

TKP4140 Process Control. Autumn 2024. Schedule / updated as we go along

Week	Week 2024	Topic lectures (book chapters from Seborg In parenthesis)	Exercise (out Wednesday, help session next Thursday 14-16, hand in Monday at 16:00, solution Tuesday)
1	34	Control fundamentals («crash course, part 1») NOTE: The first "extra" lecture is 1415-1600 on Wed. 21 Aug, 2024 in room S4. This week we also have a MATLAB/Simulink lecture Thursday 22 Aug. 1215-1400 in room H1. No lecture Friday this week (23 Aug).	Ex.1 reactor control structure. "Shower process", Extra help session for Exercise 1 (mainly problem 1) is Thursday 22 Aug. 14-16 in room H2.. The "normal" help session for Exercise 1 is Thursday 29 Aug. 14-16 in R10.
2	35	Crash course continued; Part 1. Part 2(Step responses and SIMC PID tuning). Modelling. (Skogestad ch. 11). There will 5 lectures this week: "Extra" Wed. 28 Aug. 14-16 in H2, "Normal" Thu 12-14 in H1. "Normal" Fri 13-14 in Fraggie-524.	Ex.2. Distillation. Modelling + control (Simulink) The help session for Ex. 1 is Thu 14-16. EXTRA Tuesday 27 Aug. 16-18 in H1. Use of Simulink for Exercise 1
3	36	Models: balances, state space form, linearization. Simulation (Ch.2, Skogestad ch. 11)	Ex.3 Linearization, Laplace Tue 03 Sep. Lecture project, part 1 (Simulink). 17-18, H1. (Project groups. Max 3.)
4	37	Laplace (App. A), Transfer functions, First-order system. Poles and zeros, responses, time delay,	Ex.4 Transfer functions Wed 16-18 in H1. Help session project (R10). Weekly Tue 10 Sep 17-18 in H1. Lecture about lab.
5	38	2 nd order system (ch.4), block diagrams, Closed-loop response	Ex.5. 2 nd order response (Simulink) Lab. In 2nd floor K4 (required for all students) 16-20 Sep (each student has one day).
6	39	Zeros, FOD approx, half rule (ch.5). Closed-loop response (ch.10), SIMC rules. Lectures moved this week to: Mon 23 Sep. 11-12 in H1, Tue 24 Sep. 16-18 in H1	Ex.6 (closed-loop TF, SIMC).
7	40	Derivation of SIMC PID tuning rules (ch. 11). PID implementation, windup, bumpless transfer, discrete control (7.6).	Ex.7. Closed-loop responses (Ex.1 revisit) Friday 04 Oct. 2024: Project part1 deadline
8	41	PID implementation (continue) Advanced control: cascade control, feedforward, (ch. 14, 15)	Ex.8: Tuning ZN+Shams Tue: 08 Oct. Lecture project part 2: 17-18, (H1)
9	42	Continue advanced. Thu 17 Oct.. 12-14 (H1): Advanced control in Perstorp Co. (Krister Forsman)	Ex. 9: Feedforward, cascade
10	43	MIMO control. RGA, Decoupling 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, Two extra lectures (in addition to Tue 16-17 in H1 and Thu 14-16 in H1): Tue 29 Oct. 17-18 in H1 and Wed 30 Oct. 15-16 in R10.	Ex. 11: Routh-Hurwitz, complex no.s

12	45	Freq. Analysis, continued (These lectures are moved to the week before). No ordinary lectures this week, but: Thu 07 Nov. 12-13 in H1: MPC in Equinor (Pål Kittilsen)	Ex. 12: Bode diagrams.
13	46	No lecture Tuesday this week. Advanced control part 2, switching, selectors, split range control, inventory control	Ex. 13: Bode stabilité condition. GM, PM Wednesday: 13 Nov: Project deadline, part 2 .(Note: deadline for revised report if not approved is Friday 29 Nov.)
14	47	Controllability analysis, summary	

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Lectures: Tuesday 16:15 – 17:00 (H1)
Thursday 12:15 – 14:00 (H1)

Exercise help session: Thursday 14.15 – 16:00 (R10).

Project help sessions : *Wednesday 16-18 (R10)*

Instructors exercises/lab/project

vit.ass. Lucas Cammann (main responsible ; lucas.cammann@ntnu.no)

vit.ass. Jonas Fraihat

vit.ass. Marius Fredriksen

vit.ass. Patrick Souza Lima

Assistants exercises (Stud.ass)

1. Tinus Øen
2. Nevena Cabrilo
3. Paul Jonathan Groening

Required exercises: 65% (=8, 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 (Tuesday 10 Dec. 2024. 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/TKP4140/2024>