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Department of
Information and Communication Technology (ICT)
Comilla University

Syllabus
For
Bachelor of Science
Information and Communication Technology

Session: 2018-2019, 2019-2020, 2020-2021

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Course Schedule:

First Year First Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-101	Mathematics-I	3.00	0.00	3.00
ICT-103	ICT Fundamental	3.00	0.00	3.00
ICT-105	Computer Programming with C	3.00	0.00	3.00
ICT-107	Bangladesh Studies	2.00	0.00	2.00
ICT-109	Basic Electrical Circuits	3.00	0.00	3.00
ICT-111	Physics	2.00	0.00	2.00
ICT-106	Computer Programming with C Lab	0.00	2.00	1.00
ICT-110	Basic Electrical Circuits Lab	0.00	2.00	1.00
			Total	**18.00**

First Year Second Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-201	Mathematics-II	3.00	0.00	3.00
ICT-203	Statistics	2.00	0.00	2.00
ICT-205	Electronic Circuits-I	3.00	0.00	3.00
ICT-207	Discrete Mathematics	3.00	0.00	3.00
ICT-209	Data Structure	3.00	0.00	3.00
ICT-206	Electronics Circuits-I Lab	0.00	2.00	1.00
ICT-210	Data Structure Lab	0.00	2.00	1.00
ICT-200	Viva-voce	0.00	0.00	2.00
			Total	**18.00**

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Second Year First Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-301	Mathematics-III	3.00	0.00	3.00
ICT-303	Object Oriented Programming with C++	3.00	0.00	3.00
ICT-305	Electronic Circuits-II	3.00	0.00	3.00
ICT-307	Algorithm Design and Analysis	3.00	0.00	3.00
ICT-309	Numerical Analysis with MATLAB	3.00	0.00	3.00
ICT-311	Financial and Managerial Accounting	2.00	0.00	2.00
ICT-304	Object Oriented Programming with C++ Lab	0.00	2.00	1.00
ICT-306	Electronic Circuits-II Lab	0.00	2.00	1.00
ICT-308	Algorithm Design and Analysis Lab	0.00	2.00	1.00
ICT-310	Numerical Analysis with MATLAB Lab	0.00	2.00	1.00
			Total	**21.00**

Second Year Second Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-401	Mathematics- IV	3.00	0.00	3.00
ICT-403	Electromagnetic Theory and Antenna	3.00	0.00	3.00
ICT-405	Digital Logic Design	3.00	0.00	3.00
ICT-407	Database Management Systems	3.00	0.00	3.00
ICT-409	Computer Organization and Architecture	3.00	0.00	3.00
ICT-411	Analog Communication	3.00	0.00	3.00
ICT-406	Digital Logic Design Lab	0.00	2.00	1.00
ICT-408	Database Management Systems Lab	0.00	2.00	1.00
ICT-412	Analog Communication Lab	0.00	2.00	1.00
ICT-400	Viva-voce	0.00	0.00	2.00
			Total	**23.00**

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Third Year First Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-501	Data Communication and Computer Networks	3.00	0.00	3.00
ICT-503	Software Engineering	3.00	0.00	3.00
ICT-505	Microprocessor and Microcontroller	3.00	0.00	3.00
ICT-507	Operating System	3.00	0.00	3.00
ICT-509	Object Oriented Programming with Java	3.00	0.00	3.00
ICT-502	Data Communication and Computer Networks Lab	0.00	2.00	1.00
ICT-504	Software Engineering Lab	0.00	2.00	1.00
ICT-506	Microprocessor and Microcontroller Lab	0.00	2.00	1.00
ICT-508	Operating System Lab	0.00	2.00	1.00
ICT-510	Object Oriented Programming with Java Lab	0.00	2.00	1.00
			Total	**20.00**

Third Year Second Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-601	Digital Signal Processing	3.00	0.00	3.00
ICT-603	Digital Communication	3.00	0.00	3.00
ICT-605	Mobile Application and Game Development	3.00	0.00	3.00
ICT-607	Information Theory and Coding	3.00	0.00	3.00
ICT-609	Telecommunication Engineering	3.00	0.00	3.00
ICT-602	Digital Signal Processing Lab	0.00	2.00	1.00
ICT-604	Digital Communication Lab	0.00	2.00	1.00
ICT-606	Mobile Application and Game Development Lab	0.00	2.00	1.00
ICT-600	Viva-voce	0.00	0.00	2.00
			Total	**20.00**

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Fourth Year First Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-701	Wireless and Mobile Communication	3.00	0.00	3.00
ICT-703	Microwave Engineering	3.00	0.00	3.00
ICT-705	Optical Fiber Communication	3.00	0.00	3.00
ICT-707	Web Technologies and Programming	3.00	0.00	3.00
ICT-709	Image Processing	3.00	0.00	3.00
ICT-702	Wireless and Mobile Communication Lab	0.00	2.00	1.00
ICT-704	Microwave Engineering Lab	0.00	2.00	1.00
ICT-706	Optical Fiber Communication Lab	0.00	2.00	1.00
ICT-708	Web Technologies and Programming Lab	0.00	2.00	1.00
ICT-710	Image Processing Lab	0.00	2.00	1.00
ICT-809	Research Project	0.00	0.00	0.00
			Total	**20.00**

Fourth Year Second Semester

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-801	E-commerce and E-governance	3.00	0.00	3.00
ICT-803	Artificial Intelligence and Expert System	3.00	0.00	3.00
ICT-805	Network Security and Cyber Law	3.00	0.00	3.00
ICT-807	Satellite Communication and Radar	3.00	0.00	3.00
ICT-804	Artificial Intelligence and Expert System Lab	0.00	2.00	1.00
ICT-806	Network Security and Cyber Law Lab	0.00	2.00	1.00
ICT-809	Research Project	0.00	0.00	4.00
ICT-800	Viva-voce	0.00	0.00	2.00
			Total	**20.00**

Grand Total: **160**

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First Year First Semester
Course Title: Mathematics-I

Course Code: ICT-101 **Course Credit: 3.0** **Full Marks: 100** **Hours/Week:3**
(Final: 60, Before Final:40)

Rationale: The purpose of this course is to increase students' participation with differential and integral calculus. To focus on functions, limits, successive differentiation, partial differentiation, etc. in differential calculus and integration by method of substitution, integration by part, definite integrals, Cartesian and polar co-ordinates etc. in integral calculus.

Objectives: The objectives of this course are:

- To provide the understanding of calculus basics
- To use various methods in problem solving of differentiation and integration
- To enhance students' fundamental mathematical skills on both derivative based and integral based problems.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand basics of differentiation and integration,
- Differentiate between derivative and integral,
- Summarize the fundamental features of these two,
- Write incorporate methods of functions to solve problems,
- Know Euler's rule on homogeneous functions for differential calculus,
- Know fundamental theorem of integral calculus.

Course Contents:

Differential Calculus: Functions; Limit; Continuity; Differentiation of exponential and logarithmic functions; Successive differentiation; Indeterminate forms; Maxima and minima; Partial differentiation, partial differentiation for a transformation of variables; Euler's rule on homogeneous functions, Tangent, Normal, Sub tangent and subnormal in Cartesian and polar coordinates.

Integral Calculus: Definitions of integration, integration by method of substitution, Integration by part, Standard integrals, Integration by the methods of successive reduction, Definite integrals, Its properties and use in summing series; Fundamental theorem of integral calculus; Area under a plane curve in Cartesian and polar co-ordinates, Area of the region enclosed by two curves in Cartesian and polar co-ordinates.

References &Books:

1. **M. R. Spiegel,** Vector Analysis, Schaum's Outline Series.
2. **B.C. Das and B.N. Mukherjee,** Differential calculus.
3. **Mohammad, Bhattacharjee and Latif ,**A text book on differential calculus.
4. **B.C. Das,** Integral calculus.
5. **Dr. Abdul Matin,** Integral calculus.

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Course Title: ICT Fundamentals

Course Code: ICT-103 **Course Credit: 3.0** **Full Marks: 100** **Hours/Week:3**
(Final: 60, Before Final:40)

Rationale: The purpose of this course is to ensure students' understanding with the fundamental concepts of information technology and as well the basic concept of computer architecture, programming, computer codes, operating systems, data communication, networking and so on.

Objectives: The objectives of this course are:

- To provide the understanding of fundamental concepts of information technology
- To gather knowledge about various portion computer organization
- To know about computer programming and software
- To enhance understanding about communication and networking

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Provide the basic principles of information technology,
- Make solid foundations in the basic concepts of computer coding,
- Know a substantial number of management criteria in OS,
- Use the tools for computer organization and architecture,
- Enhance understanding about communication and networking.

Course Contents:

Introduction to computer: Early history of computing devices; Computers; Major components of a computer; Hardware, processor, memory, I/O devices; Basic Information Technology; the internet.

Computer organization and architecture: Introduction, Central Processing Unit, Internat communications, Machine cycle, the bus, Instruction set.

Memory and Storage Systems: Introduction, Memory representation, Random Access Memory, Read Only Memory, Storage systems, Magnetic storage systems, Optical storage systems, Magneto Optical systems, Solid state storage devices.

Input and Output Devices

Computer codes and arithmetic: Introduction, Number system: binary, octal, decimal, hexadecimal; Binary Coded Decimal (BCD), binary arithmetic.

Computer Programming and software: Basic programming concepts;, program development stages, flow charts, programming constructs: data types, operators, expressions, statements, control statements, functions, array. Types of computer software, System management programs, System development programs, Standard application programs, unique application programs, Problem solving, Structuring the logic.

Operating Systems: Introduction, History and functions of operating systems, Process management, Memory management, File management, Device management, Security management, Types of operating systems, popular operating systems.

Data communications and networks: Introduction, Data communication using modem, Computer network, Network Topologies, Network protocols and software, Applications of network, IT for telecom networks, IT applications, Intelligent systems and E-commerce, Information Technology and systems.

References & Books:

1. E.Balagurusamy, Fundamentals of computers.
2. William M. Fouri, Computer and Information Processing.
3. Peter Norton, Introduction to computer.
4. Suresh K Basandra, Computers Today.
5. V.Rajarman, Fundamentals of computers.
6. Allen B. Tucker et.al, Fundamentals of computing.
7. E.Balagurusamy, Programming in ANSI C.
8. Hebert Schildt, C made Easy.

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Course Title: Computer Programming with (C)

Course Code: ICT-105 **Course Credit: 3.0** **Full Marks: 100 (Final: 60, Before Final:40)** **Hours/Week:3**

Rationale: The purpose of this course is to deepen students' engagement with the principles of programming language written in C through the understanding of basic knowledge and skillful implementation. This is an introductory programming course designed to prepare the students with fundamantal tools and techniques and to build up a rigorous footing in programming.

Objectives: The objectives of this course are:

- To provide the understanding of programming principles
- To use programming principles in problem solving by transferring the model-based problem into computer based solution
- To enhance communication social skills through group project

Learning Outcomes: Upon successful completion of this course a student possesses advanced knowledge, skills competences in Structured Programming that enable them to:

- Understand basic computer programming principles, distinguish and classify them,
- Know the control statements for decision making,
- Apply decision repetition structures in program design,
- Write incorporate methods of functions to demonstrate program competence,
- Define variables arrays used in program methodology,
- Implement input output to access processed files,
- Apply recursion techniques to problem solving,
- Know application of Structure and Pointer in C.

Course Contents:

Introduction: Introduction of C and its structure, history and Characteristics, Introduction to keywords, constants and identifiers, Fundamental of C variable and data types, Rules of constants, Introduction to arithmetic, relational and logical operators, Introduction to expressions, Managing data input, Managing data output.

Control statements: Decision making and branching. *If* and *if… else* statements, other control statements, *switch* and the '?' operator, Decision making and looping. *While* looping, *do…while* and *for* looping statements, Jump statement *goto, break* and *continue.*

Function: Need for multifunction programs, return values, types and some examples, Calling functions and Arguments (Actual & Formal Arguments), Recursions, passing arrays to functions, Storage class.

Array: Introduction to arrays. One dimensional array, Two dimensional array, Multi-dimensional array. Some sample programs, String handling in C and some examples.

Structure: Definition of Structure, Union, Structure union applications, Array vs. Structure, Some relevant examples.

Pointer: Fundamental of pointers, Pointers and arrays. Dynamic memory allocation, Pointers and functions, pointers and structures, some special features of C (Macros, Enumerations).

File management: File management concept in C, Defining, opening and closing a file, Input/output operations in file, Error handling and command line arguments.

References & Books:

1. Byron S. Gottfried ,Theory and Problems of Programming with C.
2. Herbert Schild, Teach Yourself C.
3. Deitel H. M. and Deitel P J, C++: How to Program.
4. Robert Lafore, The Waite Group's C Programming using Turbo C++.
5. YashavantKanetkar, Let Us C.
6. Herbert Schildt, Turbo C/C++: The Complement Reference.
7. E. Balagurusamy, Programming in ANSI C.
8. C Kernighan & D.M. Ritchie, The C programming Language.

Course Title: Bangladesh Studies

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Course Code: ICT-107 **Course Credit: 2.0** **Full Marks: 50** **Hours/Week:2**
(Final: 30, Before Final:20)

Rationale: This course has been designed to help the students in obtaining comprehensive idea about the history, culture and heritage of Bangladesh. It will introduce students to the economy, society, politics, diplomacy and foreign policy of Bangladesh. Students will learn about the challenges and potentials of Bangladesh in shaping its peaceful and sustainable future. Students learn about roles and contribution of Bangladesh in the regional and international bodies.

Objectives: The objectives of this course are:

- Introduce students with rich history, culture and heritage of Bangladesh.
- To providing them in-depth knowledge on the major political events that shaped Bangladesh as an independent sovereign state.
- Improve their understanding on political, economic and social development of Bangladesh.
- Help them think critically and comprehensively about foreign policy of Bangladesh, its relationship with other countries and its important roles in the international organizations like UN, Commonwealth and SAARC etc.
- Increase understanding on the challenges and potentials of Bangladesh in shaping its peaceful and sustainable future

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

- Identify specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and critically analyse plurality of cultural identities of Bangladesh.
- Critically analyse and present cogent argument on why tensions and contestations between and among social groups may emerge within and among states both in written and oral form.
- Critically analyse how different constitutional bodies and socio-political institutions operate and how their behavior impact on political governance.
- Explain the economy and patterns of economic changes through qualitative and quantitative analysis. This will increase their awareness on global issues of development processes and the nature of environmental challenges including ways to address them effectively.

Contents:

Historical Background of Bangladesh: 1204-1947: Indian Independence Act, 1947. 1947-1971: Language Movement of 1952, General Election of 1954 along with 21-point program, Constitution of Pakistan of 1956 (Feature, National Assembly of 1956), Power and Functions of President and Prime Minister, Causes of failure of the constitution of 1956, Martial-Law of 1958 and its impact on Pakistan politics, Constitution of 1962 (Basic democracy and causes of its failure), Movement for Autonomy (Disparity towards East Pakistan with its description), 6-point program of 1969, Agartala Conspiracy case, 1969, Mass upsurge of 1969, Election of 1970 and its result, Declaration of Independence, Mujib Nagar government and final victory of the war of liberation.

Government of Bangladesh: Constitution of the Peoples' Republic of Bangladesh- 1972, Executives of Bangladesh government (power and functions of President and Prime Minister), Legislature of Bangladesh, The Judiciary system of Bangladesh, Administration system of District administration, Local government and Local self-government.

Economic Planning in Bangladesh: Short and Long-range Planning, Population policy and Manpower Training.

