# DEPT. OF ELECTRONICS \& TELECOMMUNICATION ENGINEERING GOVERNMENT POLYTECHNIC, BALASORE QUESTION BANK <br> ON <br> TH3- DIGITAL SIGNAL PROCESSING <br> SEMESTER \& BRANCH : - 6H $^{\text {TH }}$ SEM, E \& TC ENGINEERING 

## 2 MARKS QUESTIONS

1. Define sampling Theorem.
2. Differentiate between discrete signal and digital signal.
3. What is an LTI system?
4. Define ROC.
5. Write down any two properties of Z- transform.
6. What is the condition for system stability?
7. What is Zero padding?
8. Distinguish between DFT \& DTFT.
9. Define causal \& non causal system
10. Define DFT
11. Define periodic \& Aperiodic signals.
12. Define Twiddle factor.
13. What is Radix 2 FFT
14. Define time-varient \& time-invarient signals
15. What is multichannel signal?
16. What is shifting operation on discrete time signal?
17. What is quantization?
18. What is signal processing? Give any two application of it?
19. Find the Z-transform and ROC of $x(n)=\{2,3,0,1,3\}$
20. Draw the basic butterfly diagram for DIF-FFT
21. Verify whether $x(n / 2)=y(n)$ is a time invariant system.
22. Define correlation
23. State sampling theorem
24. What are the properties of frequency response of an LTI system?
25. Define the pole and zero of a system function.
26. What do you mean by time domain aliasing?
27. How many complex additions and multiplications are required for a 16 bit sample in DIT-FFT algorithm?
28. Write down properties of Convolution.
29. Define a stable system.
30. Relate DFT to Z-Transform
31. What are the advantages of FIR Filters?
32. Determine $x(n)=u(n+1)$ is a casual signal or non-casual signal.
33. What are the necessary conditions for stable system?
34. Write down all methods are used for find out inverse z-transform
35. Write down the periodicity and time reversal properties of DFT
36. State the applications of FFT algorithm
37. What is $z$ transform?
38. What is Twiddle Factor?
39. What is the need of signal processing and give any two applications.
40. Draw the basic butterfly diagram for DIT - FFT and DIF-FFT.
41. Define signal and system.
42. State the difference (any four) between FIR and IIR systems.
43. Define z-transform and where it is used?
44. Name number of complex multiplications \& additions required to compute $N$ point DFT.
45. State direct and inverse z-transform.
46. Distinguish between energy and power signal.
47. Why is folding of a signal required in convolution of two signals?
48. What is LTI system? Give one example.
49. What are the major classifications of digital signals?
50. Define multichannel and multidimensional signal.
51. Find the $z$-transform of the sequence $x(n)=\{-1,3,3,1,0,2\}$
52. What do you mean by N-point DFT?
53. What are digital filters?
54. What is discrete-time signal?
55. Define continuous time and discrete time.

## 5 MARKS QUESTIONS

1. Determine the system described by $y(n)=[x(n)+1 / x(n)]$ is linear or non linear, where $x(n) \& y(n)$ are input and output respectively.
2. Write down the properties of Z-transform.
3. Find the 4 -point DFT of the sequence $x(n)=\{1,2,1,1\}$
4. Sketch the block diagram representation of discrete time system described by the input, output output relation $y(n)=2 y(n-1)+3 y(n+1)+x(n)+[1 / 2 x(n+1)]+[1 / 4 x(n-2)]$, where $x(n)$ is the input sequence \& $y(n)$ is the output sequence.
5. Determine the Power and Energy of Unit step signal.
6. Compare the advantage of digital signal processing over analog signal processing.
7. Explain the properties of recursive and non recursive discrete time system
8. What are the elementary of discrete time signal and explain?
9. Determine the system function \& unit sample response of the system? $y(n)=1 / 2 y(n-1)+2 x(n)$
10. Discuss various properties of Z-transform.
11. Determine the inverse $z$-transform of the sequence using long division method

$$
\mathbf{X}(\mathbf{z})=\frac{1+2 z^{-1}}{1-2 z^{-1}+z^{-2}} ; \quad \text { if } x(n) \text { is causal } .
$$

