PES UNIVERSITY

PES University, Bengaluru
(Established under Karnataka Act No. 16 of 2013)

UE19EC203 / UE16EC204 / UE17EC204 / UE18EC202

DECEMBER 2020: END SEMESTER ASSESSMENT B. Tech. ECE III - SEMESTER (ESA)

UE19EC203 / UE16EC204 / UE17EC204 / UE18EC202 - SIGNALS AND SYSTEMS

Time: 3 Hours	Answer All Questions	Max Marks: 100

1.	a)	Consider 2 signals defined by $x(t) = cos\left(\frac{t}{6}\right)$ and $y[n] = cos\left(\frac{n}{6}\right)$. Determine if they are **periodic**. If yes compute their fundamental periods and if not give reasons.	06
	b)	Consider a DT sequence $p[n] = \{\mathbf{0}, 1, 2, 3, 4, 0\}$. Sketch ***p[n]*** and plot ***p[2n]*** and ***p[2-n]***. *The sample at origin is indicated in bold.*	07
	c)	Consider a system defined by $y_1(t) = sin(x_1(t))$. Check whether the system is **time invariant**. Now consider another system defined by $y_2(t) = tx_2(t)$. Check whether this system is **linear**. Give necessary proofs.	07
2.	a)	Convolve $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = u(t+2)$.	06
	b)	Convolve $x_1[n] = \alpha^n u[n]$ and $x_2[n] = \beta^n u[n]$.	07
	c)	Consider an LTI DT system defined by $y[n] - 2y[n-1] - 3y[n-2] = x[n] + 4x[n-1]$. Determine its Total response if input is $x[n] = 2^n u[n]$ and initial conditions being ***y[-2] = 0*** and ***y[-1] = 5***.	07
3.	a)	Compute the **Fourier Series expansion** of $x[n] = cos^2\left(\frac{\pi}{8}\right)n$.	07
	b)	Consider a CT periodic signal having a fundamental period T = 2 sec represented by $x(t) = t$ for $-1 < t < +1$ over one period. Compute its **Fourier Series coefficients**.	07
	c)	Give the mathematical expressions for the properties of **time shifting**, **time reversal** and **Parseval's Identity** as applicable for **CTFS** and **DTFS.**	06
4.	a)	Find the CTFT of the signal ***x(t) = δ(t + 0.5) - δ(t - 0.5)***. Give the expressions for the **magnitude** and **phase** of $X(j\omega)$.	06
	b)	Evaluate the DTFT of the signal $x[n] = -a^n u[-n-1]$.	07
	c)	Using the properties of CTFT evaluate the Fourier transform of $x(t) = \mathbf{sin}(\pi t)\, e^{-2t}u(t)$.	07
5.	a)	Compute the ***X(Z)*** if $x[n] = 3\left(\frac{-1}{2}\right)^n u[n] - 2\{(3)^n u[-n-1]\}$ and plot the ROC.	07
	b)	Evaluate $x[n]$ if $X(z) = \frac{3-\frac{5}{6}z^{-1}}{\left(1-\frac{1}{4}z^{-1}\right)\left(1-\frac{1}{3}z^{-1}\right)}$ for $\lvert z\rvert > \frac{1}{3}$ and $\lvert z\rvert < \frac{1}{4}$	07
	c)	Using **Z-Transform** perform the **convolution** $y[n] = x[n] * h[n]$ where ***x[n] = δ[n] + δ[n - 1] + 4δ[n - 2]*** and ***h[n] = (1/2)^n*** for ***0 ≤ n ≤ 2*** and **zero** elsewhere.	06