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EE-302

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121302

Roll No.

B. Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15

BASICS OF SIGNAL AND SYSTEM

Time : 3 Hours] [Total Marks : 100

Note : Attempt all questions.

1 Answer any **two** parts : **10×2=20**

(A) (i) Define periodic and a periodic signal. Determine whether the signal $x(t) = \sin(20\pi t) + \sin(5\pi t)$ is periodic or not. If periodic, determine fundamental period.

(ii) Define energy and power signal. Determine whether the signal $x(n)=(1/2)^n u(n)$ is energy or power signal and calculate their energy or power.

(B) Define signal. Give brief classification of signals. Give the examples of each.

Prove that the power of energy signal is zero over infinite time.

(C) Plot the signal with respect to time

$x(t)=u(t)-r(t-1)+2r(t-2)-r(t-3)+u(t-4)-2u(t-5)$

State whether this signal is energy or power signal. Find even and odd parts of this signal.

2 Answer any **two** parts : **10×2=20**

(A) State and prove the following properties of z transform

(i) Linearity (ii) Time shifting

(iii) Differentiation (iv) Correlation

(v) Scaling.

(B) (i) Find the inverse z-transform of the function

$X(z) = \{1+z^{-1}\}/\{1-(2/3)\,z^{-1}\}^2$ ROC$|z|>2/3$

(ii) Check whether the system with system function

$$H(z)=\frac{1}{1-\frac{1}{2}z^{-1}}+\frac{1}{1-2z^{-1}}$$

with ROC $|z| < \frac{1}{2}$ is causal and stable.

(C) (I) Find the inverse Laplace transform of

$$F(s)=\frac{-3}{(s+2)(s-1)}$$

If ROC is,

(i) $-2 < \text{Re}(s) < 1$

(ii) $\text{Re}(s) > 1$

(iii) $\text{Re}(s) > -2$

(II) The transfer function of the system is given as

$$H(s)=\frac{2}{(s+3)}+\frac{1}{(s-2)}$$

Determine the impulse response if the system is

(i) Stable

(ii) Causal

Whether this system will be stable and causal simultaneously.

3 Answer any **two** parts : **10×2=20**

(A) Find the Fourier transform of the signal $x(t)=e^{-at}\,u(t)$ and plot its magnitude and phase spectrum.

(B) (i) State and prove Parseval's theorem.

(ii) State and prove following properties of Fourier transform

(a) Time scaling

(b) Time shifting.

(c) Frequency shifting.

(C) (i) Explain the condition which is required to be satisfied for the signal to be fourier transformable.

(ii) Define the Fourier transform for periodic signals and explain its significance.

4 Answer any **two** parts : **10×2=20**

(A) Determine whether the following continuous time system $y(t) = x(t)\cos(100\pi t)$ is

(i) Static or dynamic

(ii) Linear or non-linear

(iii) Shift variant or shift invariant

(iv) Causal or non-causal

(v) Stable or unstable.

(B) (i) Determine the output of the LTI system whose input and unit sample response are given as follows:

$x(n)=b^n\,u(n)$

and $h(n)= a^n\,u(n)$

(ii) Determine the range of the values 'a' and 'b' for which the LTI system with impulse response

$h(n)=\{a^n \quad n > 0$

$\quad\;\; b^n \quad n < 0$

(C) The impulse response of the discrete time system is given by

$$h(n) = \frac{1}{2}\,\delta(n) + \delta(n-1) + \delta(n-2)$$

(i) Determine the frequency response

(ii) Find the step response of the system.

5 Answer any **two** parts : **10×2=20**

(A) (i) Derive the impulse response and step response of first order continuous time systems.

(ii) Derive an expression for bode plot of first order continuous time system. Comment on the bode plot.

(B) (i) Derive the impulse response and step response of first order discrete time systems. Also derive an expression for magnitude and phase response.

(ii) Derive an expression for impulse response of second order discrete time system. Comment on impulse response.

(C) Explain step response of ideal low pass filter. Why non-ideal filters are used ? How the non ideal filters are represented?
