2021 SCHEME

Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | |

Course Code

2	1	E	E	6	3

Sixth Semester B.E. Degree Examinations, September/October 2024

SIGNALS & DIGITAL SIGNAL PROCESSING

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.**	For the signal x(t) is shown in Fig. Q 1(a), perform the following operation: (i) x(t+3) (ii) x(0.5t+2) (iii) x(2-t)	**05**	**(3:1:1.3.1)**

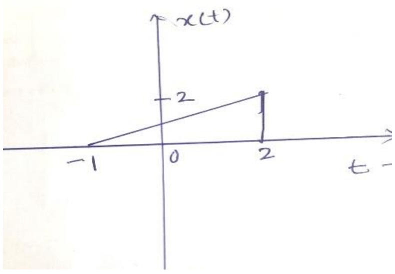

Fig.Q1(a)

Q. No		Question	Marks	(RBTL:CO:PI)
	b.	Determine energy and power of the signal shown in Fig. Q1(b).	**05**	**(3:1: 1.3.1)**

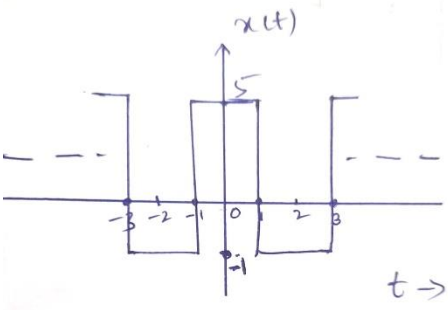

Fig.Q1(b)

Q. No		Question	Marks	(RBTL:CO:PI)
	c.	Determine whether the system y(t)= sin[x(t)] is linear, casual, time invariant, memoryless and stable.	**05**	**(3:2:1.4.1)**
	d.	For the input signal x(n)= (4,2,1,5) and impulse response h(n)=(2,6,4) Determine convolution sum y(n)=x(n)*h(n)	**05**	**(3:2:1.4.1)**

(OR)

Q. No		Question	Marks	(RBTL:CO:PI)
2.	**a.**	Sketch the even and odd components of the signal shown in Fig. Q 2(a).	**05**	**(3:1:1.4.1)**

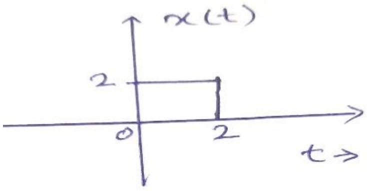

Fig.Q 2(a)

Q. No		Question	Marks	(RBTL:CO:PI)
	b.	Determine whether the following signals are periodic or not. Find the period if periodic. (i) x(t)= sin(π/3)t cos(π/4)t (ii) x(n)= cosπn	**05**	**(3:1:1.4.1)**
	c.	Determine whether the system y(n)= log[x(n)] is linear, casual, time invariant, memoryless and stable.	**05**	**(3:2:1.4.1)**

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

	d.	Determine convolution integral $y(t)=x(t)*h(t)$ where $x(t)= e^{-3t}u(t)$ and $h(t)=u(t-2)$	**05**	**(3:2:1.4.1)**

Module-2

3	**a**	Obtain 4 point DFT of the sequence $x(n)= (2,-3,5,1)$.	**06**	**(3:3:1.4.1)**
	b	Determine circular convolution of sequences $x_1(n)= (1,0,2,5)$ and $x_2(n)= (3,-4,1,6)$ using concentric circles method	**06**	**(3:3:1.4.1)**
	c	A sequence $x(n)= (2,5,-1,3,7,2,8,1,2,5,1,5)$ is filtered through a filter having impulse response $h(n)=(1,-1, 1)$. Using overlap and save method determine output $y(n)$ of the filter. Use 6 point circular convolution.	**08**	**(3:3:1.4.1)**

(OR)