12. Verify whether the following systems are time variant or time invariant $Y(n)=X(-n)$ (ii) $Y(n)=X(n)+X(n-1)$
13. Compute poles, zeros and system response of the following: $Y(n)=2 y(n-1)+3 x(n)$
14. Determine the value of power and energy of $x(n)=\operatorname{Sin}(n \pi / 4)$.
15. Determine the $z$-transform and ROC of the signal $x(n)=\{2,4,5,7,0,1\}$ with the starting index of the sequence is equal to -2 .
16. If the signal $x(n)=\{1,2,6,4,3,7,5\}$ then find $x(2 n), x(n / 2), x(n+2), x(3-n), 3 x(n-1)$
17. What is twiddle factor and define zero padding with example.
18. Define Linear Convolution. State its properties.
19. Differentiate between analog and digital filter.
20. Compute 4 point DFT of a sequence $x(n)=\{0,1,2,3\}$ using DIF-FFT algorithm
21. Classify Different Signals.
22. $\mathbf{y}(\mathbf{n})=\mathbf{2 x}(\mathrm{n})+\mathbf{1} / \boldsymbol{x}(\boldsymbol{n - 1})$ is Linear or Nonlinear System verify.
23. Determine Z-Transform and ROC of Signal $\mathbf{x}(n)=a^{n} u(n)$.
24. Explain recursive and non-recursive discrete time system
25. Describe different properties of DFT.
26. Compute DFT of a sequence $x(n)=\{1,-1,1,-1\}$ using DIT Algorithm.
27. What is signal processing? Draw block diagram \& explain digital signal processing system
28. Draw and explain principle of Analog to Digital Converter.
29. Find the $z$-transform and ROC of a system $x(n)=a^{n} u(n)-b^{n} u(n)$.
30. Determine the Inverse z-transform of $X(z)=1 / 1-1.5 z^{-1}+0.5 z^{-2}$ Where (i) ROC : $|z|>1$ (ii) ROC : $|z|<0.5$ (iii) ROC : $0.5<|z|<1$
31. Write down the advantages of Digital Signal Processing over analog signal processing.
32. Determine z-transform \& ROC of the finite duration signals: $x(n)=\{1,0,3,-1,2\}$
33. Discuss the algorithm of DIT - FFT.
34. Draw the reduced flow graph for 4 point DIF - FFT.
35. Compute the Convolution $y(n)$ correlation $r(n)$ for the given signals: $x 1(n)=\{1,2,3,4\} \& x 2(n)=\{1,2,3,4\}$
36. Find the step response of the following differential equation: $y(n)-5 y(n-1)+6 y(n-2)=x(n)$
37. Find the $z$ transform and ROC of $x(n)=(0.4)^{n} u(n)+(0.3)^{n} u(n-4)$
38. Determine the IDFT of $X(K)=\{1,0,1,0\}$
39. Show the graphical representation of the signals, $x(n-2), x(n+3), x(-n-2)$, and $x(-n+3)$ where $x(n)=\{1,2,1,2,1\}$
40. Find the system function of the system described by the difference equation $y(n)=x(n)+2 x(n-1)-4 x(n-2)+x(n-3)$
41. Find the circular convolution of two finite duration sequence $x 1(n)=\{1,2,3,4\} \& x 1(n)=\{4,3,2,1\}$
42. State the difference between analog filter and digital filter.
43. What are the various types of realization structure for FIR and IIR filter?
44. State and explain symmetry property of DFT.
45. Discuss the radix-4 FFT algorithm
46. Compute DFT of the four point sequence $x(n)=\{0,1,2,3\}$
47. Determine if the following systems are causal or non causal.
i. $\quad y(n)=x(n)+\frac{1}{x(n)}$
(ii) $y(n)=x\left(n^{2}\right)$

