Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:2141005 Date:24/02/2021

Subject Name:Signals and Systems

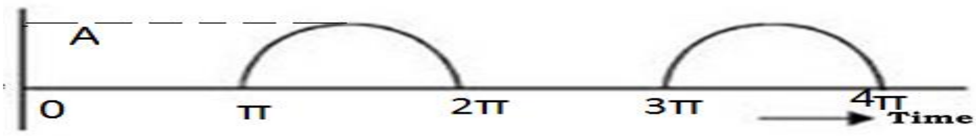
Time:02:30 PM TO 04:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Define following terms, (1) Power Signal (2) Deterministic Signal (3) Causal system	**03**
	(b)	Comment on stability of system $y(n) = \sum_{k=0}^{n} x(k)$	**04**
	(c)	(1) Check the following systems for time invariance and linearity. (i) $y(n) = n[x(n)]^2$ (ii) $y(n) = x(n)\cos(n\pi/4)$	**04**
		(2) Determine period of following signal, $x(n)=e^{-j\pi n/4}$	**03**
Q.2	**(a)**	Determine whether the discrete signal $x(n) = 6cos\frac{2\pi n}{4}$ is power signal or energy signal? Prove it.	**03**
	(b)	Find even and odd parts of following signals, (1) $x(t) = e^{i2t}$ (2) $x(t) = \cos(w_0 t + \frac{\pi}{3})$	**04**
	(c)	(1) Find convolution of two sequences $x(n) = [1, \underset{\uparrow}{2}, 4]$ and $h(n) = [1,\underset{\uparrow}{1},1,1]$ using graphical method.	**04**
		(2) Compute convolution for the following signals $x(n) = (1/5)^n u(n)$, $h(n) = (1/2)^n u(n)$.	**03**
Q.3	**(a)**	Decide whether system with following impulse response, is causal and stable? $h(n)=(-1)^n u(-n)$	**03**
	(b)	Determine and prove the system y(t)=2x(t)+3 is linear or nonlinear?	**04**
	(c)	What is stable system? Derive necessary and sufficient condition for stable LTI system.	**07**
Q.4	**(a)**	Find DTFT of $x(n) = \delta(n-2) - \delta(n+2)$.	**03**
	(b)	Prove that a DT LTI system is causal if and only if h(n)=0 for n<0.	**04**
	(c)	Verify that the impulse response h[n] for this system is $h[n] = a^n u[n]$, $\|a\|<1$. Is the system (i) memoryless? (ii) causal? (iii) stable?	**07**

Q.5	**(a)**	Find Fourier transform of $\cos(w_0 t)u(t)$.	**03**
	(b)	State and prove differentiation in time property of Fourier Transform.	**04**
	(c)	State and prove time convolution theorem for Fourier transform.	**07**
Q.6	**(a)**	Find inverse Fourier transform of $X(w) = \frac{jw}{(2+jw)^2}$	**03**
	(b)	State and prove frequency differentiation property of Fourier Transform.	**04**
	(c)	Discuss the relationship between Fourier transform and Laplace transform.	**07**
Q.7	**(a)**	Prove linearity and time shifting properties of Fourier series.	**03**
	(b)	Determine the Z-transform and ROC of $x(n) = a^n u(n) - b^n u(-n-1)$.	**04**
	(c)	Discuss the properties of ROC for Z-Transform.	**07**
Q.8	**(a)**	Find DTFT of (i) $\delta(n-m)$ (ii) $a^n u(n)$	**03**
	(b)	Find the inverse Z-transform of $X(z) = \frac{z^{-1}}{3-4z^{-1}+z^{-2}}$; ROC;|z|>1	**04**
	(c)	Find the Fourier series expansion of the half wave rectified sine wave shown in below figure,	**07**



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