

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Fifth semester B.Tech degree examinations (S) September 2020

**Course Code: EE307****Course Name: SIGNAL AND SYSTEMS**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer all questions, each carries 5 marks.*

Marks

- 1 Check whether the given signal  $x(t) = e^{-3t}u(t)$  is an energy or power signal. (5)
- 2 Find the ROC of the signal  $x(t) = e^{-b|t|}$  using Laplace transform. (5)
- 3 State and prove the convolution property of Fourier transform. (5)
- 4 Briefly explain sampling process and sampling theorem. (5)
- 5 Find the initial and final values of  $X(z) = \frac{(2z+4)(3z+5)}{(z+2)(4z+5)}$ . (5)
- 6 State and prove time delay theorem of Z transform. (5)
- 7 Find the DTFT of the sequence  $x(n) = 5nu(n)$ . (5)
- 8 Explain different types of nonlinearities present in the system. (5)

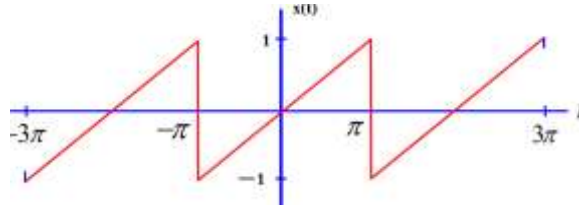
**PART B***Answer any two full questions, each carries 10 marks.*

- 9 Briefly explain the classification of different types of systems with example. (10)
- 10 a) A continuous time LTI system is described by the differential equation  $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$ . Find the impulse response using Laplace transform, if the system is stable. Assume zero initial conditions. (5)
- b) Find the inverse Laplace transform of  $X(s) = \frac{2}{(s+4)(s-1)}$  if ROC is i)  $\text{Re}(s) > 1$  ii)  $\text{Re}(s) < -4$  iii)  $-4 < \text{Re}(s) < 1$  (5)
- 11 a) Determine whether the system  $y(t) = t^2x(t-1)$  is linear, time invariant or both. (6)
- b) Check whether the given signal  $x(t) = 2\cos(10t+1) - \sin(4t-1)$  is periodic or not and find the fundamental period if the signal is periodic. (4)

**PART C**

Answer any two full questions, each carries 10 marks.

- 12 Obtain the trigonometric Fourier series representation of the waveform shown below. (10)



- 13 a) Briefly explain sampling theorem and signal reconstruction. (4)  
 b) Find the output signal  $y(n)$  if the input sequence is  $x(n) = \{1,4,3,2\}$  and  $h(n) = \{1,3,2,1\}$ . (6)
- 14 The input and output of a causal LTI system is related by the differential equation  $\frac{d^2 y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$ . Find the impulse response of the system and also find the unit step response if  $x(t) = te^{-2t}u(t)$ . (10)

**PART D**

Answer any two full questions, each carries 10 marks.

- 15 a) State and prove properties of Z transform. (10)
- 16 a) Find the DTFS representation for  $x(n) = 5 + \sin \frac{n\pi}{2} + \cos \frac{n\pi}{4}$ . (5)  
 b) Evaluate the integral  $\int_{-\pi}^{\pi} \left| \frac{1}{1 - \frac{e^{-j\omega}}{4}} \right|^2 d\omega$  using Fourier transform (5)
- 17 a) Find the inverse Z transform  $X(z) = \frac{z}{(z-1)(z-2)(z-3)}$  using partial fraction method. (6)  
 b) Find the Z transform and ROC of the signal  $x(n) = a^n u(n)$ . (4)

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