GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (24)
SIMULATION TOOLS
SUBJECT CODE: 2162408
B.E. 6th SEMESTER

Type of Course: Engineering Science (Power Electronics)

Prerequisite: None

Rationale: This subject focuses on simulation skill development required for logical verification of various system to be studied before practical implementation.

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		
0	0	2	2	00	00	00	50	30	20	100

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; E- Exam; M- Mid Semester; V- Viva; I- Internal; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP- Open Ended Problems; ALA- Active Learning Assignments.

Learning Objectives:

- Simulation skill development
- Simulation of simple circuits used in Power Electronics Engineering
- Study of EDA tools for preparing schematic diagrams for simulation
- Technical report writing
- Mastering LATEX for technical report writing

Course Outcome:
After studying this course, the students should be able to:

1. Design interfacing circuits for voltage measurement, current measurement, temperature transducer, isolated gate driver circuit etc. and their interfacing with the micro controller.
2. Prepare schematic diagram using EDA tools for simulation.
3. Understand datasheet and use the parameters for simulation.
4. Test the designed circuit through simulation soft wares.
5. Writing a small report (5-10 pages) for the work done with test report (Use LATEX for preparing report)

Laboratory Work:
Objectives: The laboratory work is aimed at putting the theory learnt in class in practice. Also, before doing practical work, it is important to test the circuit for technical correctness according to requirements and to verify that the results are matched with theory closely. In this context, following are the core objectives for laboratory work of this subject.

Directions for Laboratory work:
At the starting of the semester, students should be grouped. Each group should consist of 3 or 4 students. Each group should be given minimum 3-4 circuit for designing. Students should be asked to simulate the designed circuit and complete the work in following steps.

1. Identify the function of the circuit
2. Based on function, identify the basic components to be used
3. Study the datasheets of the components

4. Prepare the schematic and carry out design calculations
5. Prepare schematic / logical diagram of the circuit for simulation using EDA tools/ system simulation software.
6. Simulate the circuit.
7. Prepare report for the circuit (using LATEX)

List of Design Based (DP)/Open Ended Problems:

Sample list of circuits to be designed

1. Simulate isolated gate driver circuit for half bridge circuit and its interface with the microcontroller or DC to DC controller IC (e.g. SG3524).
2. Simulate V/F converter (e.g. LM331) based temperature measurement using microcontroller.
3. Simulate current measurement circuit (using shunt, Current Transformer, Hall Effect Transducer) and read the measured signal into microcontroller.
4. Simulate microcontroller based voltage measurement circuit
5. Simulate Programmable Gain Data Amplifier and its interface
6. Simulate buck/boost/buck-boost converter (open loop)

Major Equipment:

- Bread board, Function Generator, AC & DC Power Supply, Oscilloscope, Multimeter etc.
- Consumable Items: Various Power Semiconductor Switches, Various Control ICs, Various Ferrite Cores, Copper Wires for Inductors & Transformers, Soldering Iron, Desoldering Pump, Electronics Toolkit, etc.

List of Open Source Software/learning website:

Open Source Software:

- Fritzing (http://fritzing.org/home/)
- TINA-TI for circuit simulation (http://www.ti.com/tool/tina-ti)
- OSCAD for CAD application (http://www.oscad.in/downloads)
- Multisim for circuit simulation (http://www.ni.com/multisim)
- http://sourceforge.net/projects/ktechlab/
- http://www.cburch.com/logisim/

Web-based tools for design:

- www.st.com
- www.nxp.com
- www.irf.com
- www.infineon.com
- www.ti.com
- www.vishay.com
- www.linear.com
- http://india.ni.com
- http://www.cosmoferrites.com
- http://www.tdk.com
- http://en.tdk.eu
- http://www.tdk.com/design-tools.php
- http://www.smps.us/smpsdesign.html
- http://www.poweresim.com
- www.snubberdesign.com
- https://www.circuitlab.com/editor

Open source for Math Tools:

- http://maxima.sourceforge.net
- www.scilab.org

- www.sagemath.org
- www.gnu.org/software/octave/

Learning website:

- http://www.datasheetcatalog.com
- http://nptel.iitm.ac.in/courses.php
- http://ocw.mit.edu
- http://www.smpstech.com
- http://www.ni.com/white-paper/14676/en/
- http://www.irf.com/product/_/N~1nje1m
- http://www.allaboutcircuits.com/vol_3/chpt_3/4.html
- http://www.deltapowersolutions.com/en/tps/rectifiers.php
- http://www.electrical-engineering-portal.com