Books:

1. Bangladesh Politics: Problems and Issues , Rownak Jahan
2. Constitutional Development in Bangladesh , Dilara Chowdhury
3. Government & Politics of Pakistan , Dr. M. A. Chowdhury

Course Title: Basic Electrical Engineering

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Course Code: ICT-109 **Course Credit: 3.0** **Full Marks: 100**
Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This subject will assist the students in understanding the theory, concepts and working principles of basic electrical components and circuits used in electrical systems along with their applications. The knowledge acquired by student will help them to design, test, analyze and troubleshoot electrical systems and installations.

Objectives: The objectives of this course are:

- Impart a basic knowledge of electrical quantities such as current, voltage, power, energy andfrequency to understand the impact of technology in a global and societal context.
- To explain the working principle, construction, applications different active and passive elements in a circuit.
- Provide working knowledge for the analysis of basic DC and AC circuits used in electrical andelectronic devices.
- Highlight the importance of transformers in transmission and distribution of electric power.

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

- Predict the behavior of any electrical and magnetic circuits.
- Formulate and solve complex AC, Dc circuits.
- Identify the type of electrical machine used for that particular application.
- Realize the requirement of transformers in transmission and distribution of electric powerand other applications.
- Function on multi-disciplinary teams.

Contents:

Network Theory and Analysis: Classification of circuits, Important terms of circuit analysis, Different types of power sources, EMF, Difference between EMF and potential difference, Kirchhoff's laws, Methods of analysis- Branch current, Mesh and Nodal analysis, Superposition theorem, Thevenin's Theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's Theorem, Star-delta and delta-star conversion. **Basic Passive elements:** Resistors, Inductors and Capacitors in series and parallel; Resistance and Ohm's law; Capacitance and Dielectrics, Transient response in capacitive networks; Charging and discharging phases; R-L transients; Storage cycle, Decay phase; Faraday's experiment.

Fundamentals of AC and the Basic elements and Phasors: Generation of alternating voltage & currents; Sine wave; General format of sinusoidal voltage and currents; Phase & algebraic representation of sinusoids; Average &MS (effective) values; Response of basic R, L, C elements to a sinusoidal voltage & currents; Frequency response R of basic elements; Resonance; Average power & power factor; Complex numbers; Rectangular & polar form Active & reactive power; Series & parallel resonance circuit; Qualify factor; Selectivity.

Transformer: Working principal, E.M.F. equations, Voltage transformation ratio-former equivalent circuit; Transformer on no load and on load; Phasor diagram; Transformer rating; Losses and efficiency.

Books:

1. R.L. Boylestad, Introductory Circuit Analysis.
2. R.M. Kerchner, G.F. Corcoran, Alternating Current Circuits.
3. J. Nagarath and D.P. Kothari, Electric Machines.
4. F. Puschstein, T. C. Loyd, A. G. Conrad, Alternating Current Machines.
5. J.A.Edminister,Schaum's outline series: Theory & Problems of Electric circuits.

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Course Title: Physics
Course Code: ICT-111 **Course Credit: 2.0** **Full Marks: 50** Hours/Week:2
(Final: 30, Before Final:20)

Rational: A course in elementary physics, covers the basic concepts, principles and history of physics. Course topics will include selected topics in mechanics, heat, light, sound, electricity and magnetism, and modern physics.

Objectives: The course is tailored to the needs of students in other fields of science than physics, mathematics or geophysiscs. The course gives an overview and understanding of basic physics, with morderate use of mathematical formalism.

Learning Outcomes: By the end of the course, students will be able to:

- Assess the role of science, and in particular, physics, in helping us to better understand the complex, technological society of which we are a part
- Trace the history of physics and the evolution of scientific thought from ancient to modern times
- Define and analyze the concepts of velocity, acceleration, force, inertia, mass, work, energy (kinetic, potential, etc.) momentum (linear and angular), gravity, tides, power, pressure, density, temperature, thermal expansion, heat, specific heat capacity, waves, sound, electric charge, current, magnetism, electromagnetic waves (including light), photons, and radioactivity.
- Discuss the various types of motion, Newton's Laws (including his Universal Law of Gravitation), the conservation laws of physics, the laws of electricity (e.g. Coulomb's and Ohm's Laws) and magnetism.
- Solve a variety of basic problems in particle kinematics (uniform motion and accelerated motion including "free fall"), dynamics using Newton's Laws of Motion and the conservation laws of energy and momentum (e.g. collisions), fluid mechanics (including Archimedes' and Bernoulli's Principles), thermodynamics, wave motion, basic electricity (Coulomb's and Ohm's Laws), and radioactive decay
- Interpret the results of simple experiments and demonstrations of physical principles.

Course Contents:
Electricity: Electric charge and Electric field, Point charge in an electric field, Electric dipole, Dipole in an electric field, Electric flux, Gauss's law, Coulombs law from Gauss's law, Capacitor and Dielectric, Charging and Discharging of a capacitor, Ohm's law and Kirchhoff's law.
Magnetism: Fundamental postulates of magnetostatics, Magnetic force and Torque, Ampere's circuital law, Torque on a current carrying loop, Hall effect, Biot-savart law and its application, Faraday's law, Lenz's law, Self-induction and mutual induction, Classification of magnetic materials, Maxwell's equation, pointing vector.
Optics: Wave theory of light, Huygen's Principle, Verification of laws of reflection and refraction from this principle, Coherent sources, Interference, Fresnel's bi-prism, Newton's ring, Diffraction and Diffraction grating, X-ray diffraction, Polarization, Polarization by reflection and double refraction method, Nicol prism, Optical activity.
Books:
1. **Rafiqullah and Roy,** Concept of electricity and Magnetism.
2. **D.K. Cheng,** Fields and waves electromagnetism.
3. **R. Whimmery and V. Duger,** Fields and waves.
4. **Brijlal,** Optics.
5. **Jankin and White,** Fundamental of optics.

Course Code: ICT-106 **Course Credit: 1.00** **Full Marks: 100**
Hours/Week:3

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(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand basic computer programming principles, distinguish and classify them,
- Apply the control statements for decision making,
- Apply decision repetition structures in program design,
- Write incorporate methods of functions to demonstrate program competence,
- Implement variables arrays used in program methodology,
- Implement input-output to access processed files,
- Apply recursion techniques to problem solving,
- Know application of Structure and Pointer in C.

Course Contents:

Fundamentals of C and its structure; Introduction to different operators, expressions, managing data input and output and their applications; Application of decision making and branching; Application of decision making and looping; User-defined functions, calling functions, recursions; Application of Array, Pointers, Structures and File management.

Books:

- **Byron S. Gottfried ,** Theory and Problems of Programming with C.
- **Herbert Schild,** Teach Yourself C.
- **Deitel H. M. and Deitel P J,** C++: How to Program.
- **Robert Lafore,** The Waite Group's C Programming using Turbo C++.
- **Yashavant Kanetkar,** Let Us C.
- **Herbert Schildt,** Turbo C/C++: The Complement Reference.
- **E. Balagurusamy,** Programming in ANSI C.
- **C Kernighan & D.M. Ritchie,** The C programming Language.

Course Title: Basic Electrical Engineering Lab

Course Code: ICT-110 **Course Credit: 1.00** **Full Marks: 100** Hours/Week:3

(Final: 60, Before Final:40)

Learning Outcomes: By the end of the class, students should be able to

- Build electronics circuits and characterize circuit behavior using the appropriate instruments and techniques.
- Access and use the most basic functions of electrical test and measurement equipment including oscilloscopes, multimeters, function generators and power supplies.
- Read circuit schematics and construct linear circuits using resistors, capacitors, inductors etc.
- Measure resistance, DC and AC voltages, current, and power, and experimentally verify the results for a variety of electrical circuits.
- Test circuits, analyze data and compare measured performance to theory and simulation.
- Use a circuit simulation program and other computer applications to predict or describe circuit behavior.
- Troubleshoot and repair simple electric circuits.
- Record and document results of lab work using text and graphs.
- Work effectively in groups by sharing responsibilities and collaborating on findings.

Course Contents: Verification of Ohm's law, Kirchhoff's voltage law, Kirchhoff's current law, Norton's Theorems, Reciprocity Theorem, Superposition Theorem, Maximum power transfer theorems, Thevenin's Theorem, Millman's Theorem, finding equivalent resistance of series and parallel connected resistors, study of different kinds of filters etc.

Books:

1. **R.L. Boylestad,** Introductory Circuit Analysis.
2. **R.M. Kerchner, G.F. Corcoran,** Alternating Current Circuits.
3. **J. Nagarath and D.P. Kothari**, Electric Machines.
4. **F. Puschstein, T. C. Loyd, A. G. Conrad,** Alternating Current Machines.
5. **J.A.Edminister,** Schaum's outline series: Theory & Problems of Electric circuits.

First Year Second Semester

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Course Title: Mathematics-II

Course Code: ICT-201 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Rationale: The purpose of this course is to ensure students' understanding with the fundamental concepts of algebra of matrices, characteristic equation, geometry of two dimensions and three dimension, general equation of second degree and Sphere.

Objectives: The objectives of this course are:

- To provide the understanding of fundamental concepts of matrix
- To gather knowledge about various dimensions of geometry
- To know about general equation of second degree
- To enhance understanding to solve problems on sphere.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Know the basics of different types of matrices and their solution,
- Summarize the fundamental features of characteristic equations,
- Write incorporate methods of geometry of various dimensions,
- Understandthe general equation of second degree,
- Know the fundamentals of sphere.

Course Contents:

Algebra of Matrices: Definition and Algebra of Matrices, Special types of matrices, Determinant of square matrix, Properties, Cramer's rule, Rank of a matrix, Elementary transformation and normal form. The adjoin and inverse of a square matrix, matrix inversion by partitioning, Solution of system of linear equations, Gauss-Jordan method.

Characteristic Equation: Eigenvalues, Eigenvectors and Caley-Hamilton theorem, Similar matrices and diagonalization.

Geometry of Two Dimensions:

Co-ordinate systems: Cartesian co-ordinates, Polar co-ordinates, Parameters, Standard Equations in different co-ordinates systems and their parametric representations, Transformation of co-ordinates.

Pair of straight lines: Condition for a general equation of 2nd degree in two variables to represent pair of straight lines, Properties of pair of straight lines.

System of circles: Circles and system of circles, General properties, orthogonality of two circles, limiting circle, radical axis, co-axial circles.

Conics: The general equation of 2nd degree in two variables and reduction to standard forms, identification of conics; Parabola, Ellipse and Hyperbola: Derivation of standard forms and properties.

Geometry of Three Dimensions:

Co-ordinate systems: Cartesian, Cylindrical and Spherical co-ordinate systems, Direction cosines and direction ratios, Projection, Angle between two lines.

Planes and Straight lines : Planes, different form of planes and conversions, angle between two planes, Lines, different form of lines and conversions, angle between two lines, angle between a line and a plane, Plane containing a line, plane containing two lines, shortest distance between two lines.

General equations of second degree: The general equations of second degree and reduction to standard forms, identification of conicoids, cone, Generators, condition for a general equation of second degree to represent Cylinder or Cone, right circular cone, right circular Cylinder.

Sphere: Equation of sphere, a plane and a sphere, a line and a sphere, plane of contact, tangent planers, polar planes, angle of intersections of two spheres, condition of orthogonality, radical line, plane and centers, co-axial spheres.

Books:

1. M. L. Khanna : Matrices
2. Theory and Problems of Matrices : F. Ayres
3. Md. Abdur Rahman : Co-Ordinate Geometry
4. Shahidullah and Bhattacharjee : Higher Algebra and Trigonometry
5. Analytic Geometry of Conic Sections : H.H. Askwith
6. Analytic Geometry of Conic Sections : C Smith
7. A Treatise on Three dimensional Geometry : J. T Bell

Course Title: Statistics

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Course Code: ICT-203 **Course Credit: 2.0** **Full Marks: 50** Hours/Week:2
(Final: 30, Before Final:20)

Rationale: Statistics is the science and, arguably, also the art of learning from data. As a discipline it is concerned with the collection, analysis, and interpretation of data, as well as the effective communication and presentation of results relying on data. Statistics lies at the heart of the type of quantitative reasoning necessary for making important advances in the sciences, such as medicine and genetics, and for making important decisions in business and public policy.

Objectives: The objectives of this course are:

- Identify shape of a distribution of data – right skew, left skew, or symmetric) when presented with a histogram.
- Given a variable of interest, identify whether the variable is categorical (binary, ordinal, nominal) or quantitative (discrete, continuous).
- From a numerical description of a variable, predict what shape the histogram would most likely take.
- Explain how mean and median are related for different distribution shapes (right skew, left skew, and symmetric).
- Describe how outliers affect various numerical summaries (mean, median, range, and standard deviation).
- Identify from a probability scenario events that are simple, complementary, mutually exclusive, and independent.
- Explain the difference between events that are mutually exclusive and independent.
- Correctly apply multiplication rule for two independent events, the addition rule for union of two events, and the complement rule.

Learning outcomes:

- Ability to calculate and apply measures of location and measures of dispersion -- grouped and ungrouped data cases.
- Ability to apply discrete and continuous probability distributions to various business problems.
- Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values.
- Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis

Be able to perform a multiple regression using computer software

Course Contents:

Introduction: Definition of Statistics, Its necessity & importance, Population and Sample, Variable and Constants, Different types of variables, Statistical data, Data Collection and presentation, Construction of Frequency distribution, Graphical presentation of Frequency distribution.

Measures of Central Tendency: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode, Weighted Mean, and Theorems & Problems.

Measures of Dispersion: Range, Standard Deviation, Mean Deviation, Quartile Deviation, Variance, Moments, Skew ness and Kurtosis, Theorems & Problems.

Correlation and Regression: Correlation: Linear Correlation Its measures and significance, Rank Correlation, Theorems & Problems. Regression: Linear and non-linear regression, Least-square method of curve fittings, Theorems & Problems.

Probability and Probability Distributions: Elementary Concepts, Laws of Probability – Additive and Multiplicative Law, Conditional Probability and Bay's theorem, Random Variables, Mathematical Expectation and Variance of a random variable, Theorems & Problems. Binomial distribution, Poisson distribution and Normal distribution – Their properties, uses, Theorems & Problems.

Books:

1. **S.C. Gupta and V.K. Kapoor,** Fundamentals of Mathematical Statistics
2. **Alberto Leon Garcia,** Probability & Random Process for Electrical Engg.
3. **R.N. Shill & S.C. Debnath,** An introduction to the theory of Statistics
4. **M.G. Mostafa,** Methods of Statistics
5. **Murry R. Spiegel,** Theory and problems of Statistics
6. **J.N. Kapoor & H.C. Saxena,** Mathematical Statistics

Course Title: Electronic Circuits-1

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Course Code: ICT-205 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This subject is intended to teach the students the concepts, principles and working of basic electronic circuits. It is targeted to provide a basic foundation for technology areas like communication systems, industrial electronics as well as instrumentation, control systems and electronic circuit design.

Objectives: The objectives of this course are:

- Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.
- Develop the ability to analyze and design analog electronic circuits using discrete components.
- Observe the amplitude and frequency responses of common amplification circuits.
- Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

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

- Explain the theoretical principles essential for understanding theoperation of electronic circuits.
- Measure the characteristics of electronic circuits and presentexperimental results.
- Analyze electrical circuits and calculate the main parameters.
- Develop, design and create simple analogue and digital electronic circuits.
- Choose an engineering approach to solving problems, starting from the acquired knowledge essential for the design of electronic circuits.

