

**ANNA UNIVERSITY, CHENNAI**  
**NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY**  
**M.E. COMMUNICATION AND NETWORKING**  
**REGULATIONS – 2021**  
**CHOICE BASED CREDIT SYSTEM**

**1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

- I. Acquire core competence and excel in communication and networking based industries.
- II. Serve in research establishments and contribute towards the development of sophisticated signal processing systems.
- III. Provide consultancy and offer networking solutions for establishments.
- IV. Work towards doctoral and post-doctoral degrees in the area of Data Centre Networking and 5G Networks
- V. Become entrepreneurs and contribute towards indigenous product development which could compete in global market.

**2. PROGRAM SPECIFIC OUTCOMES (PSOs):**

By the completion of Communication and Networking programme, students will have the following programme specific outcomes.

- I. Foundation of communication and signal processing systems: Ability to understand the basics principles of Networking, communication, signal processing, Security Network and understand their implementation issues.
- II. Foundation of networking systems: Ability to understand the various technologies behind the recent communication standards like 5G Communication Techniques, Wireless Broadband Networks and work towards improved solutions.
- III. Foundations of Mathematical concepts: Ability to apply mathematical knowledge to solve complex signal processing algorithms and networking issues.
- IV. Applications of Communication and networking and Research ability: Ability to use knowledge in various Domains to identify research gaps and provide innovative solutions.

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**CHOICE BASED CREDIT SYSTEM**  
**I TO IV SEMESTERS CURRICULA AND 1<sup>st</sup> SEMESTER SYLLABI**  
**SEMESTER I**

S. NO.	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4156	Linear Algebra, Probability and Queueing Theory	FC	3	1	0	4	4
2.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
3.	DS4152	Statistical Signal Processing	PCC	3	0	0	3	3
4.	CU4151	Advanced Wireless Communication	PCC	3	0	0	3	3
5.	EL4151	Modern Digital Communication Systems	PCC	3	0	0	3	3
6.	NC4101	High Performance Networks	PCC	3	0	0	3	3
7.		Audit Course – I*	AC	2	0	0	2	0
PRACTICALS								
8.	NC4111	Communication Networks Laboratory	PCC	0	0	3	3	1.5
9.	CU4161	Advanced Digital Signal Processing Laboratory	PCC	0	0	3	3	1.5
TOTAL				19	1	6	26	21

\*Audit course is optional

**SEMESTER II**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	NC4251	Cognitive Radio Networks	PCC	3	0	0	3	3
2.	NC4201	Internet of Things and Cloud	PCC	3	0	2	5	4
3.	NC4202	RF System and Antenna Design	PCC	3	0	0	3	3
4.	CP4252	Machine Learning	PCC	3	0	2	5	4
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Professional Elective II	PEC	3	0	0	3	3
7.		Audit Course – II*	AC	2	0	0	2	0
PRACTICALS								
8.	NC4211	Internet of Things Laboratory	PCC	0	0	4	4	2
9.	NC4212	Term Paper and seminar	EEC	0	0	2	2	1
TOTAL				20	0	10	30	23

\*Audit course is optional

**SEMESTER III**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	NC4301	Data Centre Networking	PCC	3	0	0	3	3
2.		Professional Elective III	PEC	3	0	0	3	3
3.		Professional Elective IV	PEC	3	0	2	5	4
4.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
5.	NC4311	Project Work I	EEC	0	0	12	12	6
TOTAL				12	0	14	26	19

**SEMESTER IV**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	NC4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

**TOTAL NO. OF CREDITS: 75**

 The logo of Anna University is a large, faint watermark in the background. It features a gear-like outer border with a book icon in the center. Below the gear, a banner contains the text 'PROGRESS THROUGH KNOWLEDGE'.
 

