



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS



CURRICULUM & SYLLABUS
B. Tech (Honours) *in*
**ELECTRONICS AND COMMUNICATION
ENGINEERING**
Basket-Communication Engineering

www.sjcetpalai.ac.in



Signed By: DEVASSIA V P
Approved by Academic
Council dtd.19.06.2026

CURRICULUM

B.Tech (Honours) is an enhanced version of the Bachelor of Technology degree, offering the students the opportunity to undertake additional courses within their own discipline. This pathway allows students to deepen their knowledge in emerging or advanced areas of Engineering relevant to their field of study, providing a stronger foundation for specialized career paths or further academic pursuits.

For the award of B.Tech (Honours) in Electronics and Communication Engineering, the student shall fulfil all the curricular requirements for B.Tech in Electronics and Communication Engineering as per SJCTET B.Tech Academic Regulations 2024 and shall earn 15 additional credits by undergoing the following courses, which shall be further governed by clause R16 of the Regulation

Sl. No	Semester	Course Code	Course Name/Type	Weekly hours				Total Marks		Credits
				L	T	P	SS	CIE	ESE	
1	4	24SJHNECT411	STOCHASTIC PROCESSES FOR COMMUNICATION SYSTEMS	3	1	0	5	40	60	4
2	5	24SJHNECT511	INTRODUCTION TO MIMO COMMUNICATION SYSTEMS	3	1	0	5	40	60	4
		24SJHNECM5XX	Approved MOOC *							
3	6	24SJHNECT611	COMMUNICATION NETWORKS AND SECURITY	3	1	0	5	40	60	4
		24SJHNECM6XX	Approved MOOC *							
4	7	24SJHNECT711	ANTENNA DESIGN AND ANALYSIS	3	0	0	5	40	60	3
		24SJHNECM7XX	Approved MOOC *							
Total Credits										15



SEMESTER 4

STOCHASTIC PROCESSES FOR COMMUNICATION

Course Code	25SJHNECT402	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	4:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Mathematics for Electrical science and Physical science – 4	Course Type	Theory

Course Objectives:

- To develop an understanding of stochastic processes, random signal analysis, power spectral density, noise modelling, and filtering techniques used in communication systems.
- To introduce the principles of information theory and discrete communication systems, including entropy, channel capacity, source coding, and channel coding concepts.
- To familiarize students with Markov processes, Poisson processes, and basic queuing models for analysing stochastic systems and communication networks.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Review of probability. Axiomatic definitions of probability, Bayes theorem and conditional probability. Independence. Discrete random variables. The cumulative distribution and density functions for discrete random variables. Joint distribution and conditional distribution. Statistical averages. Mean, Variance and standard deviation, Gaussian density function.	10
2	Stochastic Processes. Stationarity and ergodicity. WSS and SSS processes. Gaussian Random process, Mean and autocorrelation and power spectral density functions. Weiner Kinchine theorem, Bandwidth of a random process, PSD of a Pulse Amplitude Modulated wave. White noise, Filtering of discrete WSS process by LTI systems. Signal to Noise Ratio, Matched Filter.	10
3	Basics of discrete communication system, Sources, channels and receivers. Discrete memoryless sources. Entropy. Source coding theorem (statement only). Mutual Information. Discrete memoryless channels. Matrix of channel transmission	10



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	probabilities. Noiseless and noisy channels, binary symmetry channels. Channel coding theorem (statement only) Channel capacity for BSC (derivation required), Differential entropy, Channel capacity of AWGN channel (statement only).	
4	Markov process. Definition and model. Markov chain. Transition probability matrix. State diagram and characteristics of a Markov chain. Chapman Kolmogorov equation. Poisson process. Overview of queuing theory. M/M/1, M/M/∞	10

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8×3 = 24 marks)	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4×9 = 36 marks)	60



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Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Explain basic probability concepts, including rules, conditional probability, Bayes theorem, independence, and discrete random variables with mean, variance, and standard deviation.	K2
CO2	Apply the principles of random processes to analyze stochastic processes, including stationarity, ergodicity, Gaussian processes, power spectral density, and the response of LTI systems to random signals.	K3
CO3	Describe the concepts of information theory, including entropy, mutual information, source and channel models, and analyze the characteristics of discrete memoryless channels and binary symmetric channels.	K2
CO4	Apply the concepts of Markov processes and queuing theory to model systems using Markov chains, transition probability matrices, Poisson processes, and basic queuing models such as M/M/1 and M/M/∞.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	2	-	-	1	-	-	-	-	-	-	2	1
CO 2	3	3	2	2	2	2	2	2	2	2	2	3	2
CO 3	3	2	-	-	1	-	-	-	-	-	-	2	1
CO 4	3	3	-	2	2	-	-	-	-	-	-	3	2

