MALLA REDDY COLLEGE OF ENGINEERING &TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

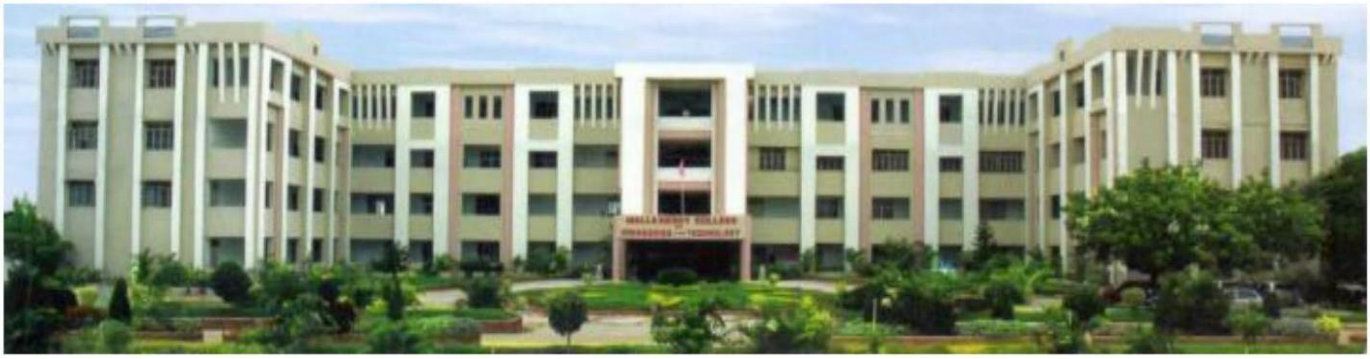
(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade, ISO 9001:2008 Certified)

Maisammaguda, Dhulapally, Secunderabad – 500100.

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

III B. TECH II SEMESTER

QUESTION BANK (2024 – 25)



R22-REGULATION

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech II Semester

Digital Signal Processing

(ECE)

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B

Part A is compulsory which carriers 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

****

PART – A (10Marks)

1.

(a) Define linear shift invariant system. **(1M)**

(b) Check the system y(x) = x(n/2) is stable or not. **(1M)**

(c) State the difference between DITFFT and DIFFFT algorithms. **(1M)**

(d) Determine the IDFT of X(k) = { 3, (2+j), 1, (2-j)}. **(1M)**

(e) Using Bilinear transformation, find H (z) from H (s) = 2 / [(S+1) (S-1)] withT = 1 sec. **(1M)**

(f) Determine the order of the LPF for Butterworth approximate, with 3 dB attenuation at 500 Hz and an attenuation of 40 dB at 1000 Hz**.** **(1M)**

(g) What are finite word-length effects**?** **(1M)**

(h) What are the conditions for a FIR system to have linear phase? **(1M)**

(i) What are the applications of Digital signal processor**?** **(1M)**

(j) What is the advantage of very large instruction word architecture in Digital signal Processor. **(1M)**

PART – B (50 Marks)

SECTION – I

2. Check for the linearity and time invariant of the following systems **(10M)**

(i) $y(n) = x(n)\, x(n-2)$

(ii) $y(n) = a^n u(n)$

(OR)

3. Determine and sketch the magnitude and Phase response of the given system

$y(n) = 1/3 [x(n) + x(n-1) + x(n-2)]$ **(10M)**

SECTION – II

4. Determine the IFFT using DIF method for X(K) = { 1, 1+j, -j2, 1, 0, j2, 1+j } **(10M)**

(OR)

5. Find the DFT of the Sequence x(n) defined by **(10M)**

$x(n) = 1$ for $2 \leq n \leq 6$

$= 0$ for $n = 0, 1$ and 7.

Use DIF algorithm. Give all intermediate results.

SECTION – III

6. Design a Chebyshev IIR digital low pass filter to satisfy the constraints using bilinear transformation method and assuming T= 1s.

$$0.707 \leq |H(\omega)| \leq 1 \; ; \quad 0 \leq \omega \leq 0.2\pi$$
$$|H(\omega)| \leq 0.1 \; ; \quad 0.5\pi \leq \omega \leq \pi$$ **(10M)**

(OR)

7. Design a Butterworth IIR low pass filter with the following specifications: pass band Ripple α_p =1 dB, stop band attenuation α_s =40 dB, pass band edge frequency is 2 KHz, stop band edge frequency 10 KHz, Sampling frequency is 25 KHz. Use the bilinear transformation technique. **(10M)**

SECTION – IV

8. Design a FIR high pass filter of length 11 to approximate the ideal filter with a pass band cut off frequency at 1 KHz. Use triangular window. **(10M)**

(OR)

9. Differentiate between IIR and FIR filters. Discuss the various steps in designing FIR filter. **(10M)**

SECTION – V

10. a. Explain the spectrum of down sampling. **(5M)**
b. What are the applications of multi rate digital signal processing? **(5M)**

(OR)

11. Write short notes on **(5M)**
(i) Methods to prevent overflow.
(ii) Up sampling, Interpolation and the concept of decimation. **(5M)**

****

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech II Semester

Digital Signal Processing

(ECE)

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B

Part A is compulsory which carriers 10 and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

****

PART – A (10 Marks)

1.

