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 OUTCOMES (POs)

   1. An ability to independently carry out research/investigation and development work to solve practical problems
   2. An ability to write and present a substantial technical report/document
      Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
   3. 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.
   4. Foundations of Mathematical concepts: Ability to apply mathematical knowledge to solve complex signal processing algorithms and networking issues.
   5. Applications of Communication and networking and Research ability: Ability to use knowledge in various Domains to identify research gaps and provide innovative solutions.
### Semester I

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## PROFESSIONAL ELECTIVES

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AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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<td>TOTAL CREDIT</td>
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</table>
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

UNIT – II  PROBABILITY AND RANDOM VARIABLES  12

UNIT – III  RANDOM PROCESSES  12

UNIT – IV  QUEUEING THEORY  12

UNIT – V  LINEAR PROGRAMMING  12

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:

RM4151 RESEARCH METHODOLOGY AND IPR

UNIT I RESEARCH DESIGN
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS

UNIT V PATENTS

TOTAL: 30 PERIODS

REFERENCES:
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

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

UNIT V  ADAPTIVE FILTERS  9

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:45 PERIODS
REFERENCES:

CU4151 ADVANCED WIRELESS COMMUNICATION

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

UNIT III DIVERSITY
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
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
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:

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

UNIT II EQUALIZATION TECHNIQUES

UNIT III BLOCK CODED DIGITAL COMMUNICATION
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


UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS

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.

REFERENCES:


TOTAL:45 PERIODS

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
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
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
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
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
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.

COURSE OUTCOMES:
CO1: Students will be able to differentiate concepts of ATM, SONET and ISDN.
CO2: Students will have an understanding of various multimedia networking applications and services.
CO3: Students will have an exposure to the advanced networks concepts.
CO4: Students will be able to model the traffic based on the various models and theorems.
CO5: Students Will have an understanding of the various networks security issues and management concepts.

REFERENCES:
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.

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 be able to analyze the performance 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 down sampled 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
COURSE OBJECTIVES:

- Understand the fundamental concepts of cognitive radio networks.
- Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Understand the functions of MAC layer and Network layer and its various protocols.
- Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading.
- Interpret the basics of security management and the various attacks & its countermeasures.

UNIT I  INTRODUCTION TO COGNITIVE RADIO  9

UNIT II  SPECTRUM SENSING AND TRADING  9

UNIT III  MAC PROTOCOLS AND NETWORK LAYER DESIGN  9

UNIT IV  DYNAMIC SPECTRUM ACCESS AND MANAGEMENT  9
Spectrum broker, Dynamic spectrum access architecture- centralized dynamic spectrum access, distributed dynamic spectrum access, Inter- and intra-RAN dynamic spectrum allocation, Spectrum management, Spectrum sharing, Spectrum mobility issues.

UNIT V  TRUSTED COGNITIVE RADIO NETWORKS AND RESEARCH CHALLENGES  9

COURSE OUTCOMES:
Upon the completion of the course, students will be able to

CO1: Understand the fundamental concepts of cognitive radio networks.
CO2: Interpret the basics of various spectrum sensing techniques and algorithms.
CO3: Understand the functions of MAC layer and Network layer and its various protocols.
CO4: Recognize the concepts of cooperative spectrum sensing and handoff process.
CO5: Understand fundamental issues regarding dynamic spectrum access, the radio-resource.
management and trading, as well as a number of optimization techniques for better spectrum exploitation.

REFERENCES

NC4201
INTERNET OF THINGS AND CLOUD
L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT

UNIT II PROTOCOLS FOR IoT

UNIT III CASE STUDIES/INDUSTRIAL APPLICATIONS
Case studies with architectural analysis: IoT applications – Smart City – Smart Water – Smart Agriculture – Smart Energy – Smart Healthcare – Smart Transportation – Smart Retail – Smart waste management.

UNIT IV CLOUD COMPUTING INTRODUCTION

UNIT V IoT AND CLOUD
IoT and the Cloud - Role of Cloud Computing in IoT - AWS Components - S3 – Lambda - AWS IoT Core -Connecting a web application to AWS IoT using MQTT- AWS IoT Examples. Security
COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Understand the various concept of the IoT and their technologies.
CO2: Develop IoT application using different hardware platforms
CO3: Implement the various IoT Protocols
CO4: Understand the basic principles of cloud computing.
CO5: Develop and deploy the IoT application into cloud environment

TOTAL: 45 PERIODS

REFERENCES

NC4202 RF SYSTEM AND ANTENNA DESIGN

COURSE OBJECTIVES:
- To model high frequency circuit using scattering matrices
- To acquire knowledge on the RF filter design
- To design microwave amplifier
- To get familiar with design of RF oscillator
- To learn about the high frequency antennas

UNIT I NETWORKS AND MATRICES 9

UNIT II HIGH FREQUENCY CIRCUIT DESIGN 9

UNIT III MICROWAVE AMPLIFIER DESIGN 9
Types of amplifiers, Power gain equations. Introduction to narrow band amplifiers basic concepts, Maximum gain design, Low noise design. High power design, Negative resistance, reflection amplifiers – various kinds – stability considerations, Microwave transistor amplifier design – input and output matching networks – constant noise figure circuits.

UNIT IV MICROWAVE TRANSISTOR OSCILLATOR DESIGN 9
One port and two port negative resistance oscillators. Oscillator configurations, Oscillator design using large signal measurements, Introduction to Microwave CAD packages, Microwave integrated circuits, MIC design for lumped elements.
UNIT V RF AND MICROWAVE ANTENNAS

Radiation from surface current and line current distribution, Basic Antenna parameters, Feeding structure-Patch Antenna, Ring Antenna, Micro strip dipole, Micro strip arrays, Traveling wave Antenna, Antenna System for Mobile Radio-Antenna Measurements and Instrumentation. Propagation characteristics of RF and Microwave signals, Introduction to EBG structures.

