Second Year Second Semester

Course Title: Mathematics-IV

Course Code: ICT-401 Course Credit: 3.0 Full Marks: 100

Hours/Week:3

(Final: 60, Before Final:40)

Rationale: One has to be achieved knowledge about Complex Variable, Laplace Transformation, Fourier series and Fourier Transformation for being a computer Engineer.

Objectives: The objectives of this course are:

To help students to achieve knowledge about Complex Variables as well as to know and apply the Laplace Transformation, Fourier series and Fourier Transformation.

Learning Outcomes: Upon completion of this course, students are expected to:

- Be able to solve simple linear differential equations
- Be able to apply Laplace Transform, Fourier Analysis and Complex Analysis

Course Contents:

Fourier Analysis: Fourier series, Convergence of Fourier Series, Fourier analysis; Fourier Integral; Fourier transforms and their uses in solving boundary value problems of wave equations.

Laplace Transform: Definition; Laplace transforms of some elementary functions; Sufficient conditions for existence of Laplace transforms; Inverse Laplace transforms; Laplace transforms of derivatives. The unit step function; Periodic function; Some special theorems on Laplace transforms; Partial fraction; Solutions of differential equations by Laplace transforms; Evaluation of improper integrals.

Books:

1. M.R. Spigel, Laplace Transform, S.series.
2. M.R. Spigel, Linear Algebra, S.series.
3. Md. Abdur Rahman, Mathematical Methods.

Course Title: Electromagnetic Theory and Antenna

Course Code: ICT-403 Course Credit: 3.0 Full Marks: 100 **Hours/Week:3**
(Final: 60, Before Final:40)

Rationale: This course builds on the Electromagnetics courses to discuss the conditions and constraints of wave propagation and the design of antennas to be used to achieve radio wave probation.

Objectives: The objectives of this course are:
Obtain an understanding of Maxwell's equations and be able to apply them to solving practical electromagnetic fields problems. Fundamental concepts covered will include: laws governing electrodynamics, plane wave propagation in different media, power flow, polarization, transmission and reflection at an interface, transmission lines, microwave networks, waveguides, radiation and antennas, wireless systems design and examples.

Learning Outcomes: On completion of the course, the student should be able to:

- Use Maxwells equations to calculate fields from dynamic charge/current distributions
- Analyse plane waves in lossless and lossy media
- Analyse TEM waves in transmission lines
- Analyse EM-waves in waveguide
- Explain the meaning of retardation
- Analyse antennas and radiating system
- Calculate fields from antennas and antenna systems

Course Contents:

Field Equations: Field equations based on laws of Coulomb, Ampere and Faraday; Displacement current; Maxwell's equation: Units and dimensions of field vectors; E-H symmetry; Lorenz's lemma; Scalar and vector potentials; Retarded potentials.

Propagation of Electromagnetic Waves: Wave equations; Plane wave concept; Plane electromagnetic waves in free-space, in conducting, Dielectric and in ionized media. Pointing vector; Joule heating in good conductors; Intrinsic impedance and propagation constant.

Reflection and Refraction of Electromagnetic Waves: Boundary conditions; The laws of reflection and Snell's law of refraction; Reflection from dielectrics and conductors; Fresnel's equations; The Brewster angle; Total reflection; Skin effect; Phase and group velocities, Reflection and refraction in the ionosphere.

Antennas: Introduction, Wire Antennas; Aperature, Microstrip, Array, Reflector and Lens Antennas; Radiation mechanism; Current distribution on a thin wire antenna.

Fundamental Parameters of Antenna: Radiation patterns, Radiation power density, Radiation intensity, Beamwidth, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input impedance, Antenna radiation efficiency, Vector effective length, Maximum directivity and maximum effective area, Antenna temperature, Friis Formula: Antennas in Free Space.

Array, Loop, and Other Antennas: Antenna Arrays:Introduction, Linear and Planar Arrays, The Uniform Linear Array, Parasitic Elements: Uda Yagi Antennas, Reflector Antennas, Monopole Antennas, Corner Reflectors, Parabolic Reflector Antennas, Horn Antennas, Loop Antennas, Helical Antennas, Patch Antennas.

Antenna measurements: Antenna Ranges, Radiation patterns, Gain and directivity measurements; Radiation efficiency; Impedance, current and polarization measurements; Scale model measurements.

Books:

1. S. Ramo, J.R. Whinnery and T.V. Duzer: Fields and Waves in Communication Electronics
2. J.D. Ryder: Networks, Lines and Fields
3. Corson and Lorain: Introduction to Electromagnetic Field and Wave.

