NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OUTLINE TEMPLATE			
Course Title	**ADVANCED DIGITAL SIGNAL PROCESSING**		
Course Code	**EE664**	**No. of Credits**	**3**
Department	Electrical and Electronics Engineering	**Faculty**	Mr. R.Parthasarathy
Pre-requisite Course	Signals and Systems, Circuit Theory		
Course Coordinator	-		
E-mail	rpartha@nitt.edu	**Telephone No.**	9894684295
Course Type	Elective		

COURSE OVERVIEW

Digital Signal processing is an area of science and engineering that has developed over recent years. This rapid development is a result of significant advances in digital computer technology and integrated circuit fabrication. These inexpensive and relatively faster digital circuits have made it possible to construct highly sophisticated digital systems capable of performing complex digital signal processing functions and tasks which is too difficult to be performed by analog signal processing systems.

Digital signal processing is heavily used in day to day applications. This course has been framed such that initial topics deals with analysis of discrete-time signals and systems and upon completion would help the students to choose appropriate techniques for analysis and design of systems.

Hence on completion of this course an M.Tech. student upon graduating as Electrical Engineer would have a basic knowledge on analysis and design of digital signal processing systems for various electrical applications.

COURSE OBJECTIVES

Review and understanding of discrete-time systems and signals, Discrete-Time Fourier Transform and its properties, the Fast Fourier Transform, design of Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters, implementation of digital filters

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
On completion of the course the students will be able to 1. Understand the basic of discrete-time signals, systems and Z-Transform ; 2. Perform discrete-time Fourier Transform and digital Fourier Transform; 3. Design different kinds of digital filters.	 $PO_1 – PO_{14}$ $PO_1 – PO_{14}$ $PO_1 – PO_{14}$

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week	Topic	Mode of Delivery
1.	I week of Aug (July 31st – 3rd Aug) **1 hr**	Introduction to the course and course plan	**Lecture**
2.	I week of Aug (July 31st – 3rd Aug) **1 hr**	Review of Discrete – Time Signal & System	**Lecture** *Chalk and talk / PPT or any suitable mode*
3.	I week of Aug (July 31st – 3rd Aug) **1 hr**	Discrete – Time Signal & System representation in Z – Transform domain	**Lecture** *Chalk and talk / PPT or any suitable mode*
4.	II week of Aug (7th – 11th Aug) **2 hrs**	Z – Transform – Properties	**Lecture** *Chalk and talk / PPT or any suitable mode*
5.	II week of Aug (7th – 11th Aug) **1 hr**	System characterization in Z – domain	**Lecture** *Chalk and talk / PPT or any suitable mode*
6.	III week of Aug (14th – 18th Aug) **1 hr**	Inverse Z – Transform	**Lecture** *Chalk and talk / PPT or any suitable mode*

7.	III week of Aug (14^{th} – 18^{th} Aug) **1 hr**	Equivalence between Fourier Transform and the Z - Transform of a Discrete signal	**Lecture** *Chalk and talk / PPT or any suitable mode*
8.	III week of Aug (14^{th} – 18^{th} Aug) **1 hr**	Assessment 3 – Solving Numerical problems related to Unit 1 – 5 Marks	**Lecture** *Chalk and talk / PPT or any suitable mode*
9.	IV week of Aug (21^{st} – 25^{th} Aug) **1 hr**	DTFT - Sampling in Fourier domain	**Lecture** *Chalk and talk / PPT or any suitable mode*
10.	IV week of Aug (21^{st} – 25^{th} Aug) **1 hr**	Discrete Fourier Transform and its properties	**Lecture** *Chalk and talk / PPT or any suitable mode*
11.	V week of Aug (28^{th} – 1^{st} Sept) **2 hrs**	Linear filtering using DFT	**Lecture** *Chalk and talk / PPT or any suitable mode*
12.	V week of Aug (28^{th} – 1^{st} Sept) **1 hr**	Resolution of DFT - FFT Algorithm	**Lecture** *Chalk and talk / PPT or any suitable mode*
13.	I week of Sept (4^{th} – 8^{th} Sept) **2 hrs**	Radix-2 FFT Algorithm - DIT Structure	**Lecture** *Chalk and talk / PPT or any suitable mode*
14.	I week of Sept (4^{th} – 8^{th} Sept) **1 hr**	Radix-2 FFT Algorithm - DIF Structure	**Lecture** *Chalk and talk / PPT or any suitable mode*
15.	II week of Sept (11^{th} – 15^{th} Sept) **1 hr**	Higher Radix schemes	**Lecture** *Chalk and talk / PPT or any suitable mode*
16.	II week of Sept (11^{th} – 15^{th} Sept) **1 hr**	Assessment 3 – Solving Numerical problems related to Unit 2 – 5 Marks	**Lecture** *Chalk and talk / PPT or any suitable mode*
17.	II week of Sept (11^{th} – 15^{th} Sept) **1 hr**	Filters - Classification of filter design	**Lecture** *Chalk and talk / PPT or any suitable mode*
18.	III week & IV week of Sept (18^{th} – 29^{th} Sept) **2 hrs**	Design of IIR filters – Bilinear transformation technique	**Lecture** *Chalk and talk / PPT or any suitable mode*

