Department of Electronics & Communication Engineering.

NATIONAL INSTITUTE OF TECHNOLOGY, ROURKELA

MID-SEMESTER EXAMINATION. Autumn 2011

CLASS: B.Tech, 5th sem (EC & EI) TIME: 2hours

SUBJECT: **DSP** F.M:30

SUBJECT CODE: **EC341**

*Answer any **three** question including **Q.1***

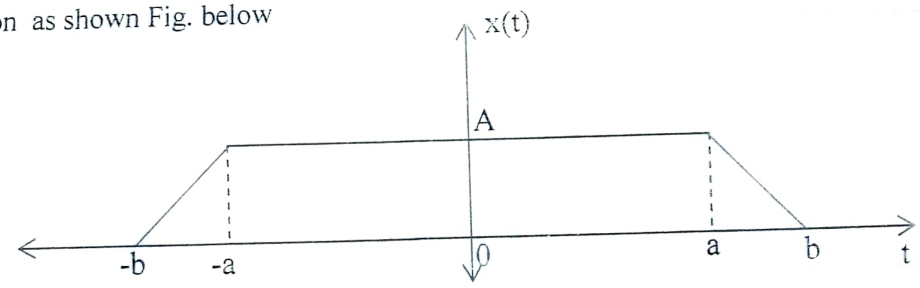
Figures in the right hand margin indicate marks.

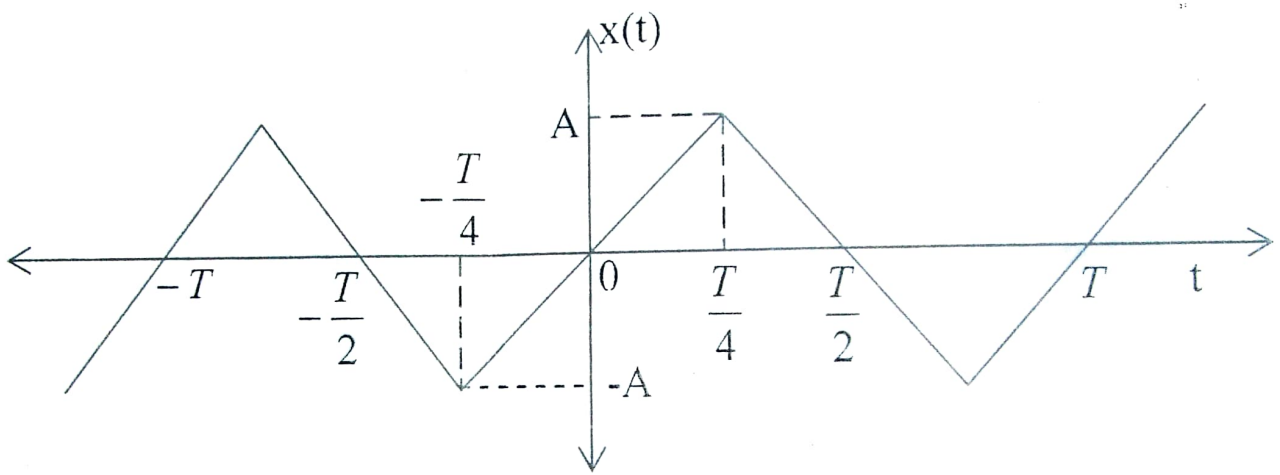
All parts of a question should be answered in one place

This question paper contains 3 pages

Q No.			Marks
1	a	Write down four advantages of digital signal processing over analog signal processing.	1
	b	Consider the analog signal $x(t) = 3cos2000\pi t + 5sin6000\pi t + 10\cos 12000\pi t$. What is the discrete time signal obtained if the signal is sampled at 5000samples/sec.	1
	c	Draw the ROC of the following type of LTI systems (i)Causal and stable(ii) Causal and unstable(iii) anticausal and stable (iv) anticausal and unstable	2
	d	If $x(t)$ is an arbitrary signal with its even part and odd part denoted by $x_e(t)$ and $x_o(t)$ respectively then show that $\int_{-\infty}^{\infty} x^2(t) = \int_{-\infty}^{\infty} x_e^2(t) + \int_{-\infty}^{\infty} x_o^2(t)$	1
	e	Determine and sketch the convolution of following two signals $x(t) = \begin{cases} 1 & -1 < t < 1 \\ 0 & elsewhere \end{cases}$ and $h(t) = \delta(t+1) + 2\delta(t+2)$	2
	f	Show that a discrete time sinusoid is periodic only if its frequency is a rational number	1
	g	Explain with a suitable example eigenfunction of a system.	1
	h	Find out the Fourier transform of sgn(t) .	1
2	a	A causal LTI system is described by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$ where $x(n)$ and $y(n)$ are the input and output of the system respectively. (i)Determine the system function $H(z)$ for causal system function.	5

3-5-4 3.5-5 Ex-3.6.7

		(ii)Find the impulse response of the system.	
		(iii)Find the step response of the system.	
	b	An LTI system is characterized by the system function $$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$ Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions. (i)The system is causal and unstable. (ii) The system is noncausal and stable. (iii) The system is anticausal and unstable	5
3			
	a	Graphically findout the convolution between following two signals. x[n]=[2, 5, 1, 1, 1], h[n]=[1, -2, 3,4].	2
	b	Prove the following properties for DTFT (i)Multiplication of two sequences (ii)Parseval's relation	2
	c	Using differentiation property find out the Fourier Transform of the following function as shown Fig. below  	4
	d	Show that autocorrelation value is maximum at origin.	1
	e	Show that folding and time delaying are not commutative	1
4	a	Find the correlation between following two signals using Z- transform. x(n)=[1, 4, 6, 8, 9, 2], h(n)=[2, 5, 8, 4, 1, 7].	2
	b	Determine the signal x(n) whose Z transform is given by $$X(z) = \log(1 + az^{-1}) \qquad |z| > a$$	2
	c	A signal $x(n)$ with its autocorrelation $R_{xx}(k)$ is applied to an LTI system with impulse response $h(n)$. Find out the expression of $R_{yx}(k)$, $R_{xy}(k)$ and $R_{yy}(k)$ in terms of $R_{xx}(k)$.	3

	d	Obtain the trigonometric Fourier Series of x(t) given in fig. below. 	3