4. D. K. Chang: Electromagnetic Fields and Waves
5. Constantine A. Balanis: Antenna Theory
6. J D Kraus: Antennas

Course Title: Digital Logic Design
Course Code: ICT-405 Course Credit: 3.0 Full Marks: 100
Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This subject is intended to teach the students basics, concepts, principles and working of digital circuits putting forth the use of a transistor as a switch, number systems, Boolean Algebra, logic gates, counters and so on. The cognition attained in this subject will be useful later for solving problems in technology areas like Microprocessors and Microcontrollers, Communication Systems, Industrial Electronics, Instrumentation as well as Control Systems and their design.

Objectives: The objectives of this course are:

- Understand how logic circuits are used to solve engineering problems.
- Understand the relationship between abstract logic characterizations and practical electrical implementations.
- Demonstrate knowledge of fundamental Boolean principles and manipulation and their application to digital design.
- In-depth understanding of combinational and sequential digital/logic circuits, and modular design techniques.
- Acquire the ability to design, analyze and synthesize logic circuits.

Learning Outcomes:

On completion of the course students should be able to

- Explain the elements of digital system abstractions such as digital representations of information, digital logic, Boolan algebra etc.
- Describe how analog signals are used to represent digital values in different logic families, including characterization of the noise margins.
- Create the appropriate truth table from a description of a combinational logic function.
- Create a gate-level implementation of a combinational logic function described by a truth table using and/or/inv gates, muxes or ROMs, and analyze its timing behavior.
- Describe the operation and timing constraints for latches and registers.
- Draw a circuit diagram for a sequential logic circuit and analyze its timing properties.
- Evalute combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power
- Properly incorporate synchronous and asynchronous memories into a circuit design.

Contents:

Basic Logic Gates and Families: OR, AND, NOR, NAND, NOT, XOR, XNOR logic gates; AND, OR, INVERTER, other logic families with TTL, DTL, RTL, RCTL, TIL, ECL, IIL, SOS, FET, & CMOSTT families, basic input output characteristics of digital logic ICs, sealed integration.

Boolean Algebra and Boolean Functions: Boolean Algebra, different form of Boolean functions or expressions, De Morgan's Theorem, Canonical and Standard forms and their conversions, Simplification using Boolean algebra, Map method (Karnaugh map or Vietch diagram), Tabulation method (Quine M-CLusky method), iterative consensus method

Combinational Circuits: Half and Full Adders, Sub tractor, BCD adder circuit, adder with look ahead carry, Code conversion circuit: BCD to excess-3 code, BCD to reflected code, binary to reflected code and reverse, Comparator: Parity generator, ALU

Encoding and Decoding: Encoders & Decoders: BCD to 7 segment, BCD to decimal decoder, Comparator; Parity generator, Multiplexer, Demultiplexers, implementation of logic functions using multiplexers, ALU ;

Sequential Circuits: S-R, M/S, JK, D and T Flip-flops, NOR and NAND Latches, race around condition, master slave FFs, state diagram, excitation table of FFs, application of FFs.

Registers, Counters and Memories: Asynchronous and Synchronous counters, Up and down counters, Modulo-n counters, Ring counter, Johnson counter, Random count sequence counter design, Counter application: Frequency and Digital Clock , Different types of Registers, shift registers, modes of operation of shift registers, Charge Coupled Devices, Magnetic Bubble Memories.

Converters: D/A Converter, Weighted register, R-2R ladder DAC, DAC specifications, A/D Converter, Digital Ramp ADC, Successive approximation ADC.

Books:

Course Title: Database Management Systems
Course Code: ICT-407 Course Credit: 3.0 Full Marks: 100 (Final: 60, Before Final:40) Hours/Week:3

Rationale: The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively information from a DBMS.

Objectives: The objectives of this course are:

- To understand the different issues involved in the design and implementation of adatabase system.
- To study the physical and logical database designs, database modeling.
- To understand and use data manipulation language to query, update, and manage adatabase
- To develop an understanding of essential DBMS concepts such as: database security,integrity, concurrency.
- To design and build a simple database system and demonstrate competence with thefundamental tasks involved with modeling, designing, and implementing a DBMS.

Learning Outcomes: By the completion of the course, students should be able to

- Explain the fundamental concepts of a relational database system.
- Utilize a wide range of features available in a DBMS package.
- Analyze database requirements and determine the entities involved in the system and their relationship to one another.
- Develop the logical design of the database using data modeling concepts such as entity-relationship diagrams.
- Create a relational database using a relational database package.
- Manipulate a database using SQL.
- Assess the quality and ease of use of data modeling and diagramming tools.

