

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: AE306

Course Name: DIGITAL SIGNAL PROCESSING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) Find the DFT of a sequence $x(n)=\{1,2,3,4,4,3,2,1\}$ using DIT algorithm. (8)
- b) Check if all the roots of the characteristic equation $z^3+0.25z^2+z+0.25=0$ lie within the unit circle using Jury's test. (7)
- 2 a) State and explain sampling theorem (3)
- b) Find the nyquist rate of $x(t)=\sin 400\pi t+\cos^2 500\pi t$ (4)
- c) Determine the Z transform and ROC of (8)
 - I. $x_1(n) = (2)^n \cos \omega n$
 - II. $x_2(n) = nu(n)$.
- 3 a) Find the DTFT of $x(n)=a^{|n|}$ (3)
- b) Find the inverse Z transform of $X(z)=\frac{z}{(z-\frac{1}{2})(z-2)}$ for all possible ROC's. (9)
- c) Compare the computational complexities of DFT computation for $N=16$ using DIT FFT and direct method. (3)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Design an ideal digital differentiator with frequency response $H_d(e^{j\omega})=j\omega$ for $-\pi \leq \omega \leq \pi$ using rectangular window with $N=8$ (7)
- b) For the analog transfer function $H(s)=\frac{2}{(s+1)(s+2)}$, determine $H(z)$ using impulse invariance method (Assume $T=1$ sec) (8)
- 5 a) Using bilinear transform, design a high pass filter, monotonic in pass band with cut off frequency of 1000Hz, $\alpha_p=3$ dB and, $\alpha_s=10$ dB at 350Hz. The sampling frequency is 5000Hz (10)
- b) Design an ideal low pass FIR filter with $H_d(e^{j\omega})=1$ for $-\frac{\pi}{2} \leq \omega \leq \frac{\pi}{2}$ (5)
 $= 0$ for $\frac{\pi}{2} \leq |\omega| \leq \pi$

Find $h(n)$ for $L=11$ using direct truncation

- 6 a) Explain the classification of linear phase FIR filter (10)
- b) Given the specification $\alpha_p=1\text{dB}$, $\alpha_s=30\text{dB}$, $\Omega_p=200\text{ rad/sec}$ and, $\Omega_s=600\text{ rad/sec}$. (5)
Determine the order of the filter.

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Obtain the direct form I, direct form II, cascade and parallel realization of the system $H(z)=\frac{1+\frac{1}{3}z^{-1}}{1-\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}$ (10)
- b) Draw and explain the architecture of TMS 320C 5X (10)
- 8 a) Explain the von-Neumann architecture with a neat block diagram. (10)
- b) Realize the following FIR system function using minimum number of multipliers (5)
 $H(z)=\{1+\frac{1}{2}z^{-1}+\frac{1}{2}z^{-2}+\frac{1}{3}z^{-3}\}\{1+\frac{1}{3}z^{-1}\}$
- c) Explain the fixed point and floating point representation of numbers (5)
- 9 a) Explain (10)
- I. Harvard architecture
 - II. Pipelining
- b) Explain the effects of quantization and round off in digital filter coefficients (6)
- c) Explain the errors resulting from rounding and truncating (4)
