DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the Programme and specialization	B.Tech., Electrical and Electronics Engineering		
Course Title	Digital Signal Processing		
Course Code	EEPE18	**No. of Credits**	03
Course Code of Pre-requisite subject(s)	EEPC14, MAIR32		
Session	January 2022	**Section**	A&B
Faculty	Dr. Karthik Thirumala	**Department**	Electrical and Electronics Engineering
E-mail	thirumala@nitt.edu	**Telephone No.**	9848626021
Name of Course Coordinator (if applicable)			
Course Type	☐ **Core course** ☑ **Elective course** ☐ **Laboratory course**		

Syllabus (approved in BoS)

Linearity shift - invariance - Unit sample response characterization – Convolution summation, causality, linear difference equations with constant coefficients and their solution using Z-transform – System function-concept.

Discrete Fourier Transform and its properties – Circular convolution – Linear convolution of two finite length sequences through circular convolution, Sectioned convolutions–Relationship between ZTransform, Fourier Transform and the Discrete Fourier Transform, Digital filter sampling, Introduction to radix-2 FFT – decimation-in-time and decimation-in-frequency radix-2 algorithm.

Amplitude and phase response of FIR filters–Linear phase filters – Windowing technique for the design of linear phase FIR filters – Rectangular Hamming and Kaiser windows – Frequency sampling technique – Introduction to optimal filters.

Properties of IIR digital filters – Design of IIR filters from continuous time filters – Impulse invariance and Bilinear transformation technique – Finite Word Length Effects – Elementary ideas of finite word length effects in digital filters.

Architecture and features of signal processor and motion controller.

Essential Readings

1) Oppenheim and Schaffer, 'Discrete Time Signal processing', Pearson Education Publications, 3rd Ed, 2010.
2) John G Proakis, Dimitris K Manolakis, 'Digital Signal Processing', Prentice Hall International, 4th Ed, 2007.
3) Ludemann L. C., 'Fundamentals of Digital Signal Processing', Harper and Row Publications, 1st Edition, 1992.
4) Rabiner & Gold, 'Theory and Applications of Digital Signal Processing', PHI Learning Publications, 1st Edition, 2009.

5) Hamid A.Toliyat and Steven G. Campbell, 'DSP Based Electro Mechanical Motion Control', CRC Press, 1st Edition, 2004.

COURSE OBJECTIVES

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

COURSE OUTCOMES (CO)

Course Outcomes Upon completion of the course, the student will be able to	**Aligned Programme Outcomes (PO)**
1. *Understand the operations on digital signals.*	1, 2, 3, 7, 8, 11, 12
2. *Analyze the signal processing concepts.*	1, 2, 3, 7, 8, 11, 12
3. *Design the systems required for digital signal processing.*	1, 2, 3, 7, 8, 11, 12

COURSE PLAN – PART II

COURSE OVERVIEW

Over the past several decades, the field of Digital Signal Processing made a significant impact on many areas of technology. As a result, DSP is being a basic course for many branches of Engineering. To align with the above said requirement, this course is designed for Electrical and Electronics Engineering students such a way that it covers the basic concepts like linear time-invariant systems, convolution, solution of difference equations and frequency response of LTI systems and Deals with the use of z-Transform in the analysis of linear-time invariant systems and realization structures of IIR systems. Other part of the syllabus engages DFT and IDFT using radix-2 FFT algorithms. Finally, this course introduces FIR and IIR filter design by using different techniques.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week / Contact Hour	Topic	Mode of Delivery
1.	29 - 31 Dec 2021 (2 hours)	Discussion on course plan – Introduction to DSP Course - Linearity shift - invariance	Online/chalk & Talk
2.	3 – 7 January 2021 (3 hours)	Unit sample response characterization - Convolution summation - causality	
3.	10 – 13 January 2021 (3 hours)	Linear difference equations with constant coefficients and their solution using Z Transform	
4.	17 – 21 January 2021	Tutorial Session	

