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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – MAY / JUNE 2014

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

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT – I

1. a) Determine whether or not each of the following signals is periodic. If a signal is periodic, determine its fundamental period. (04)

   (i) Sin (Π+0.2n)

   (ii) $\sin(3\Pi t/5)\cos(\frac{4\Pi t}{6})$

   b) Fig.1 (b) shows a pulse x(t) that may be viewed as superposition of three rectangular pulses. Starting with the rectangular pulse g(t) shown in Fig.1(b),construct this waveform and express x(t) in terms of g(t). (06)

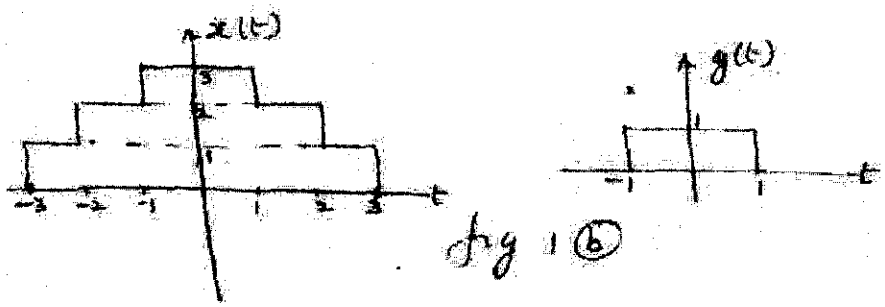

fig 1(b)

   c) For the systems given below, determine whether each of them is memory-less, linear, time invariant, causal and stable. (10)

   i) y(n) = T(x(n)) = x(n) + 3 u (n+1)

   ii) y(n) = n x(n)

2 a) Distinguish between i) Continuous time and Discrete time signals ii) Even and Odd signals iii) Periodic and non-periodic signals iv) Energy and Power signals (06)

b) A continuous time signal x(t) is shown in fig 2(b) . Sketch the following sequences i) x(t) u(t) ii) x(t) u(2-t) iii) x(t) δ(t-3/2) (04)

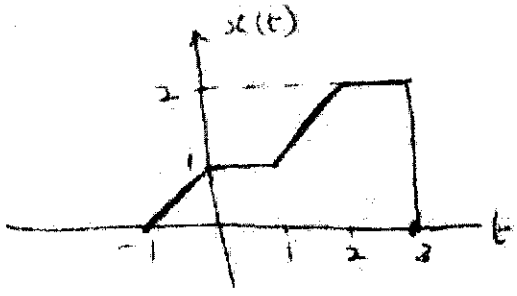

fig 2(b)

c) For the systems given below, determine whether each of them is memory-less, linear, time invariant, causal and stable. (10)
(i) $y(n) = x(n)x(n-1)$
(ii) $y(t) = T\{x(t)\}$ = x(t) Cos ωt

UNIT – II

3. a) Use convolution sum to prove the following properties i) Commutative ii) Distributive iii) Associative. (09)

b) Convolute the sequences $x(n)$ and $h(n)$ given below. (07)
x(n) = 1 $0 \le n \le 4$
= 0 otherwise
h(n) = $a^n 0 \le n \le 6$ $a > 1$
= 0 otherwise
Sketch the output waveform

c) Find the step response for the LTI systems with impulse reponse (04)
i) $h(n) = (1/2)^n u(n)$ ii) h(t) = tu(t)

4. a) Show that a discrete time LTI system is causal if its impulse response is h(n) = 0 for $n < 0$ (04)

b) Consider a LTI system with unit impulse response $h(t) = e^{-t} u(t)$. If the input applied to this system is $x(t) = e^{-2t}$ (u(t) - u (t-2)). Find the output of the system and sketch the output waveform. (08)

c) Check whether the following systems are stable and causal (08)
i)$h(t) = e^{-4t} u(t+10)$ ii) $h(n) = n(1/2)^n u(n)$

UNIT – III

5. a) Find the forced response of the system described by the difference equation (06)
$y(n) = \frac{1}{4}y(n-1) + \frac{1}{8}y(n-2) + x(n) + x(n-1)$
for $x(n) = (1/8)^n u(n)$

b) Realize the block diagram direct form I and II for following differential equation (06)
$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + 3y(t) = x(t) + 3\frac{dx(t)}{dt}$

c) Solve the differential equation (08)
$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 2x(t)$
with y(0) = -1 , $y'(0) = 1$ and $x(t) = Costu(t)$