TOTAL:45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Apply scattering parameters in RF circuit and systems
CO2: Develop filters for high frequency applications
CO3: Design amplifiers for RF transceivers
CO4: Understand the RF oscillator design techniques
CO5: Develop antennas for high frequency applications.

REFERENCES

CP4252 MACHINE LEARNING

UNIT I INTRODUCTION AND MATHEMATICAL FOUNDATIONS

UNIT II SUPERVISED LEARNING
UNIT III  UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING


UNIT IV  PROBABILISTIC METHODS FOR LEARNING-


UNIT V  NEURAL NETWORKS AND DEEP LEARNING

Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning- Convolution Neural Networks – Recurrent Neural Networks – Use cases

SUGGESTED ACTIVITIES:
1. Give an example from our daily life for each type of machine learning problem
2. Study at least 3 Tools available for Machine Learning and discuss pros & cons of each
3. Take an example of a classification problem. Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree
4. Outline 10 machine learning applications in healthcare
5. Give 5 examples where sequential models are suitable.
6. Give at least 5 recent applications of CNN

PRACTICAL EXERCISES:
1. Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.
2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?" (use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.
3. Classification with Nearest Neighbours. In this question, you will use the scikit-learn’s KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset
4. In this exercise, you’ll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.
dataset
6. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset
7. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.
   a. Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach.
   b. You can either pick a project of your own design, or you can choose from the set of
pre-defined projects.

c. You are free to use any third-party ideas or code that you wish as long as it is publicly available.

d. You must properly provide references to any work that is not your own in the write-up.

e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Projects (datasets available)
1. Sentiment Analysis of Product Reviews
2. Stock Prediction
3. Sales Forecasting
4. Music Recommendation
5. Handwriting Digit Classification
6. Fake News Detection
7. Sports Prediction
8. Object Detection
9. Disease Prediction

COURSE OUTCOMES:
Upon the completion of course, students will be able to
CO1: Understand and outline problems for each type of machine learning
CO2: Design a Decision tree and Random forest for an application
CO3: Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.
CO4: Use a tool to implement typical Clustering algorithms for different types of applications.
CO5: Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.

TOTAL:75 PERIODS

REFERENCES
COURSE OBJECTIVES:
- To implement the concepts of IoT.
- To interface different platforms like Arduino and Raspberry pi.
- To design and implement the related applications.
- To learn how to analysis the data in IoT.

LIST OF EXPERIMENT:
1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform.
10. Design an IoT based system

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to
- CO1: Use microcontroller based embedded platforms in IoT
- CO2: Use microprocessor based embedded platforms in IoT
- CO3: Use wireless peripherals for exchange of data.
- CO4: Make use of Cloud platform to upload and analyse any sensor data
- CO5: Use of Devices, Gateways and Data Management in IoT.
- CO6: Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.

NC4212  TERM PAPER WRITING AND SEMINAR  L T P C  0 0 2 1

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.

Activities to be carried out

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<th>Activity</th>
<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<tr>
<td>Selection of area of interest and Topic</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
<td>2nd week</td>
<td>3 % Based on clarity of thought, current relevance and clarity in writing</td>
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<td>Stating an Objective</td>
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| Collecting Information about your area & topic| 1. List 1 Special Interest Groups or professional society  
2. List 2 journals  
3. List 2 conferences, symposia or workshops  
4. List 1 thesis title  
5. List 3 web presences (mailing lists, forums, news sites)  
6. List 3 authors who publish regularly in your area  
7. Attach a call for papers (CFP) from your area. | 3rd week        | 3% (the selected information must be area specific and of international and national standard)                                                                                                           |
| Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter | • You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar  
• When picking papers to read - try to:  
  • Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them,  
  • Favour papers from well-known journals and conferences,  
  • Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper),  
  • Favour more recent papers,  
  • Pick a recent survey of the field so you can quickly gain an overview,  
  • Find relationships with respect to each other and to your topic area (classification scheme/categorization)  
• Mark in the hard copy of papers whether complete work or section/sections of the paper are | 4th week        | 6% (the list of standard papers and reason for selection)                                                                                                                                             |
<table>
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<tr>
<th>Reading and notes for first 5 papers</th>
<th>Reading Paper Process</th>
<th>5th week</th>
<th>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</th>
</tr>
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|                                     | - For each paper form a Table answering the following questions:  
- What is the main topic of the article?  
- What was/were the main issue(s) the author said they want to discuss?  
- Why did the author claim it was important?  
- How does the work build on other’s work, in the author’s opinion?  
- What simplifying assumptions does the author claim to be making?  
- What did the author do?  
- How did the author claim they were going to evaluate their work and compare it to others?  
- What did the author say were the limitations of their research?  
- What did the author say were the important directions for future research?  
Conclude with limitations/issues not addressed by the paper (from the perspective of your survey) | | |
<p>| Reading and notes for next5 papers | Repeat Reading Paper Process | 6th week | 8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
| Reading and notes for final 5 papers | Repeat Reading Paper Process | 7th week | 8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
| Draft outline 1 and Linking papers | Prepare a draft Outline, your survey goals, along with a classification / categorization diagram | 8th week | 8% (this component will be evaluated based on the linking and classification among the papers) |</p>
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<tr>
<th>Abstract</th>
<th>Prepare a draft abstract and give a presentation</th>
<th>9th week</th>
<th>6% (Clarity, purpose and conclusion) 6% Presentation &amp; Viva Voce</th>
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<tbody>
<tr>
<td>Introduction Background</td>
<td>Write an introduction and background sections</td>
<td>10th week</td>
<td>5% (clarity)</td>
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<tr>
<td>Sections of the paper</td>
<td>Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey</td>
<td>11th week</td>
<td>10% (this component will be evaluated based on the linking and classification among the papers)</td>
</tr>
<tr>
<td>Your conclusions</td>
<td>Write your conclusions and future work</td>
<td>12th week</td>
<td>5% (conclusions – clarity and your ideas)</td>
</tr>
<tr>
<td>Final Draft</td>
<td>Complete the final draft of your paper</td>
<td>13th week</td>
<td>10% (formatting, English, Clarity and linking) 4% Plagiarism Check Report</td>
</tr>
<tr>
<td>Seminar</td>
<td>A brief 15 slides on your paper</td>
<td>14th &amp; 15th week</td>
<td>10% (based on presentation and Viva-voce)</td>
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TOTAL: 30 PERIODS

