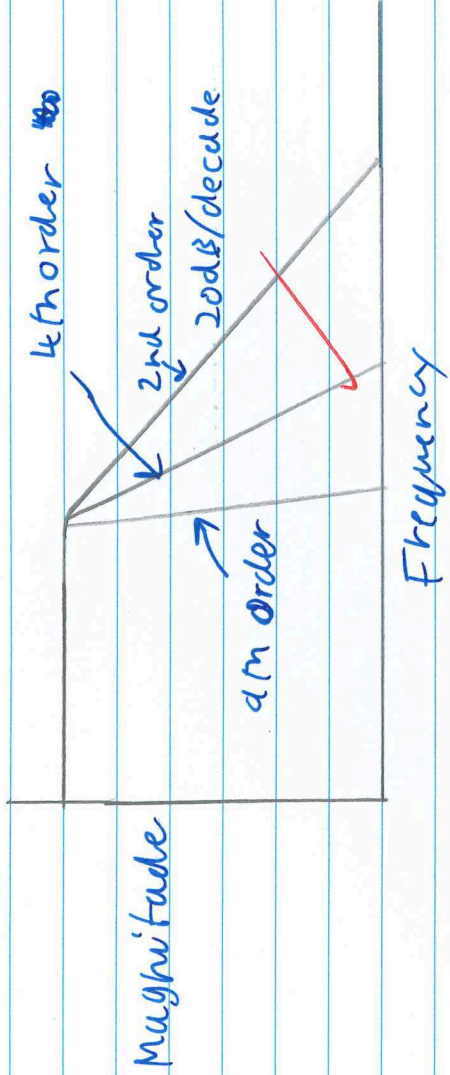
A Colpitts oscillator uses 2 capacitors with an inductor tapped between them, which is known as the tank circuit and is given by:

$$f = \frac{1}{2\pi \sqrt{LC_T}} \quad \checkmark$$

When the circuit is turned on, the capacitors are charged. They then discharge through the inductor, thus creating oscillations.

NEED TO MENTION POSITIVE
FEEDBACK + LOOP GAIN

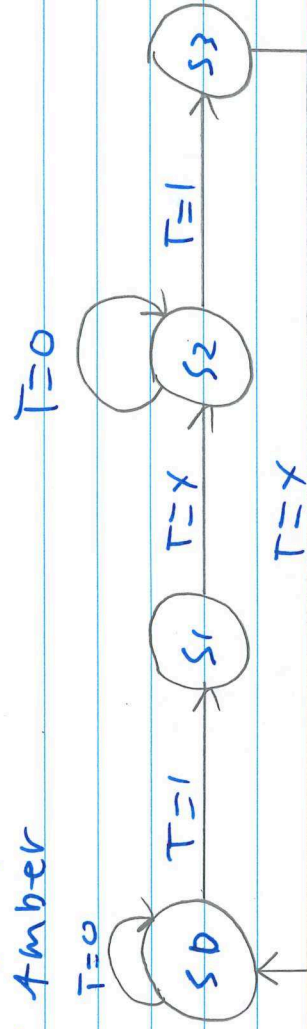
Question No.		Examiner Only	Question No.		Examiner Only
5.	A quartz crystal undergoes electromechanical resonance and is equivalent to the circuit below: 		7.	$Q = \frac{f_0}{BW}$ $Q = \frac{10 \times 10^6}{75 \times 10^3}$ $Q = 133.33$ ✓	3
	When the crystal isn't vibrating, it is equivalent to C_m , also known as mounting capacitance. When the crystal is vibrating, it's equivalent to LRC. (C_m is due to the dielectric plates & the capacitor.)	3	8.	$R_1 = \frac{1}{\omega f_c \times C \times a_2}$ $R_1 = \frac{1}{\pi \times 120 \times 10^3 \times 1 \times 10^{-9} \times 1.3617}$ $R_1 = 1948.52$ ✓ $R_2 = \frac{a_2}{4\pi f_c \times C \times b_2}$ $R_2 = \frac{1.3617}{4\pi \times 120 \times 10^3 \times 1 \times 10^{-9} \times 0.6180}$ $R_2 = 1461.52$ ✓	8
6.	$f = \frac{1}{2\pi\sqrt{LC}}$ $\sqrt{LC} = \frac{1}{2\pi f}$ $LC = \frac{1}{(2\pi f)^2}$ $C = \frac{1}{L(2\pi f)^2}$ $C = \frac{1}{(2.2 \times 10^{-2}) (2\pi \times 20 \times 10^6)^2}$ $C = 31.66 \text{ nF}$ ✓ $C = 31.66 \text{ pF}$ ✓	4			
Answer yn unig	7	Rhif y Cwestiwn	Arholwr yn unig		Rhif y Cwestiwn