PROGRESS THROUGH KNOWLEDGE

**PROFESSIONAL ELECTIVES****SEMESTER II, ELECTIVE I**

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	DS4251	Multimedia Compression Techniques	PEC	3	0	0	3	3
2.	NC4001	Network Analytics	PEC	3	0	0	3	3
3.	CU4071	Advanced Satellite Communication and Navigation Systems	PEC	3	0	0	3	3
4.	AP4078	Signal Integrity in High Speed Design	PEC	3	0	0	3	3

**SEMESTER II, ELECTIVE II**

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	NC4002	Server Architecture	PEC	3	0	0	3	3
2.	CU4072	High Speed Switching and Networking	PEC	3	0	0	3	3
3.	EL4351	Optical Networks	PEC	3	0	0	3	3
4.	CP4080	Speech Processing	PEC	3	0	0	3	3

**SEMESTER III, ELECTIVE III**

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CU4074	Ultra Wide Band Communications	PEC	3	0	0	3	3
2.	NC4003	Broadband Networks	PEC	3	0	0	3	3
3.	NC4004	Virtual Private Networks	PEC	3	0	0	3	3
4.	NC4005	Telecommunication Switching System Modeling	PEC	3	0	0	3	3

**SEMESTER III, ELECTIVE IV**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CU4073	Image Processing and Video Analytics	PEC	3	0	2	5	4
2.	DS4071	Radar Signal Processing	PEC	3	0	2	5	4
3.	NC4006	Network Protocols and Programming	PEC	3	0	2	5	4
4.	EL4072	Signal Detection and Estimation	PEC	3	0	2	5	4

**AUDIT COURSES (AC)**

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

[www.binils.com](http://www.binils.com)

PROGRESS THROUGH KNOWLEDGE

**COURSE OBJECTIVES:**

The objective of this course is to enable the student to

- grasp the basic concepts of Probability, Random variables, correlation and regression.
- characterize the phenomena which evolve with respect to time in a probabilistic manner.
- encourage students to develop a working knowledge of the ventral ideas of linear algebra.
- acquire skills in analyzing Queueing Models.
- develop a fundamental understanding of linear programming models and apply the simplex method for solving linear programming problems.

**UNIT – I      LINEAR ALGEBRA****12**

Vector spaces – Norms – Inner products – Eigenvalues using QR transformations – QR factorization – Generalized eigenvectors – Jordan Canonical forms – Singular value decomposition and applications – Pseudo inverse – Least square approximations.

**UNIT – II      PROBABILITY AND ROANDOM VARIABLES****12**

Probability Concepts – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability functions – Two-dimensional random variables – Joint distributions – Marginal and conditional distributions – Correlation – Linear Regression.

**UNIT – III      RANDOM PROCESSES****12**

Classification – Stationary random process – Markov process – Markov chain – Poisson process – Gaussian process – Auto correlation – Cross correlation.

**UNIT – IV      QUEUEING THEORY****12**

Markovian queues – Single and multi-server models – Little's formula – Steady state analysis – Self-service queue.

**UNIT – V      LINEAR PROGRAMMING****12**

Formulation – Graphical solution – Simplex method – Big M method – Variants of Simplex method – Transportation problems – Assignment models.

**TOTAL: 60 PERIODS****COURSE OUTCOMES:**

After the completion of the course, the student will be able to

- apply various methods in Linear Algebra to solve the system of linear equations.
- use two-dimensional random variables, correlations and regression in solving application problem.
- apply the ideas of Random Processes.
- understand the basic characteristic features of a queueing system and acquire skills in analyzing queueing models.
- apply the Simplex method for solving linear programming problems.

**REFERENCES:**

1. Miller, S.L. and Childers D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.
2. Friedberg A.H, Insel A.J. and Spence L, "Linear Algebra", Prentice Hall of India, New Delhi, 2004.

