

DEPARTMENT OF MECHATRONICS

I SEMESTER M.TECH. (INDUSTRIAL ROBOTICS AND AUTOMATION) END SEMESTER EXAMINATIONS (PART-B), February 2022 SUBJECT: SIGNAL PROCESSING AND APPLICATIONS [MTE 5003]

(Date: February 14, 2022)

Time: 75+10 Minutes

MAX. MARKS: 20

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, if any, can be suitably assumed.

Q	Question	Μ	CO	PO	LO	BL			
No									
Descriptive Type Questions $(1 \times 30 = 30)$									
1A	Consider the following causal CCDE, y[n]+2y[n-1]=3x[n]+2.5x[n-1]. Determine the transfer function of the system, plot zeros, poles, and ROC.	5	2	1	1	3,4			
1B	Fig1B: direct for II representation of a system Compute the h[n] for the LTI system. Plot the zeros and poles of the system	3	2	2	2	3,4			

1C	Plot the frequency components corresponding to 2D sinusoids	2	2	2	2	5
	varying in horizontal and vertical directions.					-
	Fig1C: 2D sinusoids					
2A	In dual-tone multi-frequency (DTMF) or touch-tone telephone	5	4	3	3	5
	dialing, each number is represented by a dual-frequency tone. The					
	DTMF tones corresponding to the telephone number 080-					
	4872550, by sampling the sum of two sinusoids at the required					
	frequencies at $S = 8192$ Hz for each digit. Analyse the key pressed					
	1209Hz11336Hz1477Hz					
	697Hz1 2 3					
	770Hz4 5 6					
	852Hz 7 8 9					
	941Hz* 0 #					
2B	In Indian classical music, a raga is a musical composition based	3	4	4	4	5
	on an ascending and descending scale. The notes and their order					
	constructs musical passages using only the notes allowed. The					
	performance of a raga can last from a few minutes to an hour or					
	more! Raga Malkauns is a pentatonic raga (with five notes) and					
	the following scales:					
	Ascending: DFGBCD Descending: CBGED					
	The final note in each scale is held twice as long as the rest.					
	f0=340; d=f0; % Pick a frequency and the note D					
	$f=f0*(2^{(3/12)}); g=f0*(2^{(5/12)}); \%$ The notes F and G					
	d^2-2*d : % The note D (an octave higher)					
	Elaborate how to generate a signal with sampled sinusoids at these					
	frequencies, using 8192 Hz sampling rate; concatenate them,					
	assuming silent passages between each note. How would you					
	analyse the Raga when a short clip of audio signal is provided to vou?					

2C	Differentiate echo and reverb filter with mathematical equations.	2	3	4	4	4
	Input z^D α					
	An echo filter A reverb filter					
	Fig2C: block diagram of echo and reverb filter					