Signals and Systems

Course Summary Sheet

Your Name Course code: EE—000

Core signals

Linearity: $T\{ax_1 + bx_2\} = aT\{x_1\} + bT\{x_2\}$. **Time invariance**: A shift in $x(t)$ causes the same shift in $y(t)$. **Convolution**: $(x * h)(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)\,d\tau$. **Impulse response**: For an LTI system, $y = x * h$ and $h = T\{\delta\}$.

Transforms

$$X(j\omega) = \int x(t)e^{-j\omega t}dt, \qquad x(t) = \frac{1}{2\pi}\int X(j\omega)e^{j\omega t}d\omega.$$

Convolution theorem: $x * h \leftrightarrow XH$. **Differentiation**: $dx/dt \leftrightarrow j\omega X(j\omega)$. **Sampling**: $f_s > 2f_{\max}$ prevents aliasing for band-limited signals.

Filters

Filter	$H(j\omega)$	Cutoff
RC low-pass	$1/(1 + j\omega RC)$	$1/RC$
RC high-pass	$j\omega RC/(1 + j\omega RC)$	$1/RC$

Problem checklist

1. State assumptions and units.
2. Draw the system boundary and identify the input/output.
3. Choose time or frequency domain; do not mix conventions.
4. Check limiting cases and dimensions.
5. Interpret the result in one sentence.

Exam workspace

Common pitfalls

Sign errors in Fourier exponents; forgetting initial conditions; treating a finite-duration sample as band-limited; reporting a magnitude without units.