- Gross, D., Shortie, J.F., Thompson, J.M and Harris, C.M., "Fundamentals of Queueing Theory", 4<sup>th</sup> Edition, Wiley,2014.
- T. Veerarajan, "Probability, Statistics and Random Process with Queueing Theory and Queueing Network, Tata McGraw Hill, 4<sup>th</sup> Edition,2017.
- Taha H.A., "Operations Research: An Introduction", 9<sup>th</sup> Edition, Pearson Education Asia, New Delhi,2016.
- Richard Bronson, "Matrix Operations" Schaum's outline series, McGraw Hill, 2<sup>nd</sup> Edition, New York,2011.
- Oliver C. Ibe, " Fundamentals of Applied Probability and Random Processes", Academic Press, (An Imprint of Elsevier), Boston,2014.

<b>RM4151</b>	<b>RESEARCH METHODOLOGY AND IPR</b>	<b>L T P C</b>
		<b>2 0 0 2</b>
<b>UNIT I</b>	<b>RESEARCH DESIGN</b>	<b>6</b>
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.		
<b>UNIT II</b>	<b>DATA COLLECTION AND SOURCES</b>	<b>6</b>
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.		
<b>UNIT III</b>	<b>DATA ANALYSIS AND REPORTING</b>	<b>6</b>
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.		
<b>UNIT IV</b>	<b>INTELLECTUAL PROPERTY RIGHTS</b>	<b>6</b>
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.		
<b>UNIT V</b>	<b>PATENTS</b>	<b>6</b>
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.		
<b>TOTAL : 30 PERIODS</b>		

#### REFERENCES:

- Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
- Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
- David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
- The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

**COURSE OBJECTIVES:**

- To introduce the basics of random signal processing
- To learn the concept of estimation and signal modeling
- To know about optimum filters and adaptive filtering and its applications

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING****9**

Discrete random processes – Ensemble averages – Wide sense stationary process – Properties - Ergodic process – Sample mean & variance - Auto-correlation and Auto-correlation matrices- Auto covariance and Cross covariance- Properties – White noise process – Wiener Khintchine relation - Power spectral density – Filtering random process – Spectral Factorization Theorem – Special types of Random Processes – AR, MA, ARMA Processes – Yule-Walker equations.

**UNIT II PARAMETER ESTIMATION THEORY****9**

Principle of estimation and applications-Properties of estimates-unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE)-Cramer Rao bound- Efficient estimators; Criteria of estimation: Methods of maximum likelihood and its properties ; Bayesian estimation : Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation

**UNIT III SPECTRUM ESTIMATION****9**

Estimation of spectra from finite duration signals, Bias and Consistency of estimators - Non-Parametric methods: Periodogram, Modified Periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric Methods: AR, MA and ARMA spectrum estimation - Detection of Harmonic signals - Performance analysis of estimators. MUSIC and ESPRIT algorithms

**UNIT IV SIGNAL MODELING AND OPTIMUM FILTERS****9**

Introduction- Least square method – Pade approximation – Prony's method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Wiener Filter -- MSE – State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.

**UNIT V ADAPTIVE FILTERS****9**

FIR Adaptive filters - Newton's steepest descent method – Widrow Hoff LMS Adaptive algorithm – Convergence – Normalized LMS – Applications: Noise cancellation, channel equalization, echo canceller, Adaptive Recursive Filters: RLS adaptive algorithm, Exponentially weighted RLS-sliding window RLS. Matrix inversion Lemma, Initialization, tracking of nonstationarity.

**COURSE OUTCOMES:**

**On the successful completion of the course, students will be able to**

- CO1: Analyze discrete time random processes  
CO2: Apply appropriate model for estimation and signal modeling for the given problem  
CO3: Analyze non-parametric and parametric methods for spectral estimation  
CO4: Design optimum filter for the given problem  
CO5: Design adaptive filters for different applications

**TOTAL PERIODS:45**



## REFERENCES:

1. Monson. H. Hayes, Statistical Digital Signal Processing and Modelling, John Wiley and Sons, 1996 (Reprint 2008)
2. Simon Haykin, Adaptive Filter Theory, Pearson Prentice Hall, 5<sup>th</sup> edition, 2014
3. D.G. Manolakis, V.K. Ingle and S.M. Kogon, Statistical and Adaptive Signal Processing, Artech House Publishers, 2005.
4. Steven. M. Kay, Modern Spectral Estimation, Theory and Application, Pearson India, 2009
5. A.Veloni, N I. Miridakis, E Boukouvala, Digital and Statistical Signal Processing, CRC Press, 2019
6. S Nandi, D Kundu, Statistical Signal Processing- Frequency Estimation, Springer Nature Singapore, 2<sup>nd</sup> edition , 2020
7. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan, Statistical Signal Processing with Applications, PHI, 1996.

