Choose a 3rd order (at least) linear system. You may use simplified version of a system in the papers in your research area. You can also adopt a system in text books, especially with the focus on practical systems. You are to give reference to the source of the adopted system in your final report. Perform the following steps with the adopted system. Use Matlab if required.

1. Begin your report with a brief description of your system and its possible applications.
2. Write down the state space equation of the system and derive its diagonal form.
3. Find the eigenvalues and discuss the internal stability.
4. Find the transfer function of the system and its poles. Discuss the zero-state stability.
5. Plot the impulse response of the system, including the states and the output.
6. Is the system realizable with an Op-Amp circuit using $V_{cc}=\pm10$ volts? If not, perform a magnitude scaling to find a transformation for realization. Plot the resulting impulse responses.
7. Determine if the system is controllable/observable. If not, perform Kalman decomposition to find a controllable/observable subsystem.
8. Select proper desired eigenvalues for your system and find the gain matrix for state feedback such that your system has the desired eigenvalues. Explain your reasons for selecting the desired eigenvalues.
9. Add any item which you feel it can enhance your report.
You are to deliver your report within two weeks after the final exam by email or hard copy. The report should contain step by step responses to above questions including possible plots. In addition, email your Matlab code to mfathi@uok.ac.ir in an email with subject mod_ctr_prj (Your Name).

Good Luck.

M. Fathi