ELEC3004 · SIGNALS, SYSTEMS & CONTROL

Exam Sheet Guide

What to write on your one handwritten A4 sheet, why each line earns its space, what to leave off, and a box-by-box layout for both sides.

Built for: the 2026 course and its exam rules: one two-sided A4 sheet of handwritten formulae, closed book, 180 minutes

Every line is tiered: A must have, B should have, C only if room

Ends with: a drawn layout for side 1 (signals and systems) and side 2 (control)

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How to think about the sheet

The sheet is not a summary of the course. It is a lookup table for the things that cost marks when you misremember them.

The rules (2026)

- One A4 sheet, both sides, of **handwritten** formulae. Typed sheets are not allowed. Writing on a tablet and printing it is accepted.
- Closed book otherwise. Casio fx-82 series or a labelled UQ-approved calculator.
- The exam is 40% with a hurdle: 40% to pass, 50% for a 6, 60% for a 7.

The test for every line

Ask two questions. Would I lose marks if I got this slightly wrong? Could I rebuild it in under a minute from something simpler? A line earns space if the answers are yes and no. That rules in tables (z-transform pairs, error constants, window types) and fiddly formulas (pre-warping, Butterworth order, lead α). It rules out definitions you can say in a sentence and anything you can derive quickly, like $\omega_d = \omega_n\sqrt{1-\zeta^2}$ from the pole positions.

The tiers

Tier	Meaning	Rough share of the sheet
A	Used in almost every paper, and easy to get wrong from memory. Write these first and biggest.	About 60%
B	Shows up often, or saves real time when it does.	About 30%
C	Useful for an unusual question. First to go if you run out of space.	About 10%

How to write it

1. **Draw the boxes first** in pencil, using the layout at the end of this guide. Fixed boxes stop one topic eating the page.
2. **Write the A lines, then B, then C.** If a box fills up, you know what to drop.
3. **Write small but not tiny.** Under exam stress you must read it in two seconds. Test it: put the sheet at arm's length and find the pre-warp formula. Too slow means too cramped.
4. **Use two colours.** One for formulas, one for conditions ("only if poles inside $|z| = 1$"). The conditions are where marks go missing.
5. **Write the sheet early and use it.** Do every practice question with the sheet and nothing else. Anything you keep reaching for that isn't there goes on. Anything you never touch comes off.

What to leave off

- Definitions and explanations (linear, causal, WSS, why linear phase matters). You need to say them in words, and the sheet can't do that for you.
- Derivations, and anything the calculator does (complex arithmetic, roots of a quadratic).
- Worked examples copied in full. One-line "recipe" versions beat full solutions.
- Content outside the 2026 course: continuous-time Fourier series drills, Sallen-Key circuit design and similar older material.

Side 1: signals and systems

Side 1 covers weeks 1 to 8. The z-transform box is the biggest single box on the sheet, because the long signals question nearly always runs through it.

Box 1: z-transform (biggest box)

Line	Why it earns space	Tier
$\delta \to 1$; $u[n] \to \frac{z}{z-1}$; $a^n u[n] \to \frac{z}{z-a}$, $\lvert z\rvert > \lvert a\rvert$; $-a^n u[-n-1] \to \frac{z}{z-a}$, $\lvert z\rvert < \lvert a\rvert$	The core pairs, with ROC, because ROC questions need the left-sided pair	A
$na^n u[n] \to \frac{az}{(z-a)^2}$	Repeated poles. Easy to misplace the a	A
$r^n \cos \Omega_0 n \to \frac{z(z - r\cos\Omega_0)}{z^2 - 2r\cos\Omega_0 z + r^2}$, and the sine pair $\frac{r \sin \Omega_0 z}{(\cdot)}$	Complex poles. Impossible to rebuild quickly under pressure	A
Delay $z^{-k}X$; with initial condition $x[n-1] \to z^{-1}X + x[-1]$; conv $\to$ product; $a^n x \to X(z/a)$; $nx \to -zX'$	Properties table. The initial-condition version is the one people forget	A
IVT $x[0] = \lim_{z\to\infty} X$; FVT $\lim_{z\to 1}(z-1)X$ *if* poles of $(z-1)X$ inside	Free checks on every answer. Write the condition in your second colour	A
"PF on $X(z)/z$, then multiply back by z"	The most common method slip in the course	A
$H(z) = \dfrac{\sum b_k z^{-k}}{1 + \sum a_k z^{-k}}$ from the difference equation	Sign of the a_k terms	B
$z = \mathrm{e}^{sT}$: $\lvert z\rvert = \mathrm{e}^{\sigma T}$, $\angle z = \omega T$; stable causal: poles inside $\lvert z\rvert = 1$	Links both halves of the course	A
$\lvert H\rvert = K \dfrac{\prod \text{dist to zeros}}{\prod \text{dist to poles}}$	Fast frequency-response sketches	C

Box 2: frequency response and the Fourier family

Line	Why it earns space	Tier
$H(\mathrm{e}^{\mathrm{j}\Omega}) = H(z)\lvert_{z=\mathrm{e}^{\mathrm{j}\Omega}}$; $\Omega = \omega T = 2\pi f/f_s$	Unit conversions cause most slips here	A
$\tau_g = -\dfrac{d\angle H}{d\Omega}$; symmetric FIR: $\tau_g = \frac{N-1}{2}$	Group delay questions are short and common	A
Distortionless: $\lvert H\rvert$ flat and $\angle H = -\Omega n_d$ over the band	One line covers amplitude and phase distortion	B
DTFT pair; $a^n u[n] \to \frac{1}{1 - a\mathrm{e}^{-\mathrm{j}\Omega}}$; 4-row table "sampled in one domain = periodic in the other"	Saves mixing up the four transforms	B
Single pole a: group delay at DC $= a/(1-a)$	Quick check, rarely needed	C

Box 3: signals, systems and convolution

Line	Why it earns space	Tier
Periodic iff $\Omega/2\pi = k/N$ (rational)	Trap question every year	B
$\sum_0^\infty r^n = \frac{1}{1-r}$; $\sum_0^{N-1} r^n = \frac{1-r^N}{1-r}$	Energy, step responses, DTFTs of exponentials all need them	A
Quick fails: offset/square $\Rightarrow$ nonlinear; n outside $x[\cdot]$ or $x[2n] \Rightarrow$ time-varying; $x[n+k] \Rightarrow$ non-causal	Turns a property table into two minutes of work	B
$y = \sum x[k]h[n-k]$; length $L + M - 1$; $\sum y = \sum x \sum h$	The sum check catches arithmetic slips	A
Sinusoid power $A^2/2$; even/odd parts	Easy marks	C