Schedule 2022

Electromagnetic sensor systems (RRY 057)

Location: Room SB- L113 or https://chalmers.zoom.us/j/4178286748 Password: EMSS

Monday 13:15-15, exercise class

Lectures: Monday 15.15-17, Thursday 10-11.45, Friday 15:15-17 and 2 laboratory excercises

Resp teacher: Johan Mellqvist (johan.mellqvist@chalmers.se)

WEEK 1	
Course introduction 2022-01-17 (Mon), 13:15 – 15:00: Room ML13 ALL All Course overview and practicalities. Presentation of involved teachers	Lecture
Basic concepts and considerations 2022-01-17 (Mon), 15:15 – 17:00, Room SB- L113 What is it all about ☺, chapter 1. Theory about electromagnetic waves in free space: Polarisation and coherence. Flux and radiance. Blackbody and solar radiation. Reading instruction: Chapter 2.1, 2.2 2.5, 2.6	Lecture Johan Mellqvist
Interaction between EM waves and matter 2022-01-20 (Thu), 10:00 – 11:45, Room SB- L113 Complex refractive index and absorption length. Surface reflections and BRDF. Attenuation and the Beer-Lambert law. Book section 3.1-3.3 (3.1-3.3).	Lecture Johan Mellqvist
Properties of the atmosphere 2022-01-21 (Fri), 15:15 – 17:00, Room SB- L113 Structure and composition of the atmosphere. Impact of molecules, aerosols, clouds and precipitation. Refraction and turbulence. The ionosphere. Book section 3.4 and 4 (3.4.2 and 4).	Lecture Johan Mellqvist
WEEK 2	
Remote sensing, radiation and complex refractive index 2022-01-24 (Mon), 13:15 – 15:00, Room SB- L113	Problem solving *Olof Forssén*
Optical remote sensing systems 2022-01-24 (Mon), 15:15 – 17:00, Room SB- L113 Hardware used for optical remote sensing (ORS) measurements. This includes spectrometers, lasers, photomultipliers, diodes, CCDs, prisms and diffraction gratings used. Parts of book section 6 (6) + extra material.	Lecture Johan Mellqvist
Spectroscopic measurements using IR and UV 2022-01-27 (Thu), 10:00 – 11:45, Room SB- L113 Principle. Applications from ground and from space. Parts of book section 6 (6) + extra material. Principle, applications ranging from industrial measurements of petrochemical flares to volcanic ash in volcanoes to gas measurements from planets in space. Extra material	Lecture Johan Mellqvist
WEEK 3	
Radiative transfer 2022-01-31 (Mon), 13:15 – 15:00, Room SB- L113	Problem solving Olof Forssén

Industrial leakage measurements using optical remote sensing 2022-01-31 (Mon), 15:15 – 17:00, Room SB- L113	Guest Lecture Samuel Brohede Fluxsense
Application of lasers for distance, speed and concentration. 2022-02-03 (Thu), 10:00 – 11:45, Room SB- L113 LIDAR, DEMO of LIDAR sensor, wind LIDAR, topography, bathymetry, DIAL,	Lecture Johan Mellqvist
LIDAR for self driving cars 2022-02-04 (Fri), 15:15 – 17:00, Room SB.L113, A walkthrough of the use of sensors for active safety and autonomous driving applications at Volvo Cars. There will be a general overview for automotive sensing applications and a deep dive into lidar technology	Guest Lecture Henrik Eliasson
WEEK 4	
Optical systems 2022-02-07 (Mon), 13:15 – 15:00, SB- L113	Problem solving Olof Forssén
Satellite Imaging systems and **measurements of surface properties** 2022-02-07 (Mon), 15:15 – 17:00 Room SB- L113 Satellite and airborne surveillance, spectral and spatial resolution. Main optical, IR and applications. Atmospheric correction	Lecture Johan Mellqvist
Passive infrared measurements Group I 2022-02-08 (Tue) 9-12 ORS laboratory	Lab exercise Johan Mellqvist
Passive infrared measurements Group 2 2022-02-08(Tue) 13-16 ORS laboratory	Lab exercise Johan Mellqvist
Passive infrared measurements Group 3 2021-02-10 (Thu) 13-16 ORS laboratory	Lab exercise Johan Mellqvist
Passive Microwave measurements of the atmosphere 2022-02-10 (Thu), 10:00 – 11:45, Room SB- L113 Description: Hardware and measurements	Lecture Peter Forkman
Basic Radar systems 2022-02-11 (Fri), (Fri), 15:15 – 17:00, Room SB- L113 Radar principles, radar cross section, radar equation, range resolution. Scatterometry. . Book sections 9.2-9.3 (9.3-9.4).	Lecture Leif Eriksson
WEEK 5	
Optical system II 2022-02-14 (Mon), 13:15 – 15:00, Room SB- L113	Problem solving Olof Forssén
Short range Radar 2022-02-14 (Mo), 15.15 – 17:00, Room SB- L113 Preparation for lab exercise and description of short range radar for autonomous vehicles.	Lecture Albert Monteith Hardware
Sensor system in automotive and other industry and data retrieval 2022-02-18 (Fri), 15:15 – 17:00, Room SB- L113Ole Martin Christensen QamCom Sensor, data algoritms. OR Thursday	Guest Lecture
WEEK 6	
Microwave measurement and satellite observations	Problem solving

2022-02-21 (Mon), 13:15 – 15:00, Room SB- L113	Olof Forssén
Imaging radar	Lecture
2022-02-24 (Thu), 10:00 – 11:45, Room SB- L113	Leif Eriksson
Real aperture radar, imaging geometry, geometric distortions, azimuth resolution. SAR principles. Book sections 9.4-9.5 (9.5-9.6).	
Radar in industry applications	Guest Lecture
2022-02-25 (Fri), 15:15 – 17:00, Room SB- L113	Christoffer Widahl, Emerson
How Radar is used for level, distance, volume and other measurements in industry applications. Basic principles, signal processing, industry specific challenges and future applications.	
WEEK 7	
Radar	Problem solving
2022-02-28(Mon), 13:15 – 15:00, Room SB- L113	Olof Forssén
Wrapup Optical remote sensing	
2022-02-28 (Mon) 15. 15-16 wrapup optical remote sensing Room SB- L113	Johan Mellqvist
Radar, Group I	**Lab exercise**
2021-03-01 (Tue), 09-12 TBC	Albert Monteith
Radar, Group 2	**Lab exercise**
2021-03-01 (Tue), 13.15-16, (TBC)	Albert Monteith
Radar, Group 3	**Lab exercise**
2021-03-02 (We), 09-12 (TBC)	Albert Monteith
Radar, Group 4	**Lab exercise**
2021-03-02 (We), 13.15-16 (TBC)	Albert Monteith
Synthetic aperture radar and applications	Lecture
2022-03-03 (Thu), 10:00 – 11:45, Room SB- L113	Leif Eriksson
Speckle. Range ambiguity. SAR Interferometry. SAR applications.	
WEEK 8	
Radar and SAR	Problem solving
2022-03-07 (Mon), 13:15 – 15:00, Room SB- L113	Olof Forssén
Wrapup Radar	
2022-03-07 (Mon) 15.15-17, Room SB- L113	Leif Eriksson and Albert Monteith
Exam 2022-03-19 Morning	