NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III-Year (July Session) Section-A

COURSE OUTLINE TEMPLATE			
Course Title	DIGITAL SIGNAL PROCESSING		
Course Code	EEPE20	No. of Credits	3
Department	Electrical and Electronics Engineering	Faculty	Ms. R. AGASTHIYA
Pre-requisite Course	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS, DIGITAL ELECTRONICS		
Course Coordinator	Ms. R. AGASTHIYA		
E-mail	agasthiya@nitt.edu	Telephone No.	-
Course Type	Elective Course		

COURSE OVERVIEW

This course gives the knowledge of analyzing digital signals using different types of transforms like Z-Transform, Discrete Fourier Transform and the properties behind these transforms.

The course also deals with realization of digital filters like Infinite Impulse Response Filter and Finite Impulse Response Filter.

Finally this course also includes the architecture and features of signal processor and motion controller.

COURSE OBJECTIVES To explore the basic concepts of digital signal processing in a simple and easy-to-understand manner.

COURSE OUTCOMES (CO)

Course Outcomes	**Aligned Programme Outcomes (PO)**
On completion of the course the students will be able to	
1. Understand the operations on digital signals.	**PO_1, PO_2, PO_3,PO_6, PO_8, PO_{12}, PO_{13}**
2. Analyze the signal processing concepts.	**PO_1, PO_2, PO_3,PO_6, PO_8, PO_{12}, PO_{13}**
3. Design the systems required for digital signal processing.	**PO_1, PO_2, PO_3,PO_6, PO_8, PO_{12}, PO_{13}**

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	**Week**	**Topic**	**Mode of Delivery**
1.	II week of July (10^{th} – 14^{th}) **1 hr**	Introduction to the course	**Lecture** Ppt
2.	II week of July (10^{th} – 14^{th}) **2 hrs**	Z- Transform – basic formulae and problems	**Lecture** *Chalk and talk*
3.	III week of July (17^{th} –21^{st}) **3 hrs**	Linearity shift - invariance - Unit sample response characterization – Convolution summation, causality	**Lecture** *Chalk and talk*
4.	IV week of July (24^{th} – 28^{th}) **3 hrs**	Linear difference equations with constant coefficients and their solution System function-concept	**Lecture** *Chalk and talk*

5.	I week of August (1^{st} – 4^{th}) **3 hrs**	Discrete Fourier Transform and its properties – Circular convolution – Linear convolution of two finite length sequences through circular convolution, Sectioned convolutions	**Lecture** *Chalk and talk*
6.	II week of August (7^{th} – 11^{th}) **3 hrs**	Relationship between Z Transform, Fourier Transform and the Discrete Fourier Transform	**Lecture** *Chalk and talk*
7.	III week of August (14^{th} – 18^{th}) **1 hr**	**Assessment 1**	**Objective type**
8.	III week of August (14^{th} – 18^{th}) **2 hrs**	Digital filter sampling, Introduction to radix-2 FFT – decimation-in-time and decimation-in-frequency radix-2 algorithm	**Lecture** *Chalk and talk*
9.	IV week of August (21^{st} – 24^{th}) **2 hrs**	Problem Solving	**Lecture** *Chalk and talk*
10.	V week of August (28^{th} – 31^{st}) **2 hrs**	Amplitude and phase response of FIR filters Linear phase filters	**Lecture** *Chalk and talk*
11.	I week of September (1^{st} – 8^{th}) **3 hrs**	Windowing technique for the design of linear phase FIR filters – Rectangular Window, Hamming and Kaiser windows	**Lecture** *Chalk and talk*
12.	I week of September (1^{st} – 8^{th}) **1 hrs**	**Assessment 2**	**Problem Solving**
13.	II week of September (11^{th} – 15^{th}) **3 hrs**	Frequency sampling technique	**Lecture** *Chalk and talk*
14.	III week of September (18^{th} – 20^{th}) **1hr**	Introduction to optimal filters	**Lecture** *Chalk and talk*