Contents:

Theory of Semiconductor: Energy Band Diagram of Conductor, Insulator and Semiconductor, Covalent Bonding in Semiconductors, Semiconductor Materials, intrinsic and extrinsic semiconductor, effects of temperature on extrinsic semiconductors, current in semiconductors.

Diode Applications: Introduction, Rectifier Circuit, Half-wave, Full-wave and Bridge Rectifiers, Clippers, Clampers and Voltage Multiplier Circuit, Filter Circuit, Different types of Filter, Regulated Power Supply, LED, LCD, Varactor Diode, Tunnel Diode, PIN Diode, Photodiodes, solar cells.

Bipolar Junction Transistor (BJT): Introduction, PNP and NPN transistors construction and operation, Biasing and thermal stability; CB, CE and CC configuration and their I/O characteristics, Application to Transistor as amplifier and as a Switch.

Transistor Biasing & Load Line Analysis: Transistor Biasing, Need for biasing a transistor, Factors affecting bias variations, Stability factor, Biasing Rule, Different types of Transistor biasing, Operating Point, Load Line analysis, Stabilization, DC load line, Q-point and maximum undistorted output.

Single and Multistage Amplifiers: Concept of amplification, classification of amplifiers, amplifier notations, Application of BJT as single stage Amplifier, DC and AC equivalent circuit, Load line analysis, Frequency response of single stage Amplifier. **Multistage Amplifiers**- Basics concepts, RC coupled, Transformer coupled, DC amplifier, cascade, Darlington pair.

Field Effect Transistor (FET): Introduction, Types of FET, Construction, Characteristics curve, Principle of operation, Channel conductivity, Channel ohmic and pinch-off region, Characteristics parameter of the FET, Effect of temperature on FET, Depletion type and Enhancement type MOSFET, introduction to CMOS and its application. application of FETs as amplifier and switches.

Power amplifiers: Introduction—Definitions and Amplifier Types, Performance quantities of Power amplifiers, Class-A Operation, Series-Fed Class A Amplifier, Transformer-Coupled Class A Amplifier , Class-B Operation, Class-B Push Pull, Class C and Class D Amplifiers.

Books:

1. **Robert L. Boylestad, L Nashelsky** ,Electronic Devices and Circuit Theory .
2. **Robert L. Boylestad, L Nashelsky** ,A Textbook of Electrical Technology Vol-I to IV
3. **V. K. Mehta** ,Principle of Electronics.
4. **A. P. Malvino** ,Principle of Electronics
5. **Gupta & Kumar** ,Hand Book of Electronics
6. **Thomas L. Floyd** , Electronic devices
7.

Course Title: Discrete Mathematics

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Course Code: ICT-207 **Course Credit: 3.0** **Full Marks: 100**
Hours/Week:3
(Final: 60, Before Final:40)

Rationale: Discrete methods underlie the areas of data structures, computational complexity and the analysis of algorithms. Recent advances in technology - particularly in applications of computing - have enhanced the importance of discrete mathematics as a basis for understanding the foundations of computing and for further studies in computer analysis.

Objectives: To introduce students to language and methods of the area of Discrete Mathematics. The focus of the module is on basic mathematical concepts in discrete mathematics and on applications of discrete mathematics in algorithms and data structures. To show students how discrete mathematics can be used in modern computer science.

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

- Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
- Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.
- Be able to use effectively algebraic techniques to analyse basic discrete structures and algorithms.
- Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
- Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

Course Contents:

Set Theory, Relations and Functions: Set theory – Definitions and Set Identities, Venn Diagrams, Operations of Sets; Relations – Definition, Inverse Relation, Composition, Types of Relations, Closure Properties, Equivalence Relations, Partial Ordering; Functions– Functions as Relations, Composition of function, One-to-One, Onto, and Inverse function.

Propositional and Predicate Logic: Propositions and Compound Propositions, Basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions, Logical Equivalence; Predicate and Quantifiers, Interpretations (models) of predicate logic, Predicate calculus.

Counting: Basic Counting principle, Permutation, Combination, Pigeonhole Principle, Inclusion-Exclusion principle.

Basic Notions and Algorithms on Graph: Graphs and Multigraph, Subgraphs, Isomorphic Graphs and Homeomorphic Graphs, Paths and Connectivity, Labeled and Weighted Graphs, Tree Graphs, Planar Graphs, Graph Coloring, Euler Graphs, BFS, DFS. Dijkstra's Algorithm, Checking whether a graph is Euler graph.

Grammars and Languages: Definition of Formal Language, Words and Subwords, Languages – Operations on Languages, Regular Expressions and Regular Languages, Finite State Automata – Pumping and Kleene Theorem, Phrase-structure Grammars – Types of Grammars, Derivation Tree, Backus-Naur form.

Latices: Order Sets, Lattices as Partially Ordered Sets and Their Properties, Lattices and Algebraic Systems, Sub Lattices, Complimented, Bounded and Distributive Lattices, Direct Products and Homomorphism.

Books

1. **Seymour Lipschutz& Marc Laris Lipson**, Theory and Problems of Discrete Math.
2. **Kenneth H.Rosen**, Discrete Mathematics and its Applications.
3. **Olympia Nicodemi**, Discrete Mathematics.
4. **Knuth**, Concrete Mathematics.
5. **Donald F. Stanat& David F. McAllister**, Discrete Mathematics in Computer Science.

Course Title: Data Structures

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Course Code: ICT-209 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The study of data structure is an essential part of computer science. Data structure is a logical mathematical model of storing & organizing data in a particular way in a computer. In system programming application programming the methods & techniques of data structures are widely used. The study of data structure helps the students in developing logic & structured programs.

Objectives: The objectives of this course are:
To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms. In addition, another objective of the course is to develop effective software engineering practice, emphasizing such principles as decomposition, procedural abstraction, and software reuse.

Learning Outcomes: After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms.
- Describe applications for arrays, records, linked structures, stacks, queues, trees, and graphs.
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees.
- Compare alternative implementations of data structures with respect to performance.
- Compare and contrast the benefits of dynamic and static data structures implementations.
- Describe the concept of recursion, give examples of its use, describe how it can be implemented using a stack.
- Design and implement an appropriate hashing function for an application.
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.

Course Contents:
Introduction and Preliminaries: Basic Terminology; Elementary Data Organization; Data Structures; Data Structure Operations; Mathematical Notation and Functions; Algorithmic Notation; Control Structures; Complexity of Algorithms; Subalgorithms; String Operations; Word Processing; Pattern Matching Algorithms-First and Second Pattern Matching Algorithms.

Arrays, Records and Pointers: Types of Data Structures; Linear Arrays; Representation of Linear Arrays in Memory; Traversing Linear Arrays; Inserting and Deleting; Multidimensional Arrays; Pointer Arrays; Record Structures; Parallel Arrays; Matrices; Sparse Matrices.

Sorting and Searching: Complexity of Sorting Algorithms; Bubble Sort; Insertion Sort; Quick Sort; Heap Sort. Linear Search; Binary Search.

Linked Lists: Definition; Representation of Linked Lists in Memory; Traversing a Linked List; Searching a Linked List; Memory Allocation; Garbage Collection; Insertion into a Linked List; Deletion from a Linked List; Header Linked Lists; Polynomials; Two-Way Lists; Operations on Two-way Lists

Stacks, Queues, and Recursion: Stacks and Postponed Decisions; Array Representation of Stacks; Minimizing Overflow; Arithmetic Expressions; Polish Notation; Evaluation of a Postfix Expression; Transforming Infix Expressions into Postfix Expressions; An Application of Stacks. Representation of Queues; Insert and Delete of Queues; Deques and its Insertion Deletion Operations; Priority Queues. Recursion Definitions and Factorial Function; Fibonacci Sequence; Divide-and-Conquer Algorithms; Towers of Hanoi; Implementation of Recursive Procedures by Stacks;

Tree: Binary Trees; Terminology; Complete Binary Trees; Extended Binary Trees. Representing Binary Trees in Memory; Traversing Binary Trees; Traversal Algorithms-Preorder Traversal, Inorder Traversal; Postorder Traversal. Binary Search Trees; Searching and Inserting in Binary Search Trees; Application of Binary Search Trees; Deleting in a Binary Search Tree. Heap; Heapsort; Inserting into a Heap; Deleting the Root of a Heap; Complexity of Heapsort. Path lengths; Huffman's Algorithm; Computer Implementaiton of Huffman's Algorithm; Application to Coding. General Trees.

Graphs: Graphs Theory Terminology-Graphs, Multigraphs, Directed Graph. Sequential Representation of Graphs; Adjacency matrix; Path matrix, Warshall's Algorithm, Shortest Path Algorithm. Linked Representation of a Graph; Operations on Graphs: Insertion of an Edge or a Node, Deletion of an Edge or a Node. Traversing a Graph: Breadth First Search, Depth First Search. Posets: Topological Sorting. Spanning Trees and Connected Component. Finding Minimum Cost Spanning Tree using Prim's Algorithm.

Books:

1. **Edward M. Reinggold**, Data structures
2. **Robert Sedgwick**, Algorithms in C
3. **Horowitz E and Sahni S Galgotia**, Fundamentals of Data Structures.
4. **Niklauswirth**, Algorithms and Data Structures.
5. **S. Lipschetz**, Data Structure
6. **Y. Langsam, Augenstein, A. M. Tanenbaum** , Data Structures using C and C++

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Course Title: Electronics Circuits-1 Lab
Course Code: ICT-206 **Course Credit: 1.00** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: After completing this course satisfactorily, a student will be able to:

- Design a complete electronic circuit system using a top-down approach which starts from system specifications,
- Model the design using such tools as PSpice and MatLab,
- Build the circuit,
- Test the completed circuit and verify that it meets design specifications.

Course Contents:

n-and p-type semiconductors, Majority and Minority Carriers, p-n junction diodes and their volt-ampere characteristics, diode models, Zener diode, Rectifier Circuit, Half-wave, Full-wave and Bridge Rectifiers, Clippers, Clampers and Voltage Multiplier Circuit, Filter Circuit, Different types of Filter, Regulated Power Supply, LED, LCD, Varactor Diode, Tunnel Diode, PIN Diode, Photodiodes, solar cells, PNP and NPN transistors construction and operation, Biasing and thermal stability; CB, CE and CC configuration and their I/O characteristics, Transistor Biasing, Need for biasing a transistor, FET Characteristics curve, Principle of operation, Channel conductivity, Channel ohmic and pinch-off region, Characteristics parameter of the FET, Effect of temperature on FET, Depletion type and Enhancement type MOSFET, introduction to CMOS and its application. application of FETs as amplifier and switches.

Application of BJT as single stage Amplifier, DC and AC equivalent circuit, Load line analysis, Frequency response of single stage Amplifier, Performance quantities of Power amplifiers, Class-A Operation, Series-Fed Class A Amplifier, Transformer-Coupled Class A Amplifier , Class-B Operation, Class-B Push Pull, Class C and Class D Amplifiers.

Books:

1. **Robert L. Boylestad, L Nashelsky** ,Electronic Devices and Circuit Theory .
2. **Robert L. Boylestad, L Nashelsky** ,A Textbook of Electrical Technology Vol-I to IV
3. **V. K. Mehta** ,Principle of Electronics.
4. **A. P. Malvino** ,Principle of Electronics
5. **Gupta & Kumar** ,Hand Book of Electronics
6. **Thomas L. Floyd** , Electronic devices

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Course Title: Data Structures Lab
Course Code: ICT-210 **Course Credit: 1.00** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: After completing this course satisfactorily, a student will be able to:

- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees.
- Compare alternative implementations of data structures with respect to performance.
- Compare and contrast the benefits of dynamic and static data structures implementations.
- Describe the concept of recursion, give examples of its use, describe how it can be implemented using a stack.
- Design and implement an appropriate hashing function for an application.
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.

Course Contents:

Traversing Linear Arrays; Inserting and Deleting. Bubble Sort; Insertion Sort; Quick Sort; Heap Sort. Linear Search; Binary Search. Traversing a Linked List; Searching a Linked List; Insertion into a Linked List; Deletion from a Linked List. Stacks and Postponed Decisions; Evaluation of a Postfix Expression; Transforming Infix Expressions into Postfix Expressions; Queues; Insert and Delete of Queues. Recursion, Factorial Function; Fibonacci Sequence; Divide-and-Conquer Algorithms; Towers of Hanoi; Implementation of Recursive Procedures by Stacks; Binary Trees; Complete Binary Trees; Extended Binary Trees. Traversing Binary Trees; Traversal Algorithms-Preorder Traversal, Inorder Traversal; Postorder Traversal. Binary Search Trees; Searching and Inserting in Binary Search Trees; Deleting in a Binary Search Tree. Heapsort; Inserting into a Heap; Deleting the Root of a Heap. Huffman's Algorithm. Adjacency matrix; Path matrix, Warshall's Algorithm, Shortest Path Algorithm. Linked Representation of a Graph; Operations on Graphs: Insertion of an Edge or a Node, Deletion of an Edge or a Node. Traversing a Graph: Breadth First Search, Depth First Search. Posets: Topological Sorting. Spanning Trees and Connected Component. Finding Minimum Cost Spanning Tree using Prim's Algorithm.

Books:

1. **Edward M. Reinggold**, Data structures
2. **Robert Sedgwick**, Algorithms in C
3. **Horowitz E and Sahni S Galgotia**, Fundamentals of Data Structures.
4. **Niklaus wirth**, Algorithms and Data Structures.
5. **S. Lipschetz**, Data Structure
6. **Y. Langsam, Augenstein, A. M. Tanenbaum** , Data Structures using C and C++

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Second Year First Semester

Course Title: Mathematics-III

Course Code: ICT-301 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Rationale: This course is aimed to provide an introduction to the theories for functions of a complex variable. It begins with quick review on the exploration of the algebraic, geometric and topological structures of the complex number field.

Objectives: The aim of this course is to introduce complex functions and their applications. Students learn about analytical functions, complex integration, classification of singularities etc. They would also learn conformal mappings. Some special functions and their applications will also be introduced.

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

- Solve linear differential equations using power-series methods.
- Approximate polynomials in terms of legendre, bessel, chebyshev.
- Solve real definite integrals using cauchy's residue theory.

Course Contents:

Concept of Analytic Functions: Complex Numbers, Complex Planes, Complex Functions; Analytic Functions; Entire Functions; Harmonic Functions; Elementary Functions: Complex Exponential, Logarithmic and Hyperbolic Functions.

Infinite Series: Power Series, Derived Series, Radius of Convergence; Taylor Series and Laurent Series.

Conformal Representation: Transformation, Conformal Transformation; Linear Transformation; Möbius Transformations.

Complex Integration and Argument Principles: Complex Integrals; Cauchy-Goursat Theorem; Cauchy's Integral Formula and their Consequences; Liouville's Theorem; Morera's Theorem - The Converse of Cauchy's Theorem; Derivative of an Analytic Function; Lorentz Theorem; Differentiation of Complex Functions; Residue Theorem; Evaluation of Definite Integrals; Mittag–Leffler's Expansion Theorem. Argument Theorem; Rouche's Theorem.

Special Functions: Gamma and Beta functions; Bessel functions; Orthogonal functions; Legendre, Leaguer; Chebyshev and Hermite polynomials. Hypergeometric Function; Zeta Function; Elliptic Functions.

