

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EE307

Course Name: SIGNALS AND SYSTEMS (EE)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

- | | | Marks |
|---|--|-------|
| 1 | Define unit step function and plot $x(t)$ and $x(2t)$, if $x(t) = u(t+2) - u(t-2)$ | (5) |
| 2 | Find the unilateral Laplace Transform of ramp function $r(t) = t u(t)$. Specify the region of convergence | (5) |
| 3 | Explain the Dirichlet's condition for the existence of Fourier Transform | (5) |
| 4 | Define and plot the discrete time ramp signal $r(n)$. Also plot $r(n-2)$. | (5) |
| 5 | Prove that the sequences $x(n) = a^n u(n)$ and $x(n) = -a^n u(-n - 1)$ have the same $X(z)$ and differ only in ROC | (5) |
| 6 | State and prove the convolution property of Z- transform | (5) |
| 7 | Prove that the discrete Fourier series coefficient $C_k = \frac{1}{N} \sum_{n=0}^{(N-1)} x(n) e^{-\frac{j2\pi kn}{N}}$ for $k=0,1,2,\dots,N-1$ | (5) |
| 8 | Write the Fourier series representation of a discrete time periodic signal with periodicity N . What is the difference between continuous time and discrete time Fourier series? | (5) |

PART B

Answer any twofull questions, each carries 10 marks.

- 9 a) Check whether the given signal $x(t)$ is energy or power signal. Find the energy and power of the signal. $x(t) = e^{-5t} u(t)$ (4)
- b) The impulse response of a LTI system is $h(t) = (2 + e^{-3t}) u(t)$. Check whether the system is (i) Stable or unstable (ii) Causal or non causal (iii) Memory or memory less (6)
- 10 a) Find the response of a LTI system with impulse response $h(t) = e^{-2t} u(t)$ for an input $x(t) = t u(t)$. (4)
- b) Check whether the system $y(t) = x(t) x(t - 1)$ is (6)
- i) Linear or Non linear ii) Causal or Non causal
 iii) Time invariant or Time variant
- 11 For the following system described by differential equation, find the impulse response, if the system is (i) stable (ii) causal (10)

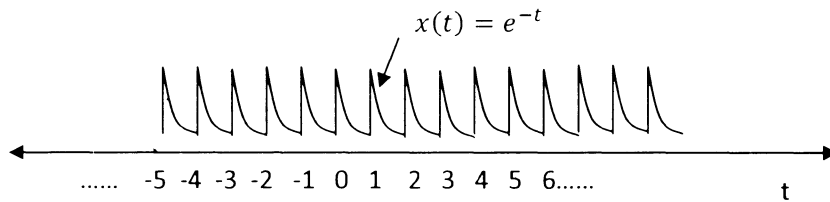
$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = \frac{d^2 x(t)}{dt^2} + 8 \frac{dx(t)}{dt} + 13x(t)$$

Assume initial conditions as zero.

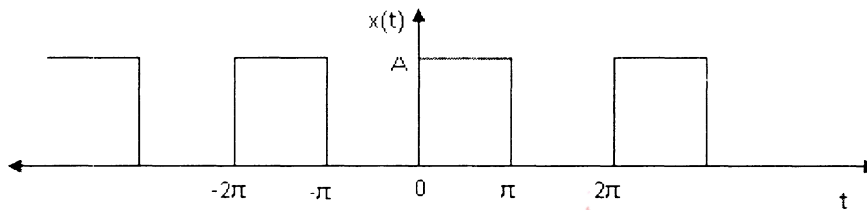
PART C

Answer any twofull questions, each carries10 marks.

- 12 Find the exponential Fourier series of the given signal. Plot the magnitude and phase spectrum. (10)



- 13 a) Find the Fourier transform of the signal $x(t) = e^{-at}u(t)$ (4)
 b) Obtain the trigonometric Fourier series of the following signal (6)



- 14 a) State and prove Sampling Theorem (5)
 b) Using matrixmethod find the convolution of $x[n] = \{1, 4, 3, 1\}$ and $h[n] = \{1, 2, 3, 2\}$ (5)

PART D

Answer any twofull questions, each carries 10 marks.

- 15 a) Find the z-transform and ROC of $x(n) = \left(\frac{1}{3}\right)^n u(n)$ (4)
 b) Find the inverse Z-transform of $X(z) = \frac{3z^{-1}}{(1-z^{-1})(1-2z^{-1})}$ if (6)

i) ROC is $|z| > 2$ ii) ROC is $|z| < 1$

- 16 An LTI system is described by the difference equation (10)

$$y(n) - \frac{9}{4}y(n-1) + \frac{1}{2}y(n-2) = x(n) - 3x(n-1)$$

Specify the ROC of $H(z)$, and determine $h(n)$ for the following conditions

- i) The system is stable ii) The system is causal

- 17 Determine the Fourier series representation of the following discrete time signal and sketch the frequency spectrum (10)

$$x(n) = \{ \dots, 1, 2, -1, 1, 2, -1, 1, 2, -1, \dots \}$$