

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

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

**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.*

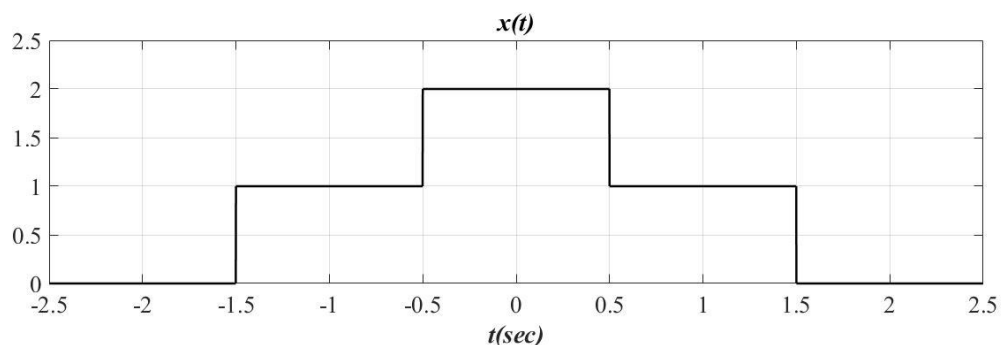
Marks

- 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)

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

- 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)  

$$H(z) = \frac{1}{1 - 2.5z^{-1} + z^{-2}}; \text{ ROC: } 0.5 < |z| < 2$$
- 9 a) Find the inverse z-transform using partial fraction method. (4)  
 $X(z) = 0.25z^{-1}/(1-0.5z^{-1})(1-0.25z^{-1}); \text{ ROC: } |z| > 0.5$
- 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  $x[n] = 2(0.1)^n u[n]$

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