Total No. of Printed Pages:04

S.E.(Electronics & TC) / Electronics & Comm Engg) Semester- IV (Revised Course 2007-08)
EXAMINATION MAY/JUNE 2019
Signals & Systems

[Duration : Three Hours] **[Max.Marks : 100]**

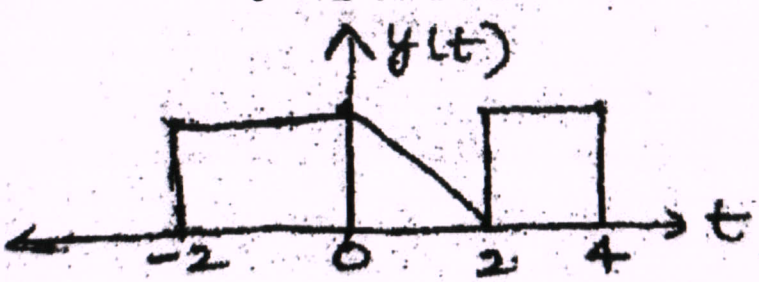
Please check whether you have got the right question paper.

Instructions:-
1) Assume suitable data **wherever** necessary.
2) Answer **five full** questions taking **at least one** from each module.

Module -I

Q.1 a) Find even and odd components of $x(t) = Sin\left(wot + \frac{\pi}{4}\right)$ **02**

b) A signal is transformed into another signal y(t) given as $y(t) = x\left(1 - \frac{t}{2}\right)$ as shown below. Sketch the original signal. **06**



c) Answer the following: **04**
1) $y[n] = x[n]x[n-2]$, check if system is invertible.
2) y(t) = x(t) u(t), check time invariance property.

d) Determine whether the following systems are causal, stable, linear and time invariant or not. **08**
1) $y[n] = \frac{1}{3}\{x[n] + x[n-1] + x[n-2]\}$
2) $y[n] = x[2n]$
3) $y(t) = x(Sin\ 3t)$
4) y[n] = (n+3) x[n]

Q.2 a) Compute the convolution of $x[n] = \left(-\frac{1}{2}\right)^n u[n-4]$ with $h[n] = 4^n u[2-n]$ **08**

b) Find the convolution of the following signals. **08**

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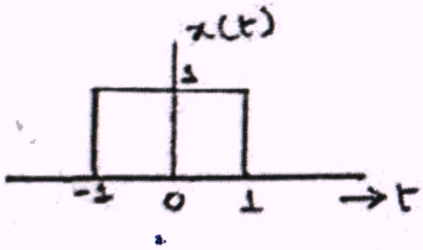
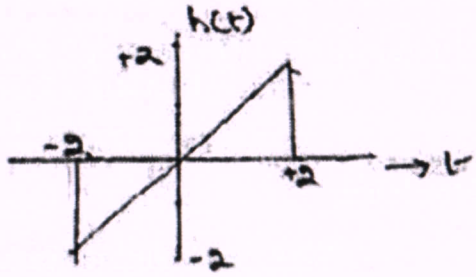
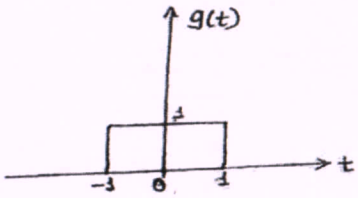
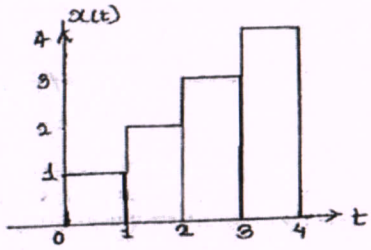




c) x(t) can be viewed as superposition of four rectangular pulses starting with rectangular pulse g(t). Express x(t) in terms of g(t). **04**