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation



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Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Probability, Random Variables and Stochastic Processes	Athanasios Papoulis and S. Unnikrishna Pillai	McGraw Hill (MH)	4th Edition, 2002
2	Analog and Digital Communication Systems	Hwei P. Hsu	McGraw Hill (Schaum Outline Series)	2nd Edition, 2003
3	Digital Communication	John G. Proakis	John Wiley & Sons	5th Edition, 2007
4	Probability and Random Processes	Scott Miller and Donald Childers	Academic Press	2nd Edition, 2012
5	Data Networks	Dimitri Bertsekas and Robert Gallager	PHI Learning	2nd Edition, 2008

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Communication Systems	Simon Haykin	John Wiley & Sons	4th Edition, 2001
2	Probability and Random Processes for Electrical and Computer Engineers	John A. Gubner	Cambridge University Press	1st Edition, 2006
4	Elements of Information Theory	Thomas M. Cover and Joy A. Thomas	Wiley-Interscience	2nd Edition, 2006
5	Queueing Systems Volume 1: Theory	Leonard Kleinrock	Wiley-Interscience	1st Edition, 1975

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1,2	https://nptel.ac.in/courses/117105085
4	https://nptel.ac.in/courses/108102117



Simulation Assignments

The following simulations can be done Python/R/MATLAB/SCILAB.

Generation of Discrete Stochastic Signals

1. Simulate stochastic signals of

- Uniform
- Binomial
- Gaussian
- Rayleigh
- Ricean

probability density functions and test their histograms.

2. Compute the statistical averages such as mean, variance, standard deviation etc.
3. To compute the autocorrelation matrix for each signal. Compare the autocorrelation of Gaussian signal with others.
4. To observe the spectrum of the signal and relate it with the autocorrelation function.

Central Limit Theorem–Gaussianity of Channels

- Simulate a coin toss experiment that generates a string of length N of 0s and 1s that are uniformly distributed.
- Toss the coin M times and sum up the string in every toss.
- Plot the normalized histogram of the sum values for $M = 100, 1000, 5000$. Observe that it is a Binomial distribution.
- Plot the function $q = \binom{M}{r} p^r (1-p)^{M-r}$ and compare with the histogram.
- Make M very large and observe that the histogram tends to become Gaussian, justifying the central limit theorem.



SEMESTER 5

INTRODUCTION TO MIMO COMMUNICATION SYSTEMS

Course Code	25SJHNECT502	CIE Marks	40
Teaching Hours/Week (L : T:P: R)	4:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Nil	Course Type	Theory

Course Objectives:

- To get an idea about the OFDM systems
- To study about the estimation and PAPR of OFDM
- To understand the concepts of MIMO
- To familiarize the diversity in MIMO Communication

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamentals of OFDM Systems: Multi carrier communication and OFDM fundamentals, OFDM system model and comparison with single carrier systems , Channel capacity and OFDM, FFT implementation of OFDM , Power spectrum characteristics , Timing and frequency offset in OFDM systems Timing and frequency offset estimation techniques , Pilot based and non-, pilot based synchronization methods Channel estimation in OFDM systems ,Differential and coherent detection techniques , Pilot symbol aided channel estimation , Block type and comb type pilot arrangements , PAPR properties of OFDM signals.	10
2	PAPR Reduction Techniques in OFDM: Introduction to Peak to Average Power Ratio (PAPR), Signal distortion based PAPR reduction techniques, Distortion less PAPR reduction methods, Selective Mapping (SLM) techniques, Optimization techniques for PAPR reduction.	10
3	MIMO Channel Models and Capacity Analysis: Review of SISO fading communication channels, MIMO channel models, Classical and extended IID channel models, Frequency selective and correlated channel models, Capacity of MIMO channels, Ergodic and outage capacity, Capacity bounds Influence of channel	10