	(3 hours)	Discrete-time Fourier Transform, Discrete Fourier Transform and its properties.	Online/chalk & Talk
5.	24 – 28 January 2021 (1 hour)	Linear convolution of two finite length sequences through circular convolution	
6.	1 - 4 February 2021 (3 hours)	Sectioned convolutions Relationship between Z-Transform, Fourier Transform and the Discrete Fourier Transform	
7.	7 - 11 February 2021 (3 hours)	Introduction to radix-2 FFT - decimation-in-time and decimation-in frequency radix-2 algorithm	
		Tutorial Session	
		Assessment I	
8.	14 - 18 February 2021 (3 hours)	Amplitude and phase response of FIR filters - Linear phase filters	Online/chalk & Talk
9.	21 - 25 February 2021 (2 hours)	Windowing technique for the design of linear phase FIR filters — Rectangular Hamming and Kaiser windows	
10.	1 – 4 March 2021 (3 hours)	Frequency sampling technique - Introduction to optimal filters.	
		Tutorial Session	
11.	7 – 11 March 2021 (3 hours)	Properties of IIR digital filters - Design of IIR filters from continuous time filters	Online/chalk & Talk
12.	14 – 18 March 2021 (3 hours)	Impulse invariance and Bilinear transformation technique - Finite Word Length Effects - Elementary ideas of finite word length effects in digital filters.	
13.	21 – 25 March 2021 (3 hours)	***Assessment II***	Online/chalk & Talk
		Architecture and features of signal processor	
14.	28 – 31 March 2021 (3 hours)	Motion controller	
15.	4 – 8 April 2021 (3 hours)	Applications	
16.	4 – 8 April 2021	***Assessment – III & Compensation Assessment***	
17.	19 – 25 April 2021	***Assessment IV - End Semester Examination***	

COURSE ASSESSMENT METHODS (Shall range from 4 to 6)

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Assessment I (1^{st} & 2^{nd} unit)	7 - 11 February 2021	1 hour	20%
2.	Assessment II (3^{rd} & 4^{th} units)	21 – 25 March 2021	1 hour	20%

3.	Miniproject / Seminar	Continuous	-	30%
CPA	Compensation assessment (entire syllabus)	4 – 8 April 2021	1 hour	80% of the weightage of the A1 or A2
4.	End Semester Examination (entire syllabus)	19 – 25 April 2021	120 mins	30%

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Students feedback through class committee meetings
2. Feedback questionnaire from students – twice during the semester
3. Feedback from students on the course outcomes shall be obtained at the end of the course

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

Mode of Correspondence

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 NITT webmail of the students or MS Teams.
3. The students can contact me through the email *thirumala@nitt.edu* for any academic related issues with respect to this course.

Compensation Assessment Policy

1. Flexibility is given to the students to fix the date for each assessment convenient to majority of the students.
2. Only one instance of absence in internal assessment is permitted. Only one compensation assessment for absentees in internal assessments will be conducted.
3. The compensation assessment (CPA) is for entire syllabus and the weightage is 80% of the weightage of the internal assessments A1 or A2. In any case, CPA is not considered as an improvement test.

Attendance Policy

1. All the students are expected to attend all the contact hours. Students should maintain 75% minimum physical attendance by the end of the course to attend the end semester examination.
2. Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' Grade. Student have to REDO the course.
3. A maximum of 10% attendance shall be allowed under On Duty (OD) category. OD is allowed only for the students having minimum attendance of 65%.

Academic Honesty & Plagiarism

1. Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
2. The answer sheet of the student will not be evaluated and ZERO mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
3. The departmental disciplinary committee including the course faculty member, PAC chairperson

and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
ADDITIONAL INFORMATION
The minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.
FOR APPROVAL

Course Faculty	CC – Chairperson	Head of the Dept. EEE
03/01/21		05/01/2022
[Dr. Karthik Thirumala, AP/EEE]	Aneesa Farhan	(I/C)

Guidelines:

a) The number of assessments for a course shall range from 4 to 6.

b) Every course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in					P.G.
2019 and later	2018	2017	2016	2015	
35% or class average/2 whichever is greater.			Peak/3 or class average/2 whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.