Learning Objective: To provide a comprehensive hands-on experience to the students about the development of a complete project starting from analysis to testing. The students can also take a research project for innovating a new idea and its implementation.

Prerequisites: Electronics and Computer related subjects till III year.

COURSE CONTENTS
The major emphasis (but not limited to) shall be given on Microcontroller, Microprocessors, Analog and Digital Electronics/Communication, VLSI and VHDL etc. These are practice-oriented areas of interest. The students shall be making the system, application or simulation packages depending upon the idea, technology chosen and expertise available. The architectural issues shall be important while the exposure to the technology needs to be gained by the students through thorough practice.

The students (in a batch) shall be required to be continuous interaction with the guide for the advice, guidance and facilities periodically and show the progress. They shall also be taking a certificate in the diary for satisfactory remarks or comments. Batch size shall be decided as per need and the quantum of the project.

The students shall make presentation and submit an originally drafted project reports periodically and at the end of the semester.

Learning Outcomes:
Upon completing the course, Student would be able to:
- Work in a team
- Develop small working projects through designing, analysis and testing of model
- Able to give presentation on the project developed

BOOKS RECOMMENDED:
[1] Reference books and web links of the relevant material the must be consulted as advised by the guide.
Learning Objectives:
The course contents are aimed to provide:
A detailed working of different telecommunication networks used for accessing broadband.

Prerequisites:
Knowledge of analog communication, digital communication and basics of computer networks.

COURSE CONTENTS

UNIT-I
Introduction: Classification of different wireless and wired telecommunication networks, their comparison, Broadband access, Classification of Legacy broadband technologies, Fixed wired broadband technologies, Fixed wireless broadband technologies, Mobile wireless broadband technologies, Overview of 2G, 3G, 4G & 5G networks, Telecommunication Traffic- unit of traffic, network traffic load and parameters, grade of service and blocking probability.

UNIT-II
Public switched telephone networks (PSTN): Various subsystems of PSTN - subscriber end instruments, subscriber loop systems, transmission system, signalling system, trunk networks. speech digitization, line coding, frame formats used in PSTN, switching.

UNIT-III
Integrated Services Digital Networks (ISDN): Evolution from PSTN, basic principles, architecture and reference points, various frame formats, protocol stack, ISDN services. Broadband ISDN architecture, protocol stack, cell format, BISDN services.

UNIT-IV
Digital subscriber line (DSL): Dial up internet connection, its shortcomings, wired broadband technologies : (DSL), its types ADSL, SDSL, VSDL etc. working principle of DSL, Discrete multi tone modulation, Cable modem & its working principle.

UNIT-V
Learning Outcomes:
Upon completing the course, student will able to learn about various wired and wireless telecommunication networks used for broadband access, their comparison, technologies used in these networks.

BOOKS RECOMMENDED:

Learning Objectives: To understand fundamentals of optical communication system, its various elements, and optical networking

Prerequisites: Basic knowledge of electromagnetic theory

COURSE CONTENTS

UNIT-I
Introduction to optical fiber communication system, Advantages of optical fiber communication over conventional electrical communication, review of optical fiber fundamentals, ray theory transmission, electromagnetic mode theory for optical propagation in optical waveguides, Types of optical fibers: step index fibers, graded index fibers, single mode fibers etc., cut off wavelength

UNIT-II
Transmission characteristics: fiber attenuation, absorption and scattering losses, fiber bend loss, fiber dispersion, intermodal and intra-modal dispersion, overall fiber dispersion, dispersion shifted fibers, dispersion flattened fibers, non-zero-dispersion shifted fibers, polarization maintaining fibers.

UNIT-III
Optical sources: Lasers and LEDs: basic concepts, injection laser, characteristics, temperature dependence, dynamic response, noise, reliability, Optical detection principle, absorption, quantum efficiency, responsivity, large wavelength cut off, pin photodiode, avalanche photodiode, receiver: basic concepts and types of noise.

UNIT-IV
Optical networks: Basic principles and components, couplers, isolators, circulators, multiplexers: gratings, Fabry perot filters, multilayer dielectrics, Mach-Zehnder interferometer, Acousto-optic tunable filters, Optical amplifiers-Semiconductor optical amplifiers, Erbium doped fiber amplifiers, wavelength converters, optical switches, optical add-drop multiplexers

UNIT-V
Optical networks: architecture, Synchronous optical network/ synchronous digital hierarchy- elements, multiplexing, layers, frame structure, WDM network architectures, broadcast and select networks,
wavelength routed networks, routing and wavelength assignment (RWA), access networks, Optical OFDM, Flexible optical networks

**Learning Outcomes:**

Upon completing the course, students will be well versed with the fundamental concepts of optical communication, and will be able to contribute to the current and upcoming advances in the technology.