15.	IV week of September (25^{th} – 28^{th}) **1hr**	**Assessment 3**	**Assignment Test**
16.	IV week of September (25^{th} – 28^{th}) **1hr**	Properties of IIR digital filters	**Lecture** *Chalk and talk*
17.	I week of October (3^{rd} – 6^{th}) **2 hrs**	Design of IIR filters from continuous time filters – Impulse invariance and Bilinear transformation technique	**Lecture** *Chalk and talk*
18.	I week of October (3^{rd} – 6^{th}) **1 hr** II week of October (9^{th} – 13^{th}) **1 hr**	Finite Word Length Effects – Elementary ideas of finite word length effects in digital filters	**Lecture** *Chalk and talk*
19.	II week of October (9^{th} – 13^{th}) **1 hr**	**Assessment 4**	**Objective type test**
20.	II week of October (9^{th} – 13^{th}) **1 hr**	**Architecture and features of signal processor and motion controller** Von Neumann Architecture	**Lecture** *Chalk and talk*
21.	III week of October (16^{th} – 20^{th}) **2 hrs** IV week of October (23^{th} – 27^{th}) **1 hr**	Harvard Architecture Addressing modes and instruction set	**Lecture** *Chalk and talk*
22.	IV week of October (23^{th} – 27^{th}) **1 hr**	**Assessment 5**	**Problem solving**
23.	II week of November (6th – 11th) **1 hr**	**CPA**	
24.	III Week of November (13^{th} - 17^{th}) **2 hrs**	**Assessment 6**	**End semester exam- Descriptive Type**

COURSE ASSESSMENT METHODS				
S. No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1.	**Objective Type**	III week of August (14^{th} – 18^{th})	1 hr	10%
2.	**Problem solving**	I week of September (1^{st} – 8^{th})	1 hr	10%
3.	**Assignment test**	IV week of September (25^{th} – 28^{th})	1 hr	20%
4.	**Objective Type**	II week of October (9^{th} – 13^{th})	1 hr	10%
5.	**Problem Solving**	IV week of October (23^{th} – 27^{th})	1hr	20%
6.	**CPA**	II week of November (6th – 11th)	1hr	20%
7.	**End Semester exam**	III Week of November (13^{th} - 17^{th})	2 hrs	30%

ESSENTIAL READINGS : Text books, Reference books, Website addresses, Journals, etc

Text Books:

1. Oppenheim and Schaffer, 'Discrete Time Signal processing', Pearson Education Publications, 3 rdEdition, 2010.
2. John G Proakis, Dimitris K Manolakis, 'Digital Signal Processing', Prentice Hall International, 4 th Edition, 2007.
3. Ludemann L. C., 'Fundamentals of Digital Signal Processing', Harper and Row Publications, 1 st Edition, 1992.

Reference Books:

1. Rabiner & Gold, 'Theory and Applications of Digital Signal Processing', PHI Learning Publications, 1 st Edition, 2009.
2. Hamid A.Toliyat and Steven G. Campbell, 'DSP Based Electro Mechanical Motion Control', CRC Press, 1 st Edition, 2004.

COURSE EXIT SURVEY

1. Students' feedback through class committee meetings
2. Feedback questionnaire from students – twice during the semester
3. Feedback from students on Course Outcomes at the end of the semester

COURSE POLICY

1. All the students are expected to attend all the contact hours.
2. Students who fall short of 75% attendance to the contact hours are not eligible to appear for the final written examination of 30% weightage.
3. Any Student who fails to maintain 75% attendance needs to appear for a CPA exam. Student who scores more than 50% will be eligible for attending the end semester examination.
4. Students not having 75% attendance and also fail in CPA exam will have to redo the course.
5. Attending all the assessments is MANDATORY for every student.
6. If any student is not able to attend any of the continuous assessments, due to genuine reason, student is permitted to attend the compensation assessment (CPA) with 20 % weightage. At any case, CPA will not be considered as an improvement test.
7. Relative grading with a passing minimum is as per our institute norms
   In case of any student found guilty indulging in any mal practice, 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 Course Coordinator 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. Agasthiya, TF/EEE]	[Dr. Sishaj P Simon]	
Course Faculty	CC-Chairperson	HoD/EEE