Books:

1. **D. G. Zill and P. D. Shanahan**, Complex Analysis, (Jones and Bartlett Publishers)
2. **H. S. Kasana**, Complex Variables: Theory and Applications, (Prentice Hall)
3. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, (McGraw Hill)
4. **M. R. Spiegel**, Complex Variables, (McGraw Hill)
5. **Louis L. Pennisi**, Elements of Complex Variables, (Holt, Linehart and Winston)
6. **M. R. Spiegel, S. Lipschutz, J. J. Schiller, D. Spellman**, Complex Variables, (Schaum's Series, McGraw Hill)
7. **ShahnazBathul**, Special Functions and Complex Variables (Eng. Mathematics III)
8. **M. L. Khanna**, Functions of a Complex Variable, (Jai PrakashNath& Co)

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Course Title: Object Oriented Programming with C++

Course Code: ICT-303 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale

C++ is an important language to learn because of its compact syntax and ability to interact with hardware directly. Because compiled C++ interacts directly with the hardware it is running on, C++ is a good choice for programmers that are writing drivers for custom hardware. In addition, due its high-performance C++ is also a good choice for programming games that utilize fast-paced 3D graphics. Finally, this course provides another example of how object-oriented programming has been realized, and this presents an excellent opportunity for comparing and contrasting languages such as Java. C++ is used frequently in areas such as game development, hardware manufacturing, embedded systems, and for military applications.

Objectives: The objectives of this course are:

- To learn how to implement copy constructors and class member functions.
- To understand the concept of data abstraction and encapsulation.
- To learn how to overload functions and operators in C++.
- To learn how containment and inheritance promote code reuse in C++.
- To learn how inheritance and virtual functions implement dynamic binding with polymorphism.

Learning outcomes:

Upon completion of this course, students should be able to:

- explain how an existing C++ program works
- discover errors in a C++ program and describe how to fix them
- critique a C++ program and describe ways to improve it
- analyze a problem and construct a C++ program that solves it

Course Contents:

C++ Basics: Introduction to C++ **,** the origin of C++, Basic structure of C++ programs, Variables, constants, operators and expressions, data types, Program control statements, recursion, Arrays and strings, pointers, Advanced data types, access modifiers, pointer to function, dynamic memory allocation, User defined data types, advanced operators.

Concepts of object oriented programming: objects, Classes, Inline functions, friend functions, passing object to functions, arrays of objects, References, Dynamic allocation using new and delete, Static class members, virtual functions and polymorphism.

Constructor and destructor: parameterized constructors, multiple constructors in class, copy constructors, destructors

Overloading: Function and operator overloading, overloading constructor functions, Rules for overloading operators.

Inheritance: Single Inheritance, Multiple Inheritance, multilevel Inheritance, Hierarchical Inheritance.

I/O operations and File: C++'s I/O class library, C++ streams, creating insertors and extractors, formatting I/O, file I/O, C++'s complex and BCD classes, the message based philosophy, using C++'s memory model, Using VROOMM overlay technology, Using command line compiler, compiling multiple file program.

Books:

1. **Balagurusamy**, "Object-Oriented Programming with C++"
2. **Herbert Schildt**, "Teach yourself C++"
3. **Robert Lafore**, "Object Oriented Programming in C++"
4. **Irvine,** "C++ Object Oriented Programming"

Course Title: Electronic Circuits-1I

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Course Code: ICT-305 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This subject is intended to teach the students the concepts, principles and working of basic electronic circuits. It is targeted to provide a basic foundation for technology areas like communication systems, industrial electronics as well as instrumentation, control systems and electronic circuit design.

Objectives: The objectives of this course are:

- Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.
- Develop the ability to analyze and design analog electronic circuits using discrete components.
- Observe the amplitude and frequency responses of common amplification circuits.
- Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

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

- Explain the theoretical principles essential for understanding theoperation of electronic circuits.
- Measure the characteristics of electronic circuits and presentexperimental results.
- Analyze electrical circuits and calculate the main parameters.
- Develop, design and create simple analogue and digital electronic circuits.
- Choose an engineering approach to solving problems, starting from the acquired knowledge essential for the design of electronic circuits.

Contents:

Theory of Semiconductor: Energy Band Diagram of Conductor, Insulator and Semiconductor, Covalent Bonding in Semiconductors, Semiconductor Materials, intrinsic and extrinsic semiconductor, effects of temperature on extrinsic semiconductors, current in semiconductors.

Diode Applications: Introduction, Rectifier Circuit, Half-wave, Full-wave and Bridge Rectifiers, Clippers, Clampers and Voltage Multiplier Circuit, Filter Circuit, Different types of Filter, Regulated Power Supply, LED, LCD, Varactor Diode, Tunnel Diode, PIN Diode, Photodiodes, solar cells.

Bipolar Junction Transistor (BJT): Introduction, PNP and NPN transistors construction and operation, Biasing and thermal stability; CB, CE and CC configuration and their I/O characteristics, Application to Transistor as amplifier and as a Switch.

Transistor Biasing & Load Line Analysis: Transistor Biasing, Need for biasing a transistor, Factors affecting bias variations, Stability factor, Biasing Rule, Different types of Transistor biasing, Operating Point, Load Line analysis, Stabilization, DC load line, Q-point and maximum undistorted output.

Single and Multistage Amplifiers: Concept of amplification, classification of amplifiers, amplifier notations, Application of BJT as single stage Amplifier, DC and AC equivalent circuit, Load line analysis, Frequency response of single stage Amplifier. **Multistage Amplifiers**- Basics concepts, RC coupled, Transformer coupled, DC amplifier, cascade, Darlington pair.

Field Effect Transistor (FET): Introduction, Types of FET, Construction, Characteristics curve, Principle of operation, Channel conductivity, Channel ohmic and pinch-off region, Characteristics parameter of the FET, Effect of temperature on FET, Depletion type and Enhancement type MOSFET, introduction to CMOS and its application. application of FETs as amplifier and switches.

Power amplifiers: Introduction—Definitions and Amplifier Types, Performance quantities of Power amplifiers, Class-A Operation, Series-Fed Class A Amplifier, Transformer-Coupled Class A Amplifier , Class-B Operation, Class-B Push Pull, Class C and Class D Amplifiers.

Books:

8. **Robert L. Boylestad, L Nashelsky** ,Electronic Devices and Circuit Theory .
9. **Robert L. Boylestad, L Nashelsky** ,A Textbook of Electrical Technology Vol-I to IV
10. **V. K. Mehta** ,Principle of Electronics.
11. **A. P. Malvino** ,Principle of Electronics
12. **Gupta & Kumar** ,Hand Book of Electronics
13. **Thomas L. Floyd** , Electronic devices

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Course Title: Algorithm Design and Analysis

Course Code: ICT-307 **Course Credit: 3.0** **Full Marks: 100**
Hours/Week:3
(Final: 60, Before Final:40)

Rationale: Algorithm is the heart of computer science, the subject has countless practical applications as well as intellectual depth. This course is an introduction to algorithms for learners with at least a little programming experience. The course is rigorous but emphasizes the big picture
of conceptual understanding over low-level implementation of mathematical details.

Objectives: The objectives of this course are:

- To provide the understanding of principles of algorithm
- To use programming principles in problem solving for various algorithm techniques
- To enhance communication social skills through group project

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand and explain the basic design principles for algorithms,
- Learn the basic concepts of algorithms with solid foundations,
- Know a substantial number of basic algorithms use them in problem solving,
- Know the tools for implementing algorithms in C and use them to analyze complex problems,
- Select and design algorithms which are appropriate for problems that they might
- encounter.

Course Contents:

Algorithm and Data structure: Algorithm, Properties of good algorithm, Application Areas of Algorithm. Complexity Analysis of Algorithms, Asymptotic Notations, Recurrences, Insertion Sort and its Complexity Analysis

Divide and Conquer approach & Heaps: Divide and Conquer approach and Merge Sort, Algorithm of Merge Sort, Complexity Analysis Merge Sort, Quick Sort and its Algorithm, Complexity Analysis of Quick Sort, Heap Construction Algorithm, Heap sort, Application of Heap: Priority Queue.

Dynamic Programming: Algorithm of LCS**,** Dynamic Programming, Matrix Chain Multiplication Example, Algorithm of MCM, and Example of Longest Common Subsequence, Complexity Analysis

Greedy Algorithm: Greedy Algorithm, Activity Selection Problem, Huffman Codes and it's application, Knapsack problem, *NP*-Hard and *NP*-Complete Problems, Traveling Salesperson Problem, Complexity Analysis

Graphs basic & traversal techniques: Representation of Graphs, Breadth First Search, Depth First Search, Algorithm of BFS and DFS, Minimum Spanning Tree, Kruskal and Prims Algorithm, Complexity Analysis.

Shortest Path& Backtracking: Single Source Shortest Paths, Dijkstra's Algorithm, and Bellman-Ford Algorithm. All pair Shortest Path, Floyd Warshall Algorithm, Backtracking, *n*-Queen Problem, and Complexity Analysis, Branch and Bounds.

Computational Geometry & Number Theory: Computational Geometry, Line Segment Properties, Convex Hull, Graham Scan Algorithm of Convex Hull, Number Theory, GCD, Modular Arithmetic, Prime Number generation, Complexity Analysis.

References & Books:

1. **Cormen,** Introduction to Algorithms
2. **Horowitz, Shanny,** Computer Algorithms
3. **D. E. Knuth,** The art of Computer Programming
4. **M. Allen,** Data Structure and Algorithm analysis in C++.

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Course Title: Numerical Analysis with MATLAB
Course Code: ICT-309 Course Credit: 3.0 Full Marks: 100 Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The aim of the course is to present a creation, analyzing, and implementation algorithms for obtaining numerical solutions to problems of calculus; selection of a best element (with regard to some criteria) from some set of available alternatives.

Objectives: The objective of the course is teach to

- Find acceptable approximate solutions when exact solutions are either impossible or so arduous and time-consuming as to be impractical
- Devise alternate methods of solution better suited to the capabilities of computers
- Formulate problems in their fields of research as optimization by defining the underlying independent variables, the proper cost function, and the governing constraint functions

Learning Outcomes: After completing this course, students will know how to:

- Use numerical methods for solving a problem
- Locate and use good mathematical software
- Get the accuracy you need from the computer
- Assess the reliability of the numerical results
- Determine the effect of round off error or loss of significance

Course Contents:

Approximations and Errors: Accuracy and precision, Error definitions, Round-off errors, Truncation errors.
Roots of Equations: The bisection method, the false-position method, the iteration method, the Newton-Raphson method.

Direct solution and Iterative solution: Gauss elimination, Gauss Jordan method, Jacobi iteration, Gauss Seidel method

Interpolation: Newton's forward and backward formula for interpolation with equal distance, Newton's divided difference interpolating polynomials, Lagrange interpolating polynomials.

Curve Fitting: Linear regression, Linear curve fitting methods, Least square method, Non-linear curve fitting methods, Polynomial of *n*th degree, Power function, Exponential function, Polynomial regression.

Numerical Differentiation and Integration: Numerical differentiation, The trapezoidal rule, Integration with unequal segments.

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series, Euler's method, Runge-Kutta methods.

Books:

1. **Lipshutz** : Theory and Problems of Discrete Mathematics, Schaum's outline series.
2. **C.L. Liu** : Elements of Discrete Mathematics, 2nd Ed, McGraw-Hill, 1985.
3. **Sharon Ross** : Discrete Mathematical Structure.
4. **S.S. Sastry** : Introductory Methods of Numerical Analysis.

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Course Title: Financial and Managerial Accounting

Course Code: ICT-311 **Course Credit: 2.0** **Full Marks: 50**

Hours/Week:2

(Final:30, Before Final:20)

Rationale: The course covers the financial reporting process and uses of accounting data, linkages between accounting information and management planning, decision making and control. Managerial topics include product costing, cost terminology, budgeting, cost-volume-profit analysis, standard costs and activity based costing.

Objectives:

- To understand the financial statements of an organization, with emphasis on the Income Statement and Balance Sheet.
- To understand, analyze and explain the financial performance of a company and to make managerial decisions using this information.
- To be able to prepare in-depth financial analysis of a company.

Learning Outcomes: After completion of the curse, students should be able to

- Understand and analyze a company's income statement, balance sheet and statement of cash flows
- Understand the impact various decisions or transactions will have on the company's statements and financial health.
- Prepare an analysis of the financial health of a public company using ratio analysis.
- Prepare a detailed financial budget.
- Make decisions using managerial accounting information.
- Be able to comfortably communicate with senior financial and non-financial leaders about financial statement issues and the financial impact of business decisions.

Contents:

Preliminaries: Introduction to Accounting, History and development of accounting thought, types of accounting, Accounting as an information system; computerized system and applications in accounting. Accounting Equation & Transaction Analysis.Introduction to Financial Statements and automation accounting system.

Recording Business Transactions: The Accounts & their types.Double-Entry Book keeping system; Invoice, discount from purchase price, purchase return and allowances, Sale of inventory, sales discount, sales returns and allowances; Journals, ledger & Trial balance.Correcting errors in the trial balance.

The Adjusting & Closing Procedure: The adjusting process, Accrual versus cash basis Accounting, Preparation of Adjusted trial balance and financial statements, Closing entries & Reversing entries. Using accounting information in decision-making.

Accounting in practice: Worksheet. Purchase book, sales book, cashbook, patty cashbook, etc. Control accounts and subsidiary accounts. Bank reconciliation statement.

Cost In General: objectives & classifications; Costing Journals; Job order costing, Process costing & Overhead costing, cost sheet; Cost of goods sold statement.

Marginal & Relevant costing: Marginal costing tools and techniques, cost-volume-profit analysis. Guidelines for decision making. Short-term investment decisions: relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.
Budget: Capital budgeting; Planning, evaluation & control of capital expenditures.

Books:

1. **Charles T. Horngren&walter T. Harrison, Accounting.**
2. **Adolph Matz& Milton F. Usry, Cost Accounting Planning & Control.**
3. **Sankar Prasad Basu&Monilal Das, Practice in Accountancy.**
4. **Jerry J. Weygandt, Donald E. Kieso, Accounting Principles.**
5. **Jay M Smith & K Fred Skousen, Intermediate Accounting.**
6. **Charles T. Horngren&walter T. Harrison, Accounting**
7. **Adolph Matz& Milton F. Usry, Cost Accounting**

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Course Title: Object-oriented Programming with C++ Lab

Course Code: ICT-304 **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

- Learn about the various types of variables such as built-in primitive types, structures and classes.
- Creation, destruction and copying of objects within class hierarchies and apply these concepts in the context of interesting and useful design patterns
- See how operator overloading works and how it can be used for convenience.

Course Contents: Basic structure of C++ programs, Variables, constants, operators and expressions, data types, Program control statements, recursion, Arrays and strings, pointers, Advanced data types, access modifiers, pointer to function, dynamic memory allocation, User defined data types, advanced operators, objects, Classes, Inline functions, friend functions, passing object to functions, arrays of objects, References, Dynamic allocation using new and delete, Static class members, parameterized constructors, multiple constructors in class, copy constructors, destructors, Function and operator overloading, overloading constructor functions, Single Inheritance, Multiple Inheritance, multilevel Inheritance, Hierarchical Inheritance.

Books:

1. **Balagurusamy**, "Object-Oriented Programming with C++"
2. **Herbert Schildt**, "Teach yourself C++"
3. **Robert Lafore**, "Object Oriented Programming in C++"
4. **Irvine,** "C++ Object Oriented Programming

Course Code: ICT-308 **Course Credit: 1.00** **Full Marks: 100**
Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand and explain the basic design principles for algorithms,
- Learn the basic concepts of algorithms with solid foundations,
- Apply a substantial number of basic algorithms by problem solving,
- Know the tools for implementing algorithms in C and use them to analyze complex problems,
- Select and design algorithms which are appropriate for problems that they might encounter.

