

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109 DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SESSION: 2021-2022 (EVEN SEMESTER)

CO-PO MAPPING

Type: Core		Course Code: 18EC45					
	No o	f Hours					
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours				
3	0	3	50				
	M	arks	Halm the Process of the Paris				
Internal Assessme	nt Examination	Total	Credits				
40	60	100	3				

- 1. To classify different kinds of signals and perform operations on signals.
- 2. To discuss the system properties and obtain system response using convolution sum and convolution integral.
- 3. To illustrate the impulse response properties and frequency components of periodic signals using Fourier series.
- 4. To illustrate the use of Fourier Transform and its properties to non-periodic signals.
- 5. To discuss Z transform, ROC and its properties and inverse Z transform.

Course Learning Outcomes

After completing the course, the students will be able to

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CO1	Define, Classify and Solve signals based on their classification and operations.	Applying (K3)				
CO2	CO2 Classify Systems and Determine response of a LTI system for given impulse response.					
CO3	Determine impulse response properties, step response and frequency components of a given periodic signal using Fourier Series.	Applying (K3)				
CO4	Build Spectrum of a non-periodic signal using Fourier Transform and their properties.	Applying (K3)				
CO5	Construct the Z transform and ROC of a signal using definition and properties of Z Transform	Applying (K3)				
	Syllabus Content					
MOD system	ULE 1: Introduction and Classification of signals: Definition of signal and and and control system as examples Classification of signals.	CO1				
Basic	Operations on signals: Amplitude scaling, addition, multiplication, differentiation, ation, time scaling, time shift and time reversal.	8 hrs				
Eleme	PO1-3					
function	PO2-2					
elemer	PO4-1					
LO: A	PO5-1					
1.	PO6-2					
	Distinguish between continuous and discrete-time, even and odd, analog and digital, energy & power, periodic & non-periodic, deterministic & random and solve the given signals for the same.	PO12 -3				
	PSO1-3					

Normaliant, causal-non causal, static-dynamic, stable-unstable, invertible. Firme domain representation of LTI System: Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular. LO: At the end of this session the student will be able to 1. Verify the following system is Linear-nonlinear, Time variant-invariant, causal-non causal, static-dynamic, stable-unstable, invertible. 2. Determine the system response for the given input and impulse response using convolution sum and convolution integral. PSOI-PSO2-Module 3: LTI system Properties in terms of impulse response: System neterconnection, Memoryless, Causal, Stable, Invertible and Deconvolution, and step response. LO: At the end of this session the student will be able to 1. Determine the given impulse response is Memoryless, Causal, Stable, Invertible and Deconvolution. 2. Find the overall impulse response for the system interconnection shown below. 3. Find the step response of the given impulse response. 4. State and prove the properties of CTFS. 5. Find the Fourier Cepficients of the given signal. PSOI-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PO12-PSO2-PSO2-PSO2-PSO2-PSO2-PSO2-PSO2-PSO	Determine and sketch the signal for given operation on signal.	PSO2-2
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1. Determine the given impulse response is Memoryless, Causal, Stable, Invertible and Deconvolution. 2. Find the overall impulse response for the system interconnection shown below. 3. Find the step response of the given impulse response. 4. State and prove the properties of CTFS. 5. Find the Fourier coefficients of the given signal. Module 4: Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform. LO: At the end of this session the student will be able to 1. Define Fourier Transform in discrete domain. 2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) Module 5:The Z-Transforms: Z transform, properties of the region of convergence, PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, PO12- Module 5:The Z-Transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems	Fourier Representation of Periodic Signals: CTFS properties and basic problems.	
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and Deconvolution. 2. Find the overall impulse response for the system interconnection shown below. 3. Find the step response of the given impulse response. 4. State and prove the properties of CTFS. 5. Find the Fourier coefficients of the given signal. Module 4: Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform. LO: At the end of this session the student will be able to 1. Define Fourier Transform in discrete domain. 2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs	1. Determine the given impulse response is Memoryless, Causal, Stable, Invertible	
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Module 4: Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform. LO: At the end of this session the student will be able to 1. Define Fourier Transform in discrete domain. 2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO1-3 PO4-2 PO5-3 PO6-2 PO12 Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems	5. Find the Fourier coefficients of the given signal.	DCOL 2
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Properties of Fourier Transform: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform. LO: At the end of this session the student will be able to 1. Define Fourier Transform in discrete domain. 2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO1-3 PO4-2 PO5-3 PO6-2 PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems	Module 4: Fourier Representation of aperiodic Signals: Introduction to Fourier	CO4
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problems on properties of Fourier Transform. LO: At the end of this session the student will be able to 1. Define Fourier Transform in discrete domain. 2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO1-3 PO4-2 PO5-3 PO6-2 PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems	Properties of Fourier Transform: Linearity, Time shift, Frequency shift, Scaling,	8 hrs
LO: At the end of this session the student will be able to 1. Define Fourier Transform in discrete domain. 2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems PO2-2 PO3-1 PO4-2 PO5-3 PO6-2 PO12- PSO1- PSO2- CO5	Differentiation and Integration, Convolution and Modulation, Parseval's theorem and	
 Define Fourier Transform in discrete domain. State and prove the properties of DTFT. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO3-1 PO4-2 PO5-3 PO6-2 PO12- PSO1-PSO2- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs	problems on properties of Fourier Transform.	PO1-3
2. State and prove the properties of DTFT. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO4-2 PO5-3 PO6-2 PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems PO4-2 PO5-3 PO6-2 PO5-3 PO6-2 PO5-3 PO6-2 PO12- PS01- PS02- **Transform** **Trans	LO: At the end of this session the student will be able to	PO2-2
2. State and prove the properties of DTT1. 3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO5-3 PO6-2 PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs	1. Define Fourier Transform in discrete domain.	PO3-1
3. Determine the FT of given signal and draw magnitude and phase plot. (using equation method and properties) PO5-3 PO6-2 PO12- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems Ross CO5 8 hrs	2. State and prove the properties of DTFT.	PO4-2
equation method and properties) PO12- PS01- PS02- Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs		PO5-3
Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs		
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Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs		PSO1-3
Module 5:The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems 8 hrs		
properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems		
properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems	Modulo 5. The 7 Transforms: 7 transform properties of the region of convergence	COS
analysis of LTI systems	properties of the 7 transform Inverse 7 transform Causality and stability Transform	003
analysis of L11 systems	properties of the Z-transform, inverse Z-transform, Causanty and stating, Transform	8 hrs
LO: At the end of this session the student will be able to		