NC4301 DATA CENTRE NETWORKING

COURSE OBJECTIVES:
- Understanding of Network Infrastructure management
- Understanding of Server Management and troubleshooting
- Understanding of system Resource Management
- Understanding of Information Security

UNIT I DATA CENTER ARCHITECTURE
Data center Architecture, Data center prerequisites Data center Requirements, Required Physical Area for Equipment and Unoccupied Space, Required power to run all the devices, Required cooling and HVAC Required weight, Required Network bandwidth Budget Constraints

UNIT II DATA CENTER SAFETY
Selecting a Geographic Location Safety from Natural hazards, Safe from Manmade disaster, Availability of local Technical talent, Abundant and Inexpensive Utilities, Selecting an Existing building.

UNIT III DATA CENTER DESIGN
Data Center design, Characteristics of an Outstanding Design, Guidelines for Planning a Data Center Data Center structures, Raised Floor Design and Deployment, Design and Plan against
Vandalism, Data center design case study, Modular Cabling Design, Points of Distribution, Data center servers, Sever Capacity Planning

UNIT IV DATA CENTER NETWORK MAINTENANCE
ISP Network Infrastructure, ISP WAN Links, Data Center Maintenance, Network Operations Center, Network Monitoring, Datacenter physical security, Data center Logical security, Data center Consolidation, Reasons for data center Consolidation, Consolidation opportunity, Server consolidation, Storage Consolidation, Network Consolidation, Service Consolidation, Process Consolidation, Staff Consolidation, Data Consolidation phases

UNIT V DATA CENTER SECURITY AND ADMINISTRATION

COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Manage Server Systems and Data Centres Infrastructure Management
CO2: Utilize the Storage, Bandwidth, Efficiency of systems and other resources for Data centre.
CO3: Monitor the Networks and Resources.
CO4: Plan for Flexible resource allocation.
CO5: To understand how the natural disaster plays role in Data Networking

TOTAL: 45 PERIODS

REFERENCES
2. Data center fundamentals, Mauricio Arregoces, Maurizio Portol, Cisco Press, 2003

MU4091 MULTIMEDIA COMPRESSION TECHNIQUES

COURSE OBJECTIVES:
- To understand the basic ideas of compression algorithms related to multimedia components – Text, speech, audio, image and Video.
- To understand the principles and standards and their applications with an emphasis on underlying technologies, algorithms, and performance.
- To appreciate the use of compression in multimedia processing applications
- To understand and implement compression standards in detail

UNIT I FUNDAMENTALS OF COMPRESSION
UNIT II  TEXT COMPRESSION  9

UNIT III  IMAGE COMPRESSION  9

UNIT IV  AUDIO COMPRESSION  9

UNIT V  VIDEO COMPRESSION  9

COURSE OUTCOMES:
Upon Completion of the course, the students should be able to

CO1: Implement basic compression algorithms familiar with the use of MATLAB and its equivalent open source environments
CO2: Design and implement some basic compression standards
CO3: Critically analyze different approaches of compression algorithms in multimedia related mini projects.
CO4: Understand the various audio, speech compression techniques
CO5: Understand and implement MPEG video coding techniques.

REFERENCES

NC4001  NETWORK ANALYTICS  L T P C
3 0 0 3

COURSE OBJECTIVES:
After the completion of the course, the student will be able

- To provide students with the mathematical tools and computational training to understand large-scale networks in the current era of Big Data.
- To introduce basic network models and structural descriptors, network dynamics
- To mine the users in the social network.
• To understand the evolution of the social network.
• To know the applications in real time systems.

UNIT I 
INTRODUCTION

UNIT II 
SOCIAL INFLUENCE

UNIT III 
INFORMATION NETWORKS AND THE WORLD WIDE WEB

UNIT IV 
SOCIAL NETWORK MINING
Clustering of Social Network graphs: Betweenness, Girvan newman algorithm-Discovery of communities- Cliques and Bipartite graphs-Graph partitioning methods-Matrices-Eigen valuesSimrank.

