USN | | | | | | | | | | | 10EC44

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Determine whether the following signal is periodic or not. if periodic, find the fundamental period.

i) $x[n] = \cos^2\left[\frac{\pi}{8}n\right]$

ii) $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$. **(08 Marks)**

b. State whether the following system represented by

$$y[n] = x[n]\cos\left[\frac{\pi(n+1)}{2}\right].$$

is linear, time-invariant, memoryless, causal, stable and invertible. **(06 Marks)**

c. Draw the waveform of $x(-t)$ and $x(2-t)$ for the signal $x(t)$ defined by

$$x(t) = \begin{cases} t; & 0 \le t \le 3 \\ 0; & t > 3 \end{cases}.$$ **(06 Marks)**

2 a. State and prove associative and distributive properties of convolution integrals. **(08 Marks)**

b. Evaluate $y(n) = x(n) * h(n)$ for the signal defined by :

$x(n) = \beta^n u(n)$ $|\beta| < 1$ and $h(n) = u(n-3)$. **(06 Marks)**

c. Evaluate $y(t) = x(t) * h(t)$ for the signal defined by $x(t) = e^{-3t}u(t)$ and $h(t) = u(t+3)$. **(06 Marks)**

3 a. Determine whether the system is stable causal and memory $h(t) = e^{-3t}u(t-1)$. **(04 Marks)**

b. Determine the output of the system described by the difference equation :

$y(n) - \frac{1}{2}y(n-1) = 2x(n)$ with the input $x(n) = (-\frac{1}{2})^n u(n)$ and initial condition $y(-1) = 3$. **(08 Marks)**

c. Convert the following differential equations into integral equation and draw the direct form I and II $d^2/dt^2\, y(t) + 5\, d/dt\, y(t) + 4y(t) = \frac{d}{dt}x(t)$. **(08 Marks)**

4 a. Find the DTFS representation for $x(n) = \cos\left(\frac{6\pi n}{17} + \frac{\pi}{3}\right)$ plot the magnitude and phase of DTFS coefficients. **(10 Marks)**

b. Use the definition of FS to determine the time domain signal represented by following FS coefficients. $X(K) = (-1/3)^{|K|}$ with $W_0 = 1$. **(10 Marks)**

PART – B

5 a. Use the equation describing the DTFT representation to determine the time domain signal corresponding to the DTFT given by :

$$X(e^{j\Omega}) = \sin(\Omega) + \cos\left(\frac{\Omega}{2}\right).$$ **(08 Marks)**

b. Use the defining equation for the FT to evaluate the frequency – domain representations of the signal given by $x(t) = t\,e^{-t}\,u(t)$. **(06 Marks)**

c. Use the properties to find the FT of the signal $x(t) = \sin(2\pi t)\,e^{-t}\,u(t)$. **(06 Marks)**

6 a. An LTI system has the impulse response $h(t) = 2\,\frac{\sin(2\pi t)}{\pi t}\cos(7\pi t)$. Use the FT to determine the system output if the input is $x(t) = \cos(2\pi t) + \sin(6\pi t)$. **(08 Marks)**

b. The output of a system in response to an input $x(t) = e^{-2t}\,u(t)$ is $y(t) = e^{-t}\,u(t)$. Find the frequency response and the impulse response of this system. **(08 Marks)**

c. Draw the frequency response of following ideal continuous and discrete time filters.
i) Low pass ii) high pass. **(04 Marks)**

7 a. Find the Z – transform of the following signals and draw the pole–zero plot.

i) $h[n] = 2^n u(n) + 3[1/2]^n u(n)$

ii) $y(n) = n(1/2)^n\,u(n-2)$. **(12 Marks)**

b. State the properties of RoC with respect to Z – transform. **(04 Marks)**

c. Find the inverse z – transform of $X(z) = \frac{z}{z^2 - 3z + 1}$ $\quad |z| < 1/2$. **(04 Marks)**

8 a. A causal discrete time LTI system is implemented by using difference equation :

$y(n) = x(n) + x(n-1) + \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2)$

i) What is the transfer function of the system
ii) Sketch the pole-zero diagram of the system
iii) Find the impulse response h(n). **(12 Marks)**

b. The DT signal x(n) is shown in diagram.

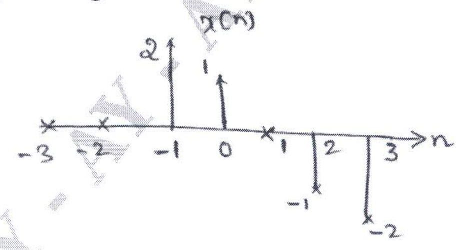

Fig.Q8(b)

i) What is the z –transform x(z) of the signal x(n)
ii) Define $y(z) = z^{-2}x(z)$, sketch the signal y(n)
iii) Define $G(z) = x(-z)$, sketch g(n)
iv) Define $F(z) = x(1/z)$, sketch f(n). **(08 Marks)**

* * * * *