

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 ...IV...

Roll No.....

ECE408:Engineering Signal & System

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. Choose the false statement

(a) $t \delta(t) = 0$

(b) $\cos(t) \delta(t - \pi) = -\delta(t - \pi)$

(b) $\delta(t) = \int u(t) dt$

(d) $t \delta'(t) = -\delta(t)$

ii. A useful property of the unit impulse $\delta(t)$ is that

(a) $\delta(at) = a \delta(t)$

(b) $\delta(at) = \delta(t)$

(c) $\delta(at) = \frac{1}{|a|} \delta(t)$

(d) $\delta(at) = [\delta(t)]^a$

iii. The discrete-time signal $x(n) = (-1)^n$ is periodic with fundamental period

(a) 6

(b) 4

(c) 2

(d) 0

iv. If the Fourier series coefficients of a signal are periodic, then the signal must be

(a) Continuous time, periodic

(b) Discrete time, periodic

(c) Continuous time, nonperiodic

(d) Discrete time, nonperiodic

v. The fourier series of a real, even periodic signal will contain only

(a) Cosine terms

(b) Sine terms

(c) Even terms

(d) Odd harmonics

- vi The Fourier transform of the exponential signal $e^{j\omega_0 t}$ is
- A constant
 - A rectangular pulse
 - An impulse
 - A series of impulse
- vii The frequency of a continuous-time signal $x(t)$ changes on transformation from $x(t)$ to $x(at)$, $a > 0$, by a factor
- a
 - $\frac{1}{a}$
 - a^2
 - $\sqrt{a}$
- viii A baseband signal has a spectral range that extends from 20 Hz to 82 Hz. Find the acceptable range of the sampling frequency.
- $> 40 \text{ Hz}, < 82 \text{ KHz}$
 - 40 Hz to 82 KHz
 - $\geq 164 \text{ KHz}$
 - $\leq 164 \text{ KHz}$
- ix Two signals $x_1(n)$ and $x_2(n)$ are related by $x_2(n) = x_1(-n)$. In the z-domain, their ROCs are
- The same
 - Reciprocal of each other
 - Negative of each other
 - Complements of each other
- x If the z-transform of $x(n)$ is $X(z)$ with ROC $|z| > R$, then, the z-transform of $a^n x(n)$, $a > 0$ and its ROC are
- $X\left(\frac{z}{a}\right), |z| > aR$
 - $X\left(\frac{z}{a}\right), |z| > R/a$
 - $X(az), |z| < aR$
 - $X(az), |z| < R/a$

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

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- Determine whether the system is linear or not $y(t) = 10 \int_{-\infty}^t x(\tau) d\tau$
- Determine whether the system is time invariant or not $y(t) = at^2 x(t) + btx(t-2)$
- Determine whether the system is static or dynamic $\frac{dy(t)}{dt} + 5y(t) = 2x(t)$
- Identify whether the system is causal or non-causal $y(t) = \int_{t-4}^{t+4} x(\tau) d\tau$

- Q.3A Determine the z-transform for the following signal. Sketch the pole-zero plot and indicate the ROC. $x(n) = n \left(\frac{1}{2}\right)^{|n|}$ 05
- Q.3B What is the condition for stability of a system? Find whether the system $h(n) = e^{-5|n|}$, is BIBO stable?. Calculate the value. 05
- Q.4A Determine IDFT of $Y(k) = \{1, 0, 1, 0\}$. 05
- Q.4B Find $x(n)$, given $h(n) = [1, 2, 3, 2]$ and $y(n) = [3, 8, 17, 25, 26, 23, 10]$ 05
- Q.5A Compute 4-point DFT of the sequence $x(n) = \cos \frac{n\pi}{4}$ and draw the phase and magnitude spectrum. 05
- Q.5B Determine the z-transform and ROC for the following signal
 $x(n) = n \left(-\frac{1}{4}\right)^n u(n) * \left(-\frac{1}{6}\right)^{-n} u(-n)$ 05
- Q.6A State the sampling theorem and find out the Nyquist rate for the signal
 $x(t) = 3 \cos(2000\pi t) + 5 \sin(6000\pi t) + 10 \cos(12000\pi t)$ 05
- Q.6B Write different properties of ROC and find out the relationship between Z-Transform and Fourier transform. 05
- Q.7A Determine the given system is (a) static, (b) causal (c) Time invariant (d) linear (e) stable
 $y(n) = \sin(2\pi x[n]) + x[n + 1]$ 05
- Q.7B Determine the value of power and energy of each of the following signals: 05
 (a) $x[n] = e^{j\left(\frac{n\pi}{2} + \frac{\pi}{8}\right)}$
 (b) $x[n] = \left(\frac{1}{2}\right)^n u[n]$
- OR
- Q.7B (a) find whether the following signals are odd or even. Find the odd and even components $x(t) = t^4 + 4t^2 + 6$ 05
- (b) Test the periodicity of the following signal and determine the fundamental period $x(t) = e^{j(\pi t - 2)}$

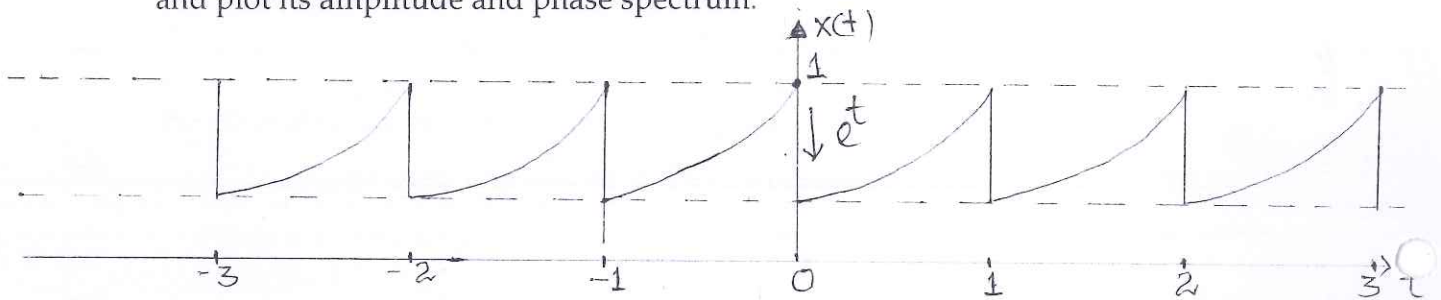
Q.8A $x(n] = 2u(n + 2) - 2u(n) - 3u(n - 1) + 3u(n - 3)$

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$h(n] = -u(n + 1) + 3u(n) - 5u(n - 1) + 3u(n - 2)$

Find $y(n] = x(n] * h(n]$ by graphical convolution.

Q.9A Find the exponential Fourier series coefficients for the signal shown in the figure and plot its amplitude and phase spectrum. 10



Q.9B Determine the trigonometric Fourier series representation of the signal $x(t)$ as shown below. 10

