GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS ENGINEERING
DIGITAL SIGNAL CONTROLLERS
SUBJECT CODE: 2182410
B.E. 8th SEMESTER

Type of Course: Engineering Science (Electronics)

Prerequisite: 1. 2141005 (Signals & Systems)
2. 2172409 (Digital Signal Processing for Power Electronics)
3. 2172407 (Embedded Systems for Power Electronics)

Rationale: This subject is aimed at developing concept of use of digital signal controller for implementing PES.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	20	10	150

Content:

Sr. No.	Topic With Details	Teaching Hrs.	Module Weightage (%)
1	Introduction: Digital signal processing, DSP architecture, Requirements of digital signal processing for power electronics	4	10
2	Introduction to C2000 family of microcontrollers: DFT - Frequency Domain Sampling and Reconstruction of Signal – Comparison of C2000 real time microcontrollers like PICOLO, DELFINO, 28M3x etc, with reference to on chip peripherals, processing capacity, applications etc.	4	15
3	Code Composer Studio Basics: Introduction to CCS as IDE for TI processors, Basics of CCS, Multiprocessing with CCS, Testing Program, debugging Breakpoints, points, Using file I/O	6	15
4	Code Composer Studio Advanced Facilities: Memory map, Watch window, Integrated editor, project environment	6	15
5	TI 320F28X Digital Signal Controllers: TMS320F28335 Introduction, Functional Overview, Memory map, brief description of available peripherals, register maps, device emulation registers, interrupts, system control	8	15
6	On chip Peripherals of TMS320F28335(or any other C2000 Family processor): Timers, PWM generation, ADC, Serial Communication, GPIO, Flash Memory	6	15
7	Programming: Writing program for some simple objectives like initializing peripheral, timer interrupt and ISR for timer interrupt, PWM generation etc.	4	10
8	Software Development Tools: Overview, description, object module, program loading and running, Assembler, Assembler directives, Macros, Linker, using C language	4	5

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**40**	**25**	**0**	**10**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and 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

Reference Books:

1. DSP-Based Electromechanical Motion Control (Power Electronics and Applications Series), Hamid A. Toliyat (Author), Steven G. Campbell, CRC press
2. Code Composer Studio User's Guide, Texas Instruments Document no. SPRU328B
3. Data Manual 28335, Texas Instruments, SPRS439MDiscrete
4. TMS320C28x Assembly Language Tools User's Guide SPRU513F
5. TMS320C28x Optimizing C/C++ Compiler SPRU514F
6. Embedded System Design A Unified Hardware Software Introduction, Frank Vahid, Tony Givargis, Wiley India
7. The DSP Handbook Algorithms, Applications and design techniques, Andrew Bateman, Iain Paterson-Stephens, Pearson Education
8. C the complete reference, Herbert Schildt

Course Outcome:

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

1. Importance of implementing digital signal processing theory in real power electronic systems.
2. Scope of use of DSC in power electronics system

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.

1. Develop understanding of basics of DSC.
2. Implementation of digital systems using different forms.

Directions for Laboratory work:

1. The list of experiments is given as a sample.
2. Minimum 10 experiments should be carried out.
3. Similar laboratory work fulfilling the objectives can also be considered.
4. 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
2. To study Code Composer studio as Integrated Development Environment
3. Using DSC for reading Analog Signal

4. Using DSC for Generating Timer interrupt and writing program for Interrupt service routine
5. Generation of PWM
6. Implementation of simple operations on signals
7. Reading digital signals from GPIO port
8. Writing signals to GPIO port

List of Open Source Software/learning website:

Open Source Software:

Web-based tools for design:

Learning website:

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

Major Equipments / Softwares:
Matlab / Octave

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.