SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. Semester VII

Subject Name: Digital Signal Processing **Subject Code: BTEL14741**

Type of course: **Professional Elective Course (PEC)**

Prerequisite: Signals and Systems

Rationale: Many Electrical and Power Electronics Applications require complex control schemes and signal processing. Hence, it is necessary for any electrical and power electronics engineer involved in product development to understand the concepts of Digital Signal Processing. The subject includes digital signal processing, applications and implementation of algorithms using DSC. The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis of DSP systems.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
3	0	0	3	60	25	15	-	-	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage %
1.	**Discrete Time Signals and systems** Introduction to Digital Signal Processing, Sampling of continuous time signals, Sampling Theorem, Aliasing Effect, Signal reconstruction. Discrete-Time Signals, Discrete-Time Systems, linear time-invariant (LTI) systems, convolution of discrete-time signals, linear difference equations with constant coefficients, realizations, frequency-domain representation of discrete-time signals and systems. **Structures for Discrete Time Systems** Block Diagram and signal flow diagram representations of Linear Constant- Coefficient Difference equations, Basic structures for IIR and FIR digital systems- Direct, Cascade, Parallel and lattice realizations, computational complexity, Finite word length effects and quantization errors.	**12**	**25**
2.	**Z-Transform** Z-transform, ROC, properties of the Z-transform, transfer	**10**	**20**

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	function representation, Inverse Z-transform, Z-transform applied to difference equations, the convolution theorem, Analysis of LTI systems in time domain, stability of discrete-time systems, frequency response of LTI discrete-time systems. All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase.		
3.	**Discrete Fourier Transform and Algorithms** Discrete Fourier Transform (DFT), Inverse DFT, Discrete Convolution, Relationship of DFT & other transforms, Analysis of LTI system using DFT, Algorithms for efficient computation of DFT and FFT- DIT Radix-2 FFT, DIF Radix-2 FFT, Computation of Inverse DFT using FFT, Fast convolution, Correlation.	**10**	**20**
4.	**Digital Filter Design** FIR and IIR filters, linear phase filters, design techniques for IIR and FIR filters, analog approximations, impulse invariant method, bilinear transformation method, matched Z-transform method, Filter design by windowing technique, realizations, analysis of finite word length effects	**8**	**20**
5.	**Architecture of Digital Signal Processor** Features of Processors– Types of architecture, Concepts of DMA, MAC, Pipelining etc., Peripherals available in DSP IC chips, requirements of on chip hardware for power electronics applications, Introduction to C2000 family of microcontrollers: Comparison of C2000 real time microcontrollers like PICOLO, DELFINO, 28M3x etc., with reference to on chip peripherals, processing capacity, applications etc.	**5**	**15**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**25**	**25**	**10**	**10**	**10**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Digital Signal Processing: Principles, Algorithms, and Applications.	Dimitris Manolakis and John G Proakis,	Prentice Hall of India	2007	Forth
2.	Theory and Application of Digital Signal Processing	Rabiner and Gold	Prentice Hall of India	2015	First
3.	The DSP Handbook Algorithms, Applications and design techniques,	Andrew Bateman, Iain Paterson-Stephens,	Pearson Education		
4.	Digital Signal Processing: A Computer Based Approach	S. K. Mitra	Tata McGraw Hill	2016	Forth
5.	Discrete Time Signal Processing	Oppencheim A.V, Schafer, Renald ,	Prentice Hall of India	2014	Third
6.	Digital Signal Processing	Babu Ramesh, P.	Scitech Pub (India Pvt.Ltd.)	2016	Sixth
7.	Digital Signal Processing	Kumar Anand A.	Prentice Hall of India Ltd.,	2016	Second
8.	DSP-Based Electromechanical Motion Control (Power Electronics and Applications Series)	Hamid A. Toliyat, Steven G. Campbell	CRC press		

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Classify the discrete time signals, systems and develop structures for realizing IIR and FIR systems.	25
CO-2	Apply signal processing techniques to real situation problems.	20
CO-3	Analyze discrete time signals and system in frequency domain.	20
CO-4	Develop various DSP FFT algorithms.	20
CO-5	Design and implement digital filters, learn features of DSP processor architecture.	15

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Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	3	3	-	1	3	2	1	2	1	1	3	3	1	2
CO-2	3	3	3	-	1	2	2	-	2	1	-	3	2	-	1
CO-3	3	3	3	-	1	-	-	-	2	-	-	3	2	-	-
CO-4	3	3	3	-	1	-	-	-	2	-	-	3	2	1	-
CO-5	3	3	3	-	1	1	1	-	2	-	-	3	2	1	1
Rationale *															

Rationale*: Explaining why it is matching this particular program outcome

List of Open Source/learning website:

1. http://nptel.iitm.ac.in/courses.php
2. http://ocw.mit.edu/
3. http://www.electrical-engineering-portal.com
4. www.ti.com
5. https://www.ti.com/microcontrollers-mcus-processors/microcontrollers/c2000-real-time-control-mcus/overview.html#portfolio
9. http://software-dl.ti.com/C2000/docs/software_guide/intro.html
10. https://software-dl.ti.com/C2000/docs/optimization_guide/index.html
11. https://www.ti.com/tool/CCSTUDIO#tech-docs
12. https://www.ti.com/tool/CCSTUDIO
13. https://software-dl.ti.com/ccs/esd/documents/users_guide/index.html

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