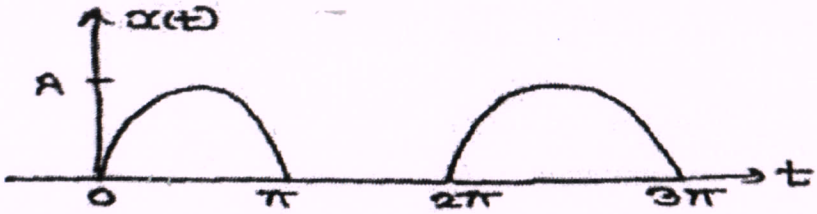


Module – II

Q.3

a) "All continuous time periodic signals have Fourier series representation". Is the above statement true or false? Justify. **04**

b) For the continuous time periodic signal as shown below, find out fourier series coefficients. **08**



c) Explain time shifting property of CTFS. **02**

d) Derive synthesis and analysis equation for CTFS. **06**

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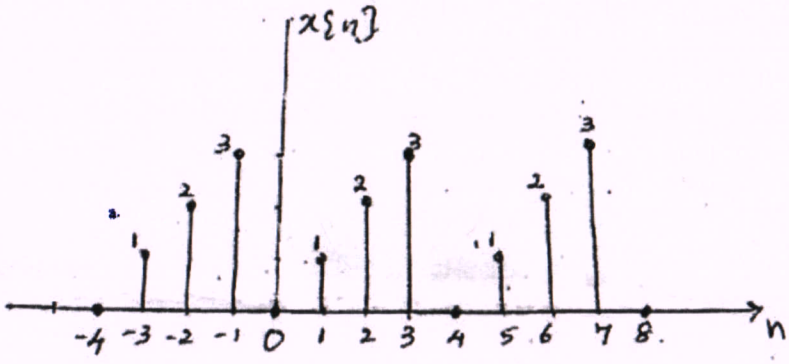
Q.4 a) For the discrete time signal given, find FS coefficients and plot magnitude and phase spectra. **06**



b) Explain frequency shifting property of DTFS. **04**

c) If the DTFS coefficients are given as $ak = [1,2,-j+0.5]$ and N=7; find out a_k values for $0 \le k \le N-1$ also find a_{-6} and a_{10} **06**

d) Discus Gibbs phenomenon. **04**

Module III

Q.5 a) Consider an analog signal $(t) = 5\cos 200\pi t$. 1) Determine the minimum sampling rate to avoid aliasing. 2) If sampling rate $F_s = 300\ Hz$. What is the DT signal after sampling? **06**

b) Prove the following DTFT properties **06**

1) $nx[n] \leftrightarrow j\frac{dX(e^{j\omega})}{d\omega}$ 2) $e^{j\omega_0 n}x[n] \leftrightarrow X(e^{j(w-w_0)})$

c) State the sampling theorem and briefly explain the method to reconstruct the signal. **08**

Q.6 a) If $x(t) \Leftrightarrow X(w)$, then using time shifting property show that **07**

1) $x(t+t_0) \Leftrightarrow e^{j\omega t_0}X(j\omega)$

2) $\frac{dx(t)}{dt} \Leftrightarrow j\omega X(j\omega)$

b) Find the FT representation for the periodic signal $x(t) = cos\, w_0 t$ and also draw its spectrum. **07**

c) A signal $x(t) = \cos(20\pi t) + \frac{1}{4}\cos(30\pi t)$ is sampled with sampling period τ. Find the Nyquist. State Sampling theorem. **06**

Module IV

Q.7 a) Find the unilateral Z-transform of **07**

1) $x(n) = \{1,2,3,4\}$

2) $y(n) = a^n u(n+1); a < 1$

b) Find IZT of the following sequence. **07**

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$$X(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1-\frac{1}{4}z^{-1}\right)\left(1-\frac{1}{2}z^{-1}\right)} \text{ with ROC: } \frac{1}{4} < |z| < \frac{1}{2};$$

c) Explain and list Laplace transform properties of ROC with example. **06**

Q.8 a) Find the Z-transform and ROC for the following sequences **06**

1) $a^n u(n)$ 2) $a^{-n}u(n)$

b) State and prove differentiation in Z-domain property of Z-transform. **06**

c) Derive any four properties of Laplace Transform. **08**

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