

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 carries 5 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)

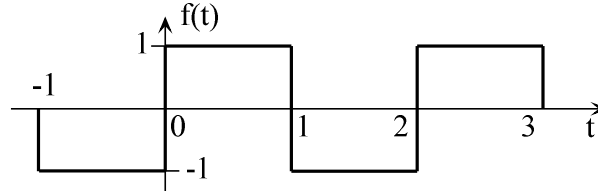
$$F(s) = \frac{2}{s(s^2 + 2s + 2)}$$
- 11 a) Determine whether the system $y[n] = n \times x[n]$ is i) linear ii) time invariant iii) dynamic and iv) causal. (5)
- b) Derive the condition for causality and stability in terms of impulse response of (5)

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)

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

- 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)
