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E – 3057

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, June 2018
(2008 Scheme)
08.604 – DIGITAL SIGNAL PROCESSING (R)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Determine whether the signals (i) $h(t) = e^{-2t} u(t-50)$ and (ii) $h(n) = n\left(\frac{1}{3}\right)^n u(n-1)$ are stable.

2. Define causal system and linear system.

3. Find the DTFT of the sequence $x[n] = 4\ 2^n u(-n)$.

4. Give four properties of the ROC of Z-transform.

5. Prove that DTFT is periodic.

6. State and prove scaling property of Z-transform.

7. What properties of the twiddle factor W_N are exploited is FFT algorithms to reduce the number of computations ?

8. A digital filter has the system function $H(z) = \frac{1-2z+3z^2}{3-2z+z^2}$. What type of filter is this ? Account for your answer.

9. Show that the response of a LSI system is unchanged if the input and system impulse response are interchanged.

10. What are the merits and demerits of representing IIR structures in direct and cascade forms ?

(10×4=40 Marks)

P.T.O.

PART – B

Answer **any one full** question from **each** Module. **Each** question carries **20** marks.

Module – I

11. a) A causal system is given by y[n] = 2y (n – 1) + x(n) + x(n – 1). Find its impulse response and determine the step response from the impulse response. **6**

b) Find the limits for m so that the difference equation y(n) – my (n – 2) – 0.4 y(n – 1) = x(n) represents a stable LTI system. Here x (n) and y (n) are input and output sequences respectively. **5**

c) Determine whether each of the following is causal, stable and time invariant.

i) $y[n] = \sum_{k=n-n_0}^{n+n_0} x[k]$

ii) $y[n] = e^{x[n]}$ **9**

12. a) Determine the impulse response and stop response of the system $y[n] = e^{k}y(n-1) - x(n)$ given that y (n) = 0 for n < 0. Also analyze the stability of the system. **9**

b) Input of a digital system is $a^n u[n]$ and its impulse response is $b^n u(n)$. Obtain the time domain output of the system. **5**

c) Plot the discrete sequences :

i) u (n + 5) – 2u (n – 3)

ii) a^n u (n – 3) where a = – 0.5

iii) 5cos(200 πt) sampled by 1 KHz. **6**

Module – II

13. a) Perform circular convolution of {2, 1, 0, 1} and {3, 1, 1, 4} using DFT-IDFT approach. Verify the result. **10**

b) Determine the inverse Z-transform of the function $x(z) = \frac{1-2z^{-1}}{1-7z^{-1}+10z^{-2}}$

for the ROCs

i) |z| > 5 ii) |z| < 2 iii) 2 < |z| < 5 **10**

14. a) Show that $\sum_{n=0}^{N-1}|x(n)|^2 = \frac{1}{N}\sum_{k=0}^{N-1}|X(k)|^2$ where X(k) is the N-point DFT of x(n). **6**

b) Using radix-2 DITFFT algorithm, obtain the 4 point DFT of the sequence $x(n) = \{1, 2, 3, 4\}$. **6**

c) Obtain the Z-transform of the following sequences

i) $x(n) = a^n \cos\omega n\, u(n)$

ii) $x(n) = n^2\, u(n)$ **8**

Module – III

15. a) A system is represented by the transfer function H(z) given by

$$H(z) = 3 + \frac{4z}{z-\frac{1}{2}} - \frac{2}{z-\frac{1}{4}}$$

i) Does this H(z) represent an IIR or a FIR filter ? Why ?

ii) Realize the system in direct form 1, direct form II and parallel realizations. **10**

b) Obtain the direct form I, direct form II, cascade and parallel structures for the system $y(n) = -0.1\, y(n-1) + 0.72\, y(n-2) + 0.7\, x(n) - 0.252\, x(n-2)$. **10**

16. a) Consider the discrete time causal system

$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{3}x(n-1)$. Draw signal flow graph to implement this system in cascade and parallel form. **10**

b) Compare the four types of digital filter realization (direct form I, direct form II, cascade and parallel) in the matter of (i) hardware requirement (ii) hardware flexibility (iii) sensitivity of coefficient quantization and (iv) dynamic range. **10**

(3×20=60 Marks)