B.E. /B.TECH (FT) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2011
ECE BRANCH
THIRD SEMESTER
EC 274 Signals and Systems
(REGLATION 2004)

Time: 3 Hours **Max.marks: 100**

Answer ALL questions

PART-A **(10X2=20 Marks)**

1. Determine the fundamental period of the signal given by $x[n]=e^{j(3\pi/2)n}$
2. State with justification whether the system defined by the following expression $h[n]=\left(\frac{1}{2}\right)^n u[-n]$ is causal and/or time-invariant.
3. Determine the fourier series coefficient for the signal $x(t)=\sin\omega_0 t$, where ω_0 is the fundamental frequency.
4. Determine the number of zeros and poles located in the finite s-plane of $x(s)=\frac{s^2-1}{s^2+2s+2}$
5. Prove the time reversal property of fourier transform.
6. Consider a system described with system function H(s) given by $H(s)=\frac{1}{s-2}$, $\mathrm{Re}\{s\}>2$. Determine whether the system is stable or not with necessary proof.
7. Let x(t) be a signal with nyquist rate ω_0 . Determine the nyquist rate for the signal defined by $x(t)\cos 2\omega_0 t$.
8. Determine the z-transform and the region of convergence for the signal given by the following expression. $x[n]=a^n u[n]$
9. State the multiplication property of discrete time fourier transform.
10. Determine the frequency response of an LTI system with impulse response $h[n]=\delta[n-4]$

PART-B **(5X16=80 Marks)**

11. i. Let $x(t)=\begin{cases}1 & 0<t<T, \\ 0, & otherwise\end{cases}$ and $h(t)=\begin{cases}e^{-t} & 0<t<2T, \\ 0, & otherwise\end{cases}$. Determine x(t)*h(t), where the symbol * denotes convolution. (12)

ii. Derive the condition for the impulse response of a continuous time system h(t) to be stable. (4)

12. (a) i. Derive the fourier series coefficient for a periodic square wave defined over one period as $x(t)=\begin{cases}1, & |t|<T_1 \\ 0, & T_1<|t|<T/2\end{cases}$, the signal is periodic with fundmental period T. Plot the fourier series coefficient for the square wave defined by the period $T=4T_1$. (8)

ii. Derive the fourier transform representation of a continous time aperiodic signal (8)

(OR)

12. (b) i. Consider a rectangular pulse x(t) defined by x(t)= $\begin{Bmatrix} 1, & |t| < T_1 \\ 0, & |t| < T_1 \end{Bmatrix}$. Derive and plot the fourier transform of x(t) (8)

ii. Consider a signal that is sum of two real exponentials given by $x(t)=4e^{-2t}u(t) - 2e^{-t}u(t)$. Determine the laplace transform and the region of convergence of x(t) (8)

13a. i. Consider an LTI system whose input x(t) and output y(t) are related by the differential equation $\frac{d}{dt}y(t) + 3y(t) = x(t)$. The system also satisfies the condition of initial rest. If $x(t)=e^{-3t}u(t)$, What is y(t)? (8)

ii.Determine the response y(t) of the LTI system with impulse response $h(t)=e^{-at}u(t)$, a>0, to the input signal $x(t)=te^{-bt}u(t)$, b>0 (8)

(OR)

13b. i.Give the block diagram representation for a causal second order system with system function $H(s)=\frac{1}{(s+2)(s+3)}$ in direct form and in parallel form representation. (8)

ii. A causal LTI system described by the system function given by $H(s)=\frac{s-1}{(s+2)(s-3)}$, derive the impulse response of the system if the LTI system is stable, causal, unstable and anticausal. (8)

14a. i. A discrete time signal is given by $x[n]=-a^n u[-n-1]$, determine X(z). Draw the pole zero plot and show the region of convergence. (8)

ii. Derive the fourier transform representation of a discrete time periodic signal. (8)

(OR)

14b. i.Let x[n] be a periodic sequence with period N with fourier series representation $x[n]=\sum_{k=<N>} a_k e^{jk\left(\frac{2\pi}{N}\right)n}$, Derive $x[n-n_o]$, x[n]-x[n-1] (8)

ii.Let $x[n]=\begin{Bmatrix} a^n, 0 \le n \le N-1, a > 0 \\ 0, \quad\quad otherwise \end{Bmatrix}$, Determine X(z). Draw the pole zero plot and show the region of convergence. (8)

15a.Consider a system with system function $H(z)=\frac{1}{1-\frac{1}{2}z^{-1}} + \frac{1}{1-4z^{-1}}$, $|z| > 4$.

i.Derive the impulse response of the system. (8)

ii.Determine with proof whether the system is causal and/or stable. (8)

(OR)

15b. Consider an LTI system whose input x[n] and output y[n] are related by the difference equation $y[n]-\frac{1}{4}y[n-1]$ =x[n]. The system satisfies the condition of initial rest. If the system is subjected to the input $x[n]=k\delta[n]$.

i. Determine the impulse response of the system. (8)

ii.Determine whether the system is causal and stable. (4)

iii. Draw a block diagram representation of the system. (4)