UNIT V 
NETWORK DYNAMICS

COURSE OUTCOMES:
At the end of the course student will be able to
CO1: understand the underpinnings of search engines and webpage ranking
CO2: make sense of large graphs, ranging from social networks to the smart power grid
CO3: have a good understanding of prediction of processes evolving on graphs, modern algorithms for topology inference, community and anomaly detection, as well as fundamentals of social network analysis
CO4: Analyze the network flow data
CO5: Estimate the size of the Internet

REFERENCES
COURSE OBJECTIVES:
To enable the students to
- Learn M2M developments and satellite applications
- Understand Satellite Communication In Ipv6 Environment

UNIT I OVERVIEW OF SATELLITE COMMUNICATION
Overview of satellite communication and orbital mechanics Link budget Parameters, Link budget calculations, Auxiliary Equations, Performance Calculations.

UNIT II M2M DEVELOPMENTS AND SATELLITE APPLICATIONS

UNIT III SATELLITE COMMUNICATION IN IPV6 ENVIRONMENT

UNIT IV SATELLITE NAVIGATION AND GLOBAL POSITIONING SYSTEM

UNIT V DEEP SPACE NETWORKS AND INTER PLANETARY MISSIONS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Discuss Satellite navigation and global positioning system
CO2: Understand deep space networks and inter planetary missions
CO3: Demonstrate an understanding of the different interferences and attenuation mechanisms affecting the satellite link design.
CO4: Demonstrate an understanding of the different communication, sensing and navigational applications of satellite.
CO5: Familiar with the implementation aspects of existing satellite based systems.

TOTAL: 45 PERIODS

REFERENCES

AP4095 SIGNAL INTEGRITY FOR HIGH SPEED DESIGN L T P C 3 0 0 3

COURSE OBJECTIVES:
- To identify sources affecting the speed of digital circuits.
- To introduce methods to improve the signal transmission characteristics

UNIT I SIGNAL PROPAGATION ON TRANSMISSION LINES 9
Transmission line equations, wave solution, wave vs. circuits, initial wave, delay time, Characteristic impedance , wave propagation, reflection, and bounce diagrams Reactive terminations – L, C , static field maps of micro strip and strip line cross-sections, per unit length parameters, PCB layer stackups and layer/Cu thicknesses, cross-sectional analysis tools, Zo and Td equations for microstrip and stripline Reflection and terminations for logic gates, fan-out, logic switching , input impedance into a transmission-line section, reflection coefficient, skin-effect, dispersion.

UNIT II MULTI-CONDUCTOR TRANSMISSION LINES AND CROSS-TALK 9
Multi-conductor transmission-lines, coupling physics, per unit length parameters ,Near and far-end cross-talk, minimizing cross-talk (stripline and microstrip) Differential signalling, termination, balanced circuits ,S-parameters, Lossy and Lossless models.

UNIT III NON-IDEAL EFFECTS 9
Non-ideal signal return paths – gaps, BGA fields, via transitions , Parasitic inductance and capacitance , Transmission line losses – Rs, tanδ , routing parasitic, Common-mode current, differential-mode current , Connectors.
UNIT IV  POWER CONSIDERATIONS AND SYSTEM DESIGN

SSN/SSO, DC power bus design, layer stack up, SMT decoupling, Logic families, power consumption, and system power delivery, Logic families and speed Package types and parasitic, SPICE, IBIS models, Bit streams, PRBS and filtering functions of link-path components, Eye diagrams, jitter, inter-symbol interference Bit-error rate, Timing analysis.

UNIT V  CLOCK DISTRIBUTION AND CLOCK OSCILLATORS

Timing margin, Clock slew, low impedance drivers, terminations, Delay Adjustments, canceling parasitic capacitance, Clock jitter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to

CO1: identify sources affecting the speed of digital circuits.

CO2: identify methods to improve the signal transmission characteristics

CO3: characterise and model multiconductor transmission line

CO4: analyse clock distribution system and understand its design parameters

CO5: analyse non-ideal effects of transmission line

REFERENCES

TOOLS REQUIRED
1. SPICE, source: http://www-cad.eecs.berkeley.edu/Software/software.html
3. SPECTRAQUEST from Cadence, http://www.spectraquest.com or any equivalent open source tool

NC4002  SERVER ARCHITECTURES

COURSE OBJECTIVES:
- To understand fundamentals of DBMS.
- To understand various concept of Database and its working.
- To acquaint the students with Client Server Architecture and PL/SQL programming

UNIT I  DATABASE COMPUTING MODEL

Client Server Computing: Functions of client, server, middleware components, Advantages and limitations of client server computing

Three Tier Architecture: Overview of thin client, application server, web server, Overview of Distributed Database, Overview of Real Application Clusters, Overview of High Performance
Database Computing, Overview of Data Warehousing and Data Mining

UNIT II OVERVIEW OF ORACLE DATABASE SERVER ARCHITECTURE
Architecture of Oracle Database and Oracle Instance, Overview of Physical and Logical Structures, Dedicated and Shared Server Configuration, Oracle Server Startup and Shutdown, Creating Database

UNIT III ORACLE TOOLS AND UTILITIES
SQL - PL/SQL Procedural Extension, Overview, PL/SQL data types & Control Structures, Cursors, Stored Procedures & Functions, Database Triggers, Package Creation, Dynamic SQL Collections

UNIT IV DATABASE ADMINISTRATION

UNIT V DATA STORAGE

COURSE OUTCOMES:
After completing the course, students will be able to:
CO1: Understand how DBMS works and the importance of various concepts of DBMS.
CO2: Understand oracle architecture and its tools.
CO3: Apply ORACLE in DBMS administration
CO4: Familiarize with the various storage devices.
CO5: Establish a Secure connectivity for a network to any environment.
CO6: Analyse the convergence between the Database and the User environment.