CU4151

ADVANCED WIRELESS COMMUNICATION

L T P C  
3 0 0 3

## COURSE OBJECTIVES:

- To learn the concepts of wireless communication.
- To know about the various propagation methods, Channel models, capacity calculations
- multiple antennas and multiple user techniques used in the mobile communication.

### UNIT I WIRELESS CHANNEL PROPAGATION AND MODEL 9

Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering-free space, two ray. Small scale fading- channel classification- channel models – COST -231 Hata model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, 5G Channel model requirements and Measurements, propagation scenarios, METIS channel models, Map-based model, stochastic model.

### UNIT II CAPACITY OF WIRELESS CHANNELS 9

Capacity in AWGN, capacity of flat fading channel, capacity of frequency selective fading channels. Capacity of MISO, SIMO systems.

### UNIT III DIVERSITY 9

Realization of independent fading paths, Receiver Diversity: Selection combining, Threshold Combining, Maximum-ratio Combining, Equal gain Combining. Transmitter Diversity: Channel known at transmitter, Channel unknown at the transmitter.

### UNIT IV MIMO COMMUNICATIONS 9

Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain: Beam forming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC, STTC, Spatial Multiplexing and BLAST Architectures.

### UNIT V MULTI USER SYSTEMS 9

Introduction to MUD, Linear decorrelator, MMSE MUD, Adaptive MUD, MIMO-MUD Application of convex optimization to wireless design.

TOTAL: 45 PERIODS

## **COURSE OUTCOME:**

**At the end of the course, the student will be able to:**

CO1: Analyze the wireless channel characteristics and identify appropriate channel models

CO2: Understand the mathematics behind the capacity calculation under different channel conditions

CO3: Understand the implication of diversity combining methods and the knowledge of channel

CO4: Understand the concepts in MIMO Communications

CO5: Understand multiple access techniques and their use in different multi-user scenarios.

## **REFERENCES:**

1. David Tse and Pramod Viswanath, *Fundamentals of wireless communications*, Cambridge University Press, First Edition, 2012
2. Andrea Goldsmith, *Wireless Communications*, Cambridge University Press, 2007.
3. Harry R. Anderson, "Fixed Broadband Wireless System Design", John Wiley, India, 2003.
4. Andreas.F. Molisch, "Wireless Communications", John Wiley, India, 2006.
5. 4. Simon Haykin & Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
6. Rappaport. T.S., "Wireless communications", Pearson Education, 2003.
7. Gordon L. Stuber, "Principles of Mobile Communication", Springer International Ltd., 2001.
8. Upena Dalal, "Wireless Communication", Oxford Higher Education, 2009.

EL4151

**MODERN DIGITAL COMMUNICATION SYSTEMS**

**L T P C**  
**3 0 0 3**

## **COURSE OBJECTIVES:**

- To understand the coherent and non coherent receivers and their performance under AWGN channel conditions
- To understand the effect of signalling through bandlimited channels and Equalization techniques used to overcome ISI
- To understand different channel models, channel capacity and different block coding techniques
- To understand the principle of convolutional coding and different decoding techniques
- To understand the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.

## **UNIT I COHERENT AND NON-COHERENT COMMUNICATION**

**9**

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – QAM modulation and demodulation Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK-BER Performance Analysis. Carrier Synchronization Bit synchronization.

## **UNIT II EQUALIZATION TECHNIQUES**

**9**

Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms– Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

### **UNIT III      BLOCK CODED DIGITAL COMMUNICATION**

**9**

Architecture and performance – Binary block codes; – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes.

