GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (24)

POWER ELECTRONICS PRACTICE-II

SUBJECT CODE: 2162406

B.E. 6th SEMESTER

Type of Course: Engineering Science (Power Electronics)

Prerequisite: 1) 2132404: Principles of Power Electronics
2) 2142405: Analog Electronics & its Applications
3) 2142406: Digital Electronics & its Applications
4) 2152406: Power Electronics Practise-I

Rationale: This subject focuses on practical skill development required for doing practical work using combined knowledge of the subjects studied during previous semester.

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	4	4	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:

- Practical skill development
- Designing of simple circuits used in Power Electronics Engineering
- Study of EDA tools for preparing schematic diagrams
- PCB designing skills
- Bread boarding
- Technical report writing
- 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
3. Design PCB for the circuit
4. Identify component packages
5. Understand datasheet
6. Test the circuit developed.
7. Writing a small report (5-10 pages) for the work they have 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 and to show 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 one circuit for designing. Also, they should be instructed to 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. Implement the circuit through bread board and test its functionality
6. Prepare final schematic through EDA tools
7. Design PCB
8. Prepare PCB
9. Implement the circuit on PCB and test the same
10. Prepare report for the circuit (using LATEX)

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

Sample list of circuits to be designed

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

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