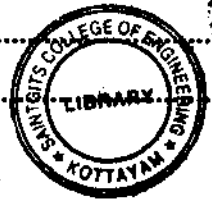


G 361

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Reg. No.....

Name.....



B.TECH. DEGREE EXAMINATION, MAY 2014

Sixth Semester

Branches : Applied Electronics and Instrumentation/Electronics and Communication/
Electronics and Instrumentation Engineering

AI 010 602/EC 010 602/EI 010 602—DIGITAL SIGNAL PROCESSING (AI, EC, ED)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours

Maximum : 100 Marks

Part A

*Answer all questions briefly.
Each question carries 3 marks.*

1. Determine if the system $y(n) = e^{x(n)}$ is time invariant or not ?
2. Find the transfer function description of the system difference equation
 $y(n) = x(n) - b_1 y(n-1) - b_2 y(n-2)$, where $x(n)$ is input and $y(n)$ is the output.
3. Draw the frequency response characteristics for the ideal low-pass, band-pass and high-pass filters.
4. Write the equations specifying Barlett and Hamming windows.
5. Obtain the linear convolution of the sequences $x(n) = \{1, 2, 3\}$, $h(n) = \{-1, -2\}$ using circular convolution.

(5 × 3 = 15 marks)

Part B

*Answer all questions.
Each question carries 5 marks.*

6. Find the z-transform of $x(n) = n2^n \sin\left(\frac{\pi}{2}n\right)u(n)$.
7. Solve the difference equation, where input sequence is $x(n) = 3^{n-2}$, $n \geq 0$, using z-transform, where
 $2y(n-2) - 3y(n-1) + y(n) = x(n)$ with the initial conditions : $y(-2) = \frac{-4}{9}$, $y(-1) = -\frac{1}{3}$.
8. Draw the cascade and parallel form realisations of $\frac{(4s+28)}{(s+1)(s+5)}$.

Turn over



9. In a band-pass filter, the desired frequency response is :

$$H_d(e^{jw}) = \begin{cases} e^{-jw\tau} & , w_{c_1} \leq |w| \leq w_{c_2} < \pi \\ 0 & , \text{otherwise} \end{cases}$$

Obtain the filter coefficients for a rectangular window for

$$N = 7, w_{c_1} = 1 \text{ rad/s}, w_{c_2} = 2 \text{ rad/s}, \tau = \frac{(N-1)}{2}$$

10. Compute the DFT of the sequence whose values for one period is given by $\tilde{x}(n) = \{1, 1, -2, -2\}$.
(5 × 5 = 25 marks)

Part C

Answer all questions.

Each question carries 12 marks.

11. Calculate the frequency response for the LTI system representation below :

- (a) $h(n) = \left(\frac{1}{2}\right)^n u(n)$.
- (b) $h(n) = \delta(n) - \delta(n-1)$.
- (c) $h(n) = (0.9)^n (e^{j\pi/2})^n u(n)$.

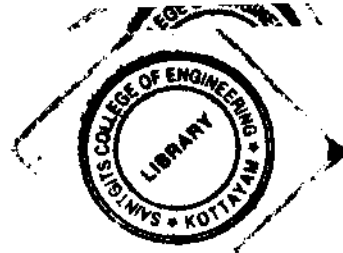
Or

12. A causal LTI system is described by the difference equation $y(n] - ay(n-1) = bx(n) + x(n-1)$ where 'a' is real and less than 1 in magnitude. Find a value of 'b' ($a \neq b$) such that the frequency response of the system satisfies $|H(e^{jw})| = 1$ for all w .

13. For the LSIV system $H(s) = \frac{z - a^{-1}}{z - a}$, where 'a' is real.

- (a) For what range of values of 'a' is the system stable ?
- (b) If $0 < a < 1$, plot the pole-zero diagram and shade the ROC.
- (c) Show graphically in the z-plane that this system is an all pass system.

Or



14. Find $H(z)$, and the frequency response of $h(n) = \left(\frac{1}{2}\right) \left[\left(\frac{1}{2}\right)^n + \left(\frac{-1}{4}\right)^n \right] u(n)$ substituting $z = e^{j\omega}$.

Locate the zeros and poles in the z -plane.

15. (a) Determine the direct form realisation of the system function

$$H(z) = 1 + 2z^{-1} - 3z^{-2} - 4z^{-3} + 5z^{-4}.$$

- (b) Obtain the cascade realisation of the system function $H(z) = 1 + \frac{5}{2}z^{-1} + 2z^{-2} + 2z^{-3}$.

Or

16. Design an ideal low-pass filter with frequency response

$$H_d(e^{j\omega}) = 1 \quad \text{for } -\frac{\pi}{2} \leq \omega \leq \frac{\pi}{2}$$
$$= 0 \quad \text{for } \frac{\pi}{2} \leq |\omega| \leq \pi.$$

Find the values of $h(n)$ for $N = 11$.

17. Design a filter with $H_d(e^{j\omega}) = e^{-j3\omega}$, $-\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4}$
- $$= 0, \quad \frac{\pi}{4} < |\omega| \leq \pi.$$

Use Hanning window with $N = 7$.

Or

18. Using Bilinear Transformation design a digital band-pass Butterworth filter with the following specifications:

Sampling frequency $f = 8$ kHz

$\alpha_p = 2$ dB in the pass-band $800 \text{ Hz} \leq f \leq 1000 \text{ Hz}$

$\alpha_s = 20$ dB in the stopband, $0 \leq f \leq 400 \text{ Hz}$ and $2000 \leq f \leq \infty$.

19. Find the output of $y(n)$ of a filter whose impulse response in $h(n) = \{1, 1, 1\}$ and input signal $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$ using (a) overlap-save method; and (b) overlap-add method.

Or

20. Find the DFT of a sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT algorithm.

(5 × 12 = 60 marks)