Question No.		Examiner Only	Question No.	Section B - Question 2	Examiner Only
9. Butterworth filters are known to have maximum pass band flatness and are also known as anti-aliasing filters. They don't have the highest roll-off and have 20dB roll off per decade per order. 	5		a) $C1 = 470\text{pF}$ $f_c = 75\text{kHz}$	Stage 1: $R1 = \frac{a1}{2\pi f_c C1}$ $R1 = \frac{0.6656}{2\pi \times 75 \times 10^3 \times 470 \times 10^{-12}}$ $R1 = 3005\Omega \quad \checkmark$ Stage 2: $R2, R3 \approx C2 > \frac{C1 \times 46}{q^2}$ $C2 > \frac{470 \times 10^{-12} \times 4(0.4128)}{1.1402^2}$ $C2 > 597\text{pF} \quad \checkmark$ Let $C2 = 600\text{pF} \quad \checkmark$ $\therefore R2, R3 = \frac{(1.1402)(600\text{pF})}{4\pi \times 75 \times 10^3 \times 470\text{pF} \times 600\text{pF}}$ $R2 = 2340\Omega \quad \checkmark$ $R3 = 2758\Omega \quad \checkmark$	
Answer yn unig	Rhify Cwestiwn	Rhify Cwestiwn	Answer yn unig	Rhify Cwestiwn	Rhify Cwestiwn

[illegible]

Section B- Question 3

- | | |
|-----|--------------------------|
| a) | $S_0 = \text{Red}$ |
| (i) | $S_1 = \text{Red/amber}$ |
| | $S_2 = \text{Green}$ |
| | $S_3 = \text{amber}$ |



- (ii)

		next				
		T=0			T=1	
	next	T=0	T=1	QA^+	QB^+	QA^+QB^+
Current						
S0	S0	S1	0	0	1	0
S1	S2	S2	1	0	1	0
S2	S2	S3	1	1	1	0
S3	S0	S0	0	0	0	0

- (iii)

$A \oplus B$

T	0	0	0	1	1	1	0
	0	0	1	0	0	0	0
	0	1	0	0	0	0	0
	1	0	0	0	0	0	1

$A \oplus B$

T	0	0	0	1	1	1	0
	0	0	1	0	0	0	0
	0	1	0	0	0	0	0
	1	0	0	0	0	0	1

$$Q_A^+ = \bar{A}B + A\bar{B} \checkmark$$

$$Q_{\beta}^{\dagger} = T \beta$$

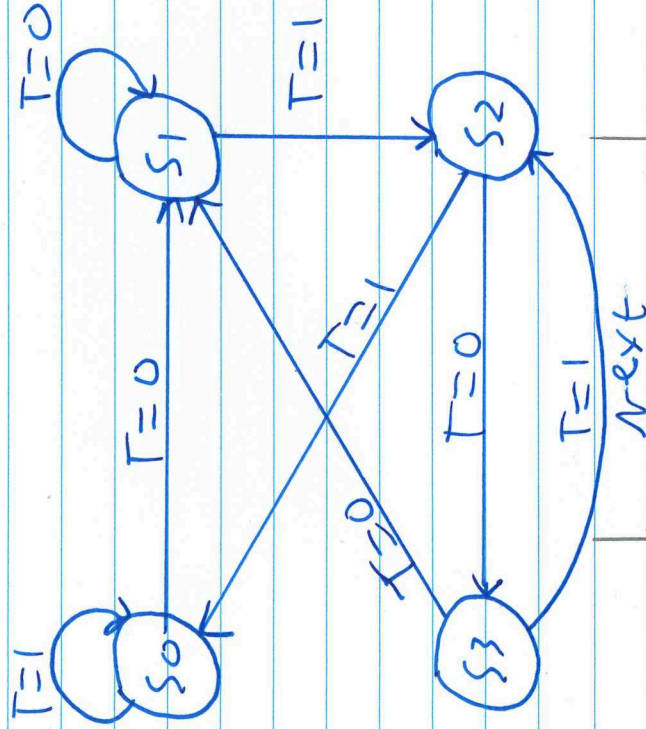
$$P = \overline{A} \overline{B} C$$

$$A = C$$

$$G = A \overline{B}$$

- 6

$S_0 = 0$ correct bits
 $S_1 = 1$ correct bits
 $S_2 = 2$ correct bits
 $S_3 = 3$ correct bits



Current	Next		next			
	$T=0$	$T=1$	$T=0$	$T=1$		
S0	S1	S0	$Q_1^+ Q_3^+$	$Q_4^+ Q_3^+$	X	Y
S1	S1	S2	0	1	0	0
S2	S3	S0	0	1	0	0
S3	S3	S0	1	0	0	1
	S1	S2	0	1	1	1

$$Q_A^T = T A^B + \bar{T} A^{\bar{B}} \quad \cancel{Q_B^T = \bar{T}}$$

$$QB = T$$

$$x = 4$$

$$\lambda = A$$

$$Z = A + B$$