TKP4140 Process Control. Autumn 2023. Schedule / updated as we go along

Week	Week 2022	Topic lectures (book chapters from Seborg In parenthesis)	Exercise (out Thursday, help next Friday 12-14, hand in Tuesday at 16:00, solution Wednesday)
1	34	Control fundamentals («crash course, part 1») NOTE: First lecture is 1215-1400 on Thu. 24 Aug, 2023 in room G1. This week we also have lectures Friday 1215-1500 in rooms H2 and H1.	Ex.1 reactor control structure. "Shower process", Help session is the following Friday, so 01 Sep. 1215-1400 in H2.
2	35	Step responses and SIMC PID tuning («crash course, part 2») . Modelling. (Skogestad ch. 11)	Ex.2. Distillation. Modelling + control (Simulink) EXTRA: Monday 28 Aug 14-16 (Aud. K5): Introduction to Matlab and Simulink
3	36	Models: balances, state space form, linearization. Simulation (Ch.2, Skogestad ch. 11)	Ex.3 Linearization, Laplace Thu 07 Sep. Lecture project, part 1 (Simulink). 14-16, F2
4	37	Laplace (App. A), Transfer functions, First-order system. Poles and zeros, responses, time delay,	Ex.4 Transfer functions
5	38	2nd order system (ch.4), block diagrams, Closed-loop response	Ex.5. 2nd order response (Simulink) Thursday 21 Sep 14-15.. Lecture about lab (F2).
6	39	Zeros, FOD approx, half rule (ch.5). Closed-loop response (ch.10), SIMC rules	Ex.6 (closed-loop TF, SIMC). Lab. In 2nd floor K4 (required for all students)
7	40	Derivation of SIMC PID tuning rules (ch. 11). PID tuning, ZN rule. PID implementation, windup, bumpless transfer, discrete control (7.6).	Ex.7. Closed-loop responses (Ex.1 revisit) Friday 06 Oct. 2023: Project part1 deadline
8	41	Advanced control, feedforward, selectors, split range control RGA, Cascade control, feedforward control (ch. 14, 15).	Ex.8: Tuning ZN+Shams Mon: 09 Oct. Lecture project part 2: 14-16, (K5)
9	42	More examples. MIMO control. RGA, Decoupling	Ex. 9 (OLD Ex.12): Feedforward, cascade
10	43	Stability,,closed-loop poles, Routh Hurwitz, effect of feedback (root locus)	Ex. 10: RGA, decoupling, feedforward
11	44	Frequency analysis (ch. 13), stability conditions, robustness,	Ex. 11: Routh-Hurwitz, complex no.s
12	45	Freq. Analysis, continued	Ex. 12: Bode diagrams.
13	46	Industrial examples	Ex. 13: Bode stabilité condition. GM, PM Friday: 10 Nov 2022 Project deadline, part 2 .(Note: deadline for revised report if not approved is Friday 01 Dec.)
14	47	MPC (ch. 16), Controllability analysis, summary	

Instructor: Professor Sigurd Skogestad (room K4-211). Phone 91371669, Email: skoge@ntnu.no

Lectures: Thursday 12:15 – 14:00 (G1)

Friday 14:15 – 15:00 (H1)

Exercises: Friday 12.15 – 14:00 (H2). *May have lectures instead some weeks.*

Project help sessions *: Wed 16-18 (K5)*

Instructors exercises/lab/project

vit.ass. Lucas Cammann (main responsible)

vit.ass. Rafael de Oliveira

vit.ass. Marius Fredriksen

vit.ass. Erbet Costa

Assistants exercises (Stud.ass)

1. Raven Bast
2. Silje Greidung
3. Jonas Fraihat

Required exercises: 65% (but you are recommended to do 100%) + required lab + required project

Grading: 100% final exam,

(Unfortunately, NTNU has changed its policy, so the old grading system cannot be used. Until 2021 it used to be 60% final, 20% midterm, 5% lab and 15% project. With the current grading system the lab and the project are required activities where a grade of 70% is required to take the exam)

Final exam (Monday 11 Dec. 2023. 09-13): 4 hour written exam (paper). You may bring one (1) A4 double-sided piece of paper with your handwritten notes to the exam. No other books or help is allowed Standard calculator is allowed.

Course material:

- D.E. Seborg, T.F. Edgar, D.A. Mellichamp, F.J. Doyle: Process Dynamics and Control, Wiley, 4th ed. 2019.
- S. Skogestad: Chemical and Energy Process Engineering, CRC Press, 2009, Chapter 11 on “Process Dynamics” (available on course home page)

More information: http://www.ntnu.edu/studies/courses/TKP4140/2023