Course Contents:

Basic foundation of Algorithm and its application areas; Complexity analysis of Algorithm; Fundamentals of Divide & Conquer method, implementation of merge sort, quick sort in programming; Fundamentals of Greedy algorithm, implementation of Huffman codes, Knapsack problem in programming; Traversal techniques, Implementation of BFS, DFS, Prims, Kruskal algorithm in programming; Implementation of Dijkstra's algorithm, and Bellman-Ford algorithm in programming.

Books:

- **Cormen,** Introduction to Algorithms
- **Horowitz, Shanny,** Computer Algorithms
- **D. E. Knuth,** The art of Computer Programming
- **M. Allen,** Data Structure and Algorithm analysis in C++

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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.

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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

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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, & CMOSTL families, basic input output characteristics of digital logic ICs, scaled 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:

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

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

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"

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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.

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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

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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"

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Course Title: Data Communication and Computer Networks

Course Code: ICT-501 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Rationale: The modern world is the era of communication. Without communication the survival is so difficult to explain. So, the main focus of this course to teach students basic data communication principles, data encoding, multiplexing, switching methods, fundamental of computer networks, OSI reference model, network security and so on.

Objectives: The objectives of this course are:

- To ensure students' participation with this basic communication course
- To obtain knowledge data encoding and multiplexing techniques
- To explain switching methods and different protocols
- To gather knowledge about computer networks andlayers of OSI model
- To increase understanding about threats of network and its security

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Realize and explain the basic facts of data communication and computer networks,
- Know how data encoding, multiplexing, and switching works,
- Describe the relationships between communication and network,
- Learn the basics of ATM, frame relay, ISDN, etc.
- Explain different layers within OSI reference model,
- Gather knowledge on network security and its threats.

Course Contents:

Data Encoding & Multiplexing: Sampling principal; Nyquist sampling rate; PAM, PWM, PPM, PCM, DPCM; Delta modulation; A-law & μ -law compandings; ASK, FSK, PSK & QPSK systems; NRZ, Bipolar AMI, Manchester, B8ZS, HDB3 coding; FDM; TDM.

Data Link Control: Flow control; Error detection; Error control; HDLC; Other data link control protocols.

Circuit Switching & Packet Switching: Switching network; Circuit switching network; Circuit switching concepts; Routing in CS; Control signaling; Packet switching principles; Routing in PS; X.25.

ATM and Frame Relay: Protocol architecture; ATM logical connection; ATM cells; Transmission of ATM cells; ATM service categories; ATM adaptation Layer; Frame Relay.

ISDN: Overview; ISDN channels; ISDN protocols; Broadband ISD

Fundamental of computer networks: Uses of computer networks; Network Hardware; Network Software; Reference Models, Transmission & switching; Network protocols; Fiber optic network, Satellite networks, Packet radio networks.

The Physical Layer: the theoretical basis for data communication, Guided transmission media, wireless transmission, communication satellites etc.

The Data link layer: Data link layer design issues, Error detection and correction, Elementary data link protocols. The medium access control sub layer: the channel allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless, Bluetooth etc**.**

The Network layer: Network layer design issues, Routing Algorithms, Congestion Control Algorithms, Quality of service, Internetworking

The Transport layer: The transport service, Elements of transport protocols, A simple transport protocols, UDP, TCP, performance issues.

The Application layer: The Domain Name System, Electronic Mail, World Wide Web, Multimedia etc.

Network Security: Cryptography, Symmetric-key Algorithm, Digital signature, Communication Security, Web
security etc.

References &Books:

1. **William Stallings,** Data and Computer Communications
2. **Prakas C. Gupta,** Data Communications
3. **Andrew S. Tanenbaum,**Computer Networks
4. **Behrouz A. Fourouzan,**Data Communications and Networking,
5. **S. Keshav,**Engineering Approach to Computer Networking

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Course Title: Software Engineering

Course Code: ICT-503	**Course Credit: 3.0**	**Full Marks: 100**	Hours/Week:3
		(Final: 60, Before Final:40)	

Rationale: The purpose of this course is to help students understand the software engineering basics with methods, techniques, models and to focus on how testing, risk management, project management are integrated in this course.

Objectives: The objectives of this course are:

- Knowledge of basic SW engineering methods practices, their appropriate application
- A general understanding of software process models such as the waterfall evolutionary models
- An understanding of the role of project management including planning, scheduling, risk management, etc.
- An understanding of software requirements the SRS document
- An understanding of software testing approaches such as unit testing integration testing
- An understanding of some ethical professional issues that are important for software

Engineers.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Gather specific requirements of the software projects,
- Analyze software requirements with existing tools,
- Differentiate between different testing methodologies,
- Understand and apply the basic project management practices in real life projects,
- Work in a team as well as independently on software projects.

Course Contents:

Software Engineering Paradigms: Defining Software; Software Application Domains; The Changing Nature of Software (Web Apps, Mobile Applications, Cloud Computing); Definition of Software Eng.; Fundamental terms of Software Eng.; Professional & Ethical responsibility of Software Eng.; The classical life cycle.

Software processes: Sociotechnical systems; Software Dependability and security;Software process models; Process activities, Agile Software Development; CASE.

Requirements Engineering**:** Requirements specification; Requirements engineering processes; Requirements elicitation and analysis; Requirements validation.

Software Design Fundamentals: Software Design and implementation,Design process; Design fundamentals; Architectural Design; Object-Oriented Design; Real-time Software Design; User Interface (UI) Design,

Software Testing Techniques and Strategies: Verification and validation; Testing Fundamentals; System Testing; Component Testing; White box testing; Basis path testing; Black Box testing.

Software Management: Project management; Quality management.

References & Books:

1. **Ian Sommerville,** Software Engineering – Eighth & Ninth Edition
2. **Roger S. pressman,** Software Engineering, A Practitioner's Approach - Eighth Edition
3. **Richard Fairley,** Software Engineering Concepts

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Course Title: Microprocessor and Microcontroller

Course Code: ICT-505 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final:60, Before Final:40)

Rationale: The purpose of this course is to teach students the fundamentals of microprocessor and microcontroller systems. Knowledge of microprocessors will provide a quicker grasping and understanding of the internal working and operation of microcontroller based control systems in industry.The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a microprocessor/controller implementation.

Objectives: The objectives of this course are:

- To introduce students with the architecture and operation of typical microprocessors andmicrocontrollers.
- Familiarize the students with the programming and interfacing of microprocessors andmicrocontrollers.
- Provide strong foundation for designing real world applications using microprocessors andmicrocontrollers.

Learning Outcomes:

After successful completion of the course, students should be able to

- Explain themicroprocessor's and Microcontroller's internal architecture and its operation within the area ofmanufacturing and performance.
- Explain the addressing of memory and peripherals in a microprocessor / microcontroller system.
- Examine the construction of CPU, know registers and bus systems.
- Compare microprocessors and microcontroller.
- Design and implement programs on 8086, PIC.
- Design and implement 8051 microcontroller based systems.
- Draw a simple memory schema, explain the planning of memory of microcomputer system.
- Evaluate assembly language programs and download the machine code that will providesolutions to real-world control problems.

Contents:

Introduction: Microprocessors and Microcomputer, Evolution of Microprocessor, Microprocessor Instruction set and Computer language, Microprocessor organization, General architecture of microprocessor and its operation, Memory, Input/Output(I/O) devices, RISC and CISC processors, Co-processors, Parallel processing.

Processor basics: CPU organization, Information and number formats, Instruction set, Instruction format and Instruction types and addressing modes.

Assembly Language Operations: Data movement, arithmetic and logic instructions, flow control, procedures, macros and subroutines.

Intel 8085 Microprocessor: Introduction, Internal Architecture, Register Structure, Memory Addressing, Addressing Modes, Instruction set, 8085 programming model, Instruction Classification, How to write, Assemble and Execute a simple program, Memory Interfacing, Interfacing Output Displays, Interfacing Input Devices.

8086 Microprocessor: properties, architecture, registers, FLAGS register, physical address calculation, addressing modes, Instruction set, Instruction format, Fetch-decode-Execution cycle, interrupt, Types of interrupt, handling interrupt request, interrupt vector and table.

Advanced Microprocessors: Intel 80286 architecture, 80286-memory management, Protection; Intel 80386 functional diagram; 80386 modes; Multi programming, 80486 and Pentium microprocessor

I/O operation: Isolated and memory mapped I/O, DMA technique, I/O ports, I/O processor.

Microcontrollers: Introduction, History, Microcontrollers versus microprocessors, Internal architecture, instruction set, microcontroller features, 8051 microcontroller architecture, 8051 addressing modes, 8051 hardware features, 8051 programming

PIC Microcontroller: PIC microcontroller features, PIC 16C6X/7X microcontroller, architecture, memory organization, I/O ports, Interrupts, Timers, A/D I/O.

Peripheral Interfacing: Parallel versus serial transmission, Synchronous and Asynchronous serial data Transmission, Basic concept of Serial I/O, Software controlled asynchronous serial I/O, The 8085-serial I/O Lines: SID and SOD, DMA controllers.

Books:

1. **Sheat and Hebber** : Microprocessor
2. **Mathure** : Microprocessor
3. **Hall, D. V.** : Microprocessor and interfacing -- Tata McGraw Hill Pub. 1986
4. **Ramesh S. Gaonkar** : Microprocessor Architecture, Programming and Applications with the 8085
5. **Rafiquzzaman** : Microprocessor and Microcomputer System Design
6. **NebojsaMatic** : PIC Microcontrollers

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Course Title: Operating System

Course Code: ICT-507 **Course Credit: 3.0** **Full Marks: 100**
Hours/Week:3
(Final: 60, Before Final:40)

Rationale: As Operating System plays a vital role in real world life, the purpose of this course is to ensure the learners to know about its inner structure and functionalities.

Objectives: The objectives of this course are:

- To understand the operating system structure
- To understand processes, process scheduling, threads, CPU scheduling
- To know the use of different management techniques in OS

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Learn the basic design principles of operating system
- Understand the process scheduling algorithms and their comparisons
- Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security
- Select appropriate approaches for building a range of distributed systems
- Know the different management and their tasks

Course Contents:

Operating system concept: Introduction to operating system; Types of operating systems; System Calls; Operating system structures; Virtual Machines; Operating system generation.
Process: Introduction to Process; Process Control; Process Scheduling; Threads; CPU Scheduling; Deadlocks.
Input-Output Management: Principles of I/O hardware and I/O software; Application I/O Interface; Kernel I/O Subsystem.
Memory management: Main Memory (Swapping; Paging; Segmentation; Paging Algorithms); Virtual Memory.
Storage Management: File systems;File structure; File directories, Security and protection techniques; Shared file and file server; File System Implementation, Disk Structure; Disk Management.
Distributed system: Definition; Architecture; Networking; Networking protocols; Distributed File Systems.
Case studies: UNIX, LINUX, MS-DOS, Influential OS, MACH System, WINDOWS.

References & Books:

1. **Abraham Silberschatz, Peter Baer Galvin, Greg Gagne**, Operating System Concepts.
2. **Andrew S. Tanenbaum,** Modern Operating Systems.
3. **Andrew S. Tanenbaum,** Distributed Operating Systems
4. **Denis,** Mastering LINUX

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Course Title: Object Oriented Programming with Java

Course Code: ICT-509 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final:60, Before Final:40)

Rationale: Today, the most likely place you will find Java is on World Wide Web. The web acts as convenient transport mechanism for Java programs and the web's ubiquity has popularized Java as an Internet development tool. Java has shifted the programming paradigm of single machine to distributed network of machines. Any application on World Wide Web can be easily implemented. Internet can have numerous applications and various protocols. This course will enable the students to learn in detail network programming language Java.

Objectives: This course provides an introduction to object oriented programming (OOP) using the Java programming language. Its main objective is to teach the basic concepts and techniques which form the object oriented programming paradigm

Learning Outcomes: Students completing the course should know:

- The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism
- Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java
- How to test, document and prepare a professional looking package for each business project using javadoc.

Course Contents:

Overview of Java: Java and its History; JDK, JRE, Java Virtual Machine (JVM) with Mechanism; Java Buzzwords; OOP principles - Polymorphism, Encapsulation, Inheritance; Installing JDK; Simple Program; Lexical Issues; Java Keywords; Data Types, Variables, Constants, Arrays; Type Conversion, Casting; Operators; Control Statements.

Classes, Objects and Methods: Class Fundamental; Declaring Objects; Controlling Access to Members; Introducing Methods - Set and Get Methods; Constructor – Parameter Passing; Overloading and overriding; Dynamic Method Dispatch; Using final with Inheritance; Enumerations; Important keywords – this, static, final; Inheritance Basics – Superclasses and Subclasses; Polymorphism - Abstract Classes and Methods.

Packages and Interfaces: Defining a package and finding classpath; Access Protection – Default, Public, Private, Protected; Importing Packages; Defining Interfaces and implementing it, Nested Interfaces, Interface Methods.

Exception Handling: When to Use Exception Handling; Java Exception Hierarchy; Uncaught Exceptions; Using try and catch block; throw and throws statements; Multiple catch Clauses.

I/O Stream, String and File Manipulations: I/O Basics-Streams, Byte and Character Streams; Reading Console Input; File – Reading and Writing Files; File Manipulation Classes; String Handling- String Operations, String Methods, StringBuffer and StringBuilder.

Multithreading: Life Cycle of a Thread; Thread Class and Runnable Interface; Thread Priorities; Synchronization; Deadlock; Using Multithreading.

Generics, Lambda Expressions and Applets: What are Generics? Generic Classes; Generic Interfaces; Applet Basics; Lambda Expressions Fundamentals, Functional Interfaces, Block Lambda Expressions, Lambda Exceptions; Life Cycle of Applet; Applet Display Methods; Adapter and Inner Classes.

GUI Layout with Swing and Event Handling: Creating graphical user interfaces with AWT, Managing graphics objects with GUI layout managers, Event handling of various components.

Networking: Socket basics, Socket-based network concepts, Client server basics, Client server algorithm, Socket for client, Socket for server.

Java Database Connectivity: JDBC, JDBC drivers, the JAVA.sql packages, SQL, JDBC connection and executing SQL, The process of building a JAVA application.

Introducing GUI Programming with JavaFX: JavaFX Basics; JavaFX Application Skeleton; Exploring JavaFX Controls; JavaFX Menus.

Advanced Java Programming: Java Servlets and Servlets architectures, RMI, Multimedia, Java Bens, Java server pages.

Books:

1. **Deitel&Deitel,** Java How to Program
2. **P. Naughton and H. Schildt,***The Complete Reference Java 2*,
3. **E. Balagurusamy ,** Programming with Java
4. **SAMS publications ,** Teach Yourself Java-2 in 21 days
5. A primer, **E Balagurusamy,** Programming with Java.

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Course Title: Data Communication & Computer Networking Lab

Course Code: ICT-502 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand the basic concepts of Matlab Programming from the context of Data Communication,
- Develop the understanding about Digital modulation techniques,
- Use analog to digital conversion in real world problem,
- Develop understanding through laboratory activities to solve problems related to key concepts taught in the classroom,
- Develop debugging capability in order to propose apply effective engineering solutions.

Course Contents:

Practical concepts of basic Data Communication fundamentals; Generating signals from different modulation techniques such as Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM) and their differences with respect to characteristics; Generating signals from Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK) and their fundamental differences; Modulation testing on Matlab by evaluating Message frequency, Carrier frequency, Modulation Index.

