

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**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<br>i) Linear or Non linear ii) Causal or Non causal<br>iii) Time invariant or Time variant                                  | (6)  |
| 11 | For the following system described by differential equation, find the impulse response, if the system is (i) stable (ii) causal   | (10) |

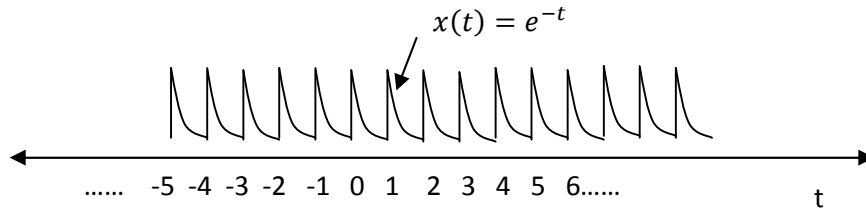
$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = \frac{d^2 x(t)}{dt^2} + 8 \frac{dx(t)}{dt} + 13x(t)$$

Assume initial conditions as zero.

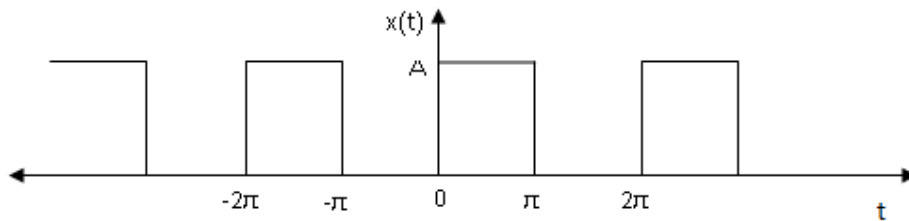
**PART C**

*Answer any twofull questions, each carries 10 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 matrix method 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)

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



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