6. a) Find the difference equation corresponding to the block diagram shown in fig 6 a) (04)

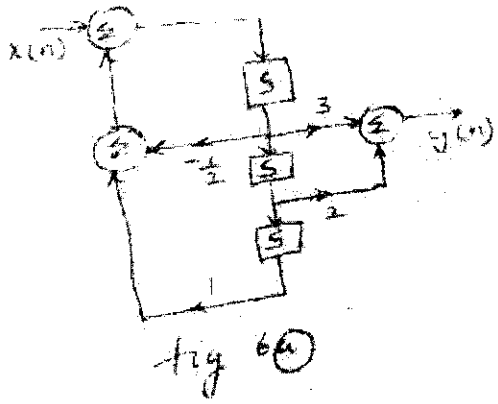

fig 6(a)

b) Find the solution of the difference equation given below by using the given initial conditions. (08)

$y(n) - 0.75y(n-1) + 0.125\, y(n-2) = x(n) = (2)^n \quad , \quad n \geq 0$

$y(-1) = 1 \quad y(-2) = 0$

c) Evaluate the system response of the following system. (08)

$y''(t) + 7y'(t) + 12\, y(t) = x(t) + x'(t)$

$x(t) = u(t) \qquad y(0) = 0, y'(0) = 1$

UNIT – IV

7. a) Prove the following properties of DTFS. (08)
i) Frequency shift property(ii) Modulation property

b) State and prove Parseval's theorem (05)

c) Using the appropriate properties find the DTFT of the following signal (07)
$x(n) = \text{Sin}\,(\Pi/4)n\,(1/4)^n\,u(n-1)$

8. a) Prove the following properties of DTFT. (12)
i)Convolution property ii) Scaling property iii) Time shift property

b) Find the discrete-time Fourier series coefficients of (08)
i) the signal shown in fig 8 b)

ii) $x(n) = \text{Sin}(\Pi/3)n + \text{Cos}(\Pi/6)n$

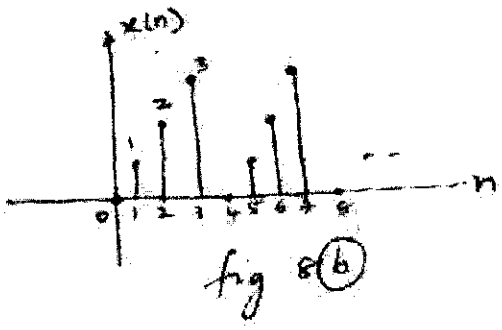

fig 8(b)

UNIT – V

9. a) Find the Z-transform of the following and sketch the ROC (08)
i) $x(n) = -a^n\,u(-n-1)$ ii) $x(n) = 7\left(\frac{1}{2}\right)^n u(n) - 6\left(\frac{1}{2}\right)^n u(n)$

b) Find the Z transform using appropriate properties (06)
$x(n) = n^2\,(1/2)^n\,u(n-3)$

c) Prove the following properties of Z-transform mentioning ROC. (06)
i)Convolution property ii) Differentiation property

10 a) Find the inverse Z – transform using partial fraction (08)

(i) $X(z) = \frac{2 - 2z^{-1} + z^{-2}}{(1 - z^{-1})\left(1 - \frac{1}{3}z^{-1}\right)^2} \quad |z| > 1$

(ii) $X(z) = \frac{z^2 - 2z}{z^2 + \frac{3}{2}z - 1} \frac{1}{2} \quad < |z| < 2$

b) A causal discrete time LTI system is described by (08)
y(n) –3/4 y(n – 1) + 1/8 y(n – 2) = x(n)
where x(n) and y(n) are the input and the output of the system respectively.
(i)Determine the system function H(z)
(ii)Find the impulse response h(n)
(iii)Find the step response of the system
(iv)Find the BIBO stability of the system

c) Determine the step response of the system (04)
y(n) = a y(n-1) + x(n) $-1 < a < 1$ with initial conditions y(-1) = 1

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