Data Communication (3 – 1 - 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1 To Appreciate the concept of Data Communication.
2 To understand the basics of communication signals.
3 To understand the requirements to get two computers exchange data.
4 To understand the basics of switching and networking.

Course Contents:

1. Introduction **2 hrs**

1.1 Evolution of Data Communication systems
1.2 Analog and Digital Data Transmission, Data Communication Terminology
1.3 Standards Organizations, Applications.

2. Data Transmission **3 hrs**

2.1 Parallel and Serial Transmission
2.2 Line Configuration, Synchronous/Asynchronous Communication
2.3 Bit Rate/ Baud rate, Transmission Channel, RS-232C and RS-449 Interface Standards

3. Signals and Systems **5 hrs**

3.1 Signals and their classification: Periodic and non-periodic signals; Deterministic andRandom signals; Energy and Power signals; Continuous and Discrete time signals
3.2 Continuous and Discrete time system
3.3 Basic system properties: Linearity, Causality, Stability and Time Invariance LTI System

4. Analysis of Signals and System's response **6 hrs**

4.1 Unit Step function and Impulse function, Impulse response
4.2 Fourier series representation: Continuous time Fourier series and Discrete time Fourier series
4.3 Fourier Transform: Continuous and Discrete time Fourier transform

5. Overview of Data Communication Networking: **3 hrs**

5.1 Network Types, Topology
5.2 OSI layers and Functions, TCP/IP layer, Local Area Networks (LAN) Architecture, LLC/MAC & Routing
5.3 IEEE Standards, Ethernet (CSMA/CD), Wide Area Networks (WAN): X.25, Frame Relay, ATM

6. Transmission Media **5 hrs**

6.1 Electromagnetic Spectrum for Telecommunication

6.2 Type of Propagation
6.3 Guided Transmission Media: Twisted–Pair Cable, Co-axial Cable, Optical Fiber. Characteristicsof Unguided Communication Bands, Antennas
6.4 Unguided Transmission Media: Terrestrial Microwave, Satellite Communication, VSAT, and Cellular Telephony

7. Impairments, Error handling and Compression Techniques **4 hrs**

7.1 Attenuation & Distortion, Delay Distortion, Noise & Types, interference, crosstalk
7.2 Types of error & its Detection and Correction Methods
7.3 Types of data Compression Techniques

8. Data Link Control and Protocol **3 hrs**

8.1 Flow Control: Stop - & - Wait, Sliding Window, Error Control: Automatic Repeat Request (ARQ), Stop–andWait ARQ, Sliding Window (ARQ)
8.2 Asynchronous &Synchronous Protocols and its types

9. Multiplexing & Switching **5 hrs**

9.1 Multiplexing types and Application
9.2 Multiplexing Vs Non-Multiplexing
9.3 The Telephone System: Analog services and its Hierarchy
9.4 Digital services and Hierarchy Circuit Switching, Packet Switching, Message Switching, and Private Branch Exchange

10. Data Encoding & Modulation **9 hrs**

10.1 Encoding Vs Modulation
10.2 Encoding of Digital Data as Digital Signals & its Techniques, Amplitude, Frequency, and Phase Shift Keying. Pulse Code and Delta Modulation. Analog Modulation (Amplitude, Frequency, and Phase Modulation)
10.3 Multilevel Modulation, Differential PSK, QPSK Modem, Higher-Data Rate Modems

Laboratory:

(The ability to complete the lab projects will depend on the facilities, availability of components, and time allocated to lab work. These projects are representative of the theory: Simulated USING MATLAB/other programming languages).

1. Signal Analysis using MATLAB (Maximum 3-Labs)
2. Analysis of Signal response using simple filters
3. Simulated simple PCM coder that converts samples into a digital code.
4. Amplitude Modulation and Demodulation.
5. Frequency Modulation and Demodulation.
6. Simulated Error Control Coding techniques.

Text Book:

William Stallings, Data and Computer Communications, fifth education.

