

2017

M.Sc. 2nd Semester Examination

ELECTRONICS

PAPER—ELC-201

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Signals and Systems)

Answer Q. No. 1 and any *three* from the rest.

1. (a) Define Unit impulse and Unit step signals.
- (b) Distinguish between analog and digital signals.
- (c) What do you mean by periodic and aperiodic signals ?
- (d) Determine periodicity of the signal $x(t) = \sin(3t)$.
- (e) What are deterministic and random signals ? 2×5

(Turn Over)

2. (a) State and prove Parseval's theorem.
- (b) Verify Parseval's theorem for the signal $g(t) = e^{-at}u(t)$ ($a > 0$). (2+5)+3
3. (a) Explain, the energy spectral density of a signal. What do you mean by essential bandwidth of a signal ?
- (b) Estimate the essential bandwidth W rad/s of the signal $e^{-at}u(t)$, if the essential band is required to contain 95% of the signal energy. (4+2)+4
4. (a) What do you mean by Energy of a signal ?
- (b) Show that the energy of the Gaussian pulse

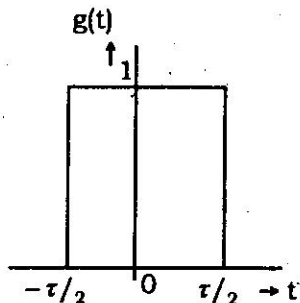
$$g(t) = \frac{1}{6\sqrt{2\pi}} e^{-\frac{t^2}{2\sigma^2}} \text{ is } \frac{1}{26} \sqrt{\pi}.$$

$$\left[\text{Use the fact that } \int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi} \right]$$

- (c) Define power of a signal.
- (d) Determine the power and rms value of the signal

$$g(t) = 10 \cos\left(100t + \frac{\pi}{3}\right) \quad 2+3+2+3$$

5. (a) Find the Fourier transform of $g(t) = \text{rect}(t/\tau)$ as shown below,



- (b) Find the Fourier transforms of the everlasting sinusoid $\cos w_0 t$.
- (c) Find the Fourier transform of the function $\text{sgn } t$.

$$\text{sgn } t = \begin{cases} 1 & t > 0 \\ -1 & t < 0 \end{cases} \quad 3+3+4$$

6. (a) What do you mean by power spectral density (PSD) of a signal? Explain it.
- (b) Show that,

$$\int_{-\infty}^{\infty} \text{sinc}^2(kx) dx = \frac{\pi}{k}. \quad (2+3)+5$$

[Internal Assessment — 10 marks]