REFERENCES

TOTAL: 45 PERIODS

COURSE OBJECTIVES:
- To explore the various space division switches
- To enable the various network performance analysis
- To get the clear idea about the various multimedia application
• To get a clear idea about the traffic and Queuing systems.
• Interpret the basics of security management and the various attacks & its countermeasures

UNIT I SWITCHING ARCHITECTURES

UNIT II NETWORK PERFORMANCE ANALYSIS
Objectives and requirements for Quality of Service (QoS) in high performance networks. Architecture of high performance networks (HPN), design issues, protocols for HPN, VHF backbone networks, virtual interface architectures, virtual interface for networking, High-speed switching and routing - internet and PSTN IP switching techniques, SRP protocols, SRP authentication, and key exchange, comparison of TCP/IP, FTP, TELNET, queuing systems, network modeling as a graph

UNIT III MULTIMEDIA NETWORKING APPLICATIONS
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 IV PACKET QUEUES AND DELAY ANALYSIS
Littles theorem, Birth and Death process, queueing discipline- Control & stability -, Markovian FIFO queueing system, Non-markovian - PollaczekKhinchin formula and M/G/1, M/D/1, self-similar models and Batch-arrival model, Networks of Queues – Burkes theorem and Jackson Theorem.

UNIT V NETWORK SECURITY AND MANAGEMENT

COURSE OUTCOMES:
Upon completion the students will be able to
CO1: Understand the fundamental concepts of the switching architecture involved in various switching types
CO2: Interpret the basics of various protocols and QOS in the network performance
CO3: Understand the various types of multimedia networking application
CO4: Recognize the concepts of various analysis method involved in the processing
CO5: Understand fundamental issues involved in providing the security as well as the management.

TOTAL:45 PERIODS

REFERENCES
2. Elhanany, Itamar, Hamdi and Mounir, —High Performance Packet Switching Architecturesll,
COURSE OBJECTIVES:

- Understand the concepts of optical components and networks.
- To gain an understanding of various issues in designing a high speed, and huge bandwidth optical network.
- To acquire knowledge of architecture and standards of optical networks.
- Thorough knowledge about the routing and access mechanism in optical networks.
- Thorough understanding of the scientific and engineering principles underlying the photonics technology.

UNIT I  OPTICAL SYSTEM COMPONENTS

UNIT II  OPTICAL NETWORK ARCHITECTURES
Introduction to Optical Networks; WDM networks , SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks- Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture. WOBAN and OTDM networks. Introduction to ASON.

UNIT III  WAVELENGTH ROUTING NETWORKS
The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment algorithms, Virtual Topology design, Architectural variations

UNIT IV  PACKET SWITCHING AND ACCESS NETWORKS

UNIT V  NETWORK DESIGN AND MANAGEMENT
Transmission system Engineering-system model, Power penalty-transmitter, receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; overall design consideration; Control and Management-Network management functions, Configuration management, Performance management, Fault management. Optical safety, Service interface.
COURSE OUTCOMES:
On completion of the course the student will be
CO1: able to design state-of-the-art optical networks.
CO2: able to implement optical network protocols.
CO3: able to design high speed networks using optical fibers
CO4: able to simulate access network
CO5: able to design the optical network infrastructure and network management methods.

TOTAL: 45 PERIODS

REFERENCES

CU4074 SPEECH PROCESSING L T P C
3 0 0 3

COURSE OBJECTIVES:
- To introduce speech production and related parameters of speech.
- To illustrate the concepts of speech signal representations and coding.
- To understand different speech modeling procedures such Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

UNIT I FUNDAMENTALS OF SPEECH PROCESSING 9

UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING 9

UNIT III SPEECH RECOGNITION 9

UNIT IV TEXT ANALYSIS 9

UNIT V SPEECH SYNTHESIS 9
Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification

**COURSE OUTCOMES:**

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

- **CO1:** Model speech production system and describe the fundamentals of speech.
- **CO2:** Extract and compare different speech parameters.
- **CO3:** Choose an appropriate statistical speech model for a given application.
- **CO4:** Design a speech recognition system.
- **CO5:** Use different text analysis and speech synthesis techniques.

**TOTAL:** 45 PERIODS

**REFERENCES**


**CU4075 ULTRA WIDEBAND COMMUNICATIONS**

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**COURSE OBJECTIVES:**

- To give fundamental concepts related to Ultra wide band
- To understand the channel model and signal processing for UWB.
- To acquire knowledge about UWB antennas and regulations.

**UNIT I INTRODUCTION TO UWB**

History, Definition, FCC Mask, UWB features, Benefits and challenges, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services.

**UNIT II UWB TECHNOLOGIES AND CHANNEL MODELS**


**UNIT III UWB SIGNAL PROCESSING**

Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit-Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity, UWB Wireless Locationing: Position Locationing Methods, Time of Arrival Estimation, NLOS Location Error , Locationing with OFDM
UNIT IV  UWB ANTENNAS
Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System. Design examples of broad band UWB antennas.

UNIT V  UWB APPLICATIONS AND REGULATIONS
Ultra wideband receiver architecture, Wireless Ad hoc Networking, UWB Wireless Sensor, RFID, Consumer Electronics and Personal, Asset Location, Medical applications, UWB Regulation and standards in various countries, UWB Regulation in ITU, IEEE Standardization

COURSE OUTCOMES:
Upon completion the students will be able to
CO1: Understand the basic concepts of UWB.
CO2: Understand the basic concepts of UWB technologies.
CO3: Assess the performance of UWB channels.
CO4: Apply the UWB signal processing
CO5: Design UWB antenna for various applications.