1.	Define Z transform and ROC.	PO1-3
2.	Explain the properties of ROC.	PO2-2
3.	Determine the Z transform of the signal x(n) given. (using equation method and	PO3-1
	properties)	PO4-2
		PO5-3
4.	Determine the inverse Z transform of given X (Z) and ROC.	PO6-2
5.	Determine the transfer function, impulse response for the given differential	PO12-3
	equation/ input x (n) and output y (n). Also determine whether the system is stable	
	and causal.	PSO1-3
		PSO2-2

Text Books

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.

Reference Books

- 1. Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
- 2. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
- 3. H.P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006.
- 4. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005.
- 5. Ganesh Rao and SatishTunga, "Signals and Systems", Pearson/Sanguine.

Useful Websites

- http://nptel.ac.in/courses/117104074/
- http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/
- http://pages.jh.edu/~signals/

Useful Journals

- Circuit System and Signal Processing, Springer Journal (http://link.springer.com/journal/34)
- International Journal on Electronic Signals and Systems (http://interscience.in/ijess.html)
- International Journal of Signal Processing Systems (www.ijsps.com/)

Teaching and Learning Methods

1. Lecture class: 50 hrs

Assessment

Type of test/examination: Written examination

Continuous Internal Evaluation(CIE): 40 marks (Average of three tests and assignments will be considered)

Semester End Exam(SEE): 100 marks (students have to answer all main questions) which will be reduced to 60 Marks.

Test duration:

1:30 hrs

Examination duration: 3 hrs

CO - PO Mapping

PO1: Science and engineering Knowledge

PO2: Problem Analysis

PO3: Design & Development

PO4:Investigations of Complex Problems

PO5: Modern Tool Usage PO6: Engineer & Society PO7:Environment and Society

PO8:Ethics

PO9:Individual & Team Work

PO10: Communication

PO11:Project Mngmt & Finance

PO12:Life long Learning

At the end of the Program, the students should:

PSO1: Be able to acquire knowledge and apply concepts in the field of engineering and interdisciplinary subjects.

PSO2: Be able to identify the existing problems, effectively utilize tools to provide solution, and disseminate the information.

со	РО	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO 11	PO12	PS O1	PS O 2
18 EC45	K-level														
CO1	K3	3	2	-	1	1	2	-	-	-	-	-	3	3	2
CO2	K3	3	2	1	1	3	2	-	-	-	-	-	3	3	2
CO3	K3	3	2	1	2	3	2	-	-	-	-	-	3	3	2
CO4	K3	3	2	1	2	3	2	1 -	-	-	-	-	3	3	2
CO5	K3	3	2	1	2	3	2	-	1 -	-	-	<u> </u>	3	3	2

Course In charge

Head of the Department

Professor & Head
Dept. of Electronics & Communication Engineer
K. S. School of Engineering & Managem
Bangalore-560 109

Principal

Principal

Principal / Director

K.S School of Engineering & Managemer

Bangalore-560 062