Contents:

Introduction: Database concepts, database management system. Database system versus file system, Data model. Database language. Database user administration. Database system structure. Storage manager. Overview of Physical storage medium. Database architecture.

Entity-Relationship Model: Entity sets. Relationship sets. Mapping Cardinalities. Keys. Attributes. Entity relationship diagram. Weak entity sets. Specialization. Generalization. Structure of Relational databases. Design of E-R Database Schema. Reduction of an E-R schema to table.

Relational Database System: Structure of relational databases, relational algebra. Extended relational-algebra operations. Modification of the database, Views. Normalization. Decomposition, Functional Dependencies, Closure of a set of Functional dependencies.

Structured Query Language: Selection, projection. Union. Set difference, Cartesian-product. Rename. Set-intersection. Natural-join. Division. Assignment. projection. Aggregate functions. Deletion, Insertion. Updating. Views. Nested sub-queries. Set membership. Set comparison. Embedded SQL. Cursors. Dynamic SQL. ODBC and JDBC.

Integrity and Security and Relational Database Design: Domain constraint. Integrity. Assertions. Triggers. Authorization. Authentication. Security. Privileges. Roles, Audit trails, Encryption-Decryption Algorithm.

Transaction: ACID Properties. Transaction state diagram. Implementation of Atomicity and Durability, Shadow copy technique. Concurrent Execution. Serializability. Recoverability. Recoverable schedule. Cascade-less Schedules. Implementation in Isolation. Testing of Serializability.

Concurrency Control, Recovery System and Distribute databases: Lock-Based Protocols. Granting of locks. Two-phase locking protocol. Graph based protocol. Tree protocol. Timestamp based protocols. Deadlock detection and recovery. Failure classification. Storage types. Checkpoints. Distributed data. Replication and Fragmentation.

Books:

1. **H. F. Korth**, "Database System Concept"
2. **Ivan Bayros**, SQL,PL SQL
3. **Litwin,Paul**, Access 2000 Developers Handbook.
4. **Oracle**, "SQL Star International Limited"

Course Title: Computer Organization and Architecture
Course Code: ICT-409 **Course Credit: 3.0** **Full Marks: 100**
Hours/Week:3
(Final:60, Before Final:40)

Rationale: This course focuses on the function and design of various components necessary to process information digitally. The study of computer architecture and organization focuses on the interface between hardware and software, and emphasizes the structure and behavior of the system.

Learning Objectives: The objectives of this course are:

- To understand aspects of computer architecture and program performance
- To provide essential understanding of different subsystems of modern computer system and design aspects these subsystems
- To understand the stages in instruction life cycle
- To understand performance enhancement methods in instruction execution

Learning Outcomes: On completion of the course, student will be able to:

- Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.
- Analyze the performance of commercially available computers.
- To develop logic for assembly language programming

Course Contents:

Introduction: Instruction sets- formats, cycle, timing etc: Addressing modes: Types of Instruction: RISC characteristics: CISC characteristics.

Computer Arithmetic: Different types of data representation: Addition and Subtraction: Multiplication Algorithms: Division Algorithms.

Memory Organization: Main memory: Auxiliary memory: Associative memory: Cache memory: Virtual memory: Memory management requirements and hardware. ROM design, PLA design.

Input-Output Organization: Input-Output Interfaces: Data transfer, Interrupts: Direct Memory Access (DMA): Input-Output channel.

Fundamentals of parallel processing: Parallel processing: Pipelining: Vector processing: Multiprocessors: Array processor: Bit-slice processor Interconnection structures.

Books:

1. **J. P. Hayes,** Computer Architecture and Organization
2. **Dr. M. Rafiquzzaman,** Fundamentals of Computer System Architecture
3. **Romesh S. Gaonkar,** Microprocessor. Architecture. Programming & Application with 8085
4. **John Hennesy, David Patterson**: Computer Organization and Design

Course Title: Digital Logic Design Lab
Course Code: ICT-406 **Course Credit: 1.00** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: On completion of the course students should be able to

- Design and simulate logic circuits using software tools.
- Recognize and define the hardware required for synthesis & implementation of simple combinational and sequential circuits in terms of standard integrated circuits.
- Analyze, design and synthesize logic circuits for low complexity applications.

Course Contents: Verification of basic logic gate behavior, construction of simple logic circuits like adder, subtractor etc. Design and simulation of simple registers counters etc. using software. Implementation of multiplexers, demultiplexers in different circuits, construction of simple Arithmetic Logic Unit (ALU) etc.

