

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: EC202

Course Name: SIGNALS & SYSTEMS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) Check whether the following signals are periodic or not. If periodic, find the fundamental period. (8)

(i) $x(t) = \sin(200\pi t) + \cos(150\pi t)$ (ii) $x[n] = \sin(0.15\pi n) + \cos(0.1\pi n)$
- b) Check whether the system, $y(t) = x^2(2t)$ is (7)

(i) Linear (ii) Time-Invariant (iii) Causal (iv) Stable.
- 2 a) Given $x(t) = \begin{cases} t+1; & -1 \leq t \leq 0 \\ 1-t; & 0 \leq t \leq 1 \\ 0 & ; \text{otherwise} \end{cases}$ $h(t) = u(t-1) - u(t-3)$ (12)

Find $y(t) = x(t) * h(t)$; where '*' denotes convolution. Also plot $x(t)$, $h(t)$ and $y(t)$
- b) Check the causality and stability of the LTI system with impulse response (3)

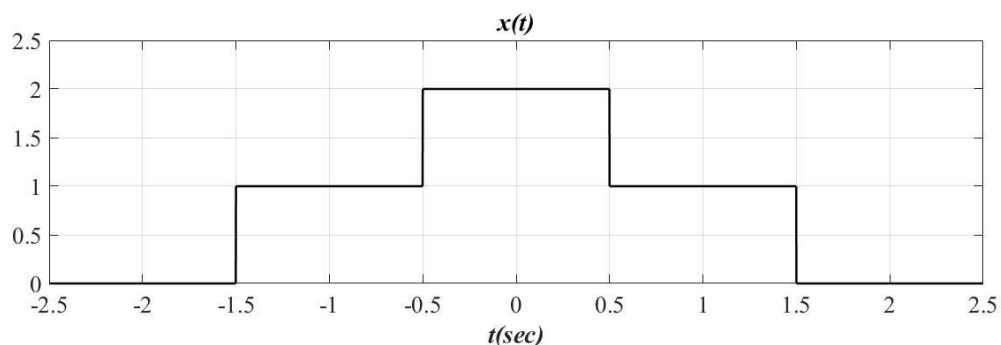
$h(t) = e^{-2t}u(t+2)$
- 3 a) Given $x(t) = u(t+1) + u(t-1) - u(t-2) - u(t-4)$. (8)

Plot (i) $x(t)$ (ii) $x(t-3)$ (iii) $x(2t)$ (iv) $x(2t-3)$
- b) What is the condition for two signals $x(t)$ and $y(t)$ to be orthogonal? Give example of two signals which are orthogonal. (3)
- c) Show that the output of an LTI system with impulse response $h[n]$ to the input $x[n]$ is the convolution sum of $x[n]$ and $h[n]$. (4)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) State the conditions for convergence of Fourier Series. Also give an example (with waveform) each, for the signals that does not satisfy the conditions. (9)
- b) Find the Fourier Transform of the following signal $x(t)$. (6)



- 5 a) Find the transfer function and ROC of the causal system represented by following differential equation. Also, find the impulse response of the system. (9)

$$\frac{d^2 y(t)}{dt^2} + 9 \frac{dy(t)}{dt} + 18 y(t) = x(t)$$

- b) (i) Find the Nyquist rate and Nyquist interval for the signals (a) $\text{sinc}(100\pi t)$ and b) $\text{sinc}(100\pi t) + \text{sinc}(50\pi t)$. (6)
- 6 a) What is ROC of Laplace Transform? State any 5 properties of ROC. (7)
- b) How do we find magnitude response and phase response of an LTI system with impulse response $h(t)$? What information about the system do they convey? (4)
- c) What is aliasing? When does aliasing occur? How can we avoid aliasing? (4)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Solve the following difference equation using Z-transform (8)
 $y[n] = 7y[n-1] - 12y[n-2] + 2x[n] - x[n-2]$ for the input $x[n] = u[n]$.
- b) Find Discrete Time Fourier Series coefficients of the periodic sequence $x[n] = \begin{cases} 1; & 0 \leq n \leq 4 \\ 0; & 5 \leq n \leq 7 \end{cases}$ (8)
 with fundamental period $N = 8$.
- c) Establish the relationship between DTFT and Z-transform (4)
- 8 a) Find the Z transform and ROC of the following sequences: (16)
 1. $\delta[n]$
 2. $2^n u[n]$
 3. $u[n] - u[n-3]$
 4. $\sin[\omega_0 n] u[n]$
- b) State whether the system with following transfer function is (i) causal (ii) stable. Give reason. (4)
 $H(z) = \frac{1}{1 - 2.5z^{-1} + z^{-2}}$; ROC: $0.5 < |z| < 2$
- 9 a) Find the inverse z-transform using partial fraction method. (4)
 $X(z) = 0.25z^{-1}/(1 - 0.5z^{-1})(1 - 0.25z^{-1})$; ROC: $|z| > 0.5$
- b) Find DTFT of $x[n] = \begin{cases} 1; & 0 \leq n \leq 4 \\ 0; & \text{Otherwise} \end{cases}$ (6)
- c) The impulse response of an LTI system is given by $h[n] = (0.3)^n u[n]$. Find the output $y[n]$ (10)
 of the system using Discrete Time Fourier Transform, for the input $x[n] = 2(0.1)^n u[n]$
