

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI - 625009
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
2023 - 2024 ODD SEMESTER
COURSE PLAN

Degree	B.E. – ECE
Course Code – Title	21EC303– Digital Signal Processing
Batch	2020 – 2024
Year/Semester/Section	III/ V/ A
Course component	Theory with Practical Course
Name of the Instructor	Dr. K. Kavitha

S. No.	Topic to be covered	Applications / Examples	Text/Reference Book Page No.	Mode of Delivery	Teaching Aid	No. of Hours	Cumulative No. of Hours
UNIT I - DISCRETE FOURIER TRANSFORM							
1.	Review of signals and systems		T1(42-69,89-108)	L+D	BB	1	1
3.	Discrete Fourier transform (DFT) - deriving DFT from DTFT	Spectral analysis	T1(449-463)	L+D	BB	2	3
4.	Properties of DFT-periodicity, symmetry, circular convolution	Filter bank	T1(464-480)	L+I	BB,LCD	2	5
5.	Linear filtering using DFT - Filtering long data sequences - overlap save and overlap add method		T1(480-488)	L+D	BB	2	7
6.	Fast computation of DFT - Radix-2 Decimation-in time (DIT) Fast Fourier transform (FFT),		T1(511-519)	L+D	BB	2	9

7.	Decimation-in-frequency (DIF) Fast Fourier transform (FFT).		T1(519-524)	L+I,RP	BB	2	11
	Linear filtering using FFT.		T1(527-532)	L+D	BB	1	12
8.	Practical: Generation of elementary Discrete-Time sequences, Convolution and Correlation, Frequency Analysis using DFT		-	Practical	-	15	27

UNIT II - INFINITE IMPULSE RESPONSE DIGITAL FILTERS

10.	Review of design of analog Butterworth and Chebyshev Filters		T1(717-718)	L+I,TPS	BB	1	28
11.	Frequency Transformation in analog domain		T1(719-724)	L+I	BB	2	30
13.	Design of IIR digital filters using Impulse Invariance technique		T1(707-711)	L+I	BB	2	32

14.	Design of digital filters using bilinear transform		T1(712-716)	L+I	BB	2	34
15.	Design of IIR filters from analog filters (LPF, HPF, BPF, BRF)	Audio amplifier, DSL	T1(701-728)	L+I	BB	2	36
16.	Frequency transformation in the analog domain		T1(730-732)	L+D	BB	1	37
17.	Structure of IIR filter - direct form I, direct form II		T1(582-589)	L+I	BB	1	38
18.	Cascade, parallel realizations		T1(589-594)	L+I	BB	1	39
19.	Practical: Sampling and Effect of Aliasing, Design of IIR filters.		-	Practical	-	10	49

UNIT III - FINITE IMPULSE RESPONSE DIGITAL FILTERS

21.	Symmetric and Anti-symmetric FIR filters		T1(660-663)	L+D	BB	2	51
22.	Design of linear phase FIR filters	Adaptive filtering	R6(6.16-6.28)	L+I	BB	1	52
23.	FIR filter design using windows (Rectangular, Hamming and Hanning window)		T1(664—670)	L+I	BB,LCD	3	55
24.	Frequency sampling method		T1(671-677)	L+I, FCR	BB	2	57
25.	FIR filter structures		T1(565-566)	L+D	BB	1	58
26.	Linear phase structure, direct form realizations		T1(566-568)	L+I		2	60
27.	Practical: Design of FIR filters.		-	Practical	-	5	65
UNIT IV - FINITE WORD LENGTH EFFECTS							
28.	Fixed point and Floating point number representations	DSP Processors	T1(601-607)	L+D	BB	1	66
29.	ADC-Quantization - Truncation and Rounding		T1(608-612)	L+D	BB	1	67
30.	Quantization noise - quantization noise power		R6(7.15-7.21)	L+I	BB	2	69
31.	Coefficient quantization error		R6(7.29-7.30)	L+I	BB	1	70
32.	Product quantization error		R6(7.21-7.29)	L+D,TPS	BB	1	71
33.	Overflow error - Limit cycle oscillations due to product quantization and summation		T1(624-629)	L+I	BB	2	73
34.	Scaling to prevent overflow		T1(629-631)	L+I	BB	1	74
UNIT V - MULTIVARIATE SIGNAL PROCESSING							

36.	Multivariate Time Series: Time Domain Approach	WEB MATERIALS	R5(40-53)	L+D	LCD	2	76
37.	Concept of Stochastic Processes, Stationarity and Ergodicity		R5(56-65,255-272) R5(100-107)	L+D	LCD	3	79
38.	Time series models: AR Models & ARMA Models		R5(70-95)	L+I	LCD	2	81
39.	Estimating time series models from data, Assessing the relations among time series		R5(111-125)	L+I	LCD	3	84
	Information theoretic measures: Mutual information and complexity.						

Total No. of hours: 84

Assignments:

1. Problems in DFT, DIT and DIF FFT
2. Problems in IIR filter design
3. Problems in FIR filter design

TEXT BOOK(S):

- T1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", 4th Edition, Pearson Education, 2007.
T2. B. Venkatramani and M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Applications", 2nd Edition, Tata McGraw Hill, 2017. T3.
V. Oppenheim, R. W. Schaffer and J.R. Buck, "Discrete-Time Signal Processing", 4th Edition, Pearson Education, 2011.

REFERENCES:

- R1. Ifeachor E.C. and Jervis B.W., "Digital Signal Processing: A Practical Approach", 2nd Edition, Pearson Education, 2002.
R2. Sanjit. K. Mitra "Digital Signal Processing - A computer based approach", 4th Edition, Tata McGraw Hill, 2011.
R3. Andreas Antoniou, "Digital Signal Processing: Signals, Systems and Filters", Tata McGraw Hill, 2006.
R4. Monson H Hayes, "Schaum's Outlines of - Digital Signal Processing", 2nd Edition, Tata McGraw Hill, 2012.

WEB MATERIALS:

- W1 <https://ccrma.stanford.edu/~jos/filters/>
W2 <http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011>
W3 www.irdindia.in/journal_ijacee/pdf/vol2_iss4/1.pdf

W4 <https://www.wiley.com/en-sg/Multivariate+Time+Series+Analysis+and+Applications-p-9781119502852>

Course I/C/Coordinator Module coordinator HOD/ECE