System and Control Project Requirements

1. Analog electric design (using Opamps) of the feed-forward transfer function G(s).
2. G(s) equation (hand analysis) based on the designed electric Circuit
3. Design values of electric circuit components of G(s) design (hand analysis) based on practical values.
4. Code and graphs of inputting different inputs (Impulse and Step) for the G(s) (Matlab, Simulink and PSpice)
5. Compare and write comments on the results.
6. Total transfer function (T.F.) (with negative unity feedback) (hand analysis)
7. Code and graphs of inputting different inputs (Impulse and Step) for the Total T.F (Matlab, Simulink and PSpice).
8. Comments on the graphs taking into consideration system type.
9. Calculate the rise time, peak time, maximum overshoot, maximum peak time, settling time(due to the step input), steady state error (due to different inputs) (hand analysis, from Matlab figures, from Simulink and from Pspice)
10. Compare results of Hand analysis, Matlab, Simulink and Pspice
11. Root Locus (Matlab)
12. Bode Plot (Matlab)
13. Design PID (equations) (hand analysis)
14. Design values of R's and C's of the PID circuit (hand analysis) based on practical values.
15. Code and graphs of inputting different inputs for the system with PID (Matlab, Simulink , Pspice)
16. Find the rise time, peak time, maximum overshoot, maximum peak time, settling time, steady state error (due to different inputs) of the system with PID (Matlab, Simulink and Pspice)
17. Compare and write Comments on the results of Matlab, Simulink and Pspice.
18. New values of tuning of the PID parameters if needed and repeat steps 14, 15 and 16.
19. Comment on graphs and tuned values.
20. Root Locus the system with PID (Matlab)
21. Bode Plot the system with PID (Matlab)
22. Design Lead-Lag Compensator (equations) (hand analysis) (instead of the PID).
23. Design values of R's and C's of the Lead-Lag circuit (hand analysis) based on practical values.
24. Code and graphs of inputting different inputs for the system with the compensator (Matlab, Simulink , Pspice)
25. Find the rise time, peak time, maximum overshoot, maximum peak time, settling time, steady state error (due to different inputs) of the system with the compensator (Matlab, Simulink and Pspice)
26. Compare and write comments on the results of Matlab, Simulink and Pspice.
27. New values of tuning of the Lead-Lag compensator - if needed - and repeat steps 23, 24 and 25.
28. Comment on graphs and tuned values.
29. Root Locus the system with compensator (Matlab)
30. Bode Plot the system with compensator (Matlab)
31. Implement the Hardware Circuit of your total system and verify the results obtained practically **(Bonus)**

N.B.

- Submit the hardcopy of the project (Screen shots of all the Matlab Codes and the resultant graphs, Simulink models and the resultant scopes, and all the circuits done on PSpice and all the resultant graphs) and get the softcopy of this project with you during the evaluation on a laptop ready for inspection.
- Solution must be in groups of 3- 4 students, not more.
- An e-mail to be sent Eng. samar.shukry@guc.edu.eg that include the name of each member in the group, ID number and the lab group.

GOOD NEWS: cross-labs is allowed ☺

- This project is of 20% of the total score of the Systems & control course.
- Evaluation dates for the project is on 4/12 and 5/12.
  (The exact timing for each group to be announced later)
- The deadline of the project will be the day of the evaluation.