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	properties on system capacity.	
4	Diversity Techniques and Space-Time Processing: Sources and types of diversity Performance analysis under Rayleigh fading, Alamouti Space Time Code, Space-Time Block Coding (STBC), Space-Time OFDM systems, Space-time receivers, ML, ZF, MMSE and Sphere decoding techniques, BLAST receivers, Diversity–multiplexing trade-off.	10

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8×3 = 24 marks)	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4×9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Explain the fundamentals of multicarrier communication and analyze the operation, synchronization, channel estimation, and PAPR characteristics of OFDM systems.	K2



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CO2	Analyze and compare various Peak-to-Average Power Ratio (PAPR) reduction techniques used in OFDM systems, including distortion-based and distortion less methods.	K3
CO3	Model MIMO wireless communication channels and evaluate the capacity performance of MIMO systems under different fading and correlation conditions.	K3
CO 4	Apply diversity techniques and space-time processing methods, including STBC, Space-Time OFDM, and advanced receiver algorithms, for improving wireless communication system performance.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	3	2	1	2	-	-	-	-	-	-	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	3	3
CO4	3	3	3	2	3	-	-	-	1	1	-	3	3

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	OFDM for Wireless Communication	Y. Li and G. Stuber	Springer	2006
2	Multicarrier Digital Communications: Theory and Applications of OFDM	Ahmad R. S. Bahai, B. R. Saltzberg and M. Ergen	Springer	2nd Edition, 2004



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Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Wireless Communication	David Tse and Pramod Viswanath	Cambridge University Press	2005
2	Space-Time Coding: Theory and Practice	Hamid Jafarkhani	Cambridge University Press	2005
3	Introduction to Space-Time Wireless Communications	A. Paulraj, R. Nabar and D. Gore	Cambridge University Press	2003
4	Space-Time Block Coding for Wireless Communications	E. G. Larsson and P. Stoica	Cambridge University Press	2008
5	MIMO Wireless Communications	Ezio Biglieri and Robert Calderbank et al.	Cambridge University Press	2007
6	MIMO-OFDM Wireless Communications with MATLAB	Y. S. Cho, J. Kim, W. Y. Yang and C. G. Kang	Wiley-IEEE Press	2010

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	http://www.digimat.in/nptel/courses/video/117104115/L34.html
4	http://www.digimat.in/nptel/courses/video/117104115/L39.html



SEMESTER S6

COMMUNICATION NETWORKS AND SECURITY

Course Code	25SJHNECT602	CIE Marks	40
Teaching Hours/Week (L : T:P: R)	4:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Computer Networks	Course Type	Theory

Course Objectives:

1. To understand communication network fundamentals and security architecture.
2. To study cryptographic techniques, block ciphers and public key cryptosystems.
3. To understand authentication, secure protocols, VPN and web security basics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Network Fundamentals, Security Architecture and Classical Cryptography: TCP/IP model and layer functions; IPv4 addressing, address classes and subnet mask basics. OSI security architecture; passive and active attacks; security services. Symmetric cipher model; cryptography and cryptanalysis; Hill cipher, one-time pad and transposition techniques.	10
2	Finite Fields and Block Ciphers: Groups, rings and fields; modular arithmetic; Euclidean and extended Euclidean algorithms; multiplicative inverse; finite fields GF(p); polynomial arithmetic; password entropy. Stream and block ciphers; Feistel structure; DES and AES; block cipher modes - ECB, CBC and CTR; comparison of AES and DES.	12
3	Public Key Cryptography, RSA and VPN: Principles of public key cryptosystems; Fermat's and Euler's theorems. RSA key generation, encryption, decryption, security analysis and digital signatures. Diffie-Hellman key exchange, perfect forward secrecy, VPN fundamentals, remote access VPN and site-to-site VPN.	11
4	Authentication, Hash Functions and Secure Protocols: Authentication	10



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	requirements; message encryption, public key encryption and MAC. Hash properties; SHA-256 and HMAC. TLS handshake overview. Web security basics - SQL injection and XSS. Blockchain cryptography basics.	
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Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 3 marks. (8 x 3 = 24 marks)	Each question carries 9 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowle dge Level (KL)
CO1	Explain TCP/IP fundamentals, IP addressing, security architecture and classical encryption techniques.	K2
CO2	Apply finite field concepts for block cipher and AES/DES analysis.	K3
CO3	Analyze RSA, Diffie-Hellman, digital signatures and VPN mechanisms.	K4
CO4	Explain authentication, hash functions, TLS, web security and blockchain cryptography basics.	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create