**BOOKS RECOMMENDED:**


**List of Practical Assignments:**

1) To set-up a fiber optic analog link
2) To set up a fiber optical digital link
3) To obtain intensity modulation of an analog signal, transmit it over a fiber cable and demodulate it at the receiver and to get back original signal
4) To obtain intensity modulation of a digital signal, transmit it over a fiber cable and demodulate it at the receiver and to get back original signal
5) To study the frequency modulation in case of fiber optic communication system.
6) To undertake the pulse width modulation in case of fiber optic communication system.
7) To determine the propagation losses in case of optical fiber communication system.
8) To evaluate bending losses in case of optical fiber communication system.
9) To determine the numerical aperture of an optical fiber
10) To study the characteristics of frequency modulation in case of fiber optic communication system.
11) To plot the electrical to optical conversion characteristics
Learning Objective: The curriculum focuses on following learning objectives:
- To get acquainted with satellite communication system and its importance.
- To understand the concepts of satellite orbit, launching mechanisms, launch vehicles, types of satellites and various access techniques.
- After learning this course student will get the knowledge of satellite link design and fundamentals, power and bandwidth requirement, effect of the transmission medium etc.
- (iv)Student will be familiar with regulatory aspects and standards, various applications of satellite and navigation system, and some value added examples.

Prerequisite: Knowledge of Digital Communication and Wireless Communication

COURSE CONTENTS

UNIT-I
Introduction to Satellite Communication: Evolution of satellites and launch vehicles, basic concept and overview of satellite communication system, comparison with other communication system, various types of satellites and their applications, recent trends in satellite communication system.

Orbital Mechanics: Orbit and trajectories, Orbiting satellites: basic principles and equation of the orbit, Orbital parameters: definition and calculation, injection velocity and resulting satellite trajectories, types of satellite orbits.

UNIT-II
Satellite Launch and In-orbit Operations: Launch sequence and its types, launch vehicles, orbital perturbations: longitudinal and inclination changes, satellite stabilization, orbital effects on communication system performance, look angles: definition and determination, sub satellite point, calculation of elevation and azimuth angle, specialization to geostationary satellite, visibility test.
The Space Segment: Satellite sub systems, Altitude and orbit control system, telemetry, tracking, command and monitoring, power system, communication subsystems-transponders, satellite antennas, space qualification and equipment reliability.

UNIT-III
Satellite Link Design: Basic transmission theory, Link parameters, frequency considerations, propagation considerations- Introduction, atmospheric losses, ionospheric effects, rain attenuation, other propagation impairments, noise considerations, interference related problems, G/T ratio, C/N ratio, Link Design: design procedure and link budget, design of uplink and downlink, combined uplink and downlink C/N ratio, link budget examples for C band, Ku band and Ka band.
The Earth Segment: Earth station, types of earth station, architecture of Earth station, Earth station Design considerations and optimization.

UNIT-IV
Modulation and Multiplexing Techniques for Satellite Links: Amplitude modulation, frequency modulation, Carson’s rule, analog FM transmission by satellite, digital modulation and demodulation, Digital transmission of analog signal, multiplexing techniques: Frequency division multiplexing and time division multiplexing.

UNIT-V
Satellite Applications: VSAT Systems-overview, network architecture, access control protocols, modulation and multiple access selection, VSAT earth station and calculation of link margin.
Low earth orbit and Non Geo—stationary satellite systems: Orbit consideration, coverage and frequency consideration, delay and throughput considerations, system considerations.
Direct Broadcast Satellite Television and Radio: Digital DBS TV system design and link budget
Satellite navigation and the Global Positioning System: Introduction, radio and satellite navigation, GPS position location principles, GPS receivers and codes-C/A code.

Learning Outcome:
After learning the course the students should be able to:
(i) To analyze satellite sub systems, space segment and Earth segment.
(ii) To design communication link for various types of satellite systems.
(iii) To understand and design various satellite applications.