4	**a**	Determine IDFT of $X(k)=(3, 2+j, 1, 2-j)$	**06**	**(3:3:1.4.1)**
	b	Obtain the DFT of $x(n)=(6,2,-3,4)$.Using circular time shift property obtain DFT of $x((n-1))_4$	**06**	**(3:3:1.4.1)**
	c	Determine the output $y(n)$ of a filter having input $x(n)= (1,-4,6,-2,3,1,5,2,7,2,4,-3)$ and impulse response $h(n)=(2,1,1)$ using overlap and add method. Use 5 point circular convolution.	**08**	**(3:3:1.4.1)**

Module-3

5.	**a.**	Using Radix-2 DIT-FFT algorithm, determine 8 point DFT of $x(n)= [1,0,1,0,1,0,1,0]$	**10**	**(3:3:1.4.1)**
	b.	Determine IDFT of $X(k)= (7,-0.707-j0.707, -j, 0.707-j0.707, 1, 0.707+j0.707, j, -0.707+j0.707)$ using Radix-2 DIF-FFT algorithm.	**10**	**(3:3:1.4.1)**

(OR)

6.	**a.**	Using Radix-2 DIF-FFT algorithm obtain the circular convolution of $x_1(n) = (1,2,1,3)$ and $x_2(n) = (2,0,2,0)$	**10**	**(3:3:1.4.1)**
	b.	Obtain IDFT of $X(k) = (2,0.5-j1.207, 0, 0.5-j0.207, 0, 0.5+0.207, 0.0.5+j1.207)$ using Radix-2 DIT-FFT algorithm	**10**	**(3:3:1.4.1)**

Module-4

7.	**a.**	Design a low pass Butterworth filter to meet the following specifications. Pass band gain = -2 dB at Ω_p = 20 rad/sec Stop band attenuation ≥ 10 dB at Ω_s = 30 rad/sec	**10**	**(3:4:1.4.1)**
	b.	Using Bilinear transformation design a Butterworth low pass filter to satisfy following specifications: $0.8 \le \lvert H(\omega)\rvert \le 1$ for $0 \le \omega \le 0.2\pi$ $\lvert H(\omega)\rvert \le 0.2$ for $0.6\pi \le \omega \le \pi$	**10**	**(3:4:1.4.1)**

(OR)

8.	**a.**	Design a Chebyshev filter to meet the following specifications: Acceptable pass band ripple of 2.5 dB Passband edge frequency of 20 rad/sec Stop band attenuation of 30 dB or more at 50 rad/sec	**10**	**(3:4:1.4.1)**
	b.	Using Impulse Invariant Technique, design a low pass filter to meet following specifications: $20 \log \lvert H(\omega)\rvert_{\omega = 0.2\pi} = -2$ dB $20 \log \lvert H(\omega)\rvert_{\omega = 0.6\pi} = -15$ dB Filter must have approximately flat frequency response.	**10**	**(3:4:1.4.1)**

Module-5

9.	a.	The desired frequency response of a low pass filter is given by $H_d(\omega)=e^{-j2\omega} \quad |\omega| \le 3\pi/4$ $= 0 \quad 3\pi/4 \le |\omega| \le \pi$ Determine filter coefficients of FIR filter using Hamming window. Also obtain the frequency response of FIR filter.	10	(3:4:1.4.1)
	b.	Draw the direct form I , direct form II and cascade realizations for IIR filter described by the system function $H(z) = \frac{(1-\frac{1}{3}z^{-1})(1+\frac{1}{8}z^{-1})}{(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2})(1+\frac{1}{2}z^{-1})}$	10	(3:5:1.4.1)

(OR)

10	a.	A filter is to be designed with following desired frequency response specifications: $H_d(\omega)= 0 \quad -\pi/2 \le \omega \le \pi/2$ $= e^{-j3\omega} \quad \pi/2 \le |\omega| \le \pi$ Determine the filter coefficients of FIR filter and the frequency response. Use rectangular window for the design.	10	(3:4:1.4.1)
	b.	Realize the following system function in direct form and linear phase form $H(z) = 1 + \frac{3}{7}z^{-1} + \frac{12}{17}z^{-2} + \frac{15}{8}z^{-3} + \frac{12}{17}z^{-4} + \frac{3}{7}z^{-5} + z^{-6}$	10	(3:5:1.4.1)

** ** **