Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

V SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE307

Course Name: SIGNAL AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1 Check whether the discrete-time system $y[n] = x[n^2]$ is dynamic, causal and time invariant. (5)

2 Solve the differential equation $\dot{x} + 2x = e^{-3t}, x(0) = 0$ using Laplace transform method. (5)

3 Find the Fourier transform of $x(t) = u(t)$ (5)

4 An analog signal is expressed by the equation $x(t) = 15\cos 50\pi t + 15\sin 300\pi t + 10\sin 100\pi t$. Calculate the Nyquist rate (minimum sampling rate) in Hz for this signal. (5)

5 Find the z-transform of $x[n] = \cos(\omega n)u(n)$. (5)

6 State and prove the time shifting property of Z-transform. (5)

7 State and prove time reversal property of discrete time Fourier series (DTFS). (5)

8 Describe random signals with examples. (5)

PART B

Answer any two full questions, each carries 10 marks.

9 a) Check whether the following signals are periodic or not. If periodic, find the period. (5)

i) $x(t) = \sin 0.5\pi t + \cos 0.5t$ ii) $x[n] = e^{j\frac{2\pi}{3}n} + e^{j\frac{2\pi}{5}n}$

b) Find the odd and even parts of the signal $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$ (5)

10 Draw the pole-zero plot of the following function in s-domain and hence find the time domain response. (10)

$$F(s) = \frac{2}{s(s^2 + 2s + 2)}$$

11 a) Determine whether the system $y[n] = n \times x[n]$ is i) linear ii) time invariant iii) dynamic and iv) causal. (5)

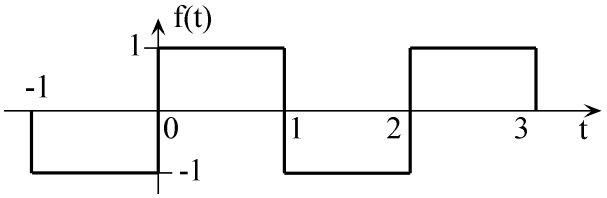
b) Derive the condition for causality and stability in terms of impulse response of (5)

a continuous time linear time invariant system.

PART C

Answer any two full questions, each carries 10 marks.

12 a) Find the exponential Fourier series of the waveform shown in figure. Also plot the magnitude spectrum with n=0,1,2,3,4 and 5. (7)



b) State and prove the time differentiation property of continuous time Fourier transform (CTFT). (3)

13 State and prove sampling theorem. Also, explain aliasing. (10)

14 a) Find the frequency response for the following linear time invariant system and hence find the impulse response. (5)

$\frac{dy(t)}{dt} + 2y(t) = x(t)$. Also find the output y(t) if the input is $x(t) = e^{-t}u(t)$

b) Find the linear convolution $y[n] = x[n] * h[n]$ if $x[n] = \delta(n+1) + \delta(n) + \delta(n-1)$ and $h[n] = 2\delta(n+1) + \delta(n) + 2\delta(n-1)$. (5)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Find Z-transform and ROC of $x[n] = u(-n-1) + \left(\frac{1}{2}\right)^n u(n)$. (6)

b) State and prove the initial value theorem of Z-transforms. (4)

16 a) A causal discrete time system is described by $y[n] = \frac{3}{4}y[n-1] - \frac{1}{8}y[n-2] + x[n]$. Find the frequency response and impulse response. (7)

b) Find the discrete time Fourier series (DTFS) of $x[n] = \{1, -1\}$. (3)

17 a) A causal LTI system is described by the difference equation $y[n] - \frac{1}{2}y[n-1] = 2x[n-1]$. Find the transfer function and impulse response of the system. (5)

b) Classify the various physical non-linearities in systems. (5)

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