**BOOKS RECOMMENDED:**


**List of Practical Assignments:**

1. Determination of orbit for a given eccentricity using Kepler’s equation.
2. Computing the orbit of satellite by providing the satellite orbital parameters.
3. Calculation of look angle (Azimuth angle and elevation angle) with the help of given latitude and longitude of earth station as well as sub-satellite point.
4. Calculation of EIRP for earth station and satellite transponder and C/N ratio at the satellite and earth station receiver.
5. Obtain the autocorrelation of an input sequence applied at the Earth Station.
6. Obtain the waveforms for input signal, sampled signal, time division multiplexed signal and recovered signal for satellite communication.
7. Obtain the waveforms for BPSK modulation and demodulation in satellite communication.
8. Obtain the waveforms for QPSK modulation and demodulation in satellite communication.
9. Simulate Code Division Multiple Access for satellite communication of N transmitter/receiver pair.
10. Link budget analysis of transponder by obtaining the graph of C/N ratio v/s Pt and Pr.
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Institute of Engineering & Technology

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<th>Instructions Hours per Week</th>
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**Learning Objective:**
- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

**Prerequisite:** Computer Network, C Language

**COURSE CONTENTS**

**Unit I**

**Unit II**

**Unit III**

**Unit IV**
Unit V

Learning Outcomes:
At the end of the course, the students would be:

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

BOOKS RECOMMENDED:


List of Practical Assignments:

1. To study the architecture of application board of Raspberry Pi.
2. To demonstration the OS (Debian) for RPi in a SD card preparation, configuration of Raspberry Pi during first booting and use of remote SSH like putty.
3. To demonstrate the basic linux commands on Raspberry pi.
4. To create a database & Store the value in Raspberry Pi.
5. To install Android on Raspberry Pi.
6. To Setup R Pi first time without using screen, mouse, keyboard.
7. To interface ADC at GPIOs of Raspberry Pi for measuring analog voltage.
Learning Objectives:
- To understand the fundamentals of Cryptography.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To design security applications in the field of Information technology.

Prerequisite: Computer Network

COURSE CONTENTS

UNIT I -

UNIT II -

UNIT III -
Introduction to Public key Cryptography—Number theory—The RSA Cryptosystem and Factoring Integer—Attacks on RSA—The ELGamal Cryptosystem—Digital Signature Algorithm—Finite Fields—Elliptic Curves Cryptography—Key management – Session and Interchange keys, Key exchange and generation—PKI.

UNIT IV -

UNIT V - Secret Sharing Schemes-Kerberos- Pretty Good Privacy (PGP)-Secure Socket Layer (SSL)- Intruders – HIDS- NIDS - Firewalls - Viruses

Learning Outcomes:

At the end of this course, students will be able to:

- Implement basic security algorithms required by any computing system.
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Analyze the possible security attacks in complex real time systems and their effective countermeasures.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical derivation, modeling, and simulations.
- Formulate research problems in the computer security field.

BOOKS RECOMMENDED:


List of Practical Assignments:

1) Design and implementation of a simple client/server model and running application using sockets and TCP/IP.
2) To make students aware of the insecurity of default passwords, printed passwords and password transmitted in plain text.
3) To teach student how to use SSH for secure file transfer or for accessing local computer using port forwarding technique.
4) Comparison between Telnet and SSH for Secure Connection.
Learning Objective: The purpose of this course is to expose the students to the basics and fundamentals of Electromagnetic Interference and Compatibility in System Design.

Prerequisite: EMF and Transmission line

COURSE CONTENTS

UNIT 1 EMI environment
Concepts of EMI and EMC and Definitions, Sources of EMI, Celestial Electromagnetic noise-Lightning Discharge, Electrostatic Discharge, Electromagnetic Pulse, Electromagnetic emissions-Noise from relays and Switches, Nonlinearities in Circuits

UNIT 2 EMI COUPLING PRINCIPLES
Capacitive coupling, Inductive coupling, Common Impedance Ground Coupling, Ground Loop coupling, Transients in power supply lines, Radiation coupling, Conduction coupling, Common – mode and Differential-mode interferences, Conducted EM noise on power supply lines

UNIT 3 EMI MEASUREMENTS
Open Area test site measurements-Measurement precautions, Open -Area test site, Anechoic Chamber, TEM-Reverberating TEM-GTEM cell, Comparisons

UNIT 4 EMI CONTROL TECHNIQUES
EMC Technology, Grounding, Shielding, Electrical Bonding, Power line filter, CM filter, DM filter, EMI suppression Cables, EMC Connectors, Isolation transformer

UNIT 5 EMI / EMC STANDARDS
Learning Outcome:

After learning the course the students should be able to know about:

- EMI Environment
- EMI Coupling and Measurements
- EMI control techniques and standards

BOOKS RECOMMENDED:


List of Practical Assignments:

The practical will be based on various EMI reduction techniques like Grounding, Shielding, Electrical Bonding, Power line filter, CM filter, DM filter, EMI suppression Cables etc.
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<td>3 L 1 T 2 P</td>
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Duration of Theory Paper: 3 Hours

Learning Objectives:
- To understand the need of databases, its architecture and schemas.
- To familiarize students with representing domains using entity-relationship modelling.
- How to design a normalized schema in the relational data model.
- Develop skills in students to implement schema and query using SQL.
- Develop ability to develop database applications based on the requirements.