REFERENCES

COURSE OBJECTIVES:
- To know about uses, applications, disadvantages of broadband networks
- To Understand the Protocols involved in Broadband Networks
- To Know the various evolutions of network
- To elaborate on the Layer level functions

UNIT I  EVOLUTION OF WIRELESS NETWORKS
Review of cellular standards, migration and advancement of GSM architecture and CDMA architecture, WLAN – IEEE 802.11 and HIPERLAN, Bluetooth.

UNIT II  WIRELESS PROTOCOLS
Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing - DHCP, Mobile transport layer-Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements. Indirect TCP, snooping TCP, Mobile TCP

UNIT III  3G EVOLUTIONS
transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA, HSUPA.

UNIT IV 4G AND BEYOND
Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E-UTRAN architecture - mobility management, resource management, services, channel logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT V LAYER-LEVEL FUNCTIONS
Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme frame structure, resource structure, mapping, synchronization, reference signals and channel estimation, SC-FDMA, interference cancellation –CoMP, Carrier aggregation, Services multimedia broadcast/multicast, location-based services.

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: design routing mechanism meeting the desired QoS in NGN.
CO2: compare various methods of providing connection-oriented services over a NGN.
CO3: compare various NGN virtual network services with reference to VPNs, VLANs, pseudo wires, VPLS and typical applications
CO4: analyse the traditional networking structure
CO5: understand the Uplink and downlink layers
TOTAL:45 PERIODS

REFERENCES

NC4004 VIRTUAL PRIVATE NETWORKS L T P C
3 0 0 3

COURSE OBJECTIVES:
To facilitate the students
• To Understand the purpose and operation of Virtual Private Network
• To identify the business and personal uses of VPN’s.
• To differentiate between a Transport mode VPN and Tunnel mode VPN
• To understand how to manage and maintain the VPN

UNIT I INTRODUCTION AND BASICS VPN TECHNOLOGIES
Security Risks of the Internet, VPNs and Internet Security Issues, VPN Solutions, A Note on IP Address and Domain Name Conventions, Firewall Deployment, Encryption and Authentication, VPN Protocols, Methodologies for Compromising VPNs, Patents and Legal Ramifications
UNIT II  IMPLEMENTING, CONFIGURING AND TESTING LAYER 2 CONNECTIONS  

UNIT III  IMPLEMENTING THE ALTA VISTA TUNNEL 98  
Advantages of the AltaVista Tunnel System, AltaVista Tunnel Limitations, working of AltaVista Tunnel Works, VPNs and AltaVista, Installing the AltaVista Tunnel, Configuring the AltaVista Tunnel Extranet and Telecommuter Server, Configuring the AltaVista Telecommuter Client, Troubleshooting Problems

UNIT IV  CREATING A VPN AND THE CISCO PIX FIREWALL  
The SSH Software, Building and Installing SSH, SSH Components, Creating a VPN with PPP and SSH, Troubleshooting Problems, A Performance Evaluation, The Cisco PIX Firewall, The PIX in Action, Configuring the PIX as a Gateway, Configuring the Other VPN Capabilities

UNIT V  MANAGING AND MAINTAINING VPN AND ITS SCENARIO  

COURSE OUTCOMES:  
Upon completion of this course, the students will be able to:
CO1: Identify the importance of Encryption, Authentication and Authorization.
CO2: Configure a site to site Internet Protocol Security VPN
CO3: Configure a Remote Access VPN.
CO4: To establish IPSEC VPN on a Cisco device
CO5: To know how to stay safe in online cyber ghost

REFERENCES

NC4005  TELECOMMUNICATION SWITCHING SYSTEM MODELING AND SIMULATION  

COURSE OBJECTIVES:

- To enable the student to understand the various aspects of simulation methodology and performance, appreciate the significance of selecting sampling frequency and modelling different types of signals and processing them.
- To expose the student to the different simulation techniques, their pros and cons and enable him to understand and interpret results using case studies.

UNIT I  SIMULATION METHODOLOGY  
Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for bandpass signals, Multicarrier signals, Non-linear and time-varying systems, Post processing – Basic graphical techniques and estimations
UNIT II  RANDOM SIGNAL GENERATION & PROCESSING  
Uniform random number generation, Mapping uniform random variables to an arbitrary pdf, Correlated and Uncorrelated Gaussian random number generation, PN sequence generation, Random signal processing, Testing of random number generators.

UNIT III  MONTE CARLO SIMULATION  
Fundamental concepts, Application to communication systems, Monte Carlo integration, Semianalytic techniques, Case study: Performance estimation of a wireless system

UNIT IV  ADVANCED MODELS & SIMULATION TECHNIQUES  
Modeling and simulation of non-linearities : Types, Memoryless non-linearities, Non-linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modelling and simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory.

UNIT V  EFFICIENT SIMULATION TECHNIQUES  
Tail extrapolation, pdf estimators, Importance Sampling methods, Case study: Simulation of a Cellular Radio System.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Understand the different signal generation and processing methods
CO2: Mathematically model a physical phenomena
CO3: Simulate a phenomena so as to depict the characteristics that may be observed in a real experiment.
CO4: Apply knowledge of the different simulation techniques for designing a communication system or channel
CO5: Validate a simulated system performance so as to match a realistic scenario

TOTAL: 45 PERIODS

REFERENCES

CU4073  IMAGE PROCESSING AND VIDEO ANALYTICS  
L T P C
3 0 2 4

COURSE OBJECTIVES:
- To comprehend the relation between human visual system and machine perception and processing of digital images
- To provide a detailed approach towards image processing applications like enhancement, segmentation, and compression.
- To also explore the integration principles of communication system working with different
• To analyze the fundamentals of digital image processing, image and video analysis
• To present the mathematics and algorithms that underlie image analysis techniques.

