Hall Ticket Number:

Code No. : 14406 O2

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (ECE) II Year II-Semester Old Examinations, May-2018

Signal Analysis and Transform Techniques

Time: 3 hours Max. Marks: 70

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Contrast between deterministic and random signals.
2. $x(t) = \cos(\frac{\pi}{3}t) + \sin(\frac{\pi}{4}t)$, Is x(t) periodic, if so find the period.
3. Mention the Transfer characteristics of ideal Low pass and High pass filters.
4. Obtain the Fourier transform of Unit step function.
5. Find the unilateral Laplace Transform of the constant D.C signal with amplitude 'A'.
6. Define Nyquist rate of Sampling and determine Nyquist rate of Sampling for the signal $x(t) = \text{sinc}(10\pi t)$
7. Determine the energy of the discrete time signal $x(n) = \left(\frac{1}{3}\right)^n u(n)$
8. Find inverse Z Transform of $\left(1 - \frac{1}{z}\right)^{-2}$
9. Obtain the relation between convolution and correlation.
10. State any two properties of cross correlation.

Part-B (5 × 10 = 50 Marks)

11. a) Check whether the following signals are energy or power signals by determining the Energy and Average Power? [5]

    i) $x(t) = e^{-2|t|}$ ii) $x(t) = 3\cos(10t)$

    b) Derive the necessary expression to represent the function x(t) using Exponential Fourier Series. [5]

12. a) With the help of Fourier transform properties, determine the time domain signal x(t), if frequency domain signal is given by $X(\omega) = j\frac{d}{d\omega}\left[\frac{e^{j2\omega}}{1+(\frac{j\omega}{3})}\right]$ [5]

    b) State and prove the following properties of Fourier transform: [5]

    i) Frequency shifting property ii) Time differentiation property.

13. a) State and prove the sampling theorem for Band limited signals. [6]

    b) Find the time signal $x(t)$ for which $X(S) = \frac{5(S+2)}{S^2(S+4)}$. [4]

14. a) Determine the Z-transform and ROC for discrete time sequence $x(n) = 7\left(\frac{1}{3}\right)^n cos(3n)$ and plot the pole-zero plot of $X(z)$. [5]

    b) Determine the Discrete time Fourier Transform (DTFT) of the signal $x(n) = \left(\frac{1}{2}\right)^n u(n) - \left(\frac{1}{4}\right)^n u(-n-1)$. [5]

Contd... 2

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15. a) Using graphical method determine the convolution of x(n)={2,-1,3,2} & h(n)={1,-1,1,1} [5]

    b) Prove that the Fourier Transform of Autocorrelation function of an Energy signal $x(t)$ is equal to the Energy Spectral Density (ESD). [5]

16. a) The relation between input and output of a Continuous time system is given by $y(t) = t\,x(t)$. Check whether the system is Linear Time-Invariant (LTI) or not? [4]

    b) Define Magnitude and phase distortions. Derive the Transfer function of a Distortion less LTI system and also draw the Magnitude and Phase spectrums. [6]

17. Answer any ***two*** of the following:

    a) State and Prove the Initial and Final value theorems of Laplace Transform. [5]

    b) Discrete time signal is given by, $x(n) = \{1,1,1,1,2\}$ Sketch the following signals [5]

    i) $x(n+1)$

    ii) Even samples of $x(n)$

    iii) Odd samples of $x(n)$

    c) Show that the output of an LTI system is given by the linear convolution of input signal and impulse response of the system. [5]