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CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	1	-	1	-	-	1	-	1	-	2	1
CO2	3	3	2	2	2	-	-	-	-	-	1	2	1
CO3	3	3	2	2	2	1	-	1	-	1	1	2	1
CO4	2	3	2	2	3	2	1	2	1	1	2	2	1

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security: Principles and Practice	William Stallings	Pearson	7th Edition, 2017
2	TCP/IP Protocol Suite	Behrouz A. Forouzan	McGraw Hill	4th Edition, 2010

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security	Behrouz A. Forouzan	McGraw Hill	2015
2	Computer Networks	Andrew S. Tanenbaum	Pearson	5th Edition, 2011

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://nptel.ac.in/courses/106106091
2	https://nptel.ac.in/courses/106105031
3	https://nptel.ac.in/courses/106105162
4	https://nptel.ac.in/courses/108101585



SEMESTER S7

ANTENNA DESIGN AND ANALYSIS

Course Code	25SJHNECT702	CIE Marks	40
Teaching Hours/Week (L : T:P: R)	4:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Electromagnetic Theory / Electromagnetic Waves	Course Type	Theory

Course Objectives:

1. To learn the fundamental antenna parameters and their significance in antenna design.
2. To study the characteristics and design methodology of wire, array, aperture, microstrip, reflector and smart antennas.
3. To understand basic analytical methods used for antenna analysis and practical antenna selection.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamental Concepts and Antenna Parameters Physical concept of radiation and radiation mechanism. Types of antennas: wire, aperture, microstrip, array, reflector and lens antennas. Radiation pattern, field regions, directivity, gain, efficiency, bandwidth, polarization, input impedance, effective aperture, Friis transmission equation and antenna temperature.	10
2	Radiation from Wire and Loop Antennas Infinitesimal dipole, small dipole, finite-length dipole and half-wave dipole. Field regions, radiation resistance, directivity and current distribution. Ground effects and linear elements near conductors. Loop antennas: small circular loop and circular loop with uniform/non-uniform current.	10
3	Antenna Arrays and Aperture Antennas Two-element and N-element linear arrays, array factor, broadside and end-fire arrays, planar array and design considerations. Aperture antennas: Huygens	10



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	principle, rectangular and circular apertures. Horn antennas: sectoral, pyramidal and conical horns.	
4	Microstrip, Reflector and Smart Antennas Microstrip antennas: characteristics, feeding methods, analysis and design of rectangular/circular patch antennas. Reflector antennas: plane, parabolic and Cassegrain reflectors. Introduction to MIMO and smart antennas; fixed and adaptive beamforming concepts.	10

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE) :

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8×3 = 24 marks)	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4×9 = 36 marks)	60



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Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Explain fundamental antenna parameters, radiation mechanisms, field regions, and antenna performance measures.	K2
CO2	Analyze the radiation characteristics, impedance, efficiency, and matching aspects of wire and loop antennas.	K3
CO3	Apply array and aperture concepts to evaluate array factor, radiation patterns, and horn/aperture antenna behaviour.	K3
CO4	Design and analyze microstrip, reflector, MIMO, and smart antenna configurations for specified radiation characteristics and applications.	K4

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	-	-	2	-	-	-	-	1	-	2	1
CO2	3	3	2	2	2	-	-	-	-	1	-	2	1
CO3	3	3	3	2	2	-	-	-	1	2	-	2	1
CO4	3	3	3	3	3	1	1	1	2	2	2	2	1

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation



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Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Antenna Theory: Analysis and Design	Constantine A. Balanis	John Wiley & Sons	4th Edition, 2016
2	Antenna Theory and Design	W. L. Stutzman and G. A. Thiele	John Wiley & Sons	2nd Edition, 1998

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Antennas for All Applications	John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan	Tata McGraw-Hill	3rd Edition, 2002
2	Antennas and Wave Propagation	G. S. N. Raju	Pearson Education	Latest Edition
3	Microstrip Antenna Design Handbook	Ramesh Garg, I. Bahl, Apisak Ittipiboon and P. Bhartia	Artech House	2001
4	Antenna Theory and Applications	Hubregt J. Visser	John Wiley & Sons	2012

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://nptel.ac.in/content/syllabus_pdf/117107035.pdf
1	https://ocw.mit.edu/courses/6-661-receivers-antennas-and-signals-spring-2003/lecture-notes/
3-4	https://volakis.eng.fiu.edu/teaching