### **UNIT IV      CONVOLUTIONAL CODED DIGITAL COMMUNICATION**

**9**

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

### **UNIT V      MULTICARRIER AND MULTIUSER COMMUNICATIONS**

**9**

Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, suboptimum detectors, successive interference cancellation.

### **COURSE OUTCOMES**

Upon completion of the course, the students will be able to

**CO1:** Differentiate coherent and non coherent receivers and analyse their performance under AWGN channel conditions

**CO2:** Illustrate the effect of signalling through bandlimited channels and Equalization techniques used to overcome ISI

**CO3:** Determine the channel capacity and design various block coding techniques to combat channel errors

**CO4:** Construct convolutional coders and analyze the performance of different decoding techniques.

**CO5:** Describe the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.

**TOTAL:45 PERIODS**

### **REFERENCES:**

1. John G. Proakis and Masoud Salehi "Digital Communication", Fifth Edition, Mc Graw Hill Publication, 2014.
2. Simon Haykin, "Digital communication Systems", John Wiley and sons, 2014.
3. Bernard Sklar and Pabitra Kumar Ray, "Digital Communications Fundamentals & Applications ", second edition, Pearson Education, 2009.
4. Lathi B P and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 2011.
5. Richard Van Nee & Ramjee Prasad, "OFDM for Multimedia Communications" Artech House Publication, 2001.
6. Theodore S.Rappaport, "Wireless Communications", 2nd edition, Pearson Education, 2002.

**COURSE OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national, international policies with a futuristic vision along with social-economic impact and issues.
- To introduce the layered communication architectures of high performance network.
- To understand various layer protocols and security issues.

**UNIT I INTRODUCTION****9**

Review of OSI, TCP/IP, Multiplexing, Modes of communication, Switching, Routing, SONET-DWDM-DSL-ISDN-BISDN, ATM-Features, Addressing signaling & Routing, Header structure, ATM adaptation layer, Management control, Interworking with ATM.

**UNIT II MULTIMEDIA NETWORKING APPLICATIONS****9**

Streaming stored audio and video-Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism integrated services, RSVP, differentiated services.

**UNIT III ADVANCED NETWORKS CONCEPTS****9**

Architecture and performance, binary block codes, orthogonal, Biorthogonal, VPN-remote access VPN, site-to-site VPN, tunneling to PPP, security in VPN, MPLS-operation, routing, tunneling and use of FEC, traffic engineering, MPLS based VPN, overlay networks, P2P connections.

**UNIT IV TRAFFIC MODELLING****9**

Little's theorem, Need for modeling, Poisson modeling and its failure, Non-poisson models, Network performance evaluation, Non-Markovian –Pollaczek-Khinchin formula and M/G/1, M/D/1, self-similar models and Batch-arrival model, Networks of Queues- Burke's theorem and Jackson theorem.

**UNIT V NETWORK SECURITY AND MANAGEMENT****9**

Network Architecture, SNMP basics, SNMP naming and OIDs, MIBs, SNMPv1 data types, SNMP operations, Authentication applications- Kerberos, X.509 authentication service, Electronic mail security-Pretty Good Privacy, IP Security-IP security overview, Firewalls- Firewall design principles.

**TOTAL:45 PERIODS****COURSE OUTCOMES:**

- Students will understand the concepts of ATM, SONET and ISDN.
- Students gets familiarized with various multimedia networking applications and services.
- Students will have an exposure to the advanced networks concepts.
- Students will be able to model the traffic based on the various models and theorems.
- Students gets familiarized with the various networks security issues and management concepts.

**REFERENCES:**

1. J.F.Kurose & K.W. Ross, "Computer Networking-A Top Down Approach Featuring the Internet", Pearson, 6th Edition, 2012.

2. Walrand. J. Varatya, "High Performance Communication Networks", Morgan Kaufman publishers, 2<sup>nd</sup> edition, 2000.
3. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet", Fifth Edition, Pearson Education, 2012.
4. Behrouz A. Forouzan, "Cryptography & Network Security", Fourth Edition.

