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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SESSION: 2021-2022 (EVEN SEMESTER)

CO-PO MAPPING

Course: SIGNALS & SYSTEMS			
Type: Core		Course Code: 18EC45	
No of Hours			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours
3	0	3	50
Marks			
Internal Assessment	Examination	Total	Credits
40	60	100	3

Aim/Objectives of the Course

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

CO1	**Define, Classify** and **Solve** signals based on their classification and operations.	**Applying (K3)**
CO2	**Classify** Systems and **Determine** response of a LTI system for given impulse response.	**Applying (K3)**
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

MODULE 1: Introduction and Classification of signals: Definition of signal and systems, communication and control system as examples Classification of signals. **Basic Operations on signals**: Amplitude scaling, addition, multiplication, differentiation, Integration, time scaling, time shift and time reversal. **Elementary signals/Functions**: Exponential, sinusoidal, step, impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals. **LO:** At the end of this session the student will be able to 1. 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.	**CO1** 8 hrs PO1-3 PO2-2 PO4-1 PO5-1 PO6-2 PO12 -3 PSO1- 3

2. Determine and sketch the signal for given operation on signal.	PSO2-2

Module 2: System Classification and properties: Linear-nonlinear, Time variant-invariant, causal-non causal, static-dynamic, stable-unstable, invertible. **Time 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.	**CO2** 8 hrs. PO1-3 PO2-2 PO3-1 PO4-1 PO5-3 PO6-2 PO12-3 PSO1-3 PSO2-2

Module 3: LTI system Properties in terms of impulse response: System interconnection, Memoryless, Causal, Stable, Invertible and Deconvolution, and step response. **Fourier Representation of Periodic Signals**: CTFS properties and basic problems. **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 coefficients of the given signal.	**CO3** 8 hrs PO1-3 PO2-2 PO3-1 PO4-2 PO5-3 PO6-2 PO12-3 PSO1-3 PSO2-2

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)	**CO4** 8 hrs PO1-3 PO2-2 PO3-1 PO4-2 PO5-3 PO6-2 PO12-3 PSO1-3 PSO2-2

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 **LO:** At the end of this session the student will be able to	**CO5** 8 hrs

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

CO	PO	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	-	-	-	-	-	3	3	2
CO5	K3	3	2	1	2	3	2	-	-	-	-	-	3	3	2

Course In charge

Head of the Department

Professor & Head
Dept. of Electronics & Communication Engine
K. S. School of Engineering & Manager
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Principal

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