Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC301 Signals and Systems

Third Semester, 2017-18 (Odd Semester)

Course (catalog) description

This course is about various classification of both continuous and discrete time signals and systems. The spectral analysis of periodic & aperiodic signals using Fourier series and Fourier transform is discussed for both CT as well as for DT signals. Analysis and characterization of the CT-LTI systems through Laplace Transform and Fourier Transform and for LTI-DT systems through Z Transform and DTFT is also discussed.

Compulsory/Elective course **:** Compulsory for ECE students

Credit & contact hours **:** 4 & 60

Course Coordinator **:** S.Beulah Hemalatha, Assoc. Professor, Department of ECE

Instructor(s)

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
Ms.S.Beulah Hemalatha	II year ECE	SA006		beulahhemalatha.ece@ bharathuniv.ac.in	12.30 - 1.30 PM

Relationship to other courses

Pre – requisite : BEC 201- Mathematics II

Assume Knowledge : Basic knowledge in algebra and complex integration, partial differential equations

Following courses : BEC505 Digital Signal Processing

Syllabus Contents

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS **12**

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, random signals, CT systems and DT systems, Classification of systems - Linear Time invariant Systems.

UNIT II ANALYSIS OF C.T. SIGNALS **12**

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis.

UNIT III LTI-CT SYSTEMS **12**

Differential equation, Block diagram representation, Impulse response, Convolution integral, Frequency response, Fourier Methods and Laplace transforms in analysis, State equations and Matrix.

UNIT IV ANALYSIS OF D.T. SIGNALS **12**

Spectrum of D.T. signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of Z-transform in signal analysis.

UNIT V LTI-DT SYSTEMS **12**

Difference equations, Block diagram representation, Impulse response, Convolution SUM, Frequency response, FFT and Z-transform analysis, State variable equation and Matrix.

Text book(s) and/or required materials

TEXT BOOK:

T1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2007.

REFERENCES:

R1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
R2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
R3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Communication | **Signal Processing** | Electronics | VLSI | Embedded

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 2nd week	Session 1 to 24	2 Periods
2	Cycle Test-2	September 2nd week	Session 25 to 48	2 Periods
3	Model Test	October 2nd week	Session 1 to 60	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

This course is about various classification of both continuous and discrete time signals and systems, spectral analysis of periodic & aperiodic signals using Fourier series and Fourier transform for both CT as well as for DT signals. Analysis and characterization of the CT-LTI systems & LTI-DT systems.	Correlates to program outcome		
	H	M	L
1. Various Classification of both CT and DT signals and systems	e	a, k	-
2. Spectral analysis of CT signals using CT Fourier methods.	a	e	
3. Analysis and Characterization of the CT systems through Laplace Transform and Fourier Transform.	e	a	c
4. Spectral analysis of DT signals using DT Fourier methods	a, e	k	-
5. Analysis and Characterization of the DT systems.	e	k	c

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem solving(Yes/No)	Text/Chapter
UNIT-I: CLASSIFICATION OF SIGNALS AND SYSTEMS			
1.	Continuous time signals Discrete time signals	No	[T1]-Chapter-1
2.	Periodic and Aperiodic signals, Even and odd signals	Yes	
3.	Tutorial (Problems in Periodic and Aperiodic signals, Even and odd signals)	Yes	
4.	Deterministic and random signals. complex exponential and Sinusoidal signals	No	
5.	Tutorial (problems in CT and DT exponential and sinusoidal signals	Yes	
6.	Energy and power signals , Deterministic and random signals Unit step, Unit ramp, Unit impulse	No	
7.	Tutorial(Problems in Energy and power signals , Deterministic and random signals	Yes	
8.	Representation of signals in terms of unit impulse, Basic operations on signals	No	
9.	Continuous time systems and Discrete time systems, Linear system , Time Invariant system	No	
10.	causal system, BIBO system , Systems with and without memory , LTI system	No	
11.	Tutorial(Problems in Linear system , Time Invariant system)	Yes	
12.	Tutorial(Problems in causal system, BIBO system , Systems with and without memory , LTI system	Yes	
UNIT-II: ANALYSIS OF CONTINUOUS TIME SIGNALS			
13.	Representation of Continuous time Periodic signals	No	
14.	Properties of Continuous time Fourier series .	No	
15.	Trigonometric Fourier series analysis	No	
16.	Tutorial (Problems in Trigonometric Fourier series analysis	Yes	
17.	complex exponential Fourier series analysis	No	

