SRN

PES UNIVERSITY

PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

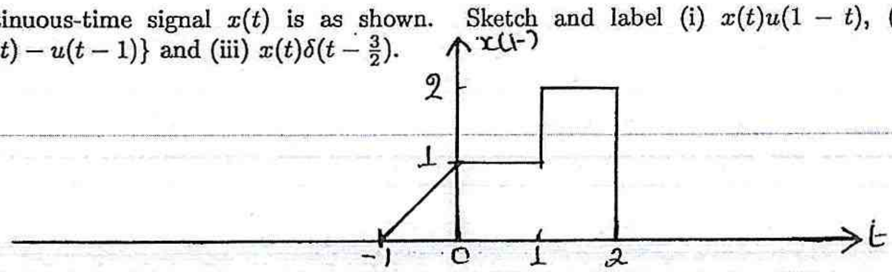
UE17EC204 / UE15EC252

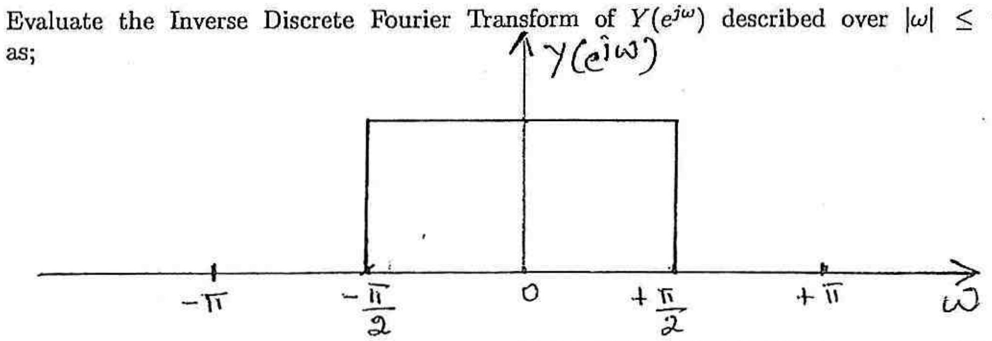
December 2018: END SEMESTER ASSESSMENT B.Tech. ECE III Semester

ESA

UE17EC204/UE15EC252 - SIGNALS & SYSTEMS

Time: 3 hours | *Answer All Questions* | Max Marks: 100

1	a	Calculate the Energy and Average Power of (i) $x_1(t) = e^{-2t}u(t)$ and (ii) $x_2[n] = cos(\frac{\pi}{4})n$. Identify whether they are Energy or Power signal.	6m
	b	A continuous-time signal $x(t)$ is as shown. Sketch and label (i) $x(t)u(1-t)$, (ii) $x(t)\{u(t) - u(t-1)\}$ and (iii) $x(t)\delta(t - \frac{3}{2})$. 	7m
	c	A discrete-time system has the following input - output relation; $$y[n] = x[n^2]$$ Determine whether the system is (i) Memoryless, (ii) Stable, (iii) Causal, (iv) Linear and (v) Time-Invariant.	7m
2	a	Find the convolution of following two continuous-time signals; $$x(t) = e^{\lvert t \rvert} \quad \text{for all } t$$ $$h(t) = \begin{cases} e^{-2t}; & t \geq 1 \\ 0; & t < 1 \end{cases}$$	7m
	b	Find the convolution of following two discrete-time sequences; $$x[n] = \begin{cases} 0; & n < -5 \\ (\frac{1}{2})^n; & n \geq -5 \end{cases}$$ $$h[n] = \begin{cases} 0; & n < 3 \\ (\frac{1}{3})^n; & n \geq 3 \end{cases}$$	7m
	c	Find the total response of an LTI discrete-time system described by; $$y[n] + 4y[n-1] + 3y[n-2] = u[n]$$ with $y[-1] = 0$ and $y[-2] = 1$.	6m

3	a	A continuous-time periodic signal with a fundamental period (T) as π and fundamental frequency (ω_0) as 2 rad/sec is defined as; $x(t) = e^{-\frac{t}{2}} \qquad 0 < t < \pi$ Find the expression for the Fourier Series co-efficients (a_k). What would be the general expression for the magnitude and phase of these co-efficients ? Finally, express $x(t)$ in terms of its Fourier Series co-efficients (Synthesis equation).	7m
	b	Evaluate $x[n]$, if its Fourier Series co-efficients are periodic with a period of 8 and given by; $a_k = \begin{cases} sin(\frac{k\pi}{3}); & 0 \leq k \leq 6 \\ 0; & k = 7 \end{cases}$	7m
	c	Let $y(t)$ be a periodic signal whose Fourier Series co-efficients are given by; $a_k = \begin{cases} 4; & k = 0 \\ j(\frac{1}{4})^{\|k\|}; & \text{elsewhere} \end{cases}$ Using the properties of Fourier Series, examine if (i) $y(t)$ is real; (ii) $y(t)$ is even and (iii) $\frac{dy(t)}{dt}$ is even.	6m
4	a	Consider the rectangular pulse $x(t)$ defined as; $x(t) = \begin{cases} A; & \|t\| < T_0 \\ 0; & \|t\| > T_0 \end{cases}$ Evaluate the Fourier Transform of $x(t)$ and sketch the spectrum of $X(j\omega)$.	6m
	b	Evaluate and sketch the Fourier Transform of the periodic Impulse train defined by; $x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT_0)$	4m
	c	Find the Fourier Transform of the discrete-time sequence $x[n]$ defined by; $x[n] = a^n u[-n-1]; \qquad \|a\| > 1$	6m
	d	Evaluate the Inverse Discrete Fourier Transform of $Y(e^{j\omega})$ described over $\|\omega\| \leq \pi$ as;  	4m
5	a	Determine the z - transform of; $x[n] = -\left(\frac{1}{2}\right)^n u[-n-1] + 2^n u[-n-1]$	6m

5	b	Consider the following z - transform of a discrete-time sequence $x[n]$; $$X(z) = \frac{3 - \frac{5}{6}z^{-1}}{(1 - \frac{1}{4}z^{-1})(1 - \frac{1}{3}z^{-1})}$$ Determine the sequence $x[n]$ for (i) $\lvert z \rvert > \frac{1}{3}$, (ii) $\frac{1}{4} < \lvert z \rvert < \frac{1}{3}$ and (iii) $\lvert z \rvert < \frac{1}{4}$.	8m
	c	Evaluate the Unilteral z - transform of; $$x[n] = 2^n u[-n] + \left(\frac{1}{4}\right)^n u[n-1]$$	6m