References:

1. U. D. Black, Data Communications and Distributed Networks Behrouz Forouzan, Introduction to Data Communications and Networking.
2. Oppeheim, Signals and Systems

Embedded Systems (3 – 1 – 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1 To provide the students with the basic information about embedded systems.
2 To familiarize students to applied computing principles in emerging technologies and applications for embedded systems.

Course Contents:

1. Introduction to Embedded Systems **3 hrs**

1.1. General Characteristics of Embedded Systems
1.2. Classification of Embedded Systems
1.3. Essential Components
1.4. Overview of Processors and hardware units in an embedded system
1.5. Application of Embedded Systems

2. Hardware and Software Design Issues **10 hrs**

2.1. Hardware Design Issues
  2.1.1. Combinational and Sequential Logic
  2.1.2. Custom Single-Purpose Processor Design
  2.1.3. Optimizing Custom Single-Purpose Processors
2.2. Software Design Issues
  2.2.1. Basic Architecture
  2.2.2. Operation
  2.2.3. Programmer's View
  2.2.4. Development Environment
  2.2.5. Application-Specific Instruction-Set Processors
  2.2.6. Selecting a Microprocessor
  2.2.7. General-Purpose Processor Design

3. Memory **5 hrs**

3.1. Memory Write Ability and Storage Permanence
3.2. Types of Memory
3.3. Composing Memory
3.4. Memory Hierarchy and Cache

4. Interfacing **6 hrs**

4.1. Communication Basics
4.2. Microprocessor Interfacing: I/O Addressing, Interrupts, DMA
4.3. Arbitration
4.4. Multilevel Bus Architecture
4.5. Advanced Communication Principles

5. Real Time Operating System (RTOS) **8 hrs**

5.1. Definitions of process, tasks and threads
5.2. The real-time Kernel
5.3. OS tasks, task states and task scheduling
5.4. Interrupt Processing
5.5. Clocking communication and task synchronization
5.6. Control blocks
5.7. Memory requirements and control kernel Services

6. Embedded Software Development Tools **2 hrs**

6.1. Cross Assemblers
6.2. Cross Compilers
6.3. Debuggers
6.4. Downloader

7. Microcontrollers **3 hrs**

7.1. Intel 8051 microcontroller family
  7.1.1. Architecture and
  7.1.2. Instruction Sets
7.2. Programming in Assembly Language
7.3. A simple interfacing example with 7 segment display

8. VHDL **8 hrs**

8.1. Background and basic concepts
8.2. Structural specification of hardware and design organization
8.3. VHDL realization of basic digital circuits
  8.3.1. Binary adder
  8.3.2. Multiplier
  8.3.3. Decoder
  8.3.4. Multiplexer
  8.3.5. Counters
  8.3.6. Shift Registers
  8.3.7. Sequence detectors

Laboratory:

1. Simulation of various digital circuits using VHDL
2. Student should complete one project work related to this subject

Text Books:

1. David E. Simon, "An Embedded Software Primer", Addison-Wesley, Latest Edition.
2. Muhammad Ali Mazidi, "8051 Microcontroller and Embedded Systems", Prentice Hall, Latest Edition.
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, Latest Edition.
4. Douglas L. Perry, "VHDL Programming by example", MCGraw Hill, Latest Edition

Object Oriented Software Engineering (3 – 1 – 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Objectives:

The objective is to provide required knowledge on the various issues of software engineering and related tasks including planning, design, development, testing, implementation, maintenance and cross life cycle activities using object oriented concepts and models as per international best practices.