19.	IV week of Sept & I week of Oct (28^{th} Sept, 2^{nd} – 6^{th} Oct) **2 hrs**	Design of IIR filters –Impulse invariance method	**Lecture** *Chalk and talk / PPT or any suitable mode*
20.	I week of Oct (2^{nd} – 6^{th} Oct) **1 hr**	Design of IIR filters –Step invariance method	**Lecture** *Chalk and talk / PPT or any suitable mode*
21.	II week of Oct (9^{th} – 13^{th} Oct) **1 hr**	Assessment 3 – Solving Numerical problems related to Unit 3 – 5 Marks	**Lecture** *Chalk and talk / PPT or any suitable mode*
22.	II week of Oct (9^{th} – 13^{th} Oct) **2 hrs**	FIR filter design – Fourier series method	**Lecture** *Chalk and talk / PPT or any suitable mode*
23.	III week of Oct (16^{th} – 20^{th} Oct) **2 hrs**	FIR filter design - Window function technique	**Lecture** *Chalk and talk / PPT or any suitable mode*
24.	III week of Oct (16^{th} – 20^{th} Oct) **1 hr**	Finite Word Length Effects	**Lecture** *Chalk and talk / PPT or any suitable mode*
25.	IV week of Oct (23^{rd} – 27^{th} Oct) **1 hr**	Assessment 3 – Solving Numerical problems related to Unit 4 – 5 Marks	**Lecture** *Chalk and talk / PPT or any suitable mode*
26.	IV week of Oct (23^{rd} – 27^{th} Oct) **2 hrs**	Introduction to Multirate Signal Processing	**Lecture** *Chalk and talk / PPT or any suitable mode*
27.	V week of Oct & I week of Nov (30^{th} Oct – 3^{rd} Nov) **1 hr**	Decimation	**Lecture** *Chalk and talk / PPT or any suitable mode*
28.	I week of Nov (1^{st} – 3^{rd} Nov) **2 hrs**	Interpolation	**Lecture** *Chalk and talk / PPT or any suitable mode*

29.	II week of Nov (6^{th} – 10^{th} Nov) **2 hrs**	Introduction to STFT WT	**Lecture** *Chalk and talk / PPT or any suitable mode*

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	**Cycle Test I (1^{st} and 2^{nd} Units)**	II week of September (11^{th} – 15^{th})	**1 hr**	**20%**
2.	**Cycle Test II (3^{rd} and 4^{th} Units)**	IV week of October (23^{rd} – 27^{th} Oct)	**1 hr**	**20%**
3.	**Assessment III** (4 Assignments/Tutorials each for 5 Marks)	During regular class hours	**1 hr**	**20%**
4.	**Compensation Exam (First 4 units)**	II week of November (6^{th} – 10^{th} Nov)	**1 hr**	**20%**
5.	**End Semester Assessment**	3^{rd} week of November (20^{th} – 24^{th} Nov)	**2 hrs**	**40%**

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. *John G. Prokis and Dimitris G. Hanolakis, 'Digital Signal Processing, Principles, Algorithms & Applications' 4th Edition, Pearson Education, 2006.*
2. *Ludemann L. C., 'Fundamentals of Digital Signal Processing', Harper and Row publications,2009.*
3. *Antoniou A., 'Digital Filters – Analysis and Design', Tata Mc-Graw Hill, 2001.*
4. *Oppenheim and Schaffer, 'Discrete time Signal processing', Pearson Education, 2007.*

COURSE EXIT SURVEY

1. Students' feedback through class committee meetings
2. Anonymous Feedback from students

COURSE POLICY (including plagiarism, academic honesty, attendance etc.,)

1. All the students are expected to attend all the contact hours.
2. Every student should maintain minimum 75% attendance to appear for the final written examination.
3. Any student falls short of 75% attendance but scored more than 50% marks in first three assessments is allowed to attend end semester assessment. Students having less than 75% attendance and also scored less than 50% marks in first three assessments will have to redo the course.
4. Attending all the assessments is mandatory for every student. Flexibility is given to the students to fix the date for each mode of evaluation convenient to all the students. If any student is not able to attend Cycle Test I/II, the student may be allowed to appear for compensation exam and should score more than 50% to make them eligible to appear for end semester exam.
5. Minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.
6. In case of any student found guilty indulging in any malpractice, he/she will be awarded no marks in that particular assessment. If found using mobile phones or any other gadgets for any mal-practice during the final written examination, the answer sheet of the student will not be evaluated and will be awarded ZERO marks in the final written examination.

ADDITIONAL COURSE INFORMATION

1. The faculty is available for consultation during the time intimated to the students then and there.
2. All correspondence will be sent to the webmail id of the students alone. Hence all students are advised to check their webmail ids regularly.

FOR SENATE'S CONSIDERATION

R. Parthasarathy 28/7/17	28/7/17	28/07/2017
[Mr. R. Parthasarathy]	**[Dr.N.Kumaresan]**	**HoD/Dept. of EEE**
Course Faculty	**CC-Chairperson**	