

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), April-May 2018

B. Tech/ M. Tech (as applicable) in Engineering, Semester ...VI...

Roll No.....

ECE 603:Digital Signal Processing

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Assume suitable data wherever required and mention it clearly.
 3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
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Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

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- i. Given a unit step function $u(t)$. Its time derivative is
 - (a) a unit impulse
 - (b) another step function
 - (c) a unit ramp function
 - (d) a sine function
- ii. The period of the signal $x(t)=10\sin(12\pi t)+4\cos(18\pi t)$ is
 - (a) $\pi/4$
 - (b) $1/6$
 - (c) $1/9$
 - (d) $1/3$
- iii. Given $x(n)=a^{|n|}$, $|a| < 1$ is
 - (a) an energy signal
 - (b) a power signal
 - (c) neither an energy nor a power signal
 - (d) an energy as well as a power signal
- iv. Any signal $x(t)$ can be represented as
 - (a) $x_{\text{even}}(t) + x_{\text{odd}}(t)$
 - (b) $x_{\text{even}}(t) - x_{\text{odd}}(t)$
 - (c) $x_{\text{even}}(t)/x_{\text{odd}}(t)$
 - (d) $x_{\text{even}}(t) \times x_{\text{odd}}(t)$

v. The DTFT of a function $x(n)$ is $X(e^{j\omega})$. The FT of $nx(n)$ will be

(a) $j \frac{dX(e^{j\omega})}{d\omega}$

(b) $\frac{dX(e^{j\omega})}{d\omega}$

(c) $j\omega \frac{dX(e^{j\omega})}{d\omega}$

(d) $\frac{X(e^{j\omega})}{j\omega}$

Vi The ROC of a causal finite duration discrete-time signal is

(a) the entire z -plane except $z=0$

(b) the entire z -plane except $z=\infty$

(c) the entire z -plane

(d) a ring in z -plane

Vii The Z-transform of $\delta(n-m)$ is

(a) z^{-n} (b) z^{-m} (c) $\frac{1}{z-n}$ (d) $\frac{1}{z-m}$

Viii What is Bilinear transformation?

Ix What is twiddle factor?

x Write the Parseval's theorem used in Fourier transform for Energy calculation.

Q.2 Short answer type questions (4 questions @ 2.5 marks)

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(a) Find whether the system is BIBO stable $h(n)=2^n u(5-n)$

(b) Determine whether the signal is energy or power $x(n)=u(n)$

(c) Test whether the following signal is periodic or not and if periodic, calculate the fundamental period. $X(n)=e^{j\frac{2\pi}{3}n} + e^{j\frac{3\pi}{4}n}$

(d) Find the even and odd component of the following signal $x(t)=u(t)$

Q.3A Find the linear convolution of the following sequences $x(n)=\{1, 2, 3, 4\}$ and $h(n)=\{2, -4, 6, -8\}$ by using graphical technique.

05

Q.3B Given $x[n]=\{2, 3, 4, 1, 6, 7, 5, 2, 4\}$ sketch the following signals

05

(a) $X(-n)u(-n)$

(b) $X(n)[u(n+2)-u(n-3)]$

- Q.4A Find the initial and final values of the following function 05

$$X(z) = \frac{10z(z-0.4)}{(z-0.5)(z-0.3)} \quad \text{ROC: } |Z| > 0.5$$
- Q.4B Find the IDFT of the following functions with $N=4$. $X(k) = \{1, 2, 3, 2\}$ 05
- Q.5A (a) Write five different properties of ROC. 05
 (b) Write the difference between analog and digital filter
- Q.5B Find the circular convolution of the following two sequences $x_1(n) = \{1, 2, 2, 1\}$ and $x_2(n) = \{2, 1, 1, 2\}$ 05
- Q.6A Determine whether the following system is static, causal, time invariant, linear and stable. $Y(n) = 5x[3^n]$ 05
- Q.6B Find the z-transform of the signal $x(n) = [3(3)^n - 4(2)^n]u(n)$ 05
- OR
- Q.6B Find the Z-transform and ROC of $X(n) = \left(\frac{1}{4}\right)^n u(n) + \left(\frac{1}{5}\right)^n u(-n-1)$ 05
- Q.7A Find the DFT of a sequence $x(n) = \{1, 1, 0, 0\}$ 05
- Q.7B Determine the direct forms I and II realization for the second-order filter given by $y(n) = 2b \cos w_0 y(n-1) - b^2 y(n-2) + x(n) - b \cos w_0 x(n-1)$ 05
- OR
- Q.7B An analog filter has a transfer function $H(s) = \frac{10}{s^2 + 7s + 10}$. Design a digital filter equivalent to this using impulse invariant method for $T=0.2$ sec. 05
- Q.8A Design an analog Butterworth filter that has a -2dB passband attenuation at a frequency of 20 rad/sec and at least -10dB stopband attenuation at 30 rad/sec. 10
- Q.9A Given $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8\}$, find $X(k)$ using Decimation in frequency FFT algorithm. 10
- Q.9B Design a low pass filter using Hanning window with a cut-off frequency of 2.4 rad and $N=7$. 10