

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

CLASS: MTECH  
BRANCH: EEE/EVT

SEMESTER : I  
SESSION : MO/2025

SUBJECT: EE501 ADVANCED DIGITAL SIGNAL PROCESSING,

TIME: 3 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

		CO	BL
Q.1(a) A system has an impulse response of $h(n)=\{1,2,3\}$ and output response $y(n)=\{1, 3, 6, 5, 3\}$ . Determine the input sequence $x(n)$ using Z-Transform.	[5]	1	2
Q.1(b) Explain DIT-FFT algorithm. Given a sequence $x(n)= \{0, 1, 2, 3, 4, 5, 6, 7\}$ , determine $X(k)$ using DIT-FFT algorithm.	[5]	1	3
Q.2(a) The system function of the analog filter is given as $H(S)= (S+2) / [(S+1) (S+2)]$ Obtain the system function and realization of the IIR digital filter by using bilinear transformation.	[5]	2	2
Q.2(b) Design a linear phase FIR lowpass filter using rectangular window by taking 9 samples of window sequence and with a cutoff frequency of 1 rad/sample. The sequence is symmetric and center of symmetric is $(N-1)/2$ , Where $N$ =Number of samples.	[5]	2	3
Q.3(a) Determine the down sampled version of the given signals for sampling rate reduction factors of $D=2$ . $x(n)= \{ 1, 2 , 3, 4 \}$ Derive the relationship between spectrum of output and input signal.	[5]	3	4
Q.3(b) Considered a spectrum of input signal $X(e^{j\omega})$ with bandwidth of $-\pi/2$ to $+\pi/2$ as shown in fig. Sketch the spectrum of a down sampled signal for sampling rate reduction factor $D=3$ and up sampled signal with interpolation factor $I=3$ .	[5]	3	4

Q.4(a) What are characteristics of adaptive system. Illustrate how any adaptive systems can be implemented for prediction electrical load consumption by BIT Mesra, Ranchi by considering it as time series data.	[5]	4	3
Q.4(b) Write short notes on (i) Identification of system using adaptive system. (ii) Noise-cancellation from any signal.	[5]	4	4
Q.5(a) Explain the fundamental architectural features of Digital Signal Processing (DSP) processors. Describe the functions of the key internal components of a typical DSP processor.	[5]	4	2
Q.5(b) Write the basic steps in finding linear and circular convolution of two signals. Write the basic instructions of TMS320Cx processor that are suitable for this signal processing application.	[5]	4	4