GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: POWER ELECTRONICS (24)
SUBJECT NAME: Digital Signal Processing for Power Electronics
Subject Code: 2172409
BE SEMESTER VII

Type of Course: Engineering Science (Electronics)
Prerequisite: 2141005 (Signals & Systems)
Rationale: This subject is aimed at developing concept of digital signals and signal processing using the same.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE End Semester Examination; PA- Progressive Assessment.

Content:

Sr. No.	Topic With Details	Teaching Hrs.	Module Weightage (%)
1	**Introduction:** Review of signals, classification of signals, Continuous time systems, Discrete time systems, DT, DTFT, DFT, Z-transformation etc.	4	10-15
2	**Discrete Fourier Transformation:** DFT – Frequency Domain Sampling and Reconstruction of Signal – Relationship of DFT & other transforms – DFT as Linear Transformation – Properties	4	10-15
3	**Fast Fourier Transformation:** FFT – Direct Computation of DFT – Radix-2 FFT & DIT Algorithm – Their Applications – Quantization Effects in Computation of DFT & FFT & Errors therein	8	20-25
4	**Implementation of Discrete Time Systems:** Structures for FIR & IIR Systems – Direct, Cascade, Parallel & Lattice State Space System Analysis & Structures	8	20-25
5	**Number Representation** Representation of Numbers – Round Off Effects in Digital Filters – Concept of Limit Cycle Oscillations & Scaling	8	20-25
6	**Architecture Of DSP** Floating point & Fixed point data representation – DSP Architecture: Von Neumann, Harvard and Modified Harvard – MAC and its features – Pipelining	8	20-25

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	**Understanding U Level**	**Application A Level**	**Analyze N Level**	**Evaluate E Level**
20%	**25%**	**25%**	**10%**	**10%**

Legends: R : Remembrance ; U = Understanding; A = Application 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

Reference Books:

1. Digital Signal Processing, A. Anandkumar
2. Discrete Time Signal Processing, Openheim, Schafer and buck
3. Digital Signal Processing, Proakis and Manolakis
4. Digital Signal Processing, Openheim¸Schafer
5. Signals and Systems, Tarunkumar Rawat
6. Signals and Systems, A. Anandkumar
7. Embedded System Design A Unified Hardware Software Introduction, Frank Vahid, Tony Givargis, Wiley India
8. The DSP Handbook Algorithms, Applications and design techniques, Andrew Bateman, Iain Paterson-Stephens, Pearson Education

Course Outcome:

After learning this course, the students should be able to understand following concepts.

1. Importance of digital signal processing for implementing real systems.
2. Scope of use of DSP in power electronics system
3. Simulate digital filters
4. Understand rounding effects and stability

Laboratory Work:

Objectives: The laboratory work is aimed at putting the theory learnt in class in practice and to show the results are nearly matched with theory. In this context, following are the core objectives for laboratory work of this subject.

- Develop understanding of basics of DSP.
- Implementation of digital systems using different forms.

Directions for Laboratory work:

- ✓ The list of experiments is given as a sample.
- ✓ Minimum 10 experiments should be carried out.
- ✓ Similar laboratory work fulfilling the objectives can also be considered.
- ✓ As far as possible printed manual should be preferred so that students can concentrate in laboratory experiments and related study.

List of Practical and Open Ended Problems:

1. Study of generation of different elementary signals and sequences used in DSP using MATLAB/ Octave
2. To study different operations on signals using MATLAB
3. To study and perform DTFT using MATLAB/ OCTAVE
4. To study and perform DFT using MATLAB/ OCTAVE

5. To study and perform FFT using MATLAB/ OCTAVE
6. To study structure and implementation IIR filter using different forms. (2 to 3 experiments)
7. To study structure and implementation FIR filter using different forms. (2 to 3 experiments)

List of Open Source Software/learning website:

Open Source Software:

Web-based tools for design:

Open source for Math Tools:

- http://maxima.sourceforge.net/
- http://www.sagemath.org/
- http://www.scilab.org/
- http://www.gnu.org/software/octave/

Learning website:

- http://nptel.iitm.ac.in/courses.php
- http://ocw.mit.edu/
- http://www.ti.com
- http://www.electrical-engineering-portal.com

Major Equipments / Softwares:

Matlab / Octave software

Active learning Assignments (AL) :

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus can be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.