## 10 MARKS QUESTIONS

1. Define the term signal and signal processing, Explain the digital signal processing system with neat block diagram.
2. Determine the Z-transform and ROC of the signal: $\mathbf{x}(\mathbf{n})=a^{n} \mathbf{u}(\mathbf{n})+\mathbf{b}^{n} \mathbf{u}(-\mathbf{n - 1})$
3. Determine the circular convolution of the sequences $\times 1(n)=\{2,1,2,1\} \& x 2(n)=\{1,2,3,4\}$
4. Find 8 -point DFT of the sequence is given by $x(n)=\{2,1,2,1,1,2,1,2\}$ by radix- 2 DIT-FFT.
5. Write down the properties of DFT.
6. Show the graphical representation of the signal, If $x(n)=\{2,1,0,2,1,3\}$, find $x(-n-2)$
7. Compute the Z-transform and ROC of $\mathbf{x}(n)=2^{n} \mathbf{u}(n)+3^{n} u(-n-1)$.
8. Compute 4-point DFT of the following sequence, $x(n)=\{0,1,2,3\}$
9. Determine the circular convolution of the given sequence using concentric circle method: $X(n)=\{1,2,3,0\}$ and $Y(n)$ $=\{1,2,1,1\}$
10. Determine the DFT of the sequence using DIT-FFT algorithm: $x(n)=\{1,2,3,4\}$
11. Find the convolution of

$$
x(n)=\left\{\begin{array}{l}
n / 2,0 \leq n \leq 5 \\
0, \text { elsewhere }
\end{array}\right\} \& h(n)=\delta(n)-\delta(n-1)+\delta(n-2)-\delta(n-3)
$$

12. Find the $z$-transform and ROC of $x(n)=(n+0.5)(1 / 3)^{n} u(n)$
13. Find the IDFT of the sequence $x(n)=\{1,1-2 j,-1,1+2 j\}$
14. Find the DFT of a sequence $x(n)=\{1$ for $0 \leq n \leq 2 ; 0$ otherwise $\}$ for $N=4$

15 . Find the Inverse $z$ transform of $X(Z)=\frac{1+3 z^{-1}}{1+3 z^{-1}+2 z^{-2}}$.
16. Define circular convolution. Find the circular convolution of $\{1,2,2,1\}$ and $\{1,2,3,1\}$ using circular convolution.
17. Determine solution of difference equation $\mathbf{y}(\mathrm{n})=5 / 6 \mathbf{y}(\mathrm{n}-1)-1 / 6 \mathbf{y}(\mathrm{n}-2)+\mathrm{x}(\mathrm{n})$ for $\mathbf{x}(\mathrm{n})=\mathbf{2}^{\mathrm{n}} \mathbf{u}(\mathrm{n})$
18. Find circular convolution of two finite duration sequence $x 1(n)=\{1,-1,-2,3,-1\}$ and $\times 2(n)=\{1,2,3\}$.
19. What are different steps required for radix-2 DIF-FFT algorithm?
20. Find the 8 -point DFT of the sequence given by $x(n)=\{2,2,2,2,1,1,1,1\}$ by using Radix -2 DIT-FFT algorithm
21. By using partial fraction expansion method, find the inverse $z$ transform of

$$
X(z)=\frac{z\left(z^{2}-4 z+5\right)}{(z-1)(z-2)(z-3)}
$$

22. Determine the causal signal $\mathrm{x}(\mathrm{n})$ having the z transform using partial fraction expansion method,

$$
x(z)=\frac{1}{\left(1-2 x^{-1}\right)\left(1-x^{-1}\right)^{2}}
$$

23. Determine the DFT of the sequence $x(n)=\{1,2,1,1,0,1,1,1\}$ using DIT-FFT algorithm
24. (i) Discuss causal and non-causal LTI systems with example.
(ii) State and explain sampling theorem.
25. Express the signal $x(n)=\{1,-2,3,0,1,-5,2,1\}$ in even and odd signal.
26. Find out the impulse response of the system $y(n)-\frac{5}{2} y(n-1)+y(n-2)=x(n)-x(n-1)$
27. Describe DFT and FFT algorithm and write the computational formula.