Books:

- **William Stallings,** Data and Computer Communications
- **Prakas C. Gupta,** Data Communications
- **Andrew S. Tanenbaum,** Computer Networks
- **Behrouz A. Fourouzan ,**Data Communications and Networking,
- **S. Keshav,** Engineering Approach to Computer Networking

Fourth Year Second Semester

Course Title: E-commerce and E-governance

Course Title: Software Engineering Lab

Course Code: ICT-504 **Course Credit: 1.0** **Full Marks: 100**
Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Gather specific requirements of the software projects,
- Analyze software requirements with existing tools,
- Differentiate between different testing methodologies,
- Understand and apply the basic project management practices in real life projects,
- Work in a team as well as independently on software projects.

Course Contents:

Software definition; Software application domains; The changing Nature of Software (Web Apps, Mobile Applications, Cloud Computing); Definition of software engineering; Introduction to designing software and tools; Implementation of requirements specification, requirements engineering processes and requirements elicitation and analysis in design tools; Software Design and implementation, Design process; Design fundamentals; Architectural Design; Object-Oriented Design; Real-time Software Design; User Interface (UI) Design.

Books:

- **Ian Sommerville,** Software Engineering – Eighth & Ninth Edition
- **Roger S. pressman,** Software Engineering, A Practitioner's Approach - Eighth Edition
- **Richard Fairley,** Software Engineering Concepts

Course Title: Microprocessor and Microcontroller Lab

Course Code: ICT-506 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes:

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After successful completion of the course, students should be able to

1. Apply the fundamentals of assembly level programming of microprocessors and microcontroller.
2. Work with standard microprocessor real time interfaces.
3. Troubleshoot interactions between software and hardware.
4. Analyze abstract problems and apply a combination of hardware and software to address the problem;
5. Use standard test and measurement equipment to evaluate digital interfaces.

Course Contents: Assembly language programming of 8086 and 8051 microcontroller, practical training of interfacing the peripheral devices with the 8086 microprocessor, exposure to the operation of typical microprocessor trainer kit and real time applications of Microprocessor as well as microcontroller.

Books:

7. **Barry B. Brey** : The Intel Microprocessors
8. **M. A. Mazidi, R. McKinlay, J. G. Mazidi** : The 8051 Microcontroller and Embedded Systems: Using Assembly and C

Course Title: Operating System Lab

Course Code: ICT-508 **Course Credit: 1.00** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Learn the basic design principles of operating system,
- Understand the process scheduling algorithms and their comparisons,
- Implement different scheduling algorithms in programming,
- Implement Banker's algorithm in programming,
- Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security.

Course Contents:

Operating systems fundamentals, structures and types; System calls, Virtual Machines; Implementation of process control, process scheduling, CPU scheduling algorithms; Practical concepts of Input-Output Management, Memory management, Storage Management; Practical concepts of Distributed systems.

Books:

- **Abraham Silberschatz, Peter Baer Galvin, Greg Gagne**, Operating System Concepts.
- **Andrew S. Tanenbaum,** Modern Operating Systems.
- **Denis,** Mastering LINUX

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Course Title: Object Oriented Programming with Java Lab

Course Code: ICT-510 Course Credit: 1.0 Full Marks: 100
Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Students completing the course should know:

- The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism
- Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java
- How to test, document and prepare a professional looking package for each business project using javadoc.

Course Contents:

Declaring Objects; Controlling Access to Members; Set and Get Methods; Constructor; Overloading and overriding; Inheritance; Enumerations; Defining and importing packages; Creating Exceptions; I/O Stream, String and File Manipulations**;** Thread Class and Runnable Interface; Synchronization; Deadlock; Generics, Lambda Expressions and Applets; GUI Layout with Swing and Event Handling**;** Socket-based network Client server; JDBC connection and executing SQL; JavaFX Application Skeleton; Java Servlets and Servlets architectures, RMI, Multimedia, Java Beans, Java server pages.

Books:

1. **Deitel &Deitel,** Java How to Program
2. **P. Naughton and H. Schildt,***The Complete Reference Java 2*,
3. **E. Balagurusamy ,** Programming with Java
4. **SAMS publications ,** Teach Yourself Java-2 in 21 days
5. A primer, **E Balagurusamy,** Programming with Java.

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Third Year Second Semester

Course Title: Digital Signal Processing

Course Code: ICT-601 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final:60, Before Final:40)

Rationale: This course helps to analyze, synthesize, modify, separate, enhance, and modify various audio, image, video, and communication signals. It forms, compresses and delivers entertainment, games, clever applications (translation, location, music ID, speech recognition, speech generation etc.). It enables, supports, and enhances interfaces between humans, between machines and between humans and machines.

Objectives: The objectives of this course are:

- Identify the signals and systems
- Apply the principles of discrete-time signal analysis to perform various signal operations
- Apply the principles of z-transforms to finite difference equations.
- Apply the principles of Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems
- Apply the principles of signal analysis to filtering
- Use computer programming tools to process and visualize signals

Learning Outcomes: Students are able to:

- Ability to specify the sampling, quantization, and signal conditioning requirements for a given DSP application.
- Ability to creatively design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Ability to estimate spectra of discrete-time signals using the fast Fourier transform (FFT) in MATLAB
- Ability to design finite impulse response (FIR) and infinite impulse response (IIR) discrete-time filters for lowpass, high-pass, bandpass, bandstop, and arbitrary frequency response applications

Course Contents:

Introduction to Digital Signal Processing (DSP): Introduction; Digital Signal Processing; Sampling and Analog-to-Digital Conversion; Discrete Time Signals; Ambiguity in Digital signals; Discrete Time Systems; Application areas for DSP; Key DSP operations: Convolution, Correlation,

The Z-Transform : Introduction to z-Transform; General Results of z-transform; Inverse z-Transform: Inspection Method, Partial Fraction Expansion, Power Series Expansion, Contour Integration; Comparison of inverse z-transform method; Properties of z-transform; Complex Convolution Theorem and Parseval's Relation.

Discrete Fourier Transform and Fast Fourier Transform: Frequency analysis of discrete time signal, properties of DFT, circular convolution method: circle method, Matrix method, DFT-IDFT method, Fast Fourier Transform, Radix-2 FFT Algorithm, Decimation in time FFT algorithm, Decimation in frequency FFT algorithm.

Implementation of Discrete-Time Systems: Introduction; Block Diagram and Signal Flow Graph Representation of Digital Networks; Matrix Representation of Digital Networks; Basic Structures of IIR Systems: Direct Form, Cascade forms, Parallel Form; Transposed Forms; Basic Structures of FIR Systems; Finite Precision Effects; Tellegen's Theorem for Digital Filters and Its Applications.

Design of Digital Filters: Introduction to Digital Filters; Types of Digital Filters: FIR and IIR; Choosing between FIR and IIR Filters: Digital Filter Design Steps; Design of FIR Filters: Design of FIR Filters by Windowing, Design of Optimum Equiripple Linear-Phase FIR Filters Design of IIR Filters: Classical Continuous-Time Low-Pass Filter Approximations, Conversion of Transfer Functions from Continuous to Discrete Time, Frequency Transformations of Low pass Filters.

Books:

1. Introduction to Digital Signal Processing, **Tatsuo Higuchi, Shoukoudou,**
2. Digital Signal Processing, Written by **A.V. Oppenheim and R.W. Schafer**, Translated by **Hikaru Date, Koronasha**
3. Digital Signal Processing -- Principles, Algorithms, and Applications, **J.G. Proakis and D.G. Manolakis,** Third Edition, ISBN 0-13-394338-9, Prentice Hall, 1996
4. Computer-Based Exercises for Signal Processing Using MatLab, **C.S. Burrus and et al**, ISBN 0-13-364845-1, Prentice Hall, 1994.
5. Digital Signal Processing-Poornachandra.

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Course Title: Digital Communication
Course Code: ICT-603 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The course is an introduction to modern digital communications at a senior undergraduate level. The primary goal of the course is to provide the student an understanding of the principles, techniques, trade-offs, and fundamental limits in modern digital communication systems. This course introduces the fundamentals of digital signaling, information theory and coding, digital transmission and reception.

Objectives: The objectives of this course are:
To understand the key modules of digital communication systems with emphasis on digital modulation techniques. To get introduced to the concept and basics of information theory and the basics of source and channel coding/decoding.

Learning Outcomes: Students are able to:

- Apply the knowledge of statistical theory of communication and explain the conventional digital communication system
- Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise
- Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code
- Describe and analyze the digital communication system with spread spectrum modulation
- Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for digital modulators and demodulator using hardware components and communication systems using CAD tool

Course Contents:

Introduction to Digital Communication Systems: Digital Communication Sources, Transmitters, Transmission Channels and Receivers, Distortion, Noise and Interference, Nyquist Sampling Theory, Sampling of Analog Signals, Spectrum of Sampled Signal, Sampling Theorem for Band-limited Signals, Effects of Aliasing, Reconstruction of Sampled Signals.

Baseband Pulse and Digital Signaling: Pulse Amplitude Modulation (PAM), Bandwidth Requirements and Reconstruction Methods, Pulse Duration Modulation (PDM), Generation of PDM Signals and Reconstruction Methods. Analog to Digital Conversion, Quantization and Encoding Techniques, Pulse Code Modulation (PCM), Quantization of Noise in PCM, Companding in PCM Systems, Differential PCM(DPCM), Delta Modulation(DM), Adaptive DM(ADM),

Multiplexing: Time Division Multiplexing (TDM), Synchronous TDM, Statistical TDM, TDM Hierarchy, The T1 PCM System, Synchronization.
Line Codes and Spectra: Different Types of Line Codes and Spectra, Eye Pattern, Regenerative Repeater.

Digital Modulation Techniques: Band Pass (modulated) Digital Data Systems, Binary Digital Modulation, ASK, PSK, DPSK and FSK. M-array Data Communication Systems, Quadrature Amplitude Modulation (QAM) Systems, Four Phase PSK, Probability of Error Expression for Binary Communications, Probability of Error in QAM Systems, Comparison of Digital Modulation systems.

Books:
1. R. E.Ziemer/W H Tranter ,Principles of Communication Fifth Edition.
2. Wayne Tomasi, Morden Electronic communication Systems. Person Education /PHI
3. John G Proakis, Digital Communication. MGH
4. Hindey Lindsey ,Digital Communication Techniques Simon , PHI
5. Simon Haykin,Communication Systems, John Wiley & Sons. Pvt. Ltd.
6. Taub& Schilling, Principles of Communication Systems, Tata McGraw-Hill
7. K Sam Shanmugam. John Weily ,Digital and Analog Communication System
8.Proakis,Communication Systems Engineering, Pearson Education.
9. Leon W Couch, Digital & Analog Communication System- Pearson Education/PHI.
11. M S Roden ,Analog And Digital Communication PHI
12. Wilson,Digital modulation and coding . Pearson Education
13. Wells, Applied coding and information Theory for engineers , Pearson education.

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Course Title: Mobile Application and Game Development

Course Code: ICT-605 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This course is best suited for Java developers who are seeking to master the Android API and best practices. Throughout the course, the students develop a real-life application, which can serve as a basis for their future Android projects.

Objectives: The objective of this course is to learn about:

- Mobile devices types
- Modern mobile operating systems
- Data transmission standards
- Systems for mobile application distribution
- How to prepare for mobile application development

Learning Outcomes: In terms of knowledge:

- Student knows mobile devices and mobile platforms
- Student has knowledge concerning mobile operating systems and their architecture
- Student is familiar with wireless communications standards and data transmission standards
- Student knows how to prepare a mobile application for distribution

Course Contents:

Introduction: What is Android? Obtaining the Required Tools, Creating Your First Android Application, Anatomy of an Android Application.
Activities, Fragments, and Intents: Understanding Activities, Linking Activities Using Intents, Fragments, Calling Built-In Applications Using Intents, Displaying Notifications.
Designing Android User Interface with Views: Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Managing Changes to Screen Orientation, Creating the User Interface, Listening for UI. Using Basic Views, Picker Views, List Views to Display Long Lists, Specialized Fragments.
Pictures, Menus and Data Persistence: Using Image Views to Display Pictures, Using Menus with Views, Some Additional Views. Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases.
Content Providers, and Messaging: Sharing Data in Android, Using a Content Provider, Creating Your Own Content Providers, Using the Content Provider. SMS Messaging, Sending E-mail.
Location-Based Services, and Networking: Displaying Maps, Getting Location Data, Monitoring a Location, Project — Building a Location Tracker. Consuming Web Services Using HTTP, Consuming JSON Services, Sockets Programming.
Developing Android Services, and Publishing Android Applications: Creating Your Own Services, Establishing Communication between a Service and an Activity, Binding Activities to Services, Understanding Threading. Preparing for Publishing, Deploying APK Files.

Books:

1. **Wei-Meng Lee:** "Beginning Android™ Application Development," John Wiley & Sons, Inc.
2. **Mark L. Murphy:** "The Busy Coder's Guide to Android Development".
3. **DonnFelker**: "Android Application Development For Dummies," Wiley Publishing, Inc.
4. **Mark L. Murphy:** "Android Programming Tutorials".
5. **J. F. DiMarzio**"Beginning Android™ Programming with Android Studio".
6. **Reto Meier:** "Professional Android™ 4 Application Development," John Wiley & Sons, Inc.
7. Introduction to Android | Android Developers "https://developer.android.com/ guide/index.html"

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Course Title: Information Theory and Coding

Course Code: ICT-607	**Course Credit: 3.0**	**Full Marks: 100**	Hours/Week:3 **(Final: 60, Before Final:40)**

Rationale: The purpose of this course is to deepen students' participation with variousinformation theories and coding designs. To focus on entropy, mutual information, probability, error correcting codes, convolution codes, different channels and channel capacity etc.

Objectives: The objectives of this course are:

- To provide the basic understanding of information theory
- To use various methods of entropy rates of stochastic process
- To enhance students' fundamental skill on error correcting codes and convolution codes
- To facilitate students' knowledge on channels and channel capacity

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand basics of various information theory,
- Summarize the fundamental features of coding designs,
- Realize different entropy rates to solve problems,
- Writelinear block error correcting codes and convolution codes,
- Know channels and channel capacity.

Course Contents:

Information Theory: Basic concept of information; Entropy; Information rate; Channel capacity.

Entropy, Relative Entropy, and Mutual Information: Entropy; Joint Entropy and Conditional Entropy; Relative Entropy and Mutual Information; Relationship between Entropy and Mutual Information; Chain Rules for Entropy; Relative Entropy and Mutual Information;

Entropy Rates of a Stochastic Process: Markov Chains; Entropy Rate; Entropy Rate of a Random Walk on a Weighted Graph; Functions of Markov Chains

Linear Block Error Correcting Codes: General considerations; Binary fields and binary vector spaces; Linear block codes; Decoding Linear block codes; Hamming codes; Error rate performance bounds for linear block; Performance of bounded-distance becoders with repear requests.

Convolutional codes: Definition of convolutional codes; Structural properties of convolutional codes; The Viterbi algorithm; Some known good convolutional codes; Soft decision decoding; The Trace back method of Viterbi decoding; Punctured convolutional codes.

Channels and Channel Capacity: Noiseless Binary Channel; Noisy Channel with Nonoverlapping Outputs; Binary Symmetric Channel; Binary Erasure Channel; Symmetric Channels; Properties of Channel Capacity; Preview of the Channel Coding Theorem; Jointly Typical Sequences; Channel Coding Theorem; Zero-Error Codes; Fano's Inequality and the Converse to the Coding Theorem; Equality in the Converse to the Channel Coding Theorem; Feedback Capacity; Source–Channel Separation Theorem.