UNIT I INTRODUCTION AND DIGITAL IMAGE FUNDAMENTALS

Image enhancement in Spatial domain: Introduction to image enhancement, basic grey level transforms, Histogram, Histogram-processing equalization, Matching & colour histogram, Enhancement using arithmetic/logic operations, spatial filtering, Smoothing spatial filtering, Sharpening spatial filtering.

UNIT II IMAGE PROCESSING TECHNIQUES

UNIT III VIDEO PROCESSING AND MOTION ESTIMATION

UNIT IV INTRODUCTION: VIDEO ANALYTICS

UNIT V MOTION UNDERSTANDING
Motion estimation and Compensation-Block Matching Method, Motion Segmentation -Thresholding for Change Detection, Estimation of Model parameters - Optical Flow Segmentation-Modified Hough Transform Method- SEGMENTATION FOR LAYERED VIDEO REPRESENTATION-BAYESIAN SEGMENTATION -SIMULTANEOUS ESTIMATION AND SEGMENTATION-MOTION FIELD MODEL - ACTION RECOGNITION - LOW LEVEL IMAGE PROCESSING FOR ACTION RECOGNITION.

45 PERIODS
PRACTICAL EXERCISES: 30 PERIODS
1. Perform basic operations on images like addition, subtraction etc.
2. Plot the histogram of an image and perform histogram equalization
3. Implement segmentation algorithms
4. Perform video enhancement
5. Perform video segmentation
6. Perform image compression using lossy technique
7. Perform image compression using lossless technique
8. Perform image restoration
9. Convert a colour model into another
10. Calculate boundary features of an image
11. Calculate regional features of an image
12. Detect an object in an image/video using template matching/Bayes classifier

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Explore the limitations of the computational methods on digital images.
CO2: Implement the spatial and frequency domain image transforms on enhancement and restoration of images
CO3: Define the need for compression and evaluate the basic compression algorithms
CO4: Study the techniques to recover the desired signal parameters and information from the signal corrupted by noisy channel
CO5: Understand the algorithms available for performing analysis on video data and address the challenges
CO6: Understand the approaches for identifying and tracking objects and person with motion based algorithms.

TOTAL : 45+30=75 PERIODS

REFERENCES
UNIT II  SIGNAL MODELS  9
Components of a radar signal, amplitude models, types of clutters, noise model and signal-to-noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model.

UNIT III  SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS  9
Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q.

UNIT IV  RADAR WAVEFORMS  9
Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency Codes.

UNIT V  DOPPLER PROCESSING  9
Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing.

PRACTICAL EXERCISES:  30 PERIODS
1. Matched filtering operation
2. Modeling the Propagation of Radar Signals
3. Modeling of radar targets
5. MTI radar design, target detection in noise
6. Estimation of bearing angle in noise, clutter modelling
7. Frequency modulated radar signal generation
8. Doppler shift Signal strength
9. SNR loss measurement in pulse compression
10. Detection performance of a radar system

TOTAL: 45+30 = 75 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: perform radar signal acquisition and sampling
CO2: perform algorithm on radar processing
CO3: design basic radar algorithm
CO4: design on aperture imaging and array processing
CO5: Illustrate theoretical results are derived and applied in practice

REFERENCES
3. Radar Principles, Peyton Z. Peebles, Wiley India 2009
COURSE OBJECTIVES:
- Define and explain the concept of a networking protocol
- To understand the requirements of a Protocol and design it.
- To Validate the designed protocols

UNIT I INTRODUCTION 9

UNIT II PROTOCOL SPECIFICATION 9

UNIT III PROTOCOL VERIFICATION AND VALIDATION 9
Finite State Machines, Design Errors, Approaches, SDL based, Communication Protocol Conformance Test Principle, Test Execution, Methodology and Framework, Architectures, Generation Methods

UNIT IV PROTOCOL PERFORMANCE TESTING 9

UNIT V IMPLEMENTATION 9
Protocol implementation, requirement, Object based, compilers, Tool for Protocol Engineering

LIST OF EXPERIMENTS
1. AODV/DSR routing
2. Design and setup a network and configure different network protocols.
3. Implement client-server communication using socket programming and TCP & UDP as transport layer protocol
4. Security algorithms in wired network
5. MAC protocols Wired and wireless
6. Configuration of LAN & Configuration of VLAN - Tunneling
7. Configuration of WLAN
8. Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure commonly used services in the network.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Compare the communication protocol development methods.
CO2: Apply protocol specification languages for the given problems.
CO3: Validate and verify using methods.
CO4: Perform protocol verification and validation testing.
CO5: Implement tools for protocol engineering.

TOTAL: 45+30=75 PERIODS
REFERENCES


EL4072 SIGNAL DETECTION AND ESTIMATION L T P C
3 0 2 4

COURSE OBJECTIVES:

- To understand the concepts of detection and estimation.
- To learn the basics of multi-user detection theory
- To understand the theory behind various estimation techniques.
- To understand Wiener filter and Kalman filter in detail.

UNIT I REVIEW OF PROBABILITY AND STOCHASTIC PROCESS 9
Conditional Probability, Bayes' Theorem, Random Variables, Conditional Distributions and
Densities, moments and distribution of random variables., Stationary Processes Cyclostationary
Processes Averages and Ergodicity Autocorrelation Function Power Spectral Density Discrete
Time Stochastic Processes, Spatial Stochastic Processes, Random Signals, Relationship of Power
Spectral Density and Autocorrelation Function.