18.	Tutorial (Problems in complex exponential Fourier series analysis)	Yes	[T1]-Chapter-3
19.	Parseval's relation –Frequency spectrum – Power density spectrum	No	
20.	Fourier transform: Representation of Continuous time signals-	No	
21.	Properties of Continuous time Fourier transform – Energy density spectrum	No	[T1]-Chapter-4
22.	Tutorial (Problems in Continuous time signals using Fourier transform)	Yes	
23.	Laplace Transform using Signal analysis	No	[T1]-Chapter-5
24.	Tutorial (Problems in Continuous time signals using Laplace transform)	Yes	
UNIT-III: LTI CT SYSTEM			
25.	Differential equation	No	[T1]-Chapter-9
26.	Tutorial (Problems in Differential equation-)	Yes	
27.	Natural response, Forced response using classical method	No	
28.	Tutorial (Problems in Natural response, Forced response using classical method)	Yes	
29.	Impulse response, step response	No	
30.	Tutorial (Problems in impulse response, step response)	Yes	
31.	Convolution Integral	No	
32.	Tutorial (Problems in Convolution)	Yes	
33.	Block Diagram Representation- Direct Form I, Direct Form II	Yes	
34.	Block Diagram Representation- Cascade Form, Parallel Form	Yes	
35.	Tutorial (problems in Analysis and characterization of LTI system using Laplace transform and Fourier transform)	Yes	[T1]-Chapter-9
36.	Tutorial (Problems in Analysis & characterization of LTI system using Laplace transform)	Yes	
UNIT IV ANALYSIS OF D.T. SIGNALS			
37.	Spectrum of D.T. signals	No	[T1]-Chapter -5
38.	Representation of sequences – Discrete time Fourier transform	No	
39.	Tutorial (Problems in Representation of sequences – Discrete time Fourier transform (DTFT)	Yes	
40.	Discrete Fourier transform (DFT) and its inverse	No	
41.	Properties of DFT	No	
42.	Convolution Properties of DFT	No	
43.	Tutorial (Problems in Discrete Fourier transform (DFT) and its properties)	Yes	
44.	Tutorial (Problems in Discrete Fourier transform (DFT) and its properties)	Yes	
45.	Z-Transform and its Region of Convergence	No	[T1]-Chapter 10
46.	Properties of Z-Transform	No	
47.	Tutorial (Problems in Z -Transform and its properties)	Yes	
48.	Tutorial (Problems in Z -Transform and its properties)	Yes	
UNIT- V LTI-DT SYSTEMS			
49.	System modeling in terms of difference equation	No	
50.	Natural response, Forced response using classical method	No	
51.	Tutorial (Problems in Natural response, Forced response using classical method)	Yes	
52.	Impulse response, step response	No	
53.	Tutorial (Problems in impulse response, step response)	Yes	
54.	Convolution Sum	Yes	
55.	Fast Fourier Transforms-DIT and DIF algorithm	Yes	
56.	Block Diagram Representation- Direct Form I, Direct Form II	Yes	
57.	Block Diagram Representation- Cascade Form, Parallel Form	Yes	

58.	State variable equations and matrix	Yes	[T1]-Chapter 10
59.	Tutorial (problems in Analysis and characterization of LTI system using Fourier transform)	Yes	
60.	Tutorial (Problems in Analysis & characterization of LTI system using Z transform)	Yes	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials,which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignments/Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: S.Beulah Hemalatha, Assoc. Professor, Department of ECE **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate:

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering**.**

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
S.Beulah Hemalatha	

Course Coordinator **HOD/ECE**