1. Familiarization with control system tool box, simulink tool box & PSPICE. (Software)
   Object: To familiarize with i) different types of tool box
   ii) different types of wave forms in simulink tool box.

2. Determination of Step response for first order & Second order system with unity feedback on CRO & calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response. (Hardware)
   Object: To study the time response of a variety of simulated linear system and to correlate the studies with theoretical results.

3. Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using PSPICE. (Software)
   Object: i) To find out step and impulse response of Type 0, Type 1, Type 2 system.
   ii) To obtain steady state errors of Type 0, Type 1, Type 2 system with step input.

4. Determination of Root locus, Bode plot, Nyquist plot using control system tool box for 2nd order system & determination of different control system specification from the plot. (Software)
   Object: To find out pole locations, gain margin, phase margin, polar plots with variation of system design. Relate the results with corresponding time response.

5. Determination of PI, PD and PID controller action of first order simulated process. (Hardware)
   Object: To study the characteristics of P-controller, PD controller, PI controller, PID controller with 1st order system for square wave input.

6. Determination of approximate transfer functions experimentally from Bode plot. (Hardware)
   Object: To find out transfer functions of a 1st order process with the help
of Bode diagram.
7. Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin with addition compensator (Software)
Object: To observe the characteristics of lead and lag compensator and find out their effects on process parameters.

CONTROL SYSTEM-II LABORATORY (EE-691)

List of Experiments:
1. Study of a practical position control system obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individualized components by simulation. Determination of un-damped natural frequency and damping ratio from experimental data. (Software)
   
   Object: i) Obtaining closed step response for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individual components in SIMULINK. ii) Determination of un-damped natural frequency and damping ratio from the experimental data.

2. Tuning of P, PI and PID controller for first order plant with dead time using Z-N method. Process parameters (time constant and delay/lag) will be provided. The gain of the controller to be computed by using Z-N method. Steady state and transient performance of the closed loop plant to be noted with and without steady disturbances. The theoretical phase margin and gain margin to be calculated manually for each gain setting. (Software)

   Object: To study the steady state and transient performance of the closed loop plant with and without steady disturbance by using Z-N method.

3. Design of Lead, Lag and Lead-Lag compensation circuit for the given plant transfer function. Analyze step response of the system by simulation. (Software)
Object: Given a plant and design of Lead, Lag and Lead-Lag compensation circuit.

4. Obtain Transfer Function of a given system from State Variable model and vice versa. State variable analysis of a physical system - obtain step response for the system by simulation. (Software)

Object: i) Transformation from State Space to transfer function. ii) State-space formulation of Transfer-Function system.

5. State variable analysis using simulation tools. To obtain step response and initial condition response for a single input, two-output system in SV form by simulation. (Software)

Object: To determine step response for a single input, two-output system.

6. Performance analysis of a discrete time system using simulation tools. Study of closed response of a continuous system with a digital controller and sample and hold circuit by simulation. (Software)

Object: Determination of time response in a discrete system and study of closed response of a continuous system.

7. Study of the effects of nonlinearity in a feedback controlled system using time response. Determination of step response with a limiter nonlinearity introduced into the forward path of 2nd order unity feedback control systems. The open loop plant will have one pole at the origin and other pole will be in LHP or RHP.

Object: i) To verify that (i) with open loop stable pole, the response is slowed down for larger amplitude input (ii) for unstable plant, the closed loop system may become oscillatory with large input amplitude by simulation. (Software)

ii) To analyze the response of a 2nd order unity feedback control system before and after the introduction of different non-linear properties in the forward path of this system.

8. Study of effect of nonlinearity in a feedback controlled system using phase Plane plots. Determination of phase plane trajectory and possibility of limit cycle of common nonlinearities. (Hardware)

Object: To study the phase plane plots of a system with an intentional nonlinearity.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.
List of extra experiment kits:

i) Compensation Design system.

ii) Temperature Controller System.

iii) Speed Control of D.C. Motor.

iv) Digital Control system.

v) The characteristics of Synchro(A.C).

vi) D.C. Position control Servo Motor.

vii) Stepper Motor Controller.