

**December 2019: END SEMESTER ASSESSMENT B.Tech. ECE III Semester
ESA**

UE18EC202/UE15EC252/UE17EC204 - SIGNALS & SYSTEMS

Time: 3 hours

Answer All Questions

Max Marks: 100

1	a	Calculate the Energy and Average Power of (i) $x_1(t) = e^{j(2t + \frac{\pi}{4})}$ and (ii) $x_2[n] = (\frac{1}{4})^n u[n]$. Identify whether they are Energy or Power signal.	7m
	b	<p>A continuous-time signal $x(t)$ is as shown. Sketch and label (i) $x(t + 2)$, (ii) $x(-t)$ and (iii) $x(-t - 2)$.</p>	6m
	c	<p>A discrete-time system has the following input - output relation;</p> $y[n] = 0.6^n x[n]$ <p>Determine whether the system thus defined is (i) Memoryless, (ii) Stable, (iii) Causal, (iv) Linear and (v) Time-Invariant.</p>	7m
2	a	Find the convolution of $x_1(t) = \cos(t) u(t)$ and $x_2(t) = t u(t)$.	6m
	b	<p>An LTI Discrete-time system has an Impulse response given by;</p> $h[n] = \left(\frac{3}{4}\right)^n u[n]$ <p>If this system is energised by a Unit Step Input, what will be its output $y[n]$?</p>	6m
	c	<p>Find the total response of an LTI discrete-time system described by;</p> $y[n] - 2y[n - 1] - 3y[n - 2] = x[n] + 4x[n - 1]$ <p>with $x[n] = 2^n u[n]$, $y[-1] = 5$ and $y[-2] = 0$.</p>	8m

3	a	<p>A continuous-time periodic signal with a fundamental period (T) and fundamental frequency ($\omega_0 = \frac{2\pi}{T}$) is defined as;</p> $x(t) = \begin{cases} A + \frac{2At}{T}; & -\frac{T}{2} \leq t \leq 0 \\ A - \frac{2At}{T}; & 0 \leq t \leq \frac{T}{2} \end{cases}$ <p>Evaluate its Fourier Series co-efficients (a_k). Also express the given $x(t)$ in terms of its Fourier Series co-efficients.</p>	8m
	b	<p>Evaluate $x[n]$, if its Fourier Series co-efficients are periodic with a period of $N=17$ and given by;</p> $a_k = \cos\left(\frac{6\pi}{17}k\right)$	6m
	c	<p>Evaluate $y(t)$ whose Fourier Series co-efficients are periodic with $T=4$ are given by;</p> $a_k = \begin{cases} jk; & k < 3 \\ 0; & \text{elsewhere} \end{cases}$	6m
4	a	<p>Evaluate the Fourier Transform of an aperiodic signal defined as;</p> $x(t) = \begin{cases} 1 + \frac{t}{T}; & -T \leq t \leq 0 \\ 1 - \frac{t}{T}; & 0 \leq t \leq T \end{cases}$	7m
	b	<p>Determine the Fourier Transform of an aperiodic Discrete-time signal defined by;</p> $x[n] = a^{ n }; \quad -1 < a < 1$	7m
	c	<p>Determine the convolution of $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = e^{-6t}u(t)$, using the property of Fourier Transform.</p>	6m
5	a	<p>Evaluate the z - transform and indicate the ROC of;</p> $x[n] = 0.5^n u[n] + 0.8^n u[-n-1]$	7m
	b	<p>Consider the following z - transform of a discrete-time sequence $x[n]$;</p> $X(z) = \frac{1}{1 - 0.8z^{-1} + 0.12z^{-2}}$ <p>Determine the sequence $x[n]$ for (i) $z > 0.6$, (ii) $0.2 < z < 0.6$ and (iii) $z < 0.2$.</p>	8m
	c	<p>Evaluate the Unilateral z - transform of;</p> $x[n] = \left(\frac{1}{4}\right)^n u[3-n]$	5m