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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JUNE 2015

Course & Branch	:	**B.E.- Electrical & Electronics Engg.**	**Semester**	:	**IV**
Subject	:	**Signals and Systems**	**Max. Marks**	:	**100**
Subject Code	:	**EE403**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.
- Assume suitably any missed data

UNIT – I

1. a) Explain these terms (i) even and odd signals (ii) invertible and inverse system With Suitable examples. (06)

   b) Is the signal shown in fig.1(b) is power or energy signal? Give reasons for your answer and further determine its energy and power. (08)

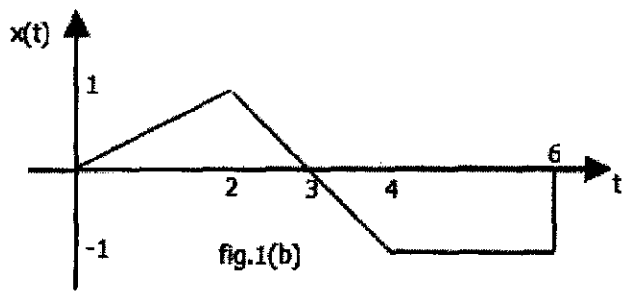

fig.1(b)

   c) The signal x(t) as shown in fig.1(c) Sketch the followings (06)
   (i) $x(2t+1)$ (ii) $x(t)u(t-1)$ (iii) $x(-t+2)$.

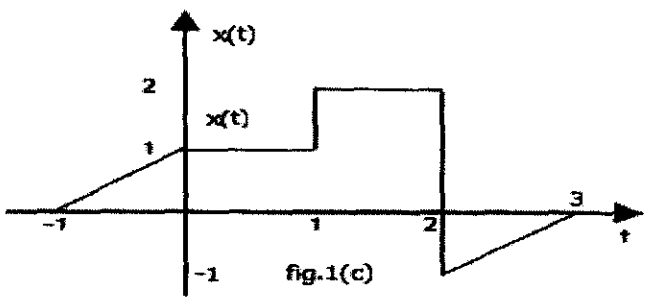

fig.1(c)

2 a) Determine whether the following signals are periodic (05)

(i) $\cos^2(\pi n/4)$

(ii) $3\cos\left(\frac{\pi t}{2}\right)+4\sin\left(\frac{3\pi t}{4}\right)$. If periodic, find the fundamental period.

b) Find even and odd components of signal as shown in fig.2(b) (06)

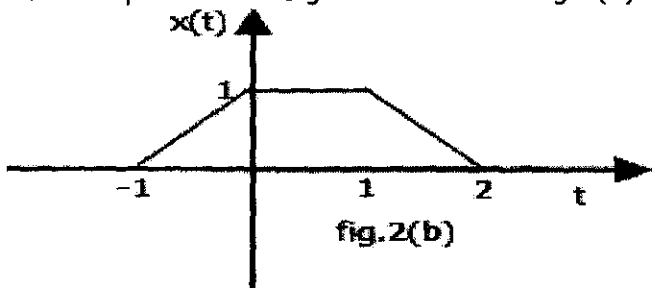

fig.2(b)

c) Determine whether the following systems are linear, time invariant and stable (09)

$(i)\ y(n)=\sum_{k=-n-n_0}^{n+n_0} x(k)$ $(ii)\ y(t)=x(2t)+5$

UNIT – II

3. a) Express the relation between step response and impulse response of the Continuous Time system. (04)

b) If $x(n)=\begin{cases}1, & for\ 0\le t\le 2\\ 0, & elsewhere\end{cases}$ and $h(t)=\delta(t-1)+0.5\delta(t-2)$, perform the convolution $x(t)\ and\ h(t)$. Also draw the convolved signal. (06)

c) Compute the convolution of the following signals (10)
$x(n)=\alpha^n u(n)\ and\ h(n)=\beta^n u(n)$ $where\ \alpha\neq\beta$.

4. a) Check whether the following system are causal and stable. (06)
$(i)\ h(t)=e^t u(-1-t)$ $(ii)\ h(n)=a^{|n|}$

b) Explain the following properties of LTI system (05)
(i) LTI system with and without memory (ii) Invetibility of LTI system.

c) Evaluate the response of a system if input to the system with impulse response $h(t)=u(t)+u(t-1)-2u(t-2)$ is $[u(t-1)-u(t-4)]$. (09)

UNIT – III

5. a) Draw the Direct form I and II structure of the system represented by the following difference equation (06)
$y(n)=-y(n-1)+0.2y(n-2)+x(n)+0.4x(n-1)$.

b) Solve the difference equation $y(n)+3y(n-1)+2y(n-2)=x(n)$, assume that the system is initially relaxed, for $x(n)=u(n)$. (08)

c) Explain these terms (i) sampling and (ii) quantization. (06)

6. a) A system is described by the differential equation $\frac{d^2y(t)}{dt^2}+\omega_0^2 y(t)=x(t)$ with initial conditions are zero. Find the impulse response of the system. (07)

b) Obtain the natural response of a system described by the difference equation (06)
$y(n)+\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=0$ with $y(0)=1$ and $y(-1)=6$

c) Consider an analog signal $x_a(t) = \sin(480\pi t) + 3\cos(720\pi t)$ (i) determine the Nyquist sampling rate for $x_a(t)$? (06)
(ii) what is the discrete time signal $x(n)$ if the signal is sampled at 600Hz?
(iii) if the signal $x(n)$ is converted back to analog what is reconstructed signal?

UNIT – IV

7. a) Obtain the DTFT of the sequence $n\left(\frac{1}{3}\right)^n u(n)$. (05)

b) State and prove the following properties of DTFS (08)
(i) Parseval's (ii) duality.

c) Evaluate and sketch the magnitude and phase spectra of the signal $x(n) = (-1)^n$ for $-\infty < n < \infty$. (07)

8. a) A discrete time system has impulse response $h(n) = 0.5\delta(n) + 0.3\delta(n-1) - 0..5\delta(n-2)$. Find the frequency response of the system. (04)

b) State and prove the following properties of DTFT (08)
(i) frequency differentiation (ii) modulation .

c) Evaluate the DTFT of the signal $x(n) = (0.5)^n u(n-4)$ and hence draw the magnitude and phase spectra. (08)

UNIT – V

9. a) State and prove the following properties of Z-transform (08)
(i) scaling and (ii) convolution in time.

b) Find the Z-transform of $x(n) = \frac{1}{n}(-a)^n u(-n-1)$ using properties of Z-transform. (07)

c) Consider a stable and causal system defined by (05)
$y(n) + \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = -2x(n) + \frac{5}{4}x(n-1)$. Find the impulse response of the system.

10 a) Solve the difference equation (06)
$y(n) - 0.9y(n-1) = x(n)$ *with* $x(n) = u(n)$ *and* $y(-1) = 2$ using unilateral Z-transform.

b) Consider the two signals $x_1(n) = \left(\frac{1}{2}\right)^{n+1} u(n+1)$ *and* $x_2(n) = \left(\frac{1}{4}\right)^n u(n)$ (08)
perform the convolution of $x_1(n)$ and $x_2(n)$ using Bilateral Z-Transform.

c) Suppose $X(z)$ is given by $X(z) = \frac{z(z^2 - 4z + 5)}{(z-3)(z-2)(z-1)}$ find $x(n)$ for the ROC $2 < |z| < 1$. (06)

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