



**Kadi Sarva Vishwavidyalaya**  
**Faculty of Engineering & Technology**  
**Fourth Year Bachelor of EC Engineering**  
(VII<sup>th</sup> sem Academic Year 2020)

<b>Subject Code: EC704B-N</b>	<b>Subject Title: Radar and Navigation Systems</b>
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**Course Objective:** The educational objectives of this course are

- To present a problem oriented introductory knowledge of Radar and Navigation systems.
- To address the underlying concepts and methods behind Radar and Navigation systems.

Teaching scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE Marks	CIA Marks	Pract. Marks	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
04	00	02	06	05	03	70	30	20	30	150

**Outline of the Course:**

Sr. No.	Title of the Unit	Minimum Hours
1.	An introduction to Radar	10
2.	CW and FMCW radar	08
3.	MTI and Pulse Doppler radar	10
4.	Tracking and Imaging Radar:	10
5.	An introduction to Navigation	06
6.	Radio Direction Findings and Ranges	08
7.	Hyperbolic Electronic Navigational Systems	08
	Total	60

**Total hours (Theory): 60**

**Total hours (Lab): Total hours:**



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**Detailed Syllabus**

SR. No.	Topic	Lecture Hours	Weight age(%)
1	<b>An Introduction to Radar:</b> Introduction, Radar block diagram, Applications of Radar, Radar frequencies, Simple form of Radar equation, Prediction of Range performance. Different Types of RADAR System, Basic Pulse RADAR System, Minimum Detectable Signal, RADAR Receiver Noise and signal to noise Ratio, RADAR Cross Section, Radar Cross Section of Targets, Cross section Fluctuations, Radar Clutter-surface clutter, sea clutter and Land clutter ,weather clutter,	10	15
2	<b>CW and FMCW radar</b> Introduction, Doppler effect, CW Radar- simple CW radar, CW radar with IF amplification, Frequency Modulated CW(FMCW) Radar, Multiple frequencies CW radar	08	10
3	<b>MTI and Pulse Doppler radar</b> Introduction, block diagram of MTI radar, Delay line cancellers, Staggered Pulse Repetition Frequencies, Range gated Doppler filters, Digital MTI signal processing, Non-coherent MTI, Pulse Doppler radar, MTI from moving platform, Limitations to MTI performance.	10	15
4.	<b>Tracking and Imaging Radar:</b> Tracking with Radar ,Block Diagram of Tracking Radar, Monopulse tracking, Conical scan and Sequential lobing, Air surveillance radar, Introduction to Synthetic aperture radar(SAR). Acquisition in RADAR	10	15
5	<b>An introduction to Navigation</b> Introduction, History, Methods of Navigation- Celestial Navigation, Pilotage, Dead Reckoning, Radio Navigation.	06	15
6	<b>Radio Direction Findings and Ranges:</b> Loop Antenna, Errors in Loop Direction Finder, Adcock Direction Finder, aural null direction finder, Goniometer,	08	15
7	<b>Hyperbolic Electronic Navigational Systems</b> Introduction, Principle of Hyperbolic Electronic systems, Introduction to Hyperbolic Electronic Navigational systems, LORAN-A, DECCA, OMEGA.	08	15
<b>Total</b>		<b>60</b>	<b>100</b>



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**Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

**Learning Outcome:**

The educational objectives of this course are

- To present a problem oriented introductory knowledge of Radar and Navigation systems.
- To address the underlying concepts and methods behind Radar and Navigation systems on successful completion of the course. The student can identify different areas Radar and Navigation systems circuits.
- Can find the applications of all the areas in day to day life.

**Text & Reference Books:**

1. Introduction to Radar System by Skolnik (TMH)
2. Radar Systems and Radio AIDS to Navigation by Dr. A.K. Sen & A.B. Bhattacharya 'Khanna Publication'
3. Elements to Electronic Navigation by Nagraj (TMH)
4. Principles of Radar by J.C Toomay, 2<sup>nd</sup> Edition – PHI, 2004
5. Fundamentals of RADAR, SONAR and Navigation Engineering by K.K. Sharma, KATSON publication

**List of experiments** (Not limited to following. Subject teacher may modify the same):

Sr. No.	Experiment Title
1.	Study of the working of Doppler Radar.
2.	Determination of the velocity of the object moving in the Radar range.
3.	Understanding the principle of Doppler Radar of Time and Frequency measurement with the help of moving pendulum.
4.	Study of the alarm system by using Radar.
5.	Study of the object counting with the help of Radar.
6.	Study of the detection of vibration of different Tuning forks.
7.	Determination of the rotation per minute (RPM) of a moving object.
8.	Study the effect of different types of materials on Radar receiving or detection.