



Course Title: Radar and Satellite Communication

Course Code: ECE405

Credit Units:4

Level: UG

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
3	0	2	0	4

Course Objectives: This course builds basic knowledge of different types of Radar systems and satellite communication along with link designing & application. It also covers different modulation schemes & channels used.

Prerequisites: Communication System

	Weightage (%)
Module I: Introduction to Radar	15%
Principle of detection and ranging, Radar frequencies & bands, Applications, Simple form of Radar Equation, Pulsed Radar system and operation.	
Module II: Radar Equation	25%
Range prediction, Minimum detectable signal, Maximum unambiguous range, Radar Receiver noise and SNR, Integration of radar pulses, Radar cross section of targets, Transmitter Power, PRF and system losses & Propagation effects, Radar displays.	
Module III: CW, MTI & Pulse Doppler Radar	20%
Doppler Effect, CW Radar, Frequency-modulated CW Radar, MTI and Pulse Doppler Radar: MTI delay lines, Delay line Cancellers, Coherent and Non-Coherent MTI, Pulse Doppler Radar, Radar Antennas.	
Module IV: Introduction to Satellite	20%
History of satellite communication, Elements of satellite communication link, Frequencies and bands, Pros and cons of Satellite Communication, Active and passive Satellite, Orbital Mechanism: Synchronous orbit, Orbital parameters, Satellite location with respect to earth, look angles, Geostationary and other orbits, Mechanism of launching satellite.	

Module V: Satellite link Design & Applications	20%
General Transmission Theory, System noise temperature, C/N and G/T Ratio, Uplink Design, Downlink Design, Complete link Design and effect of interference, Altitude and orbit control, Repeaters/ Transponders.	
Direct Broadcast Satellite (DBS), VSAT, MSAT, GPS, DTH.	

Student Learning Outcomes:

- Identify the various RADAR systems in existence, specify their applications and limitations, and explain the principles of how they work.
- Describe the most commonly used techniques in processing RADAR signals.
- Recognize and describe the various technologies used in the design of RADAR systems: antennas, transmitters, duplexers, data display screens, etc.
- Design simple radar systems and the associated signal processing, at block diagram level

- Describe the principles of radio navigation systems (including secondary radar and GPS)
- Identify the fundamentals of orbital mechanics, the characteristics of common orbits used by communications and other satellites, and be able to discuss launch methods and technologies.
- Describe the systems required by a communications satellite to function and the trade-offs and limitations encountered in the design of a communications satellite system.
- Describe the radio propagation channel for Earth station to satellite and satellite to satellite communications links, and the basics of designing antenna systems to accommodate the needs of a particular satellite system.
- Analyze an accurate link budget for a satellite or other wireless communications link.

Pedagogy for Course Delivery: The class will be taught using theory and Laboratory.

List of Experiments :

1. To measure speed of a fan.
2. To setup radar and tune it for best performance.
3. To find out the time period and frequency of a moving pendulum for different lengths.
4. To Set up a satellite communication link & Study of change in uplink & downlink frequency.
5. To Study Transmission of Audio, Video Signals & Data communication over satellite link.
6. To Study Transmission of telemetry data like temperature & light intensity over satellite link.
7. To transmit and receive PC data through satellite link.
8. To Measure the Speed of a object rolling towards the Doppler unit along an inclined plane.

9. To measure the propagation delay of signal in a satellite communication link.
10. To transmit and receive the function generator waveforms through a Satellite Communication link.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical (%)	Total
75%	25%	100%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Term Exam(CT)	S/V/Q	HA	Attendance(A)	
Weightage (%)	10%	8%	7%	5%	70%

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Lab Assessment (P):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	A	PR	LR	V	
Weightage (%)	5%	10%	10%	5%	70%

A: Attendance, PR- Performance, LR – Lab Record, V – Viva. EE- External Exam,

Text & References:

- Introduction to Radar Systems - M.I. Skolnik
- Radar Fundamentals - G.J. Wheeler.
- Radar Engineering - D.G. Rink
- Satellite Communication - R.M. Gagliardi

- Satellite Communication - T. Pratt & C.W. Boston
- Satellite Communication System Design Principles - M. Richharia.