Reg. No. :

Question Paper Code : X 67566

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth Semester
Electrical and Electronics Engineering
EC 1307 – DIGITAL SIGNAL PROCESSING
(Common to Electronics and Instrumentation Engineering)
(Regulations 2008)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is a power signal ?
2. Check if the system $y(n) = nx^2(n)$ is linear.
3. What is the relation between Fourier Transform and Z Transform ?
4. What is Dirchlet's condition ?
5. State any two DFT properties.
6. Calculate the percentage saving in calculations in a 512 – point radix 2 FFT, when compared to direct DFT.
7. List the different types of structures for realizing FIR systems.
8. List some of the finite word length effects in digital filters.
9. What is the need for specialized digital signal processor ?
10. How round-off error affects filter design ?

PART – B **(5×16=80 Marks)**

11. a) Check the causality of following system :
    i) $y(n) = x(n) - x(n-1)$ **(4)**
    ii) $y(n) = ax(n)$ **(4)**
    iii) $y(n) = x(-n)$ **(4)**
    iv) $y(n) = x(2n)$ **(4)**

(OR)

b) i) Explain the classification of signals. **(8)**

ii) List and discuss the classification of the systems with appropriate expressions. **(8)**

12. a) i) Find the Z transform of the signal $x(n) = (1/3)^{n-1}\, u(n-1)$. **(8)**

ii) Determine the causal signal x(n) which has the Z transform. **(8)**

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

(OR)

b) i) Consider a LTI system described by the difference equation $y(n) = \frac{1}{4}y(n-2) + x(n)$. Determine the impulse response of the system. **(8)**

ii) Find the poles of the system.

$$y(n) - \frac{1}{4}y(n-1) + \frac{1}{4}y(n-2) - \frac{1}{16}y(n-3) = 2x(n) - 3x(n-1)$$

and determine if the system is stable. **(8)**

13. a) i) Determine the 6-point DFT of the signal. **(10)**

$x(n) = \{3, 2, 1, 0, 1, 2\}$.

ii) Present DFT and IDFT transformation pair in matrix form. **(6)**

(OR)

b) Develop 8-point radix-2 decimation in time algorithm with input in normal order and output in digit reversed order. Derive the necessary equations and show the flow diagrams. **(16)**

14. a) Design a low pass FIR filter that approximates the following frequency response,

$$H(f) = \begin{cases} 1; & 0 \le f \le 1000 \text{ Hz} \\ 0; & \text{elsewhere in the range} \quad 0 \le f \le fs/2. \end{cases}$$

(OR)

b) Design a first-order digital Butterworth high pass filter which is equivalent to an analog filter with cutoff frequency 1 KHz at a sampling rate of 10^4 sps. Use bilinear transformation.

15. a) With a neat block diagram explain the architecture of TMS320C54X. **(16)**

(OR)

b) Study the limit cycle behavior of the system described by $w(n) = Q[aw(n-1)] + x(n)$ where w(n) is the output of the filter and Q[.] is quantization. Assume that $a = 7/8$, $x(0) = 3/4$ and $x(n) = 0$ for $n > 0$. **(16)**
