Memo 2022-03-14

Course memo, spring 2022

EI2410 Field Theory for Guided Waves (7,5 credits)

1 General and administrative

1.1 Course information on the web

`https://canvas.kth.se/courses/31135` (in Canvas: specific for this offering)
`https://www.kth.se/student/kurser/kurs/EI2410/` (course-plan)

1.2 Service center and student expedition

`https://www.kth.se/eecs/studentsupport`
`student-support@eecs.kth.se`
Here you get help with administrative matters.

1.3 Department

Electrical Engineering, Teknikringen 29-33

1.4 Course responsible, lecturer and examiner

Martin Norgren, 08-790 7410, `mnorgren@kth.se`

1.5 Course material

Reading and practice (downloadable in Canvas):

- M. Norgren, Guided Electromagnetic Waves
  (course compendium TRITA-EECS-RP-2020:1). Available at Kårbokhandeln.
- Matlab scripts and other material
- Old exam problems

Examples of text books for additional reading:

- J. Van Bladel, Electromagnetic Fields, 2:nd ed
- R. E. Collin, Foundations for Microwave engineering, 2:nd ed
- D. M. Pozar, Microwave Engineering, 4:th ed

1.6 Course disposition

15 lessons, two project supervision sessions, and studies on your own.

2 Examination moments and grading criteria

2.1 Mandatory part

2.1.1 Project work (PROA; 1.5 credits; grades A, C, E, Fx, F)

- Carried out in groups of 2-3 students.
- Project topics will be presented towards end of April. Students may also propose topics.
- For passing grades, all group members must take active part in the presentation.

Grading criteria for the project work:

F Insufficient attempt or failed completion from Fx.
Fx The main subtask carried out incorrectly and/or a poor report.
E The main subtask carried out correctly and properly reported.
C The gross part of the subtasks carried out correctly and properly reported.
A All subtasks carried out correctly and properly reported.

2.1.2 Written exam (TENA; 6 credits; grades A-F)

Consists of four tasks, each centered around a certain topic from the course content, and divided into an (a)-part and a (b)-part:

(a) To demonstrate conceptual understanding of or prove general principles for guided waves. Marked with $\{a_i = 0-5\}_{i=1}^{4}$ points. Generates exam points according to

$$P_{\mathrm{a}} = \mathrm{ceil}\left\{2\left[\frac{1}{4}\sum_{i=1}^{4}(a_i-1) + \sqrt[4]{\prod_{i=1}^{4}(a_i+1)}\right]\right\}$$

Exam points (P_{a})	0-12	13-14	15-20
Grade (TENA)	F	Fx	E

Table 1: Grading criteria for passing the written exam.

(b) To demonstrate skills in quantitatively solving specific guided wave problems. Marked with $\{b_i = 0-5\}_{i=1}^{4}$ points. Generates exam points according to

$$P_{\mathrm{b}} = \mathrm{ceil}\left\{2\left[\frac{1}{4}\sum_{i=1}^{4}(b_i-1) + \sqrt[4]{\prod_{i=1}^{4}(b_i+1)}\right]\right\}$$

Total exam points ($P_{\mathrm{a}} + P_{\mathrm{b}}$)	15-20	21-25	26-30	31-35	36-40
Grade (TENA)	E	D	C	B	A

Table 2: Criteria for higher grades, awarded if grade E has been obtained in Table 1.

Allowed aids at the written exam:

- Råde & Westergren, Beta Mathematics Handbook and/or Spiegel, Mathematical Handbook of Formulas and Tables.
  Other handbooks may be used if approved by the examiner before the writing date.
- Compilation of formulas in electromagnetic theory (from the course home-page).
- The course compendium *Guided Electromagnetic Waves* TRITA-EECS-RP-2020:1

2.1.3 Students with disability

Information under `https://www.kth.se/en/student/studentliv/funktionsnedsattning`

2.1.4 Completion task

The grade Fx permits one attempt on a completion task to reach the grade E.

- For PROA, the completion task is in the feedback on the report.
- For TENA, the completion task is communicated via email.

2.1.5 Course grade

		TENA				
		E	**D**	**C**	**B**	**A**
PROA	**E**	E	D	C	C	B
	C	E	D	C	B	A
	A	D	C	C	B	A

Table 3: The course grade determined from the grades of PROA and TENA.

2.2 Optional part: homeworks

During the course offering there will be four homeworks, handled via Canvas according to the schedule therein.

- By topic area, each homework is related to an exam problem, but wider in scope.
- Marked with $\{h_i = 0 - 5\}_{i=1}^{4}$ points.
- On the written exam, each a_i-point is replaceable with the corresponding h_i-point.

3 Schedule of course activities

Week	Activity	Content	Chapters	Old exam problems
12	L1	Maxwell's equations. Constitutive relations. Timeharmonic fields. Field decomposition.	1-4	
	L2	Introduction to metallic waveguides. Waveguide modes in the time domain.	5.1-5.4	
	L3	Waveguide modes in the frequency domain.	5.5	081217:1, 170316:1 180528:1, 210603:1
13	L4	Excitation and power transport.	5.6-5.7	071219:1, 081217:2 170316:2, 180528:2 190604:1, 200528:1a 210603:2
	L5	The mode-matching method.	5.8	071219:2 200528:2
	L6	Attenuation of waveguide modes.	5.10	081217:3, 200528:1b
14	L7	Catching up		
	L8	Cavity resonators - excitation of modes.	6.1-6.3	170316:3, 200528:3 210603:3
	L9	Cavity resonators - losses and bandwidth.	6.4-6.6	190604:3
17	L10	Introduction to dielectric waveguides.	7.1-7.2	190604:2
	L11	The optic fiber.	7.3-7.4	071219:5, 180528:3 210603:4
	L12	Multiconductor transmission lines.	8	071219:6, 081217:4 170316:4, 180528:4 190604:4, 200528:4
20	PROA	Presentations of project works		
22	TENA	Written exam		

During the course offering, the schedule may undergo minor revisions.

Project supervision will take place during weeks 18-19, and will be planned off-schedule.

If (for any reason) a lesson or project supervision is held on-line, we use the following Zoom-room: `https://kth-se.zoom.us/j/69612279287`