



Complete, fold and seal
(see note 2 below)

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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.**

1	Student Number	
2	Title of Examination Paper	ELECTRONICS II
3	Module Code	SGEE 5000
4	Date and Time of Examination	TUESDAY 10/05/22 09:30
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
A	22
B1	16
B2	22
Total	60%

60%

(Gweler yr ochr arall am y fersiwn Cymraeg)

A1. i) 90 dB $V_g = \text{antilog}(90/20) = 316.22 \times 7766$

4

ii) 35 dB $P_g = \text{antilog}(35/10) = 316.2 \times 7766$

A2. i) V_g 36 dB = $\text{antilog}(36/20) = 63.1 \text{ V} \times 5 \text{ mV}$

~~$P_{\text{out}} = \frac{V_{\text{in}}^2}{R} = \frac{(5 \text{ mV})^2}{250 \Omega} = 100 \text{ nW}$~~

1

ii) $P = \frac{V^2}{R} = \frac{63.1^2 \times 250}{250} = 995.4025 \text{ W}$

A3. Without FB = 500 $mV = 0.015$

$A_{vf} = \frac{A_v}{1 + A_v m_v} = \frac{500}{1 + 500 \times 0.015} = 58.8 \text{ V}$

3

A4. By introducing negative feedback to stabilise temperature variations it improves the circuit as temperature losses are minimised. X

0

A5. $C = ?$ $L = 4 \mu\text{H}$ $F = 20 \text{ MHz}$

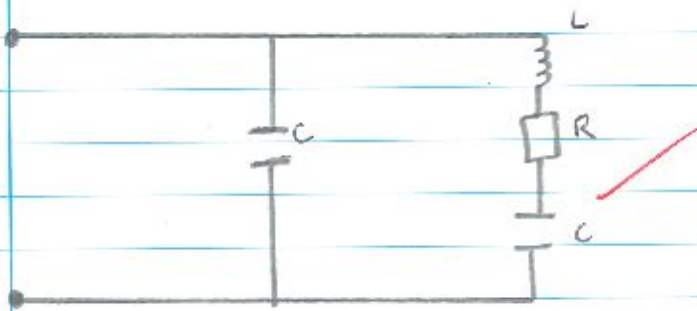
$F = \frac{1}{2\pi\sqrt{LC}} = C = \frac{1}{L(2\pi f)^2} = \frac{1}{44(2\pi \times 20\text{M})^2}$
 $= 15.8 \text{ pF}$

3

A6.

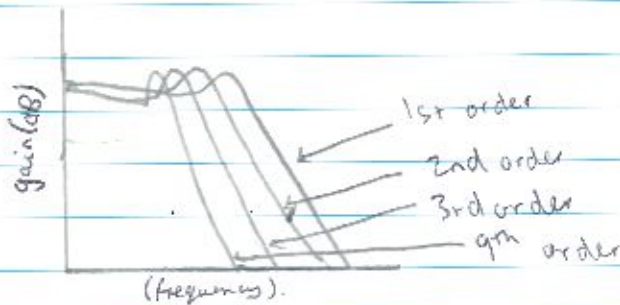
0

A7.



2

A8.



1

A9. $Q = 105$ $F_0 = 2.1 \text{ MHz}$ $BW = ?$ Cutoff frequencies = ?

$$BW = \frac{F_0}{Q} = \frac{2.1 \text{ MHz}}{105} = 20000 \quad \frac{20000}{2} = 10,000$$

Cut off frequencies = $F_0 \pm (\frac{1}{2} \text{ Bandwidth})$

$$\text{Upper frequency} = 2.1 \text{ M} + 10,000 = 2.11 \text{ MHz}$$

$$\text{Lower frequency} = 2.1 \text{ M} - 10,000 = 2.09 \text{ MHz}$$

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A10 i) Inputs are A/B/C/D
Outputs are Y



iii) Gate 1 can be described as a 4 input, 1 output AND gate.

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PART B

- A. Improves temperature stability of a circuit
Improves Oscillations of waveforms.

B. $V_{CC} = 16V$ $V_{CC} = V_{in}$

$V_{R1} = I_{R1}$

$V_{CC} = V_{in} / (R_1 + R_2) = 16V / (100k + 22k) = 131.1 \mu A$

$I_{R2} = I_{R1} \times R_2 = 131.1 \mu A \times 22k = 2.88 \mu A$

$= 2.88 - 0.7 = 2.18$

$I_{R4} = 2.18 / 4.7k = 463.8 \mu A$

$V_{CE} = R_3 \times (I_{R4} - I_{R1}) = 22k \times (463.8 \mu A - 131.1 \mu A)$
 $= 7.3V$

$7.3V - 0.7 = 6.6V$ *CASED above*

$6.6 / 10k = 660 \mu A$

$10000 \times (660 \mu A + 131.8 \mu A) = 7.918V$

C.