Books:

1. **R P Jain**, "Modern Digital Electronics", Mc Graw Hill
2. **Morris & Miller**, "Design with TTL Integrated Circuit", Mc Graw Hill
3. **Ronald J Tocci** , "Digital Systems, Principles and Applications ", Prentice Hall

Course Title: Algorithm Design and Analysis Lab

Course Title: Database Management Systems Lab
Course Code: ICT-408 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: By the completion of the course, students should be able to

- To design and implement a database schema for given problem.
- Apply the normalization techniques for development of application software to realistic problems.
- Formulate queries using SQL DML/DDL/DCL commands.

Course Contents: Practice the concepts learnt in the subject DBMS by developing sample databases with given description. Practice the designing, developing and querying in example database using "Mysql" database.

Books:

1. **H. F. Korth,** "Database System Concept"
2. **Ivan Bayros,** SQL,PL/SQL
3. **Litwin,Paul,** Access 2000 Developers Handbook.
4. **Oracle,** "SQL Star International Limited"

Course Title: Analog Communication
Course Code: ICT-411   Course Credit: 3.0   Full Marks: 100
Hours/Week 3
(Final: 60, Before Final:40)

Rationale: This course provides a thorough introduction to the basic principles and techniques used in analog communication. The course will introduce analog and digital modulation techniques, communication receiver and transmitter design, baseband and bandpass communication techniques, line coding techniques, noise analysis, and multiplexing techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.

Objectives: The goal of this course is:

- To introduce the concepts of analogue communication systems
- To equip students with various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance

Learning Outcomes: After study through lectures and assignments, students will be able to

- Gain the knowledge of components of analogue communication system
- To analyze various methods of baseband/band pass Analogue transmission and detection
- Analyze and allocate performance objectives to components of an analogue communication system and to design analogue communication systems
- To evaluate the performance of analogue communications in the presence of noise

Course Contents:

Radio Wave Propagation: Surface and space wave propagation, Sky wave through Ionosphere. Pulse method for measuring height and electron concentration of Ionospheric region: Chapman theory of layer formation, Ionospheric storm.
Modulation and Demodulation: Linear modulation – AM, SSB, DSB, and SSB generation. PLL Circuit to generate linear modulated signals, low and high power modulators. Exponential modulation- FM and PM: demodulation of AM, FM.
Broadcasting Transmitter: Transmitter classification.Elements of transmitter, AM and FM transmitters, SSB transmitter, stabilized master oscillator, Frequency multipliers, Mixer circuits, RF power amplifier, Pre-emphasis circuits, Transmitter performance-carrier frequency requirements, audio frequency response, distortion, signal to distortion ratio.
Radio Receiver: Receiver classification, Elements of receiver, AM and FM receivers, SSB receiver, Comparison of AM and FM receivers, Noise in receiver, AGC circuits, AFC circuits, Noise limiters, Receiver sensitivity, Cross modulation, Spurious responses.

Books:

1. **George Kennedy**, Electronic communication systems
2. **Taub and Schilling,** Principles of communication systems
3. **Martin S Roden** , Analog and Digital Communication systems
4. **Sol Lepatine** , Electronic communication
5. **Dennis Roody and John Coolen**, Electronic communication
6. **J Dunlop & D G Smith**, Telecommunication Engg.
7. **Simon Haykin John**, Communication Systems
8. **Proakis&Salehi,** Communication Systems Engineering
9. **B P Lathi** , Analog& Digital Communication
10. **B P Lathi,** Communication Systems

Course Title: Analog Communication Lab

Course Code: ICT-412 **Course Credit: 1.0** **Full Marks: 100 (Final: 60, Before Final:40)**

Learning Outcomes: On completion of this lab course the student will be able to:

- Able to identify and describe different analog modulation techniques.
- Able to analyze AM radio receiver
- Able to use the any AM techniques in MATLAB simulink

Course Contents:

Amplitude Modulation and Demodulation: DSB SC: SSB SC: Synchronous Detector: Frequency Modulation: Pre-Emphasis and De-Emphasis: Verification of Sampling Theorem: Phase Locked Loop: Squelch Circuit: Diode Detector Characteristics: Design Of Mixer: AGC Characteristics/ Radio Receiver Measurements- Sensitivity. Fidelity & Selectivity: Frequency Division Multiplexing

Books:

1. **George Kennedy,** Electronic communication systems
2. **Taub and Schilling,** Principles of communication systems
3. **Martin S Roden** , Analog and Digital Communication systems
4. **Sol Lepatine** , Electronic communication
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