BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN											Course Code	2	1	E	C	3	2

Third Semester B.E. Degree Examinations, March/April 2023
BASIC SIGNAL PROCESSING-I

Duration: 3 hrs. **Max. Marks: 100**

Note: *1. Answer any* **FIVE** *full questions, choosing* **ONE** *full question from each module.*
2. Missing data, if any, may be suitably assumed

Q. No		***Question***	***Marks***	*(RBTL:CO: PI)*
		MODULE – 1		
1.	**a.**	Define Signal and System. Explain the important elementary signals with suitable mathematical expressions and waveform.	**08**	(2:1: 1.3.1)
	b.	Find the even and odd components of following signals. i) $x(t) = 1 + t\,cos(t) + t^2 \sin(t) + t^3 \sin(t)\cos(t)$ ii) $x(t) = \begin{cases} 1 & -1 \le t \le 1 \\ 2 & 1 \le t \le 2 \\ 0 & otherwise \end{cases}$	**08**	(3:1: 2.1.3)
	c.	Write the MATLAB script to plot sine signal $x(t)$, when $x(t) = 5\sin\left(8\pi t + \frac{\pi}{3}\right)$ $0 \le t \le 2T$ where $T = \frac{2\pi}{\omega}$ fundamental period	**04**	(4:1: 5.1.1)
		(OR)		
2.	**a.**	Find whether the following signals are energy or power signals and find its energy or power i) $x(n) = \cos(\pi n)$ $-3 \le n \le 3$ ii) $x(t) = 6\cos(\pi t) + 3\sin(4\pi t)$.	**08**	(3:1: 2.1.3)
	b.	For the following system, determine whether the system is (i) Linear (ii) Time-invariant (iii) Memory less and (iv) Causal. $y(t) = \cos(x(t))$	**08**	(3:1: 2.1.3)
	c.	Write the MATLAB script to plot $x(-2t-4)$ when $x(t) = \sin(t)$.	**04**	(4:1: 5.1.1)
		MODULE – 2		
3.	**a.**	Evaluate the discrete time convolution sum given and also plot the output $y(n) = \left(\frac{1}{2}\right)^n .u(n-2) * u(n)$.	**08**	(3 :2: 2.1.3)
	b.	State and prove commutative and associative property of convolution.	**08**	(2 :2: 1.3.1)
	c.	Write the MATLAB script to find convolution of $y(n) = x(n) * h(n)$ when $x(n) = [1, 2, 3, 1]$ and $h(n) = [2, 1, -1, 3]$.	**04**	(4 :2: 5.1.1)
		(OR)		
4.	**a.**	An LTI system is characterized by an impulse response, $h(n) = \left(\frac{3}{4}\right)^n u(n)$. Find the step response of the system.	**08**	(3:2: 2.1.3)
	b.	Investigate causality and stability of the following System. i) $h(t) = e^{-2\lvert t\rvert}$ ii) $h(n) = 2^n u(n-1)$	**08**	(3 :2: 2.1.3)
	c.	Write the MATLAB script to find impulse response of system $h(n)$ for difference equation $y(n) - {}^4/_9\, y(n-1) = x(n-1)$	**04**	(4 :2: 5.1.1)

MODEL QUESTION PAPER

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

MODULE – 3

5.	**a.**	State and prove the following properties of CTFT i) Time Shift ii) Time differentiation	**08**	(3:3:1.3.1)
	b.	Evaluate the Fourier transform for the following signals. Sketch the magnitude. i) $x(t) = e^{-3t}\text{u}\,(t-1)$ ii) $x(t) = e^{-\lvert t\rvert}$.	**08**	(3 :3: 2.1.3)
	c.	Write the MATLAB script to find Fourier transform of $x(t) = t\,e^{-2t}u(t)$.	**04**	(4 :3: 5.1.1)

(OR)

6.	**a.**	Determine the continuous time signal corresponding to each Fourier transform. i) $X(\omega) = \frac{2\sin[3(\omega-2\pi)}{\omega-2\pi}$ ii) $X(\omega) = \cos(4\omega + \pi/3)$.	**08**	(3 :3:2.1.3)
	b.	State and prove the modulation property.	**08**	(2 :3: 1.3.1)
	c.	Write the MATLAB script to perform Amplitude modulation.	**04**	(4 :3: 5.1.1)

MODULE – 4

7.	**a.**	Determine the DTFT of the following signal and draw its spectrum $x(n) = \left(\frac{1}{2}\right)^n u(n-4)$.	**10**	(3 :3:2.1.3)
	b.	State and prove the following properties of DTFT. i)Time Shifting ii) Parseval theorem	**10**	(3 :3: 1.3.1)

(OR)

8.	**a.**	Find the inverse DTFT of $x(e^{j\Omega}) = (3-0.25e^{-j\Omega})/(-0.1e^{-j2\Omega}+1)$	**10**	(3 :3:2.1.3)
	b.	Find the DTFT of $x(n)=a^{\lvert n\rvert}$ $\lvert a\rvert<1$, Also sketch magnitude and phase	**10**	(3 :3: 1.3.1)

MODULE – 5

9.	**a.**	Explain briefly the ROC and its important properties.	**10**	(2 :5: 1.3.1)
	b.	Find the Z-transform of the following signals and indicate their ROC i) $x(n)=-a^n u(-n-1)$ ii) $x(n)= (1/3)^n \sin(\pi n/4)\, u(n)$	**10**	(3 :3: 2.1.3)

(OR)

10.	**a.**	Find the inverse Z transform for the given $x(z) = \frac{4+2z^{-1}}{(4-z^{-1})(2-z^{-1})(1-z^{-1})}$ For ROC i) $\lvert z\rvert>1$ ii) $\lvert z\rvert<0.25$ iii) $0.5<\lvert z\rvert<1$	**10**	(3 :3: 2.1.3)
	b.	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)Find the system function H(z) ii)Find the impulse response h(n) iii)Find the BIBO stability of the system	**10**	(3 :3: 2.1.3)

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Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

MODEL QUESTION PAPER