

II B.Tech I Semester(R05) Supplementary Examinations, May/June 2010
SIGNALS AND SYSTEMS

(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering and Electronics & Control Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain orthogonality property between two complex functions $f_1(t)$ and $f_2(t)$ for a real variable t .
 (b) Discuss how an unknown function $f(t)$ can be expressed using infinite mutually orthogonal functions. Hence, show the representation of a waveform $f(t)$ using trigonometric fourier series. [6+10]
2. (a) Derive an expression for complex Fourier Exponential series with the help of trigonometric Fourier series.
 (b) Explain the "Concept of Negative Frequency". [10+6]
3. (a) Find Fourier Transform of the following time function
 $x(t) = e^{-3t} [u(t+2) - u(t-3)]$
 (b) State and prove frequency and time shifting properties of Fourier Transform. [8+8]
4. (a) Explain how input and output signals are related to impulse response of a LTI system.
 (b) Let the system function of a LTI system be $\frac{1}{j\omega+2}$. What is the output of the system for an input $(0.8)^t u(t)$. [8+8]
5. (a) The waveform $V(t) = e^{-t/\Gamma} u(t)$ is passed through a high pass RC circuit having a time constant Γ .
 i. Find the energy spectral density at the output of the circuit.
 ii. Show that the total output energy is one half the input energy.
 (b) Find the cross correlation of the functions $\sin \omega t$ and $\cos \omega t$. [8+8]
6. Determine the Nyquist sampling rate and Nyquist sampling interval for the signals [4+4]
 - (a) $\sin c(100\pi t)$.
 - (b) $\sin \tau(100\pi t)$.
 - (c) $\sin c(100\pi t) + \sin c(50\pi t)$.
 - (d) $\sin c(100\pi t) + 3 \sin c^2(60\pi t)$.
7. (a) Obtain the inverse laplace transform of $F(s) = \frac{1}{s^2(s+2)}$ by convolution integral.
 (b) Using convolution theorem find inverse laplace transform of $\frac{s}{(s^2+a^2)^2}$.
 (c) Define laplace transform of signal $f(t)$ and its region of convergence. [6+6+4]
8. (a) Find the inverse Z-transform of
 - i. $X(Z) = \frac{1}{(1-az^{-1})^2} \quad |Z| > |a|$
 - ii. $X(Z) = \frac{1}{(1-az^{-1})^2} = \frac{z^2}{(z-a)^2} \quad |Z| > |a|$
 (b) Find the Z-transform and the associated ROC for each of the following sequences: [8+8]
 - i. $x[n] = a^{n+1} u[n+1]$
 - ii. $x[n] = a^{-n} u[-n]$.
