Reg No.:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

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

(9)

- 1 a) Determine if the following signals are energy signals, power signals or neither. (6) Calculate the Energy and Total average power for all signals.
 - (i) $x(t) = (-0.5)^t u(t)$
 - (ii) $x(t) = A \sin(\Omega_0 t + \theta)$
 - (iii) x[n] = u[n]
 - b) Find (6)
 - (i) x(t) * h(t), where $x(t) = e^{-\alpha t} u(t)$ and $h(t) = e^{\alpha t} u(-t)$, $\alpha > 0$
 - (ii) Given $x[n] = 1, n \ge 0$ = 0, n < 0 and $h[n] = 3\left(\frac{1}{2}\right)^n u[n] - 2\left(\frac{1}{3}\right)^{n-1} u[n]$

$$\lim_{n\to\infty} y[n], \text{ where } y[n] = x[n] * h[n]$$

Here * represents convolution.

- c) Check whether the given signals are periodic. If so, compute the period. (3)
 - (i) $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$
 - (ii) $x[n] = \sin 2n$
- 2 a) Determine whether the following systems are

2 continue wateries was a constant and

- a) causal, b) stable, c) linear, d) time invariant e) memoryless
- (i) y[n]=ax[n]+b
- (ii) $y(t) = v_m(t) \cos(\Omega_c t)$

(iii)
$$y(t) = \int_{-\infty}^{3t} x(\tau) d\tau$$

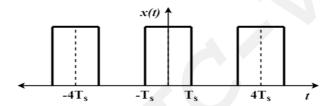
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- b) Compute and plot the autocorrelation of the signal $x(t) = A\cos(\Omega_0 t + \theta)$, where θ is a constant between 0 and 2π
- 3 a) Find the convolution between the signals $x_1(t) = e^{-2t}u(t) & x_2(t) = u(t+2)$ (8)
 - b) Find the output of a discrete LTI system described by the impulse response (7) $h[n] = [2-4\ 2]$, to the input $x[n] = [1\ 2\ 3\ 2\ 1]$

PART B

Answer any two full questions, each carries 15 marks.

4 a) Determine the Complex exponential Fourier series of the wave shown in figure. (9)



- b) Obtain the Laplace transform of the following signals, indicating the region of (6) convergence (ROC).
 - (i) $x(t) = e^{-2t} u(t) + e^{-3t} u(t)$
 - $(ii) x(t) = e^{2t} u(-t) + e^{-3t} u(t)$
 - $(iii)x(t) = e^{2t} u(t) + e^{-3t} u(-t)$
- Find the Fourier Transform of the gaussian pulse $x(t) = e^{-t^2}$, $\forall t$. Plot the signal and its spectrum.
 - b) Explain the relationship between the Fourier transform & Laplace transform. (3)
- 6 a) State the sampling theorem for a low pass signal. What is aliasing? (6)
 - b) Show that $\frac{d^{n}}{dt^{n}}x(t) \stackrel{Unilateral\ LT}{\longleftrightarrow} s^{n}X_{l}(s) s^{n-1}x(0^{-}) s^{n-2}x^{'}(0^{-}) + \dots x^{n-1}(0^{-})$, (9)

where $X_l(s)$ is the unilateral Laplace Transform of x(t), $x^{(r)}(0^-) = \frac{d^r}{dt}x(t)\big|_{t=0^-}$ and 0^- an arbitrarily small negative quantity.

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PART C

Answer any two full questions, each carries20 marks.

7 a) Compute the *z*-Transform of the following sequences.

(6)

- $(i) x[n] = na^{n-1}u[n]$
- $(ii) x[n] = a^{n+1} u[n+1]$
- b) State the properties of the Region of Convergence (ROC) of *z*-transform. (5)
- c) $X(z) = \frac{2 + z^{-2} + 3z^{-4}}{z^2 + 4z + 3}, |z| > 0$ (9)
- 8 a)

 The output y[n] of a discrete LTI system is $2\left(\frac{1}{3}\right)^n u[n]$, for x[n] = u[n].

 Find

 (i) impulse response h[n] of the system
 - (ii) output of the system for $x[n] = \left(\frac{1}{2}\right)^n u[n]$
 - b) Consider a discrete time LTI system with $h[n] = \left(\frac{1}{2}\right)^n u[n]$. Use DTFT to determine $x[n] = \left(\frac{3}{4}\right)^n u[n]$ the response of the system when excited with an input
- 9 a) Find the DTFT of x[n]=u[n]-u[n-N] (8)
 - b) Consider the discrete LTI system $y[n] \frac{1}{2}y[n-1] = x[n] + \frac{1}{2}x[n-1]$. Determine
 - (i) The frequency response of the system $H(e^{j\omega})$
 - (ii) Impulse response of the system h[n]
 - (iii) Response of the system to the input $x[n] = \cos\left(\frac{\pi}{2}n\right)$