Course Contents:

1. Introduction **6 hrs**

1.1. Software and Programs
1.2. Software Engineering
1.3. Types of Software
1.4. Brief history of Software
1.5. Software Process and Framework
1.6. Perspective Process Models
- Waterfall Model
- The V Model
- Incremental Model
- Evolutionary Model
- Spiral Model
- The RAD Model

1.7. Specialized Process Models
- Component Based Development
- Formal Methods Model
- Aspect Oriented Software Development
- Cleanroom Engineering

1.8. The Unified Process and UML
1.9. Agile Development
- Agile Process
- Agility Principles
- Extreme Programming
- Adaptive Software Development
- Scrum
- Dynamic System Development Methods
- Feature Driven Development
- Lean Software Development

2. Planning Software Projects **7 hrs**

2.1. Project Management Concepts

- Management Spectrum
- W5HH Principle

2.2. Project Planning Process
2.3. Software Scope and Feasibility
2.4. Resources
2.5. Software Project Estimation
- LOC Based Estimation
- FP Based Estimation
- COCOMO II Model
- Estimation Of Object Oriented Projects
- Make/Buy Decision and Outsourcing

2.6. Project Scheduling and Time Line Charts
2.7. Basics of Risk Management
- Reactive and Proactive Risk Handling Strategies
- Software Risks
- Risk Identification
- Risk Projection and Risk Table
- Risk Assessment
- Risk Refinement
- RMMM and RMMM Plan

2.8. Software Maintenance

3. Software Modeling **17 hrs**

3.1. Software Engineering Principles and Practice
3.2. Requirement Engineering
3.3. Requirement Elicitation
- Requirement Gathering and Quality Function Deployment

3.4. Developing Requirement Model
3.5. Requirement Validation
3.6. Requirement Analysis
- Domain Analysis
- Requirement Modeling

3.7. Scenario Based Modeling
- Use Case Modeling
  - Use Case Texts and Use Case Diagram
- Activity Diagram

3.8. Data Modeling
- Review of ERD

3.9. Class Based Modeling
- Class Diagram
- Object Diagram

3.10. Flow Oriented Modeling
- Brief Introduction Data Flow Diagram
- Brief Introduction to Process and Control Specification
- Brief Introduction to Control Flow Diagram

3.11. Behavioral Modeling

- State chart Diagram
- Sequence Diagram
- Communication Diagram

3.12. Design Process

3.13. Design Concepts
- Abstraction
- Architecture
- Patterns
- Separation
- Modularity
- Information Hiding
- Functional Independence
- Refinement
- Aspects
- Refactoring

3.14. Design Model

3.14.1. Data Design

3.14.2. Architectural Design
- Architectural Styles

3.14.3. Interface Design
- UI Design
- Interface Design Steps
- Interface Design Evaluation

3.14.4. Component Level Design
- Component Diagram

3.14.5. Deployment Level Design
- Deployment Diagram

3.15. Brief Introduction to Design Patterns

4. Quality Management and Testing **11 hrs**

4.1. Quality Concepts

4.1.1. Quality Factors

4.1.2. Cost of Quality

4.1.3. Cost Impact of Defects

4.1.4. Defect Amplification and Removal

4.1.5. Quality Control and Assurance

4.1.6. Software Review and FTR

4.1.7. Elements of SQA

4.1.8. SQA Tasks, Goals and Metrics

4.1.9. Statistical SQA and Six Sigma

4.2. Software Reliability
- Availability
- Software Safety

4.3. ISO Standards

4.4. Verification and Validation

4.5. Testing and Debugging

4.5.1. Testing Strategies
- Unit Testing
- Integration Testing
- System Testing
- Validation Testing

4.5.2. White Box Testing
- Basis Path Testing and Cyclomatic Complexity
- Control Structure Testing

4.5.3. Black Box Testing

4.6. Software Configuration Management

4.6.1 SCM Process
- Identification
- Version Control
- Change Control
- Configuration Audit
- Status Reporting

5. Advanced Topics in Software Engineering **4 hrs**

5.1. Software Process Improvement

5.1.1. Software Process Improvement Framework

5.1.2. Software Process Improvement Process

5.1.3. CMMI

5.1.4. People CMM

5.1.5. Other Software Process Improvement Frameworks

5.1.6. Software Process Improvement Return On Investment

5.2. Emerging Trends in Software Engineering

5.2.1. Technology Evolution

5.2.2. Observing Software Engineering Trends

5.2.3. Identifying Soft Trends

5.2.4. Technology Directions

5.2.5. Tools Related Trends

Case Study:

An individual case study should be given to each student on software project and should be analyzed with UML CASE tool and implemented in OO. 10% of sessional marks should be allocated for evaluation.

