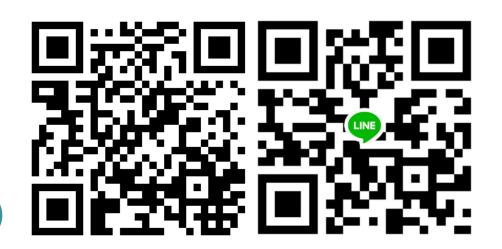
# Principles of Communications ECS 332

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4.2 Energy and Power



#### **Office Hours:**

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## Review: Energy and Power

- Consider a signal g(t).
- Total (normalized) energy:

  Parseval's Theorem [2.43]

[Defn. 4.13] 
$$E_{g} = \int_{-\infty}^{\infty} |g(t)|^{2} dt = \lim_{T \to \infty} \int_{-T}^{T} |g(t)|^{2} dt = \int_{-\infty}^{\infty} |G(f)|^{2} df.$$

• Average (normalized) **power**:

[Defn. 4.15] 
$$P_{g} = \langle |g(t)|^{2} \rangle = \lim_{T \to \infty} \frac{1}{T} \int_{-T/2}^{T/2} |g(t)|^{2} dt = \lim_{T \to \infty} \frac{1}{2T} \int_{-T}^{T} |g(t)|^{2} dt.$$
time-average operator
[Defn. 4.16a]

## Power Calculation: Special Cases

Linear combination of complex exponential functions [4.23]

Linear combination of sinusoids
[4.28]

g(t)	$P_g = \langle  g(t) ^2 \rangle$
$\sum_{k} c_k e^{j2\pi f_k t}$ where the $f_k$ are distinct	$\sum_{k}  c_k ^2$
$\sum_{k} A_k \cos(2\pi f_k t + \phi_k)$ where the $f_k$ are positive and distinct	$\frac{1}{2} \sum_{k}  A_k ^2$