References &Books:

1. **Richard B. Wells,** Applied coding and information theory for engineers
2. **TM Gover, JM Thomos,** Elements of Information Theory
3. **Roberto Togneri and Christopher J.S. deSilva,** Fundamentals of Information Theory and Coding Design

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Course Title: Telecommunication Engineering

Course Code: ICT-609 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Rationale: This course focuses on the study of transmission of signals, signs, writings, words, messages, sounds and images, by radio, wire, optical, or other types of electromagnetic systems.

Objectives: The objectives of this course are:

- To familiarize the student with the design, analysis operation and management of modern Telecommunications networks.
- To introduce the parameters of network trafficTo teach time and frequency domain techniques for estimating speech parameters
- To introduce speech recognition and speech synthesis applications
- To introduce the basics of picture transmission and reception, analysis and synthesis of composite video signal, receiver and picture tubes and television camera tubes.
- To study various colour television systems with greater emphasis on television standards
- To introduce most latest and revolutionary ideas in the field of digital TV, HDTV.

Learning Outcomes: Students are able to:

- Understand basic of telecommunication, networking and information technologies
- Architect and implement networked informative systems.
- Demonstrate applications of signal processing theory for estimation of speech parameters in time and frequency domain including pitch and formants
- Analyze application of speech processing in speech compression, speech recognition, and speech synthesis
- Understand the fundamental concepts of television transmitter and receiver systems, the transmission of video signals and importance of television standards to effectively work with broadcasting applications, trouble shooting of television systems.
- Understand different colour television systems used worldwide and its compatibility.
- Understand principles of digital video and component video signal.
- Understand advanced TV technology, MAC signals and DTH technology.

Course Contents:

Introduction: Evolution of Telecommunications, Simple Telephone Communications, Basics of Switching System, Manual Switching System, Major Telecommunication Networks.

Crossbar Switching: Principles of Common Control, Touch Tone Dial Telephone, Principles of Cross Bar Switching, Cross Bar Switch Configurations, Cross Point Technology, Cross Bar Exchange Organization.

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability.

Speech Digitization and Transmission: Sampling, Quantization and Binary Coding, Quantization of Noise, Companding, Differential Coding, Vocoders, Time Division Multiplexing. Configurations, Cross Point Technology, Cross Bar Exchange Organization.

Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching.

Telephone Networks: Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering and Charging Plans, Signaling Techniques, In-channel and Common Channel Signaling, Cellular Mobile Communication.

Television Broadcasting System: Sound and picture transmission; Standard TV channels; Vision characteristics and scanning systems; Introduction to PAL, SECAM and NTSC systems; Optical and Magnetic recording Magnetic video discs and slow motion; Introduction to CATV and CCTV.

HDTV: Introduction, Principle, Standards and Applications, TV Transmitting and Receiving antennas, Design of TV Studio, TV Booster, Digital TV and Multimedia Applications, Satellite Broadcasting Home TV System, Cable TV System.

Telegraph: Introduction to facsimile system; Scanning; Recording; Facsimile transmission & reception; Submarine cable telegraphy; E-mail.

Books:

1. Basic Television and video system, **Bernard Grob**
2. Telecommunication switching system and networks, **Viswanathan**
3. Communication Electronics, **Frenzel**
4. Electronics Communication, **Roddy and Coler**
5. Communication system, **S. Haykin, John Wiley**
6. Digital Telephony, **J. Bellamy**

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Course Title: Digital Signal Processing Lab

Course Code: ICT-602 **Course Credit: 1.0** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Learning Outcomes: Student completing this course should, be able to:

- Use Matlab to create, display, and analyze signals in the time-domain
- Use Matlab to analyze and display signals in the frequency-domain using the FFT algorithm to model the DTFT as well as for spectral analysis using the DFT
- Perform convolution and simulate LTI systems and difference equations
- Plot pole-zero diagrams for LTI systems with rational transforms, use Matlab to study properties of the z-transform and its relationship to stability
- Determine and plot the frequency response of LTI systems
- Design FIR and IIR Filters using Matlab to meet specifications on their frequency response using window design, frequency sampling design, and the bilinear transformation
- Use Matlab to apply the above methods to process real data for image and signal processing applications

Course Contents:

Sampling and Analog-to-Digital Conversion; Discrete Time Signals; Ambiguity in Digital signals; Convolution, Correlation, General Results of z-transform; Inverse z-Transform: Inspection Method, Partial Fraction Expansion, Power Series Expansion, Contour Integration; Comparison of inverse z-transform method; Properties of z-transform; Frequency analysis of discrete time signal, properties of DFT, circular convolution method: circle method, Matrix method, DFT-IDFT method, Fast Fourier Transform, Radix-2 FFT Algorithm, Decimation in time FFT algorithm, Decimation in frequency FFT algorithm,Digital Filter Design Steps; Design of FIR Filters: Design of FIR Filters by Windowing, Design of Optimum Equiripple Linear-Phase FIR Filters Design of IIR Filters: Classical Continuous-Time Low-Pass Filter Approximations, Conversion of Transfer Functions from Continuous to Discrete Time, Frequency Transformations of Low pass Filters.

Books:

1. Introduction to Digital Signal Processing, **Tatsuo Higuchi, Shoukoudou,**
2. Digital Signal Processing, Written by **A.V. Oppenheim and R.W. Schafer**, Translated by **Hikaru Date, Koronasha**
3. Digital Signal Processing -- Principles, Algorithms, and Applications, **J.G. Proakis and D.G. Manolakis,** Third Edition, ISBN 0-13-394338-9, Prentice Hall, 1996
4. Computer-Based Exercises for Signal Processing Using MatLab, **C.S. Burrus and et al**, ISBN 0-13-364845-1, Prentice Hall, 1994.
5. Digital Signal Processing-Poornachandra.

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Course Title: Digital Communication Lab
Course Code: ICT-604 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Students are able to:

- Apply the knowledge of statistical theory of communication and explain the conventional digital communication system
- Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise
- Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code
- Describe and analyze the digital communication system with spread spectrum modulation
- Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for digital modulators and demodulator using hardware components and communication systems using CAD tool

Course Contents:

Signal Sampling and reconstruction, Pulse Amplitude Modulation (PAM), Pulse Duration Modulation (PDM), Generation of PDM Signals and Reconstruction Methods. Analog to Digital Conversion, Quantization and Encoding Techniques, Pulse Code Modulation (PCM), Differential PCM(DPCM), Delta Modulation(DM), Adaptive DM(ADM), Time and Frequency Division Multiplexing (TDM and FDM); Line Coding schemes, Eye Pattern; ASK, PSK, DPSK and FSK. M-array Data Communication Systems, Quadrature Amplitude Modulation (QAM) Systems, Four Phase PSK (Simulation).

Books:

1. R. E.Ziemer/W H Tranter ,Principles of Communication Fifth Edition.
2. Wayne Tomasi, Morden Electronic communication Systems. Person Education /PHI
3. John G Proakis, Digital Communication. MGH
4. Hindey Lindsey ,Digital Communication Techniques Simon , PHI
5. Simon Haykin,Communication Systems, John Wiley & Sons. Pvt. Ltd.
6. Taub & Schilling, Principles of Communication Systems, Tata McGraw-Hill
7. K Sam Shanmugam. John Weily ,Digital and Analog Communication System
8. Proakis,Communication Systems Engineering, Pearson Education.
9. Leon W Couch, Digital & Analog Communication System- Pearson Education/PHI.
11. M S Roden ,Analog And Digital Communication PHI
12. Wilson,Digital modulation and coding . Pearson Education
13. Wells, Applied coding and information Theory for engineers , Pearson education.

Course Title: Mobile Application and Game Development Lab
Course Code: ICT-606 **Course Credit: 1.0** **Full Marks: 100**
Hours/Week:2
(Final: 60, Before Final:40)

Learning Outcomes: In terms of knowledge:

- Student knows mobile devices and mobile platforms
- Student has knowledge concerning mobile operating systems and their architecture
- Student is familiar with wireless communications standards and data transmission standards
- Student knows how to prepare a mobile application for distribution

Course Contents:

Android Environment Setup and Running Mobile App; App Requirements and Design; Installing, Debugging, Profiling, App Lifecycle Management, Logging; Functional Demonstration of Your App; Demonstration of Your App's Non-Functional Characteristics
Developing Android Services, and Publishing Android Applications

Books:

1. **Wei-Meng Lee:** "Beginning Android™ Application Development," John Wiley & Sons, Inc.
2. **Mark L. Murphy:** "The Busy Coder's Guide to Android Development".
3. **Donn Felker**: "Android Application Development For Dummies," Wiley Publishing, Inc.
4. **Mark L. Murphy:** "Android Programming Tutorials".
5. **J. F. DiMarzio** "Beginning Android™ Programming with Android Studio".
6. **Reto Meier:** "Professional Android™ 4 Application Development," John Wiley & Sons, Inc.
7. **Introduction to Android | Android Developers** https://developer.android.com/ guide/index.html

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Fourth Year First Semester

Course Title: Wireless & Mobile Communication

Course Code: ICT-701 **Course Credit: 3.0** **Full Marks: 100**

Hours/Week:3

(Final: 60, Before Final:40)

Rationale: The purpose of this course is to increase students' knowledge and understanding in wireless and mobile communication associated with cellular radio system, multiple access techniques, error detection & correction, wireless networks, digital mobile communication standards etc.

Objectives: The objectives of this course are:

- To deepen the knowledge of wireless and mobile communication
- To know the basic elements of cellular radio system
- To enhance students' understanding on various modulation techniques and error correction
- To gather knowledge about wireless networks and mobile communication systems.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Explain the basic concepts, evolution, devices and operations of wireless and mobile communication,
- Compare between these two communication system,
- Summarize the fundamental features of cellular radio system,
- Write incorporate standards of mobile communication system,
- Understand the basics of modulation techniques such as FDMA, TDMA, CDMA, etc.
- Describe wireless LAN, Wi-Fi, WiMAX, mobile ad-hoc network and so on.

Course Contents:

Introduction: Concept, History of wireless communication, Evolution and fundamentals of Mobile Communication, Mobile and Wireless devices. A market for mobile communications, mobile system architecture, design, performance and operation, antenna at cell site and mobile antenna. Radio wave propagation: Propagation characteristics, EIRP, models for radio propagation, Fresnel zone, reflection, diffraction, scattering, fading, modeling of multipath channel.

Cellular radio system: Basic Elements of a Cellular Radio System/Network, Principles of Operations, Concept of cell and cell cluster, improving the capacity of a system, frequency reuse, cell splitting and sectoring, co-site, co-channel and adjacent channel interferences, Hand off and dropped calls, frequency allocation techniques, improving coverage and capacity in cellular systems, concept of BTS, BSC and MSC, roaming, planning of mobile cellular networks.

Modulation method and coding for error detection and correction:

Introduction to Digital modulation techniques, modulation methods in cellular wireless systems, OFDM. Block coding, convolution coding and Turbo coding. Multiple access techniques: FDMA, TDMA, CDMA, Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA. **Spread spectrum Techniques:** Direct sequence spread spectrum, Frequency Hopping Spread spectrum techniques.

Wireless networks

Wireless LAN – IEEE 802.11 Standards – Architecture – Services – Mobile Ad hoc Networks- WiFi and WiMAX - Wireless Local Loop

Mobile communication systems

GSM-architecture-Location tracking and call setup- Mobility management- Handover-Security-GSM SMS –International roaming for GSM- call recording functions-subscriber and service data mgt –-Mobile Number portability -VoIP service for Mobile Networks – GPRS –Architecture-GPRS procedures-attach and detach procedures-PDP context procedure-combined RA/LA update procedures-Billing

Digital mobile communication standards: GSM, GPRS, EDGE, CDMA, 3G, Wi-Fi, WiMAX and 4G systems, mobile IP and VoIP, wireless sensor networks.

References &Books:

1. Wireless Communication Principle and Practice By T.S. Rappaport
2. Fundamentals of Wireless Communications, David Tse, PramodViswanath
3. Wireless Communications, Andrea
4. Mobile Communication by Jochen Schiller
5. Wireless and Mobile Network Architectures By Yi bing Lin.
6. Mobile Communications Design Fundamentals By William C.Y Lee
7. GSM System Survey-ERICSSON

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Third Year First Semester
Course Title: Microwave Engineering
Course Code: ICT-703 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This course uses electromagnetic principles to present the theory & operation of simple circuit devices & antennas at microwave frequencies, which are the part of modern microwave communication equipment.

Objectives: The objectives of this course are:

- Understand important and unique engineering issues at microwave and millimeter wave frequencies,
- Learn microwave network theory and the use of scattering matrix,
- Learn design criteria for waveguide and coaxial microwave components,
- Learn the application of these components in the design of useful systems such as radars, receivers, etc.
- Learn to design a useful microwave component or device

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

- Classify wave solutions to Maxwell's equations in the groups TEM, TE and TM, and account for which wave solutions that are relevant for transmission lines and hollow wave guides
- Explain and describe transmission lines both from a field point of view and by means of a circuit model
- Calculate the standing wave pattern on a terminated transmission line, and explain the concepts local impedance, local reflexion coefficient and standing wave ratio
- Use the Smith chart both as impedance diagram and admittance diagram and as a tool in the design of matching networks
- Explain the meaning of the concepts N-port network, reciprocity, impedance matrix, scattering matrix and transmission matrix
- Calculate resonance frequencies and Q-value for rectangular and circular cylindrical cavities and for open- or short-circuited transmission line resonators
- Describe, analyzee and design simple microwave circuits and devices.

Contents:

Transmission lines: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, The Lumped-Element Circuit Model for a Transmission Line, Field Analysis of Transmission Lines, The Terminated Lossless Transmission Lines, The Smith Chart, The Quarter-Wave Transformers, Generator and Load Mismatches, Impedance Matching and Tuning, Lossy Transmission Lines.

Waveguides: General Formulation, Modes of Propagation and Losses in Parallel Plate, Rectangular and Circular Waveguides.

Microstrip Lines: Structures and Characteristics.

Microwave tubes and devices: Klystron, Reflex Klystron, Magnetron,IMPATT diode, Gunn diode and other devices, Directional Couplers, Isolators, Circulator, Attenuators

Microwave Resonators: Cavity Resonators, Microstrip Resonators, Resonator for optical systems.

Microwave Network Analysis: Scattering Matrices and Multiport Analysis Techniques.

Microwave Measurements: Measurement of Power, Impedance, Phase shift, VSWR, Attenuation, Q of cavity resonator, tunable detector, bolometer, slotted line, reflectometer.

Books:

1. **D. K. Cheng** ,Fundamental of Engineering Electromagnetics
2. **Jordan and Balmain ,**Electromagnetic waves and fields
3. **W. H. Hayt** ,Engineering Electromagnetic
4. **Nasar and Paul** ,Introduction to Electromagnetic Field and Waves
5. **Samuel Y Liao** ,Microwave Devices & Circuits
6. **S.Ramo, J.R.Whinnery** ,Fields and Waves in Communication Electronics
7. **N. RAO** ,Elements of Engineering Electromagnetics, Prentice Hall
8. **JOHN D. KRAUS** ,Electromagnetics
9. **R.E.COLLIN** ,Foundations for Microwave Engineering
10. **D.M. POZAR** ,Microwave Engineering
11. **J. D. Kraus** ,Electromagnetics
12. **Parmanik** ,Electromagnetism
13. **Guru Thomson,** Fundamentals Electromagnetism
14. **K. P. Harrington** ,Introduction to Electromagnetic Engineering
15. **Saddique** ,Elements of Electromagnetics

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Course Title: Optical Fiber Communication
Course Code: ICT-705 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This course mainly focuses on different types of fiber and their applications, light sources and detectors, couplers, splitters, wavelength-division multiplexers, and state-of-the-art devices used in the latest high-bandwidth communication systems.

