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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) (FT/WP/PT) Examinations April/May 2026 (2019 Scheme)

Course Code: ECT204
Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A
(Answer all questions; each question carries 3 marks)

		Marks
1	Determine whether the signal $x(t) = 5e^{-2t}u(t)$ is an energy or power signal.	3
2	Compute the output sequence of an LTI system with impulse response, h(n)=[3 , 2] to the input x(n)=[1, 3, 2, 1]?	3
3	State the Dirichlet's conditions for the convergence of Fourier series.	3
4	Explain Gibbs phenomenon observed in Fourier series.	3
5	State sampling theorem for low pass signals and mention its significance	3
6	Determine the Nyquist rate for the signal $x(t) = 1 + cos2000\pi t + sin4000\pi t$	3
7	Determine the magnitude spectrum $\|X(e^{j\omega})\|$ of x[n]={1,2,1}.	3
8	Write any three properties of DTFS.	3
9	Define the relation between DTFT and Z-transform.	3
10	Find the Z-transform and ROC of $x(n)=a^n u[n]$;a<1. Does the Fourier transform exist for this signal?	3

PART B
(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Consider the continuous-time system described by the differential equation: 8

$$\frac{dy}{dt} + 3y(t) = x(t-2)$$

(a) Represent the system using a proper block diagram from the differential equation.

(b) Determine whether the system is linear, time-invariant, and causal. Justify each answer based on the given equation.

b) Two continuous-time signals are: $x(t) = u(t) - u(t-2)$ and $y(t) = u(t-1) - u(t-3)$. Compute the cross-correlation and sketch it. 6

12 a) A continuous-time LTI system has impulse response $h(t) = e^{-2t}u(t)$ and the input signal is $x(t) = u(t) - u(t-2)$. Determine the output signal and sketch the 8

waveform.

b) A discrete-time system is described by: 6

$$y[n] = x[n] - x[n-2].$$

(a) Test whether the system is linear, time-invariant, and causal. Provide proper reasoning for each property.

(b) For the input $x[n] = \{1,2,3\}$, sketch the shifted version $x[n-2]$ used in the system equation.

Module -2

13 a) Find the complex exponential Fourier Series representation of the given signal. 7

$x(t)=\cos 4t+\sin 6t$.

b) Determine the Laplace transforms of the following sinusoidal function: 7

$x(t)=A\sin\omega t.u(t)$.

14 a) Find the Fourier Transform of 8

(1). $x(t)=t^2\,u(t).u(t-1)$ and

(2). $x(t)=t\exp(-\alpha t).u(t)$;$\alpha>0$

b) State and prove multiplication property of Fourier transform 6

Module -3

15 a) A continuous-time LTI system is described by the differential equation: 8

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = x(t).$$

(a) Determine the transfer function H(s).

(b) Using pole locations, determine whether the system is BIBO stable and justify.

b) A continuous-time signal is 6

$$x(t) = \cos(200\pi t) + \cos(600\pi t).$$

(i) Determine the Nyquist sampling interval.

(ii) If the signal is sampled at $Fs = 400\ Hz$, determine the apparent (aliased) frequencies in the sampled spectrum and comment on aliasing.

16 a) Using Laplace transform, obtain response for the LTI system with impulse response $h(t)$ and input $x(t)$ where, 8

$$h(t) = e^{-2t}u(t), \qquad x(t) = u(t),$$

b) Derive Sampling Theorem for low-pass signals. 6

Module -4

17 a) State and prove time shifting and convolution property of DTFT. 9

b) Find the inverse Laplace transform of $X(s) = \frac{5s-7}{(s+1)(s-1)(s+2)}$ with 5

ROC -1<Re(s)<1

18 a) Determine the convolution of the signals given below using Fourier Transform. 8

$x_1(n) = \left(\frac{1}{2}\right)^n u(n)$; $x_2(n) = \left(\frac{1}{3}\right)^n u(n)$

b) Determine the DTFT of the following signals, given x(n) has a DTFT $X(e^{j\omega})$. 6

Specify the ROC also.

(1). y[n]=x(2-n)

(2). $y[n] = Ax(n)\cos\frac{1}{3}\pi n$

Module -5

19 a) The step response of a discrete time LTI system is given by $s[n] = a^n$ u[n]; 7

0<a<1. Find impulse response h[n] of the system using z-transform.

b) Obtain z-transform of $x(n) = a^n \sin(\omega_0 n)u(n)$. 7

20 a) Find inverse z-transform of X(z) using power series expansion technique. 7

$X(z) = \frac{z}{2z^2-3z+1}$; z>1.

b) A causal system is represented by the following difference equation $y(n) + \frac{1}{4}y(n-1) = x(n) + \frac{1}{2}x(n-1)$. (1). Find the system function H(z) and give the corresponding region of convergence. (2). Find the unit impulse response of the system. 7

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