UNIT II SINGLE AND MULTIPLE SAMPLE DETECTION 9
Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson
Criterion, Sequential Detection, The Optimum Digital Detector in Additive Gaussian Noise,
Performance of Binary Receivers in AWGN.

UNIT III FUNDAMENTALS OF ESTIMATION THEORY 9
Formulation of the General Parameter Estimation Problem, Relationship between Detection and
Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes estimation,
Minimax Estimation, Maximum-Likelihood Estimation, Comparison of Estimators of Parameters.

UNIT IV WIENER AND KALMAN FILTERS 9
Orthogonality Principle, Autoregressive Techniques, Discrete Wiener Filter, Continuous Wiener
Filter, Generalization of Discrete and Continuous Filter Representations, Linear Least-Squares
Methods, Minimum-Variance Weighted Least-Squares Methods, Minimum-Variance, Least
Squares, Kalman Algorithm - Computational Considerations, Signal Estimation, Continuous
Kalman Filter, Extended Kalman Filter.

UNIT V APPLICATIONS 9
Detector Structures in Non-Gaussian Noise, Examples of Noise Models, Receiver Structures, and
Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters Fading Multipath Channel
Models, Receiver Structures with Known Channel Parameters, Receiver Structures without
Knowledge of Phase, Receiver Structures without Knowledge of Amplitude or Phase, Receiver
Structures and Performance with No Channel Knowledge.
PRACTICALS:
Software Requirement: Matlab / Python / Equivalent
1. Power Spectrum Estimation of a Random Signal
2. Maximum Likelihood Estimation
3. Design of optimum receiver in AWGN channel
4. Wiener Filter Design
5. Adaptive Filter Design using LMS algorithm
6. Minimum Variance Estimation

COURSE OUTCOMES:
Upon completion of the course the student will be
CO1: Able to understand the importance of probability and stochastic process concepts in
detection and estimation.
CO2: Able to design optimum detector and estimator for AWGN channel
CO3: Able to design and analyze the various estimators.
CO4: Able to design Wiener and Kalman filters to solve linear estimation problems.
CO5: Able to design and develop novel receiver structures suitable for modern technology.

TOTAL:45+30=75 PERIODS

REFERENCES
1. Harry L. Van Trees, "Detection, Estimation and Modulation Theory", Part I John Wiley and
   Sons, Inc., 2003

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
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
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 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
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman’s

AX4092  DISASTER MANAGEMENT  

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
UNIT II  REPERCUSSIONS OF DISASTERS AND HAZARDS  6

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:

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

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

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.
UNIT I

1. தமிழின் துவக்க நூல்
   - சொகல்கு, தென்பெண், பொன்றா

2. அகநூறு (82)
   - கீவையியல் நாசகம்

3. குறிந்தியெடுக்கதுபுரோக்கலம்

4. புறநூறு (95,195)
   - பொன்றா நிகழ்வு நுழைவார்

UNIT II

1. அறநூறு வகுத்ததிருவள்ளுவர்
   - குகாக்கி, அன்புகடகம், ஒப்புறவு அறிதல், ஈகக்

2. பிற அறநூல்கள் - இலக்கியமருந்து
   - தூய்கமகயவலியுறுத்தும் நூல்

UNIT III

1. கணணகியின் புரட்சி
   - சிலப்பதிகரகுருகள்

2. மூகப்பக்கணியம்
   - மணிபமககல், சிகறக்கொட்டம், அறக்கொட்டம்

UNIT IV

1. சிறுபொணொற்றுப்பகட
   - பொரிமுல்கல்குத் தகொடுத்தது

2. நற்றிகண
   - அன்கனக்குரியபுன்னனசிறப்பு

3. திருமந்தி ரம் (617, 618)
   - இந்தியா நியமம் விதிகள்

4. புறநூறு
   - சிறுவபன வள்ளலொனொன்

5. அகநூறு (11)
   - நணர்டுகலி

6. அகநூறு (4)
   - பல்கள், புறநூறு (11) - கருங்கி

குரியகாலம் (11) - பரதனை, புறநூறு (27)

லேபிளொன் சுமிதை குறிப்பிட்டு
UNIT V
தங்கூர் தமிழ் இளக்கியம் 6

1. அரசுதலை தமிழ்,
   - கையிலே மெய்யூர் பதிலம,
   - கையிலே மெய்யூர் விளக்கம்,
   - காரண போக்கியம,
   - பாபா போக்கியம்,
   - மாதமுநர்,
2. தமிழ் முதலை மாணவப் பதிலம தமிழ் இளக்கியம்,
3. சமையல் முதலை மாணவப் பதிலம தமிழ் இளக்கியம்,
4. பொண்டா முதலை மாணவப் பதிலம மினலை மாணவப் பதிலம தமிழ் இளக்கியம்,
5. அறிவியல் தமிழ்,
6. தொல்லாம் தமிழ்,
7. குடியரசு மீது பாணாக்குதல் தமிழ் இளக்கியம்.

TOTAL : 30 PERIODS

தமிழ் மூலைத் தொல்லியல் / புத்தகங்கள்

1. தமிழ் விடுதலை வலைத்தொடர் பதிலம (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. தமிழ் முதற்களின் மீது முனைவு
4. பகுதி பயிற்சி கலையம்
   - தமிழ் பாடல்களுக்கு முனைவு, குழுவை
5. தமிழ் முதலை கலையம்
   - தமிழ் முதலை கலையம் (thamilvalarchithurai.com)
6. அறிவியல் கலையம்
   - தமிழ் பலகுகளுக்கு முனைவு, குழுவை