Course code	Course Name	L-T-P Credits	Year of Introduction
CS363	Signals and Systems	3-0-0-3	2016

Pre-requisite: NIL

Course Objectives

- To introduce fundamental concepts of continuous time and discrete time signals.
- To introduce fundamental concepts of continuous time and discrete time systems.
- To introduce frequency domain representation and analysis of signals.

Syllabus

Signals and systems –basic operations on signals – continuous time and discrete time signals – Continuous time and discrete time systems –properties of systems - Z-transform – region of convergence – properties of Z-transform – inverse Z-transform. Fourier transform (FT) of discrete time signals – properties of FT – relation between Z-transform and FT. Discrete Fourier transform (DFT) - Properties of DFT – inverse DFT - Fast Fourier transform (FFT) - Radix-2 FFT algorithms – butterfly structure. Digital filter structures –structures for IIR - Structures for FIR.

Expected Outcome

The Students will be able to

i. Identify different types of continuous time and discrete time signals.
ii. Identify different types of continuous time and discrete time systems.
iii. Analyse signals using Z Transform and FT.
iv. Analyse signals using DFT and FFT.
v. Appreciate IIR digital filter structures.
vi. Appreciate FIR digital filter structures.

Text Books

1. M.N. Bandyopadhyaya , Introduction to Signals and Systems and Digital Signal Processing, PHI, 2005.
2. S.D. Apte, Digital Signal Processing , Wiley India, 2012.

References

1. A. Ambardar, Digital Signal Processing: A Modern Introduction, Thomson India Edition, 2007.
2. A.V. Oppenheim and R. W. Schafer, Discrete Time Signal Processing (Prentice Hall Signal Processing Series), 3e, Pearson, 2009.
3. D. Ganesh Rao and V. P. Gejji, Digital Signal Processing Theory and Lab Practice, Pearson Education Ltd.
4. J.K. Proakis and D.G. Manolakis, Introduction to Digital Signal Processing, MacMillan, 1989
5. Li Tan , Digital Signal Processing, Fundamentals and Applications, Elsevier, 2013.
6. M. H. Hayes, Digital Signal Processing, McGraw Hill (SCHAUM'S Outlines), 2011.
7. P. Ramesh Babu, Digital Signal Processing, Scitech Publications, 2012.
8. S.K. Mitra, Digital Signal Processing, McGraw Hill Education, 2013.
9. S.W. Smith, Digital Signal Processing : A Practical Guide for Engineers and Scientists, Elsevier India.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks

I	Signals and systems – introduction – basic operations on signals – continuous time and discrete time signals –step, impulse, ramp, exponential and sinusoidal functions.	**07**	**15 %**
II	Continuous time and discrete time systems –properties of systems – linearity, causality, time invariance, memory, stability, invertibility. Linear time invariant systems – convolution.	**07**	**15 %**
FIRST INTERNAL EXAM			
III	Z-transform – region of convergence – properties of Z-transform – inverse Z-transform. Fourier transform (FT) of discrete time signals – properties of FT – relation between Z-transform and FT.	**07**	**15 %**
IV	Discrete Fourier transform (DFT) - Properties of DFT – inverse DFT - Fast Fourier transform (FFT) - Radix-2 FFT algorithms – butterfly structure.	**07**	**15 %**
SECOND INTERNAL EXAM			
V	Digital filter structures – block diagram and signal flow graph representation – structures for IIR – direct form structure – Cascade form structure – parallel form structure – lattice structure.	**07**	**20 %**
VI	Structures for FIR – direct form structures – direct form structure of linear phase system – cascade form structure – frequency sampling structure – lattice structure.	**07**	**20 %**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II;All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
   a. Total marks : 12
   b. *Four*questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules III and IV;T*wo*questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts

There should be at least 60% analytical/numerical questions