Laboratory Work:

The laboratory work must be accomplished by assigning every student an individual case study on software project and should be analyzed and documented with UML CASE tool.

Text Book:

1. Pressman, R.S., "Software Engineering: A Practitioner's Approach", Seventh Edition, McGraw Hill, 2010.

2. Miles, R. et all, "Learning UML 2.0: A Pragmatic Introduction to UML", O'Reilly Media, 2006.

References:

1. G. Booch, J. Rumbaugh, I. Jacobson, *The Unified Modeling Language- User Guide*, Addison-Wesley
2. G. Booch, *Object Oriented Analysis and Design with Applications* 2/e Pearson
3. C. Larman, *Applying UML and Patterns*, Pearson
4. Somerville, I. et all, *Software Engineering.*
5. Bali, V., Bali, S., *Software Engineering*, Third Edition, S. K. Kataria and Sons, 2012.
6. Jalote, P., *Software Engineering,* First Edition, Wiley India, 2012.
7. Mall, R., *Fundamentals of Software Engineering,* 3/e, 2011.

Project II (0 – 0 - 4)
(BE Computer / Software / IT)

Evaluation:

	Theory	Practical	Total
Sessional	-	100	100
Final	-	-	-
Total	-	100	100

Objectives:

1. To provide the practical knowledge of project undertaking by focusing on planning, requirements elicitation, design, development and implementation of a project.
2. To provide the knowledge of Programming tools currently used in the market by carrying out a project.
3. To teach students to work and solve problem in a team environment
4. To provide the knowledge to formulate project documentation and oral presentation for his/her project.

Procedures:
The project course requires students to get themselves involved in a group consisting of generally 3-4 members and work jointly in a team, on a proposed task under the direct supervision of the faculty members of their respective department. The project may be selected in consultation with the industries and they shall be software and or electronic hardware based. The project may be done using any programming language or any platform and it may be any type of application e.g. Scientific Applications, Information Systems, Web Applications, Games, Simulations etc but it must find its practical usage in daily life and it should be relevant, as possible, to the local industry environment and its demands.

The project must be started at the beginning of the semester, span throughout the semester and finished by the end of that very semester. The project should be undertaken preferably by group of 3-4 students who will jointly work and implement the project. Term work will be jointly assessed by a panel of examiners as appointed by head of the institution. Oral examination will be conducted by internal and external examiners as appointed by the college.

Project Work Phases:
The entire project work shall be divided in to three phases and evaluation shall be done accordingly:

First Phase:
The students are required to form a team comprised of 3-4 team members and come up with a conceptual framework for their project work which must be documented in the form of a Proposal and presented in front of an examiner in a formal presentation lasting for about 10 minutes, on the date prescribed by the college or concerned department.
30% of the marks shall be based on the following criteria:

Evaluation Criteria:
Task Accomplished (20%)

- Feasibility Study
- Requirements Analysis and Specification

- Project plan
- Creativity, Innovativeness and Usefulness of the Idea

Documentation (10%)
- Proposal Report
- Estimations
- Time Line

Second Phase:
The students are required to show the progress of their work and the work done so far must be justifiable. They must have finished the design phase including the overall system/architectural design and validation scheme. 50% of total mark shall be based on the following criteria:

Evaluation Criteria:
Task Accomplished (40%)
- System/Architectural Design
- Depth of Project work
- Progress
- Level of achievement
- Group/Team Effort
- Ability to propose solutions

Documentation (10%)
- Report organization
- Completeness and consistency of the report
- Validation Criteria
- Organization and analysis of data and results

Third Phase (20%):
All students must have finished all phases of their project work including requirements analysis, design, coding, testing on time by the time they come for the Final Project Presentation.
Students must come up with a visible output of the product that they have developed and perform an oral defense of their work in the presence of an external examiner (external to the department or from industries). The final presentation should be conducted on the last week of final semester term as far as practicable.