**NC4111**

**COMMUNICATION NETWORKS LABORATORY**

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### **COURSE OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To understand various protocols of physical, MAC and routing layers.
- To understand the security issues in wired and wireless network and implement the security algorithms.

### **LIST OF EXPERIMENTS:**

Simulation and performance evaluation using  
(QUALNET/GLOMOSIM/NS2/ MATLAB/PYTHON/ Equivalent) of:

- 1 MAC protocols for wired and wireless networks – CSMA – CD/CA, 802.11, ALOHA, etc.,
- 2 LLC Protocols for wired and wireless networks - STOP & WAIT, SLIDING WINDOW, GO BACK – N, SELECTIVE REPEAT, ETC.,
- 3 Routing protocols for wired and wireless networks – AODV, DSR, OSPF, ETC.,
- 4 Scheduling policies and queuing method on the network performance – FIFO, ROUND – PRIORITY BASED, etc.,
- 5 Cellular network modeling and performance analysis in terms of blocking probability and Spectral Efficiency – GSM, LTE, etc.,
- 6 Wireless Sensor Network implementation and analysis in terms of throughput and Energy Efficiency
- 7 Throughput, End-End delay comparison study of 802.11a,b, 802.16
- 8 Analyze the low power communication standards - WSN, 6 LOWPAN, LORA.
- 9 Simulation analysis of Cooperative communication – Relay, Amplify & Forward, Decode & Forward, Network Coding, etc.,
- 10 Analyze block ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES) and RSA.

**TOTAL : 45 PERIODS**

### **COURSE OUTCOMES:**

- Students will be able to design and analyze the performance of physical and MAC layer protocols for wired and wireless networks.
- Students will understand the need for various routing, scheduling and queuing algorithms for the wired and wireless networks.
- Students can be able to design and analyze the cellular and wireless sensor network architectures.
- Students will understand the performance analysis of existing wireless technologies.
- Students will have an exposure to the various issues and the algorithms to protect the networks.

**COURSE OBJECTIVES:**

- To enable the student to verify the basic principles of random signal processing, spectral estimation methods and additive white Gaussian noise (AWGN) channel characterization
- To design and conduct experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts.

**LIST OF EXPERIMENTS****USE APPROPRIATE SIMULATION TOOLS FOR THE FOLLOWING EXPERIMENTS:**

1. Generation of Standard discrete time sequences (Unit Impulse, Unit Step, Unit Ramp, Sinusoidal and exponential signals) and carrying out of arithmetic operations and plot the results
2. Generation of random sequences satisfying the given probability distributions such as Uniform, Gaussian, Rayleigh and Rician.
3. Design of FIR filters for the given specification and plot the frequency response of the designed filter
4. Design of IIR filters for the given specification and plot the frequency response of the designed filter
5. Analysis of finite word length effects of FIR filter coefficients
6. Estimation of power spectrum of the given random sequence using Nonparametric methods (Bartlett, Welch and Blackman Tukey)
7. Estimation of power spectrum of the given random sequence using parametric methods (AR, MA and ARMA)
8. Upsampling the discrete time sequence by L times and plot the spectrum of both the given sequence and upsampled sequence
9. Downsampling the discrete time sequence by M times and plot the spectrum of both the given sequence and downsampled sequence
10. Design an adaptive filter to extract a desired signal from the given noisy signal by cancelling the noise using LMS Algorithm
11. Design an adaptive filter to extract a desired signal from the given noisy signal by cancelling the noise using RLS Algorithm
12. Implementation of Digital Filter Banks for the given specifications

**TOTAL : 45 PERIODS****COURSE OUTCOMES:****Upon the completion of course, students will be able to**

- Generate deterministic/Random sequences using simulation tool
- Design and analyze the frequency response of FIR/IIR digital filters for the given specifications
- Estimate power spectrum of the given random sequence using parametric/nonparametric estimation methods
- Implement adaptive filters using LMS/RLS algorithm
- Analyze the discrete time systems at various sampling rates