(a) Define causal system and also linear system. **(1M)**

(b) Write the Z-transform of the sequence X(n) = [3,8,2,1,-1,4]. **(1M)**

(c) Find the IDFT of X(K) = {1,1,1,1}. **(1M)**

(d) What are the differences and similarities between DIF and DIT algorithms? **(1M)**

(e) What are the properties of Bilinear Transformations? **(1M)**

(f) Why impulse invariant method is not preferred in the design of IIR filter other than the low pass filter? **(1M)**

(g) Write the important features of IIR filters. **(1M)**

(h) Mention 4 advantages of FIR filter. **(1M)**

(i) State sampling theorem. **(1M)**

(j) What is decimation? When it is performed? **(1M)**

PART – B (50 Marks)

SECTION – I

2. a. Check for the stability and Causality of the following systems. **(5M)**

(i) $h(n) = x(n-1)$ (ii) $h(n) = n^2 x(-n)$

b. Determine and sketch the magnitude and phase response of the given system **(5M)**

$y(n) = 1/2 [x(n) + x(n-1)]$

(OR)

3. Describe the digital signal processing system. **(10M)**

SECTION – II

4. Determine the IFFT using DIT method for X(k) = { 4,-6, 8, -10, 12, -3, 2, -1} **(10M)**

(OR)

5. Find the 8-point DFT of the following Sequences by using DIT FFT algorithm: **(10M)**

x(n) = {1,1,1,1,0,0,0,0}

SECTION – III

6. Design a digital low pass IIR Chebysher filter for pass band cut off frequency of 1500 Hz, stop band cut off frequency of 7500 Hz, Attenuation in pass band 3 dB and attenuation in stop band 15dB. Assume suitable sampling frequency? Use Bilinear transformation. **(10M)**

(OR)

7. Design a Butterworth low pass filter for the specifications given below:

i) -3dB cut off frequency of 100 rad / sec.

ii) -25 dB cut off frequency of 250 rad / sec. **(2*5=10)**

SECTION – IV

8. Determine the order of low pass digital FIR filter using an appropriate window function for the following specifications:

Pass band cut off frequency fp = 150Hz, Stop band frequency fs= 250 Hz. Pass band ripple Ap = 0.1 dB Stop band attenuation As = 40dB Sampling frequency F = 100 Hz.

Also give the design procedure for the above problem**.** **(10M)**

(OR)

9. (i) Compare IIR and FIR filters **(6M)**

(ii) What is an aliasing effect **(4M)**

SECTION – V

10. a. Explain the interpolation process. How it is different from Decimation? **(5M)**

b. How do you change the sampling rate by arbitrary factor? **(5M)**

(OR)

11. Write short notes on

(i) Explain the application of multirate signal processing **(6M)**

(ii) Comparison between DSP and other microprocessor architectures. **(4M)**

******

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech II Semester

Digital Signal Processing

(ECE)

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B

Part A is compulsory which carriers 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

****

PART-A (10 Marks)

1). a	State the conditions for a system to be stable and causal.	**[1M]**
b	Check whether or not the system y(n) = T [x(n)] = x (-n) is time-invariant.	**[1M]**
c	Find the DFT if the sequence x(n) = [2 0 -1 1]	**[1M]**
d	Why FFT is preferred to DFT?	**[1M]**
e	Why impulse invariant method is not preferred in the design of IIR filter other than low pass filter?	**[1M]**
f	What are the properties of bilinear transformation?	**[1M]**
g	Distinguish between FIR and IIR filters.	**[1M]**
h	Give the expression for the frequency response of Hamming window and Hanning window.	**[1M]**
i	Explain the meaning of Interpolation.	**[1M]**
j	Give 2 applications of Multi Rate Signal Processing.	**[1M]**

PART-B (50 MARKS)

SECTION-I

2. a.	Check for the stability and causality of the following systems: (i) $H(n) = x(n^2)$ (ii) $h(n) = x(-n)$	**[10M]**
b.	Find the system's response to the input $x(n) = \{1/2\}^n .u(n)$ with zero initial conditions $y(n) = ¾\ y(n-1) – 1/8\ y(n-2) + x(n) – x(n-1)$	

OR

3. a.	Verify the system y(n) = 2 / [x(n) + 3] for its linearity time invariance, causality and stability.	**[10M]**
b.	Obtain the frequency response of the system; Y(n) = -2y(n-1) + 3 y (n-2) + 4 x(n) and plot.	

