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KAMALA INSTITUTE OF TECHNOLOGY & SCIENCE, SINGAPUR
23EC28PC305

II.B. Tech. I. Semester Supplementary Examinations, June-2025

SIGNALS AND SYSTEMS

(ECE)

Time: 3 Hours

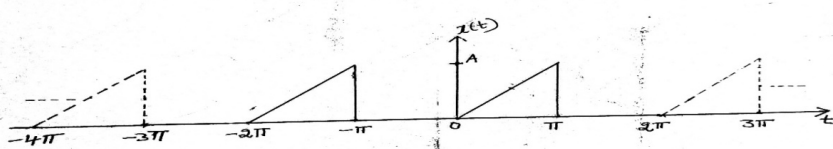
Max.Marks:60

Note: Question paper consists of Part-A & Part-B.

i) **Part-A** for 10M, ii) **Part-B** for 50marks

- **Part A** is compulsory, consists of 10 sub questions from all units carrying equal marks.
- **Part-B** consists of **10 questions** (numbered from 2 to 11) carrying **10marks** each. From each unit there are 2 questions and the students should answer one of them. Hence the student should answer **5 questions** from **Part-B**.

PART-A		(10Marks)	
Q.No	Questions	Marks	BTL
1.a)	Define Orthogonal signals space?	1	1
1.b)	Define following terms: (b) Unit step (c) Unit impulse	1	1
1.c)	List the Dirichlet's conditions of Fourier series?	1	1
1.d)	Define Fourier Transform.?	1	1
1.e)	Classification of Systems.	1	1
1.f)	Define Filter? Types of Filters.	1	1
1.g)	What is Region of convergence (ROC) in Laplace Transforms?	1	1
1.h)	Define Nyquist rate and Nyquist interval?	1	1
1.i)	What is the relationship between Laplace transform and Fourier transform?	1	1
1.j)	Difference between Autocorrelation and cross correlation.	1	1
PART-B		(50Marks)	
Q.No	Questions	Marks	BTL
2. a)	Define the error function? While approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f(t)$ and $x(t)$.	7M	3
b)	Show that the following signals are orthogonal over an interval $[0,1]$ $x_1(t) = 2$ and $x_2(t) = \sqrt{3}(1 - 2t)$	3M	3
OR			
3. a)	A rectangular function $x(t)$ is defined by $x(t) = \begin{cases} 1 & \text{for } 0 < t < \pi \\ -1 & \text{for } \pi < t < 2\pi \end{cases}$ Approximate the above rectangular function by a single sinusoid $\sin t$ over the interval $[0,2\pi]$ such that the mean square error is minimum	5M	3
b)	Classifications of signals. Define each one with an example?	5M	2

4. a)	Evaluate the trigonometric Fourier series expansion of following signal.	5M	3
		5M	3
b)	State and Prove any Four properties of Fourier Series.	5M	3
OR			
5. a)	Simplify the Fourier Transform of following Standard signals a) $\text{sgn}(t)$ b) $e^{-a t }$	4M	3
b)	Prove any three properties of Fourier Transform	6M	3
6. a)	Derive the condition for distortion less transmission through a Linear system?	5M	2
b)	Draw the ideal filter characteristics for LPF, HPF, BPF and BRF.	5M	2
OR			
7. a)	Consider a stable LTI system that is characterized by the differential equation. $\frac{d^2 y(t)}{dt^2} + 4 \frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$ Solve response for the input $x(t) = e^{-t}u(t)$.	5M	2
b)	Discuss the relationship between rise time and bandwidth?	5M	2
8. a)	State and prove sampling theorem for low pass signals.	7M	3
b)	Obtain the inverse Laplace transform of the function $X(s) = \frac{1}{s^2 + 3s + 2}, \text{ROC: } -2 < \text{Re}(s) < -1$	3M	1
OR			
9. a)	Define Sampling? Explain Natural Sampling and Flat top sampling.	5M	2
b)	Compute the Laplace transform of $x(t) = e^{-b t }$ for the cases of $b < 0$ and $b > 0$?	5M	3
10. a)	Apply the z-transform for the following signals and design its ROC? i. $x(n) = a^n u(n)$ ii. $x(n) = -a^n u(-n-1)$	5M	3
b)	Determine the autocorrelation function and energy spectral density of $x(t) = e^{-at} u(t)$	5M	2
OR			
11. a)	Simplify the inverse z-transform of $X(z) = \frac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$ for $ z > 2$	5M	3
b)	Define Autocorrelation function of energy signals and state and prove all its properties.	5M	3