Evaluation (20%):
- Presentation
- Completeness, Consistency and Final Output of the Project
- Viva
- Final Project Report

Simulation and Modeling (3-1-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objective:

- To introduce the details of modeling and simulation technologies to the students.
- To provide the students with the knowledge of discrete and continuous systems, generation of random variables, and analysis of simulation output and simulation languages.

Course Contents:

1. Introduction to Modeling and Simulation **4 hrs**

1.1 System concept
1.2 System Environment
1.3 Stochastic Activities
1.4 Continuous and Discrete System
1.5 System Modeling
1.6 Types of Models
1.7 Principles of Modeling
1.8 Area of application
1.9 Verification and Validation of model

2. System Simulation **8 hrs**

2.1 The Techniques of Simulation-Monte Carlo Method
2.2 Problems Depicting Monte Carlo Method
2.3 Comparison of simulation and analytical methods
2.4 Experimental nature of simulation
2.5 Types of system simulation
2.6 Distributed Lag Models
2.7 Cobweb Models
2.8 Steps of Simulation Study
2.9 Time advancement Mechanism
2.10 Queuing Models and its Characteristics
2.11 Queuing Discipline
2.12 Measures of queues, Single Server Queuing System

3. Continuous System **8 hrs**

3.1 Continuous system simulation and system dynamics
3.2 Continuous system models
3.3 Differential equations-Linear differential equation
3.4 Non linear differential equation

3.5 Partial differential equation
3.6 Analog computers
3.7 Components of analog computers
3.8 Analog methods
3.9 Hybrid computers
3.10 Digital analog simulators
3.11 Continuous system simulation language
3.12 CSMP III
3.12.1 Structure Statements
3.12.2 Data Statements
3.12.3 Control Statements
3.12.4 Hybrid Statements
3.13 Feedback System
3.14 Interactive system
3.15 Real time simulation
3.16 Predator pray model

4. Discrete System Simulation **8 hrs**

4.1 Discrete system simulation
4.2 Representation of time
4.3 Generation of arrival patterns
4.4 Simulation of telephone system
4.5 Gathering statistics
4.6 Counters and summary statistics
4.7 Measuring Utilization and Occupancy
4.8 Recording distribution and transit time
4.9 Discrete simulation languages

5. Probability Concepts and Random Number Generation **5 hrs**

5.1 Probability concepts in simulation- Stochastic variable
5.2 Discrete Probability function
5.3 Continuous Probability function
5.4 Random numbers
5.5 Properties of random numbers
5.6 Pseudo random number
5.7 Technique for generation of random number
5.8 Test for Random number generation
5.8.1 Uniformity test (K-S test and Chi-square test)
5.8.2 Independence test (Runs test and Auto Correlation test

6. Simulation languages **6 hrs**

6.1 Types of simulation languages
6.2 Discrete systems modeling and simulation with GPSS
6.3 GPSS programs applications
6.4 SIMSCRIPT –Organization of a SIMSCRIPT program
6.5 SIMSCRIPT programs.

7. Analysis of Simulation Output **6 hrs**

7.1 Nature of the Problem
7.2 Estimation methods
7.3 Simulation run statistics
7.4 Replication of run
7.5 Elimination of Initial Bias

Laboratory:

Develop a simulation model, the topic could be either initiated by the student or selected from a list provided by the instructor. An oral presentation with a demonstration should be part of the laboratory project report.

Text Books:

1. G. Gorden, *System Simulation,* Prentice Hall of India.
2. A.M. Law and W.D. Kelton, *Simulation Modeling and Analysis*, McGraw Hill, 1991

References:

1. J.A. Spriest and G.C. Vansteenkiste, *Computer-Aided Modeling and Simulation,* Academic Press.
2. A.M Law and R.F. Parry, *Simulation*: A *Problem-solving approach*, Addison Wesley Publishing Company.
3. Narsingh Deo, "*System Simulation with Digital Computer*"