



TEL AVIV אוניברסיטת
UNIVERSITY תל אביב

Full Syllabus



Course Title

Radar Principles (0510-7204)

Lecturer

Dr. Itzik Cohen

Semester

Fall 2026-2027

Course requirements

The course combines frontal lectures, asynchronous learning through short recorded videos for selected topics, and a semester-long project.

The project has two parts. Part A is a short simulation exercise that every student completes individually, covering the basic modules (signal generation, matched filtering, and Doppler processing). Part B is an open topic that each student develops, individually or in pairs as they prefer; the topic proposal is due by Session 5, subject to instructor approval. Project status updates are expected during the semester. Project presentations take place in Sessions 12 and 13. Attendance is mandatory for all students at both sessions (not only when their own team is presenting). The final project submission is due during the exam term.

Final grade components

Final grade:

40% project (10% part A + 30% part B)

60% final exam (individual, written exam)

Course schedule

Class no. / Date	Subject and Requirements (assignments, reading materials, tasks, etc.)
Session 1 21/10/2026	 Introduction: radar tasks, history, basic concepts, delay and Doppler, ambiguities, antennas and directivity, the radar equation, SNR, propagation in the atmosphere  (<i>asynchronous learning module</i>)
Session 2 28/10/2026	 Introduction (cont.) Matched filter: basic derivation, range-processing, pulse compression  (<i>asynchronous learning module</i>)
Session 3 4/11/2026	 Doppler processing: signal model, Doppler matched filter banks, approximations, FFT-based processing  (<i>asynchronous learning module</i>)
Session 4 11/11/2026	 Doppler processing (cont.) Multipath: Ground multipath fading, multipath ghosts Clutter: ground clutter, normalized RCS, beam-width limited illumination, pulse-width limited illumination, Doppler limited illumination, volume clutter  (<i>asynchronous learning module</i>)



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Session 5 18/11/2026	 Radar Cross Section (RCS): RCS of deterministic targets, RCS of statistical targets, coherency and decorrelation of statistical targets, Swerling models  Project milestone: project topic proposal due, subject to instructor approval  (<i>asynchronous learning module</i>)
Session 6 25/11/2026	 Ambiguity function (AF), periodic AF of a coherent pulse train  (<i>asynchronous learning module</i>)
Session 7 2/12/2026	 Detection: P_d and P_{fa} , coherent and non-coherent integration  (<i>asynchronous learning module</i>)
Session 8 9/12/2026	 Project Session: class time is dedicated to project mentoring, including short status update #1 blitz talks Project milestone: status #1 update Project milestone: part A submission (No new lecture content)
Session 9 16/12/2026	 Constant False Alarm Rate (CFAR): cell-averaging CFAR, order-statistics CFAR  (<i>asynchronous learning module</i>)
Session 10 23/12/2026	 Coded waveforms: phase coding, frequency coding CW radar: LFM CW radar, stretch processing  (<i>asynchronous learning module</i>)
Session 11 30/12/2026	 MIMO radar: angle-of-arrival estimation, the virtual array, multiplexing techniques, and the MIMO ambiguity function  (<i>asynchronous learning module</i>)
Session 12 6/1/2027	 Project presentations, order set by the instructor Attendance is mandatory for all students! Project milestone: status #2 update
Session 13 13/1/2027	 Project presentations (cont.) Attendance is mandatory for all students!



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Required course reading

N. Levanon, Radar - Concise Course, Vol. 1 & Vol. 2, 2021 (the course follows this book closely).

Optional course reading

N. Levanon, Radar Principles, Wiley, 1988.

N. Levanon, E. Mozeson, Radar Signals, Wiley, 2004.

M.A. Richards, Fundamentals of Radar Signal Processing, 3rd ed., McGraw-Hill, 2022.

P.E. Pace, Detecting and Classifying Low Probability of Intercept Radar, 2nd ed., Artech, 2009.

M. Skolnik, Introduction to Radar Systems, 3rd ed., McGraw-Hill, 2002.

M.A. Richards, Principles of Modern Radar: Basic Principles, SciTech, 2010.

W.L. Melvin, Principles of Modern Radar: Advanced Techniques, SciTech, 2012.

G.W. Stimson, Stimson's Introduction to Airborne Radar, 3rd ed., SciTech, 2014.

A.W. Rihaczek, Principles of High-Resolution Radar, Artech, 1996.

B.R. Mahafza, Radar Systems Analysis and Design Using MATLAB, 4th ed., CRC Press, 2022.

M.C. Budge Jr., S.R. German, Basic Radar Analysis, Artech House, 2015.

K.R. Griep, J.A. Ritcey, J.J. Burlingame, "Poly-Phase Codes and Optimal Filters for Multiple User Ranging," IEEE Trans. Aerospace and Electronic Systems, Vol. 31, No. 2, 1995 (recommended for students choosing a waveform-design project).