

Fourth Year Seven Semester (ODD)

Department Elective Course -4

EC401: Radar Signal Processing

Details of course:-

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Radar Signal Processing	3	1	0	Electromagnetics, signal and systems, Microwave Engineering

Course Objective: Introduction to radar system design with an emphasis on radar signal processing.

Course Outcomes:

- CO1: Explain the fundamentals of radar systems
- CO2: Analyze radar signal models
- CO3: Evaluate radar signal processing in cluttered environments
- CO4: Develop methodologies for target detection, measurement and tracking
- CO5: Implement advanced radar imaging techniques

S. No.	Content	Contact Hours
Unit 1	Radar Systems Basics: Radar Block diagram, radar specific terms, radar cross section, radar equation, Radar transmitters, receivers, and antennas, coherence, continuous wave radars	8
Unit 2	Radar signal models: components of radar signal, amplitude clutter, noise model and signal to noise ratio, jamming, frequency space and spectral models, matched filtering, wave form resolution, pulse compression.	8
Unit 3	Radar signal processing in clutter: Clutter Analysis, clutter mapping and the moving target indicator, Doppler processing, moving platform effects on doppler spectrum, Moving target indication pulse doppler processing, pulse pair processing, doppler	8

	processing issues,	
Unit 4	Target Detection: single pulse detection, Probability of False Alarm and Detection, detection Modified Radar Range Equation with Swerling Models, Measurements and tracking: range, doppler and angle estimators, sequential least square estimation, Kalman filter and tracking cycle	10
Unit 5	Synthetic Aperture Processing: Strip-map synthetic aperture radar, SAR image formation, spotlight SAR Inverse SAR Imaging, Beamforming and STAP, Spatial filtering, space time signal modelling, adaptive matched filtering	8
	Total	42

Books:-

S. No	Name of Books/Authors/Publisher
1	Fundamentals of Radar Signal Processing /Richards / 3 rd Ed, McGraw Hill 2022.
2	Introduction to Radar Systems/Skolnik /3 rd Ed., McGraw Hill 2002.
3	Handbook of Radar Signal Analysis /Mahafza, B.R., Winton, S.C., &Elsherbeni, A.Z. (Eds.) /1 st Ed., CRC2021.