

University Institute of Engineering & Technology

(Recognised Under Section 2(f) and 12B of UGC)

Kurukshetra University, Kurukshetra

TIME – 3 Hrs 15 Min

THEORY EXAMINATION – FEB 2021

B.TECH - ECE

SEMESTER – III

M.M. - 56

PAPER - EC- 209

SUBJECT- Signals and Systems

INSTRUCTIONS TO BE FOLLOWED

- Allotted time for examination is 3 hours 15 minutes that includes time for downloading the question paper, writing answers, scanning of answer sheets and E-mailing the PDF files to the designated Email ID.
- For ECE-A Regular Students, the Email ID is:- btech3rdecea@kuk.ac.in
- For ECE-B Regular and All Reappear Students, the Email ID is:- btech3rdeceb@kuk.ac.in
- The candidates will be required to attempt 75% of the question paper (maximum) by choosing to their any best questions accumulating 56 marks.
- The PDF files should be saved as Roll No. and Subject Code. Proper attention should be given while sending the email and in the subject line, the Roll Number and Subject Code should be mentioned.
- Maximum Page Limit should be 20 (Twenty) for attempting the question paper on A4 sheets which could be downloaded and printed from the sample sheets given in the Kurukshetra University Examination guidelines.
- Over-attemptation should be avoided.
- Handwriting should be neat and clean and diagrams should be clear and contrasted.
- The candidate should not write their Mobile No. otherwise Unfair Means Case will be made.
- While attempting the paper, the candidate will use blue/black pen only.
- Before attempting the paper, the candidate will ensure that he/she has downloaded the correct question paper. No complaint for attempting wrong question paper by the candidate will be entertained.
- Candidate must ensure that he/she has put his/her signature on each page of the answer sheet used by him/her. Answer sheet without the signature of the candidate will not be evaluated.

PART-A

Q. No. – 1 Answer the following questions.

15x1=15

(i)	Define Unit Step Function.
(ii)	The integration of Impulse function is_____.
(iii)	Check the causality of the system $y(t)=x(t)\cos(t+1)$.
(iv)	Write the polar form representation of Continuous Time Fourier Series.
(v)	If the function $f(x)$ is even ,then which of the following is zero (i) a_n (ii) b_n (iii) a_0 (iv)None of these
(vi)	If CTFT of $x(t)$ is $X(w)$ then $x(t-t_0)$ is _____.
(vii)	Define Nyquist rate?
(viii)	Explain the Region of Convergence.
(ix)	ROC of anti causal system is_____.
(x)	The condition $h(t)=0$ for $t<0$ should be satisfied by the system is (i) causal (ii) BIBO stable (iii) Memoryless (iv) Invertible
(xi)	Find the even part of the signal $x(t)=e^{-2t} \cos(t)$ _____
(xii)	Determine the fundamental period of the signal $x(t)= 2\cos(10t+1)-\sin(4t-1)$ _____
(xiii)	The convolution operator is (i) Commutative (ii) Associative (iii)Both (iv)None of these
(xiv)	Relationship between CDF and PDF is _____
(xv)	Condition for stability of LTI system is_____.

PART-B

2	Consider a continuous time system with input $x(t)$ and $y(t) =x(\sin t)$ (a) Is the system Causal? (b) Is the system Linear?	5
3	Compute the Convolution $y(n)=x(n)*h(n)$ of the following pair of signals (a) $X(n)=(0.8)^n u(n)$ & $h(n)= (0.4)^n u(n)$ (b) $X(n)=h(n)=a^n u(n)$ (c) $X(n)=u(n-1)$ & $h(n)=\alpha^n u(n-1)$ (d) $X(n)=r(n)=nu(n)$ & $h(n)=a^{-n} u(n-1)$ (e) $X(n)=h(n)=u(n)$	5
4	Find the exponential Fourier Series for the signal $X(t)=e^{-t/2}$; for $0<t<\pi$	5
5	Find the Laplace transform of $X(t)=e^{-2t}u(t)-e^{-3t}u(t)$ and depict the ROC and location of poles & zeroes in s-plane and Comment on stability and causality of the system.	2+ 2+ 1

PART-C

6	The system that follow have input $x(n)$ and output $y(n)$. For the system ,determine whether it is (i) memoryless (ii) stable (iii) causal (iv)linear (v) time-invariant $y(n)=x(n^2)$	10
7	(a) Write a short note on Singular function.	5+5

	(b) Determine whether the following signals are power or energy signals (i) $X(t) = t u(t)$ (ii) $X(t) = e^{-at}$, $a > 0$	
8	The CDF for a certain random variable is given as $F_X(x) = \begin{cases} 0; & -\infty < x \leq 10 \\ kx^2; & 0 < x \leq 10 \\ 100k; & 10 < x < \infty \end{cases}$ (i) Find the value of k. (ii) Find the value of $P(X \leq 5)$. (iii) Find the value of $P(5 < X \leq 7)$ (iv) Find the expression for PDF.	10
9	Explain the following properties of LTI system with proof. (a) Associative property of LTI system (b) Static and Dynamic property of LTI system (c) Stability of LTI system (d) Distributive property of LTI system (e) Unit – Step response of LTI system	10
10	Explain the sampling theorem with proof. Elaborate how the sampling of sinusoidal Signals is done and determine the Nyquist rate for the following signals (a) $x(t) = 1 + \cos(200\pi t) + \sin(400\pi t)$ (b) $x(t) = \cos^3(200\pi t)$	3+3 +4
11	Derive the expression for exponential form representation of Fourier Series .State and Prove the following properties of Fourier Series (i) Time Shifting (ii) Multiplication (iii) Time Reversal	4+6
12	Consider a stable LTI system characterised by differential equation $\frac{d^2y(t)}{dt^2} + 4 \frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$ (a) Find the frequency response $H(w)$ and impulse response $h(t)$ of the system (b) What is the response of the system if input $x(t) = e^{-t} u(t)$.	10
13	Explain the following properties of Fourier transform with proofs (i) Differentiation in Frequency Domain (ii) Frequency Shifting (iii) Time Shifting (iv) Convolution property (v) Duality	10