SECTION-II

4	Determine IFFT using DIT method for X(k) = {4, -6, 8, -10, 12, -3, 2, -1}	**[10M]**

OR

5	Find the 8 point DFT of the following sequences using DIT FFT: (i) x(n) = {1, 1, 1, 1, 0, 0, 0,0} (ii) x(n) = {1, 2, 1, 2)	**[10M]**

SECTION-III

6 Design a Butterworth filter satisfying the constraints using bilinear transformation: **[10M]**

$0.75 \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq \pi/2$

$|H(e^{j\omega})| \leq 0.2 \qquad 3\pi/4 \leq \omega \leq \pi.$

OR

7 Design a Butterworth IIR low pass filter with the following specifications: Pass band ripple α_p = 1 dB, stop band attenuation α_s = 40dB, pass band edge frequency is 2000Hz, stop band edge frequency is 10000Hz and sampling frequency is 25000Hz, using bilinear transformation technique. **[10M]**

SECTION-IV

8 The designed response of a certain FIR filter is given by: **[10M]**

$H_d(f) = \{ 1 \; 0 \leq f \leq 1$ KHz

$\{ 0 \; f > 1$ KHz.

Let the sampling rate be f_s = 10 KHz. Impulse response is of 1 milli-sec duration. Use Hamming window and compute the impulse response of FIR filter.

OR

9 Design an ideal LPF, whose response is **[10M]**

$H_d(e^{jw}) = e^{j3w} \quad 0 \leq \omega \leq \pi/3$

$= 0$ otherwise.

Using a rectangular window, N=5

SECTION-V

10 a. Derive and draw the spectrum of a down sampler used in decimator. **[5M]**

b. State and prove identities used in Multirate signal processing related to decimator. **[5M]**

OR

11 a. What are the advantages of Multi-rate signal processing? **[5M]**

b. What are the two basic operations in Multi-rate signal processing? **[5M]**

******

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech II Semester

Digital Signal Processing(ECE)

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B
Part A is compulsory which carriers 10 marks and Answer all questions.
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

****

PART-A (10 Marks)

1). a	What are advantages and disadvantages of DSP?	**[1M]**
b	Explain about linearity and time invariance of a system.	**[1M]**
c	What are differences between DIT FFT and DIF FFT	**[1M]**
d	Find the DFT of x[n] = {1,1,0,0}.	**[1M]**
e	What are the disadvantages of impulse invariant method.	**[1M]**
f	What are the important features of IIR filters?	**[1M]**
g	Write the advantages of FIR filters.	**[1M]**
h	Define Linear phase system.	**[1M]**
i	What is multi rate signal processing?	**[1M]**
j	What is interpolation?	**[1M]**

PART-B (50 MARKS)

SECTION-I

2	Check the linearity and time invariance of the following system $Y(n)= Ax^2(n)+B$ ii) $y(n)=n\,x(2n)$	**[10M]**
	OR	
3	For the given system $y(n)=x(n)-2x(n-1)+x(n-2)$, determine the magnitude and phase response.	**[10M]**

SECTION-II

4	Find the DFT of a sequence x[n]={1,1,1,1,1,0,0,0} using DIT FFT algorithm	**[10M]**
	OR	
5	Compute 8-point DFT of the sequence $x[n]= 1;\ 0\leq n \leq 7$ $=0$ otherwise by using DIF algorithm.	**[10M]**

SECTION-III

6	Design a Chebyshev filter with α_p=2.5dB, Ω_p=20 rad/sec, α_s=30dB, Ω_s=50rad/sec.	**[10M]**
	OR	
7	Using the Bilinear transform, design a high pass filter monotonic in pass band with cut off frequency of 1000Hz and down 10dB at 350Hz. The sampling frequency is 5000Hz.	**[10M]**

SECTION-IV

8 Compare IIR and FIR filters and discuss the various steps in designing FIR filter **[10M]**

OR

9 Design an ideal low pass filter with frequency response **[10M]**

$H_d(e^{jw}) = 1$ for $-\pi/2 \leq w \leq \pi/2$

$= 0$ for $\pi/2 \leq |w| \leq \pi$, find the values of h(n) for N=11,find H(z)

SECTION-V

10 a) Explain the spectrum of down sampling. **[5M]**

b) Write the applications of multi rate signal processing. **[5M]**

OR

11 a) Explain about anti-aliasing filter. **[5M]**

b) Explain about sampling rate conversion **[5M]**

******