## AUDIT COURSES

**AX4091**

**ENGLISH FOR RESEARCH PAPER WRITING**

**L T P C**  
**2 0 0 0**

### **COURSE OBJECTIVES:**

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

### **UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

### **UNIT II PRESENTATION SKILLS 6**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

### **UNIT III TITLE WRITING SKILLS 6**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

### **UNIT IV RESULT WRITING SKILLS 6**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

### **UNIT V VERIFICATION SKILLS 6**

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES:**

CO1 –Understand that how to improve your writing skills and level of readability

CO2 – Learn about what to write in each section

CO3 – Understand the skills needed when writing a Title

CO4 – Understand the skills needed when writing the Conclusion

CO5 – Ensure the good quality of paper at very first-time submission

### **REFERENCES:**

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

**COURSE OBJECTIVES:**

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

**UNIT I INTRODUCTION 6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

**UNIT III DISASTER PRONE AREAS IN INDIA 6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

**UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

**UNIT V RISK ASSESSMENT 6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

**TOTAL : 30 PERIODS****COURSE OUTCOMES:**

- CO1: Ability to summarize basics of disaster
- CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5: Ability to develop the strengths and weaknesses of disaster management approaches



## REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company, 2007.
3. Sahni, Pardeep Et. Al. , " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

**AX4093**

**CONSTITUTION OF INDIA**

**L T P C**  
**2 0 0 0**

## COURSE OBJECTIVES:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

### UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

### UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

### UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

### UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

### UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, □ Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

### UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

**TOTAL: 30 PERIODS**

## COURSE OUTCOMES:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

## SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1<sup>st</sup> Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7<sup>th</sup> Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094

நற்றமிழ் இலக்கியம்

L T P C

2 0 0 0

UNIT I

சங்க இலக்கியம்

6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்  
- எழுத்து, சொல், பொருள்
2. அகநானூறு (82)  
- இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)  
- போரை நிறுத்திய ஔவையார்

UNIT II

அறநெறித் தமிழ்

6

1. அறநெறி வகுத்த திருவள்ளுவர்  
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து  
- ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை  
(தூய்மையை வலியுறுத்தும் நூல்)

UNIT III

இரட்டைக் காப்பியங்கள்

6

1. கண்ணகியின் புரட்சி  
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை  
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV

அருள்நெறித் தமிழ்

6

1. சிறுபாணாற்றுப்படை

- பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஓளவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்

2. நற்றிணை

- அன்னைக்குரிய புன்னை சிறப்பு

3. திருமந்திரம் (617, 618)

- இயமம் நியமம் விதிகள்

4. தர்மச்சாலையை நிறுவிய வள்ளலார்

5. புறநானூறு

- சிறுவனே வள்ளலானான்

6. அகநானூறு (4) - வண்டு

நற்றிணை (11) - நண்டு

கலித்தொகை (11) - யானை, புறா

ஐந்திணை 50 (27) - மான்

ஆகியவை பற்றிய செய்திகள்

## UNIT V

### நவீன தமிழ் இலக்கியம்

6

1. உரைநடைத் தமிழ்,

- தமிழின் முதல் புதினம்,
- தமிழின் முதல் சிறுகதை,
- கட்டுரை இலக்கியம்,
- பயண இலக்கியம்,
- நாடகம்,

2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,

3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,

4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,

5. அறிவியல் தமிழ்,

6. இணையத்தில் தமிழ்,

7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL : 30 PERIODS

### தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)

- www.tamilvu.org

2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)

- https://ta.wikipedia.org

3. தர்மபுர ஆதின வெளியீடு

4. வாழ்வியல் களஞ்சியம்

- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

5. தமிழ்கலைக் களஞ்சியம்

- தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)

6. அறிவியல் களஞ்சியம்

- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்