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Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: AE307

Course Name: SIGNALS AND SYSTEMS (AE)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

- 1 a) Differentiate between energy and power signals with suitable examples. (5)
- b) Determine the response of the following system with impulse response and input signal as follows: $h[n] = \left(\frac{1}{2}\right)^n u[n]$ and $x[n] = 2^n u[n]$ (5)
- c) Check whether the following systems is static/dynamic, linear /nonlinear, time-invariant or variant and causal /non-causal. $y(t) = Ax(t) + B$ (5)
- 2 a) Evaluate the step response of the system represented by the impulse response. (5)

$$h[n] = \left(\frac{1}{2}\right)^n u[n].$$
- b) Find the odd and even components of the signal $x(t) = e^{-2t} \cos t$. (5)
- c) Find the convolution of the following sequence. (5)

$$x[n] = 2\delta[n + 1] - \delta[n] + \delta[n - 1] + 3\delta[n - 2]$$

$$h[n] = 3\delta[n - 1] + 4\delta[n - 2] + 2\delta[n - 3]$$
- 3 a) Determine the stability of the system described by difference equation. (10)

$$y[n] - \frac{5}{2}y[n - 1] + y[n - 2] = x[n] - x[n - 1]$$
- b) State and prove Distributive property of convolution. (5)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Find the trigonometric Fourier series for the continuous time periodic signal (8)

$$x(t) = 1 \text{ for } 0 \leq t < 1$$

$$= -1 \text{ for } 1 \leq t < 2$$
- b) Find the Fourier transform of $x(t) = 5 \sin^2(3t)$ (7)
- 5 a) Find the Fourier transform of the signal $x[n] = \{2, 1, -1, -2\}$ (5)
- b) Find the convolution of the signals given below using Fourier transform (10)

$$x_1[n] = \left(\frac{1}{2}\right)^n u[n]; \quad x_2[n] = \left(\frac{1}{3}\right)^n u[n]$$
- 6 a) Explain the condition for distortion less transmission through an LTI system (7)
- b) What is Hilbert transform? Explain the properties of Hilbert transform. (8)

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PART C

Answer any two full questions, each carries 20 marks.

- 7 a) State and prove convolution property of Laplace Transform. (10)
b) Find the impulse and step response of the following system (10)

$$H(s) = \frac{s + 2}{s^2 + 5s + 4}$$

- 8 a) Find the z-transform and ROC for the signal $x[n] = 2^n u[n]$. (10)
b) Plot the pole-zero pattern and determine whether the following system are stable (10)
or not $y[n] = y[n - 1] - 0.5 y[n - 2] + x[n] + x[n - 1]$
- 9 a) Find the output of the system using z-transform whose input and out related by (10)
 $y[n] = 7y[n - 1] - 12y[n - 2] + 2x[n] - x[n - 2]$ for input $x[n] = u[n]$
- b) For the transfer function $H(s) = \frac{s+10}{s^2+3s+2}$ find the response due to the input (10)
 $x(t) = \sin(2t) u(t)$.
