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. (i) $x(t) = \sin(200\pi t) + \cos(150\pi t)$ (ii) $x[n] = \sin(0.15\pi n) + \cos(0.1\pi n)$ (8)

b) Check whether the system, $y(t) = x^2(2t)$ is (7)

(i) Linear (ii) Time-Invariant (iii) Causal (iv) Stable.

2 a) Given $x(t) = \begin{cases} t+1; -1 \le t \le 0 \\ 1-t; \ 0 \le t \le 1 \\ 0 \quad ; otherwise \end{cases}$ $h(t) = u(t-1) - u(t-3)$ (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)

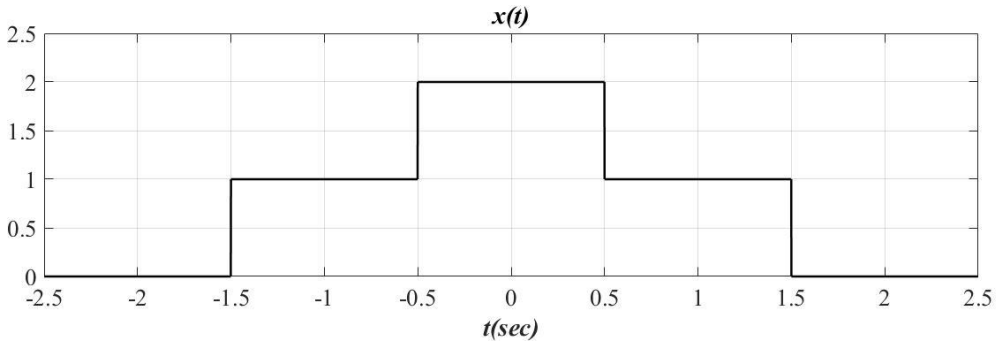
c) Show that the output of an LTI system with impulse response $h[n]$ to the input $x[n]$ is the convolution sum of $x[n]$ and $h[n]$. (4)

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) sinc (100πt) and b) sinc (100πt) + sinc(50πt). (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 carries20 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 $x[n] = \begin{cases} 1; & 0 \le n \le 4 \\ 0; & 5 \le n \le 7 \end{cases}$ with fundamental period N = 8. (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. δ[n]
2. 2^n u[n]
3. u[n]-u[n-3]
4. sin[ω_0n]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) = $0.25z^{-1}/(1-0.5z^{-1})(1-0.25z^{-1})$; ROC: |z|>0.5

b) Find DTFT of $x[n] = \begin{cases} 1; & 0 \le n \le 4 \\ 0; & Otherwise \end{cases}$ (6)

c) The impulse response of an LTI system in given by $h[n] = (0.3)^n u[n]$. Find the output ***y[n]*** of the system using Discrete Time Fourier Transform, for the input $x[n] = 2(0.1)^n u[n]$ (10)

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