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10EE52

**Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017**  
**Signals and Systems**

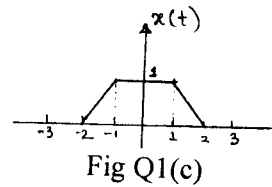
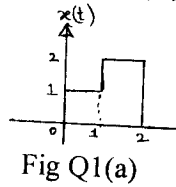
Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting at least TWO questions from each part.**

**PART – A**

- 1 a. Explain about power and energy signal with example. Determine whether signal given in Fig Q1(a) is power or energy signal, find corresponding value. (06 Marks)  
 b. Find out the even and odd component of the following signals. (06 Marks)  
 i)  $x(t) = \cos t + \sin t + \sin t \cos t$  ii)  $x(t) = 1 + t + 3t^2 + 6t^3 + 9t^4$   
 iii)  $x(t) = 1 + t \cos t + t^2 \sin t + t^3 \sin t \cos t$   
 c. For the given signal  $x(t)$  shown in Fig Q1(c) sketch and label (i)  $x(0.5t)$  (ii)  $x(t+3)$  (iii)  $x(3t+2)$  (vi)  $x(-3(t-1))$  (08 Marks)



- 2 a. Impulse response of a system is given by  $h[n] = \begin{cases} 1 & n = 0 \\ 1/2 & n = 1 \\ 0 & \text{otherwise} \end{cases}$

Input for the given system is  $x[n] = \begin{cases} 2 & n = 0 \\ 4 & n = 1 \\ -2 & n = 2 \\ 0 & \text{otherwise} \end{cases}$

Find out the output  $y[n]$  of the system.

(06 Marks)

- b. Given impulse response of the system  $h[n] = \left[\frac{1}{2}\right]^n u[n-2]$ . Find out step response of the system.

(08 Marks)

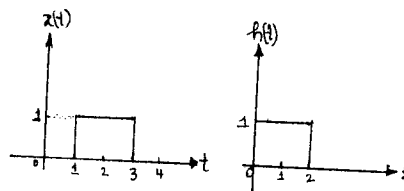
- c. Draw direct form – I and direct form – II implementation for the following difference equation.  $y[n] + \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = 2x[n] + 3x[n-1]$

(06 Marks)

- 3 a. Obtain the convolution integral for a system with input  $x(t)$  and impulse response  $h(t)$ , as shown in Fig Q3(a).

(08 Marks)

Fig Q3(a)



- b. For the given impulse response determine whether system is memory less, stable and causal, justify your answer.  $h[n] = [2]^n u[-n]$ .

(04 Marks)

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

- c. Find out the complete solution for the system described by the following differential equation.

$$\frac{d^2 y(t)}{dt^2} + 5 \frac{d}{dt} y(t) + 6y(t) = x(t), \text{ Where } x(t) = e^{-t} u(t)$$

With initial conditions  $y(0) = -\frac{1}{2}, \left. \frac{d}{dt} y(t) \right|_{t=0} = \frac{1}{2}$  (08 Marks)

- 4 a. Determine the Fourier series representation of the square wave shown in Fig Q4(a)

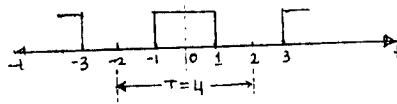


Fig Q4(a)

(08 Marks)

- b. Determine the discrete Fourier series representation for the following signal.

$$x[n] = \cos \frac{\pi}{3} n + \sin \frac{\pi}{4} n$$

(06 Marks)

- c. State and prove the time shift and frequency shift property of Fourier series.

(06 Marks)

**PART – B**

- 5 a. Using the properties of Fourier Transform find out Fourier transform of the following signals.

i)  $x(t) = \sin(\pi t) e^{-2t} u(t)$       ii)  $x(t) = e^{-3(t-2)}$

(12 Marks)

- b. Obtain the Fourier Transform of the following signals.

i)  $x(t) = u(t)$       ii)  $x(t) = e^{at} u(t)$

iii)  $x(t) = 1 \quad -0.5 \leq t \leq 0.5$   
 $= 0 \quad \text{elsewhere.}$

(08 Marks)

- 6 a. Find DTFT of the following signal

i)  $x[n] = \left[ \frac{1}{2} \right]^{n+2} u[n]$     ii)  $x[n] = n \left[ \frac{1}{2} \right]^{2n} u[n]$     iii)  $x[n] = -\left[ \frac{1}{2} \right]^n u(-n-1)$  (12 Marks)

- b. An LTI causal system is having a frequency response as  $H(e^{j\Omega}) = \frac{e^{j\Omega}}{1 + \cos \Omega}$ . Obtain linear constant difference equation of the system. (08 Marks)

- 7 a. Obtain z transform and the ROC and location of poles and zero's of x(z), for the following x[n].

i)  $x[n] = \left[ \frac{1}{2} \right]^n u[n] + \left( -\frac{1}{3} \right)^n u[n]$     ii)  $x[n] = -\left( \frac{3}{4} \right)^n u(-n-1) + \left( -\frac{1}{3} \right)^n u[n]$  (10 Marks)

- b. Obtain inverse 'z' transform of the given x(z) using partial fraction expansion

$x(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2} z^{-1}\right) \left(1 - 2z^{-1}\right) \left(1 - z^{-1}\right)}$     i) with ROC  $1 < |z| < 2$     ii) with ROC  $|z| < \frac{1}{2}$  (10 Marks)

- 8 a. Use convolution property of 'z' transform to obtain x(z) for the given x(n)

$x(n) = u(n-2) * \left( \frac{2}{3} \right)^n u(n)$  (06 Marks)

- b. Obtain inverse z transform of  $x(z) = \frac{2 + z^{-1}}{1 - \frac{1}{2} z^{-1}}$  with ROC  $|z| > \frac{1}{2}$  (06 Marks)

- c. Solve the following linear constant coefficient difference equation using z transform method

$y[n] - \frac{1}{2} y[n-1] = x[n]$  with given input  $x[n] = \left( \frac{1}{3} \right)^n$  and initial condition  $y[-1] = 1$  (08 Marks)