Prerequisites: Knowledge of Data Structures and Computer Programming and some topics of operating systems

COURSE CONTENTS

Unit-I Introduction: Database Environment:
Basic Concepts, Advantages of Database approach, Comparison with Traditional file systems, DBMS Architecture, Database Users, Data Models and Schemas, Database languages and Interfaces; Database development process: Development Lifecycle, Types of Application.

Unit-II Database Analysis & Modeling:

Unit-III Database Design:
Introduction to Logical Database Design, Relational Data Model – Codd’s Rules, Relational Algebra etc.; Integrity Constraints, Transforming ER diagrams into relations, Functional Dependencies, Normalization – 1NF, 2NF, 3NF, BCNF and 4NF etc.

Unit-IV System Implementation & Transaction Processing:
Introduction to SQL – Inserting, Updating, and Deleting data, Processing Single Tables, Processing Multiple Tables, PL/SQL Constructs - Views, Triggers, Cursors etc; Transaction
Processing – Properties, Schedules and Serializability Issues. Concurrency Control –
Introduction, Locking etc.

UNIT V - Introduction to Big Data Platform:
Challenges Of Conventional Systems – Web Data – Evolution Of Analytic Scalability, Analytic
Processes And Tools, Regression Modeling, Multivariate Analysis, Bayesian Modeling,
Inference And Bayesian Networks, Support Vector And Kernel Methods, Analysis Of Time
– Stream Data Model And Architecture – Stream Computing, Sampling Data In A Stream –
Filtering Streams – Counting Distinct Elements In A Stream – Estimating Moments – Counting
Oneness In A Window – Decaying Window – Realtime Analytics Platform(RTAP) Applications

Learning Outcomes:
Upon Completing the Course, Student will able to:
- Understand the fundamentals of relational database system including: data models, database
  architectures and database manipulations.
- Understand the theories and techniques in developing database applications and be able to
demonstrate the ability to build databases using DBMS such as MySQL.
- Be familiar with managing database systems.
- Understand new developments and trends in databases.

BOOKS RECOMMENDED:


List of Practical Assignments:
During the learning of course, students need to do assignments:
1. Designing an E-R model.
2. Solving basic SQL assignments.
3. Solving intermediate SQL assignments involving Nested and Join queries.
4. Using PL/SQL constructs involving procedures, triggers, views etc.
5. Exploring how transaction processing is handled by MySQL.
Learning Objectives: The field of machine learning is concerned with the question of how to build computer programs able to construct new knowledge or to improve already possessed knowledge by using input information. The goal of this course is to introduce the theoretical foundations of machine learning, to provide practical experience of applying machine learning techniques and to investigate new problems where machine learning techniques can do better.

Prerequisites: Basic knowledge of a programming language and Basic knowledge of probabilities and statistics is required.

COURSE CONTENTS

Unit-I Introduction:

Unit-II Supervised Learning:
Classification and Regression learning methods, Decision Tree Learning: Representing concepts as decision trees, ID3 algorithm. Picking the best splitting attribute, searching for simple trees and computational complexity. Regression and function approximation, linear regression and best fit, Order of polynomial, Polynomial regression, Cross validation.

Unit-III Unsupervised Learning:
Introduction to unsupervised learning -Clustering -Classification of clustering algorithms, Computational Learning theory, PAC Learning, VC dimension. Artificial Neural Networks Learning: Neural Network Representation, Perceptron, Backpropagation algorithm.

Unit-IV Language Learning:
Unit-V Genetic Algorithms (GAs):
Motivation, Representing Hypotheses, Genetic operators, fitness Function and Selection, Working of Genetic Algorithm, Evolutionary Programming and Genetic Programming, Case studies of Machine Learning data sets.

Learning Outcomes:
Upon Completing the Course, students will have knowledge of various machine learning techniques useful for solving the real world problems.

BOOKS RECOMMENDED:

List of Practical Assignments:
List of Assignment in Machine Learning Lab:
  1) Problem based on different machine Learning algorithm
  2) Works on different machine learning Tools
  3) Case Study on different data sets