C 1265 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. [ENGINEERING] (14 SCHEME) DEGREE EXAMINATION, APRIL 2016

EE 14 404—SIGNALS AND SYSTEMS

Time : Three Hours Maximum : 100 Marks

Part A

1. Answer any *eight* questions :

(a) Show that $x(t) = t\,u(t)$ is neither an energy signal nor a power signal.

(b) Determine whether the system $y(t) = t^2 x(t-1)$ is linear, time invariant or both.

(c) For the given signal $x(n) = \{1, 2, 3, 4, 5, 6\}$ compute $x(2n-1)$ and $x(n/2)$.

(d) Find the Fourier transform of the discrete signal $x(n) = a^{|n|}$, where $|a| < 1$.

(e) State and prove the time-scaling property of DTFT.

(f) Explain the effects of under sampling.

(g) Check the stability of the system whose impulse response $h(n) = 2nu(n)$.

(h) Find z-transform of $X(n) = u(n) - u(n-3)$ and give its ROC.

(i) What is aliasing ? How can one overcome aliasing effects ?

(j) Determine the Fourier series representation for the signal $x(t) = 1 + \sin 6t + \cos 4t$ and plot its magnitude and phase spectrum.

(8 × 5 = 40 marks)

Part B

2 (a) Convolute the following two continuous time signals :

$x_1(t) = e^{-2t}\,u(t)$.

$x_2(t) = u(t+2)$.

Or

(b) A digital system is characterized by the difference equation :

$y(n) = 0.5\,x(n) - 0.25\,x(n-1) + 0.75\,y(n-1)$. Check if the system is :

(a) Static or dynamic.

(b) Linear.

(c) Causal.

(d) Time variant (or) invariant.

(e) Stable.

Give suitable reasons for your answer.

Turn over

3 (a) Consider a causal, stable LTI system whose input $x(n)$ and output $y(n)$ are related by the second order difference equation :

$y(n) - (1/12)\, y(n-1) - (1/12)\, y(n-2) = x(n)$.

Determine the impulse response and unit step response of the given system.

Or

(b) (i) Find the Fourier series for the periodic signal $x(t) = t, 0 \le t \le 1$ and repeats Every 1 sec.

(10 marks)

(ii) Explain the conditions under which any periodic waveform can be expressed using Fourier series.

(5 marks)

4 (a) Find the response $y[n]$ of the DT system :

$y[n] - (3/4)\, y[n-1] + (1/8)\, y[n-2] = x[n] - (1/2)\, x[n-1]$ for an input $x[n] = (1/2)^n\, u[n]$ using DTFT.

Or

(b) (i) State and prove the Parseval's theorem. (5 marks)

(ii) Using Parseval's relation, evaluate the following integral.

$$\int_0^{\pi} \frac{4}{5 + 4\cos\omega}\, d\omega.$$

(10 marks)

5 (a) (i) Find the 7-transform of $x[n] = n\alpha^n u[-n]$. (7 marks)

(ii) Find the inverse Z-transform of :

$$X(Z) = \log\left(1 - \tfrac{1}{2} Z^{-1}\right);\ \text{ROC}\ |Z| > \tfrac{1}{2}.$$

(8 marks)

Or

(b) (i) Analyze and characterize the LTI system using z transform. (7 marks)

(ii) Determine the stability and causality for the LTI system with difference equation $y(n) - (1/2)\, y(n-1) = x(n) + (1/3)\, x(n-1)$.

(8 marks)

[4 × 15 = 60 marks]