$A_{vf} = \frac{A_v}{1 + A_v M_v} = mV = \frac{A_v - A_{vf}}{A_v \times A_{vf}} = \frac{200 - 20}{200 \times 20}$

$= 0.045$

d.

x

0

e. 1st stage = 4k Ω 2nd stage = 1.5k Ω F = 1kHz

$$Z = 2\pi FL \quad , \quad L = \frac{Z}{2\pi F} \quad \checkmark$$

$$1^{\text{st}} \text{ Stage} = \frac{4000}{(2\pi \times 1000)} = 0.64 \text{ mH} \quad \checkmark$$

$$2^{\text{nd}} \text{ Stage} = \frac{1500}{(2\pi \times 1000)} = 0.24 \text{ mH} \quad \checkmark$$

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B2.

a. i) STAGE 1 $C = 470\text{pF}$ $f_c = 75\text{kHz}$

$$R_1 = \frac{1}{2\pi f_c a_1 C_1} = \frac{1}{2\pi \times 75\text{k} \times 0.6656 \times 470\text{p}}$$

$$= 6783.4 \Omega \text{ or } 6.7\text{k}\Omega$$

correct
correct

2.

ii) Show that 600pF and 1.6nF for stages 2 + 3Take 600pF (STAGE 2)

$$C_2 > \frac{C_1 \times 4b}{a_2} = \frac{470\text{p} \times 4 \times 0.4128}{1.1402} = 680.6\text{pF}$$

Take 600pF

$$\text{iii) } R = \frac{a_1 C_2 \pm \sqrt{a_1^2 C_2^2 - 4b_1 C_1 C_2}}{4\pi f_c C_1 C_2}$$

$$= \frac{1.1402 \times 600\text{p} \pm \sqrt{1.1402^2 \times 600\text{p}^2 - 4 \times 0.4128 \times 470\text{p} \times 600\text{p}}}{4 \times \pi \times 75\text{k} \times 470\text{p} \times 600\text{p}}$$

$$+ = 27576.5 \Omega \quad 27576.5 \Omega \text{ or } 23903.9 \Omega$$

$$- = 23903.9 \Omega$$

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ii) Take 1.6nF (STAGE 3)

$$C_3 > \frac{C_1 \times 4b}{a_3} = \frac{470\text{p} \times 4 \times 0.3245}{0.6216} = 0.98\text{nF}$$

iii) Take $1.6nF$ ✓

$$R = \frac{a_1 C_2 \pm \sqrt{a_1^2 C_2^2 - 4 b_1 C_1 C_2}}{4 \pi f_c C_1 C_2}$$

$$R = \frac{0.6216 \times 1.6n \pm \sqrt{0.6216^2 \times 1.6n^2 - 4 \times 0.3245 \times 470p \times 1.6n}}{4 \pi \times 75k \times 470p \times 1.6n}$$

$$+ = 1564.5 \Omega$$

$$1564.5 \Omega \text{ or } 1242 \Omega$$

$$- = 1242 \Omega$$

b. $L = ?$ $F = 5MHz$ $m_v = 0.20$ $C = 2.2pF$

$$f = \frac{1}{2 \pi \sqrt{LC}}$$

$$L = \frac{1}{(2 \pi f)^2 C} = \frac{1}{(2 \pi \times 5m)^2 \times 2.2p}$$

$$= 460.5 \mu H$$

$$m_v = \frac{L_1}{L_2} \text{ therefore } \frac{L_1}{L_2} = 0.2 \quad L_2 = 5$$

$$f_0 = \frac{1}{2 \pi C R \sqrt{b}} = R = \frac{1}{2 \pi f_0 C \sqrt{b}} = \frac{1}{2 \pi \times 5M \times 2.2p \sqrt{b}}$$

$$R = 5.9 \Omega$$

C. $68\text{pF} = C$ $R = ?$ $F = 500\text{kHz}$

$$f_0 = \frac{1}{2\pi CR\sqrt{6}}$$

$$R = \frac{1}{2\pi \times f_0 \times C\sqrt{6}}$$

$$= \frac{1}{2\pi \times 500\text{k} \times 68\text{p}\sqrt{6}} \checkmark$$

$$= 1.91\text{k}\Omega$$

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