Subject Name : Elective Laboratory

The laboratory deals with the practical aspects of the two elective subjects of respective group offered in this semester. It is planned to impart the practical insight of these subjects to the students through the actual implementation, analysis and/or simulation of some of the theories covered in the subjects. The representative outline of the lab is as under:

Elective-2 (Power System Dynamics and Control)-Power Group:

List of Experiments:

1. Simulation of SMIB system with different generator models in steady state

2. Simulation of SMIB system method with and without AVR (With different generator models)

3. Eigen-analysis of SMIB with different generator models

4. Simulation of SMIB system to verify eigen-analysis for small disturbance.

5. Simulation of SMIB system for different large disturbances and different generator models

6. Simulation of multi-machine system and verification of eigen-analysis for small disturbances.

Other simulations can be designed based on the examples given in text books.

Elective-3 (Flexible AC Transmission Systems) – Power Group:

Suggested List of Practical:

1. Few simulations for performance of uncompensated transmission line
2. Simulations for performance of mid point shunt compensated transmission line
3. Simulation for performance of series compensated transmission line
4. Simulation of a transmission line with a FC-TCR at receiving end with firing control
5. Simulation of transmission line with a SVC at receiving end with firing control
6. Simulation of transmission line with a TCSC with firing control scheme

Elective-2 (DIGITAL CONTROL SYSTEMS) – Control Group:

1. Digital control tutorial using MATLAB
2. Obtain the Z-transform and Inverse Z-transform using MATLAB
3. Obtain transient response (Step and Ramp input) for the given digital control system using MATLAB.
4. Design of digital PID controller for digital DC motor position control using MATLAB
5. Design of digital PID controller for digital pendulum system
6. Design digital state feedback controller for the DC motor speed control using MATLAB.
7. Design digital state feedback controller for the pendulum using MATLAB.
8. Design of digital state feedback controller for digital bus suspension Control using MATLAB
9. Designing digital pitch controller for an aircraft using pole placement technique with MATLAB

Elective-3 (MODELLING AND SIMULATION OF DYNAMIC SYSTEMS) – Control Group:

1. The instructor can give various electrical, mechanical and hydraulic systems for modeling and simulation in MATLAB based on the syllabus topics

Elective-2 & 3(Power Quality& Advanced Power Converters) – Power Electronics Group:

1. Introduction to fourier and powergui block and their use in the measurement of harmonics and analyzing harmonic spectrum in power electronic applications.

2. Study of harmonic elimination techniques in the output voltage waveform of the bridge inverter scheme through simulation
   (i) Using two series connected inverters having phase shifted but similar outputs.
   (ii) Using two series connected inverters having different output waveforms: one with two-level and another with three levels.

3. Write a code to determine the switching positions of the single phase bridge inverter so that the output voltage waveform is free from 3^{rd}, 5^{th} and 7^{th} harmonics.

4. Using SIMULINK/MATLAB design and simulate the space vector control for operating a 3-phase bridge inverter. Study the effects of variation in the modulation index and the switching frequency on the output waveform and its harmonic contents.

5. Simulate and study the performance of a three-level multi-level inverter. Observe the output voltage waveform and also the voltage waveform across each device of the inverter. Compare these waveforms with those obtained with the two-level inverter.

6. Getting familiar with Harmonic Analyzers and its use (Connections of 1-element, 3-element meters, Connections for 1-phase, 3-phase 3-wire, 3-phase 4-wire, Connection of CTs, PTs and the related settings) for power quality measurement.

7. Obtain and study the harmonic spectrum of input voltage and current of the equipments like Television, Computer (or a group of computers), Electronic Voltage stabilizers etc.

8. Understanding the principle of Phase Locked Loop and its significance in power electronic applications. Hence, simulate a three phase PLL in SIMULINK/MATLAB.

9. Modeling and simulation of static var compensator for voltage regulation and to study its dynamic performance and its steady-state V-I characteristics.

10. Design a 48-pulse converter using four 3-phase, 3-level inverters and four phase-shifting transformers. Hence study the performance of a 48-pulse converter and the harmonic contents in the output voltage and current waveform.

Elective-2 (Digital Image Processing) – Micro Group:

Laboratory

(A). Assignments

1. What do you mean by image processing? With the help of examples explain what is the need for image processing? State and explain advantages of Image Processing
2. Discuss various applications of image processing
3. State and explain Color models used in Image Processing
4. List and explain fundamental steps carried out in the image processing.
5. Draw a schematic block diagram of a general purpose image processing system. Explain Significance and function of each block.
6. What is a pixel? Define and explain the basic relationships between the pixels in an image.
7. With the help of suitable examples, explain need for processing on histogram of an image. Differentiate between the equalization and specification processes carried out on histograms on an image.
8. What do you mean by the term histogram of an image? Explain use of histogram in image processing. Explain the method of histogram equalization

considering histogram to be continuous. What is the difference if the histogram is discrete?

9. What do you mean by the term noise in an image? Specify the different type of noise which may be present and their effect on in an image?
10. Explain the terms:
    - Contrast Stretching
    - Image Negative
    - Global Intensity Transforms
    - Digital Image representation
    - RGB Color Model and Model conversions
    - Adaptive median filtering
    - Power Law transformation
    - Gamma Correction
    - Bit Plane Slicing
    - Homomorphic Filtering
    - Image Enhancement Operations

(B). MATLAB Programming:

Develop MATLAB functions for the following Image processing Operations

1. Discrete Cosine Transform (DCT) of an (m,n) Image
2. Inverse DCT of an (m,n) Image
3. Circular Convolution by a casual Filter
4. Circular Convolution by time revrsal of Casulal Filter
5. 2-D Circular convolution by casual filter
6. 2-D Circular convolution by time reversal of casual filter
7. Computation of analysis and synthesis scaling Wavelet function from Bi orhtogonal filter Bank
8. Computation of analysis and synthesis scaling Wavelet function from orhtogonal filter Bank
9. Generation of Gaussian Window, Hamming Window, Rectangular Window, Triangular Window
10.

Elective-3 (EMBEDDED SYSTEM DESIGN) – Micro group

Reference Laboratory Resources

1] ARM7 and ARM9 Target Systems

2] ARM7 IDE

3] Central Computing System with Pre-installaed Linux and development environment for ARM9

4] Interfacing kits for LED, LCD, Key, Keyboard, 7-segment LED, GSM Modem, Finger Print, Graphic LCD, RFID etc

5] Documentation in the form of Laboratory Workbooks with more than 50 examples along with the source code

LAB EXERCISE

- Integrated Development Environment Overview
  (Project creation, down load & debug)

- Study of JTAG Debugger/on-board debugger-emulator.
- List of Practicals for ARM7 Target

GROUP - A

1) Writing basic C-programs for I/O operations
2) C-Program to explore timers/counter
3) C-programs for interrupts
4) Program to demonstrate UART operation

GROUP - B

5) Program to demonstrate I2C Protocol.
6) Program to demonstrate CAN Protocol.

GROUP - C

7) Program to interface LCD
8) Program to interface Keyboard and display key pressed on LCD
9) Program to interface stepper motor

GROUP - D

10) Program to demonstrate RF communication
11) Program to implement AT commands and interface of GSM modem
12) Implementation of USB protocol and transferring data to PC.
13) Implementation of algorithm /program for the microcontroller for low power modes.