Learning objectives: Students will try to learn:

- To learn the basic elements of optical fiber transmission link, fiberglass modes configurations and structures
- To understand different kinds of losses, signal attenuation in optical fiber & other dispersion factor.
- To learn various optical sources, LED/LASER structures, receivers (PIN, APD), and noise performance.
- Understanding of optical network system components, variety of networking aspects, SONET.

Learning outcomes: This course enables the students to:

- Apply the fundamental principles of optics and light wave to design optical fiber communication systems.
- Differentiate losses in optical fiber link and state transmission characteristics of optical fiber.
- Design optical fiber communication links using appropriate optical fibers light sources, detectors.
- Explore concept of designing and operating principles of modern optical systems and networks
- Design and manage networks with appropriate consideration

Course Contents:

Introduction: Basic Optical communication system, Advantages and application of optical fiber communication systems.

Propagation in Dielectric waveguides: Slab waveguide, Modes in symmetric and asymmetric waveguide, Coupling to the waveguide, Dispersion and distortion in the slab waveguide, integrated optic component.

Attenuation in optical fiber: Introduction, attenuation, absorption, Rayleigh scattering, Pulse distortion and information rate.

Optical fiber and fiber cables: Classification of fiber and fiber cables, step index fiber, graded index fiber, Description of modes and types of modes, Different type of modes, Numerical aperture and multipath dispersion in step-index and graded index fiber, Construction of fiber and fiber optic cable.

Light sources: LED, LD, Optical amplifiers, fiber laser, vertical cavity surface-emitting laser diodes.

Light detectors: Photo detection, photomultiplier, semiconductor photodiode, PIN photo diode, Avalanche photodiode, and their comparison.

Coupler and connectors: Connector principle, fiber end preparation, splices, connectors, source coupling, loss mechanism.

Network distribution and fiber components: Direction coupler, star coupler, optical switches, wavelength converters, isolator, Attenuators, circulator, polarization, port configuration of coupler, fiber Bragg grating, Array wave guide gratings, diffraction gratings.

Noise and detection: Thermal and shot noise's, error rates, receiver circuit design, coherent optical fiber detection system, optic heterodyne receivers.

System design: analogue and digital system design, few practical problem and example, application of fiber optic communication in telecommunication.

Optical Communication: Optical Communication system with analog and digital modulation formats; performance and system budgets; Multi channel system.

Books:

1. **John M. Senior ,** Optical Fiber Communication.
2. **D. K. Mynbaev,** Fiber Optic communication teach

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Course Title: Web Technologies and Programming
Course Code: ICT-707 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The course introduces the basic concepts of the World Wide Web, and the principles and tools that are used to develop Web applications. The course will provide an overview of Internet technology and will introduce the current Web protocols, client side and server side programming, communication and design.

Objectives: Students will be able to:

- Gain the skills and project-based experience needed for entry into web design and development careers
- Use a variety of strategies and tools to create websites
- Develop awareness and appreciation of the many ways that people access the web, and will be able to create standards-based websites that can be accessed by the full spectrum of web access technologies

Learning Outcomes: Upon successful completion of this course students should be able to:

- Define modern protocols and systems used on the Web (such as Unix, Apache, HTML, HTTPS, Git, URLs, CSS, Javascript, JSON, PHP)
- Explain the functions of clients and servers on the Web, and describe the strengths and weaknesses of the client-server internet approaches to web design and implementation
- Program, access, and manipulate data through the adoption of accepted standards, mark-up languages, client-side programming, and server-side programming
- Design and implement an interactive web site(s) with regard to issues of usability, accessibility and internationalisation
- Design and implement a client-server internet application that accommodates specific requirements and constraints, based on analysis, modelling or requirements specification
- Justify and explain particular internet application concepts, relevant alternatives and decision recommendations, including design considerations for internet security

Course Contents:

Web Design Principles and Basics: Client/Server Architecture, Basic Principles Involved in Developing A Web Site, Planning Process, Five Golden Rules of Web Designing, Designing Navigation Bar, Page Design, Home Page Layout, Design Concept, Brief History of Internet, What is World Wide Web? Why Create A Web Site? Web Standards.

Programming in Web: Web elements: Browser and Web Document, Static, Active and Dynamic pages, Programming paradigms and Web programming. Object-oriented vs. Object based programming, What should and should not be programmed on the Web, Tasks suitable for programming on the Web, Choice of programming language for Web programming.

Front End Technologies: Introduction to XHTML, *HTML* – HTML Basics, Basic Document Skeleton, Block and Inline Elements, Working with Text, Lists, Tables, Frames, Hyperlinks, Images, Multimedia, Forms and controls. HTML5 Features. *Cascading Style Sheets (CSS)* – CSS Basics, Tag Selectors, Conflicting Rules, Use CSS for Styling HTML Document, Box Model, Frames. Compound CSS Selectors, Layouts, Pseudo-Classes, Creating Style Sheet, External CSS, Fonts, Creating page Layout and Site Designs, CSS Properties. *JavaScript:*Introduction to Scripting, Control Statements, Functions, Arrays, Objects, Document Object Model (DOM), Events, XML and RSS, Ajax-Enabled Rich Internet Applications. Introduction to the Browser's Objects, Interacting with the User using HTML Forms, Using Windows and Frames Objects, String Manipulation-String Methods, Regular Expressions, String Object, Using the RegExp Object's Constructor; Timers in a Web Page, Storing Information: Cookies, Manipulating the DOM, JavaScript and XML. *Ajax:* Using the XMLHttpRequest Object, Creating Simple Ajax Module, Form Fields with Ajax. *JavaScript Frameworks:*Digging Deeper into jQuery, Diving into Prototype, Introduction to Bootstrap, Introduction to Scriptaculous.

Back End Technologies: *Web Servers* (IIS and Apache)- Multitier Application Architecture, Accessing Web Servers, Apache HTTP Server. *PHP*- Overview of PHP, Basic Scripting and Looping Constructs, Arrays, Functions, Creating PHP Pages Using PHP5, String Processing and Regular Expressions, Introduction to the Apache Web Server, Configuring and Using Mysql, Working with Databases and Forms, Using Cookies, Sending E-mail, E-Commerce Site, Wordpress. Classic Technology: Common Gateway Interface (CGI): Definition, Characteristics. Introduction to *Ruby on Rails* Scripting. Introduction to *Perl* Scripting. Introduction to *ASP.NET* (Active Server Pages.NET). An Introduction to Laravel Framework.

Books:

1. **A. Berson,** Client/Server Architecture, 2nd ed., McGraw-Hill Series on Computer Communications, 1996
2. **G. McComb,** Web Programming Languages, John Wiley & Sons, Inc., 1997
3. **Chris Bates,** Web Programming, Building Internet Applications, 2nd ed., John Wiley & Sons, Ltd., 2002
4. **Douglas E. Comer,** Computer Networks and Internets with Internet Application, 3rd ed., Prentice Hall International, Inc., 2001
5. **Marty Hall,** Core Web Programming, Prentice Hall PTR, Puuer Saddle River, NJ 07458, 1998,
6. **W. Jacson Gilmore,** Beginning PHP 5 and MYSQL, From Novice to Professional, Apress, 2004
7. **P. Wilton,** Beginning JavaScript, Wrox Press Inc., 2000
8. **John Duckett,**Beginning HTML, XHTML, CSS, and JavaScript

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Course Title: Image Processing

Course Code: ICT-709 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The purpose of this course is to ensure students' understanding with the fundamental concepts of image processing, steps and components of image processing, image sensing and acquisition, image representation, compression, filtering and so on.

Objectives: The objectives of this course are:

- To provide the fundamental knowledge of field of image processing
- To know the basic elements of visual perception
- To increase students' clear understanding on image sensing and acquisition
- To gather knowledge about histogram equalization, spatial filtering, image representation and compression.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Describe the basic concepts, fields, components of image processing,
- Know how image sensing, sampling and quantization works,
- Write the relationships between pixels,
- Understand basics of histogram,
- Explain filtering, image compression and segmentation.

Course Contents:

Introduction to image Processing, Fields of Image Processing, Steps and Components of Image Processing Systems, Elements of visual perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Sampling, Quantization, Image representation, Relationship between Pixels, Basic Intensity Transformation Functions, Histograms, Histogram Equalization, Histogram Matching (Specification), Spatial Filtering, Spatial Correlation and Convolution, Vector Representation of Linear Filtering, Generating Spatial Filter Masks, Image Restoration and Reconstruction, Image Compression, Morphological Image Processing, Image Segmentation.

References &Books:

1. **Rafael C. Gonzalez,** Digital Image Processing.
2. **Vipula Singh,** Digital Image Processing with MATLAB and LabVIEW.

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Course Title: Wireless & Mobile Communication Lab

Course Code: ICT-702 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Establish an Audio-Video satellite link between Transmitter Receiver,
- Study Frequency Hopping Spread Spectrum (FHSS) Modulation Demodulation Technique,
- Study generation (spreading) and demodulation (De spreading) of DSSS modulated signal,
- Study of Data PN Sequence Generation,
- Study GPS data like longitude, latitude using GPS receiver.

Course Contents:

Fundamentals of mobile communication systems; Multiple Access Techniques (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.; Identify the requirements of mobile communication as compared to static communication; Identify the limitations of 2G and 2.5G wireless mobile communication and use design of 3G beyond mobile communication systems; Establishing Wireless LANs.

Books:

- Wireless Communication Principle and Practice By T.S. Rappaport
- Wireless Communications, Andrea
- Mobile Communication by Jochen Schiller
- GSM System Survey-ERICSSON

Course Title: Optical Fiber Communication Lab

Course Code: ICT-706 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand the basic concepts of Matlab Programming from the context of Optical Fiber Communication,
- Develop the understanding of different cables and their comparison with optical cables,
- Install and assemble the optical fiber communication kit,
- Implement a conversation with the kit through the optical fiber cable as a medium,
- Use the light sources and light detectors with their practical implementations.

Course Contents:

Practical concepts of basic Optical Fiber Communication fundamentals; Understanding of different cables and their features; Construction of fiber and fiber optic cable and fundamental differences with other cables; Attenuation in optical cable; Different light sources and detectors and their implementations; Basic concepts of optical fiber communication kit and understanding of its installation and assembling; Establishing a conversation by the kit through optical fiber cable.

Books:

- **John M. Senior ,** Optical Fiber Communication.
- **D. K. Mynbaev,** Fiber Optic communication teach

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Course Title: Web Technologies and Programming Lab
Course Code: ICT-708 Course Credit: 1.0 Full Marks: 100 Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course students should be able to:

- Define modern protocols and systems used on the Web (such as Unix, Apache, HTML, HTTPS, Git, URLs, CSS, Javascript, JSON, PHP)
- Explain the functions of clients and servers on the Web, and describe the strengths and weaknesses of the client-server internet approaches to web design and implementation
- Program, access, and manipulate data through the adoption of accepted standards, mark-up languages, client-side programming, and server-side programming
- Design and implement an interactive web site(s) with regard to issues of usability, accessibility and internationalisation
- Design and implement a client-server internet application that accommodates specific requirements and constraints, based on analysis, modelling or requirements specification
- Justify and explain particular internet application concepts, relevant alternatives and decision recommendations, including design considerations for internet security

Course Contents:

Front End: *HTML*, Block and Inline Elements, Lists, Tables, Frames, Hyperlinks, Images, Multimedia, Forms and controls. *Cascading Style Sheets (CSS),* Selectors, Layouts, Fonts, Creating page Layout and Site Designs, *JavaScript:* Functions, Arrays, Objects, Using Windows and Frames Objects, String Manipulation-String Methods, Regular Expressions, String Object, Creating Simple *Ajax* Module, Form Fields with Ajax. *JavaScript Frameworks:* jQuery, Prototype, Bootstrap, Scriptaculous. Back End Technologies: *Web Servers* (IIS and Apache), Creating PHP Pages, Configuring and Using Mysql, Working with Databases and Forms, Using Cookies, Sending E-mail, E-Commerce Site, Wordpress. Introduction to *ASP.NET* (Active Server Pages.NET). Laravel Framework.

Books:

1. **A. Berson,** Client/Server Architecture, 2nd ed., McGraw-Hill Series on Computer Communications, 1996
2. **G. McComb,** Web Programming Languages, John Wiley & Sons, Inc., 1997
3. **Chris Bates,** Web Programming, Building Internet Applications, 2nd ed., John Wiley & Sons, Ltd., 2002
4. **Douglas E. Comer,** Computer Networks and Internets with Internet Application, 3rd ed., Prentice Hall International, Inc., 2001
5. **Marty Hall,** Core Web Programming, Prentice Hall PTR, Puuer Saddle River, NJ 07458, 1998,
6. **W. Jacson Gilmore,** Beginning PHP 5 and MYSQL, From Novice to Professional, Apress, 2004
7. **P. Wilton,** Beginning JavaScript, Wrox Press Inc., 2000
8. **John Duckett,**Beginning HTML, XHTML, CSS, and JavaScript

Course Title: Digital Image Processing Lab

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Course Code: ICT-710 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

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

- Describe the basic issues and the scope (or principal applications) of image processing, and the roles of image processing and systems in a variety of applications;
- Identify areas of knowledge which are required, select an appropriate approach to a given image processing task, and critically evaluate and benchmark the performance of alternative techniques for a given problem by simulation using, e.g., Matlab;

Course Contents:

Image representation, Basic Intensity Transformation Functions, Histograms, Histogram Equalization, Histogram Matching (Specification), Spatial Filtering, Spatial Correlation and Convolution, Image Restoration and Reconstruction, Image Compression, Morphological Image Processing, Image Segmentation.

References &Books:

1. **Rafael C. Gonzalez,** Digital Image Processing.
2. **Vipula Singh,** Digital Image Processing with MATLAB and LabVIEW.

Course Title: VLSI Circuits Design Lab

Course Code: ICT-710 **Course Credit: 1.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

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

- Do transistor level design and layout.
- Program various digital circuits in different models using Verilog.
- Use VLSI CAD tools effectively to perform VLSI design and simulation.

Course Contents: Fundamentals of VLSI circuits and systems based on silicon, VLSI design using CAD tools, Circuit and logic simulation, mask layout, layout extraction and verification; standard cell placement and routing.

Books:

1. **N. Weste and D. Harris,** CMOS VLSI Design: A Circuits and Systems Perspective
2. **K. Eshraghian& D. A. Pucknell,** Basic VLSI design: System & Circuit
3. **C. A. Mead and L. A. Conway,** Introduction to VLSI Systems

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Fourth Year Second Semester

Course Title: E-commerce and E-governance

Course Code: ICT-801 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The purpose of this course is to ensure students' understanding with the concepts of E-commerce and E-governance. The selection and implementation of technologies for better security
and to focus on payment methods, internet strategies, shopping strategies and so on.

Objectives: The objectives of this course are:

- To provide the understanding of fundamental concepts of E-commerce and E-governance
- To gather knowledge about various security technologies
- To enhance understanding about different payment methods and on-line commerce environment.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Understand and explain the basic principles of E-commerce and E-governance,
- Make asolid foundations in the basic concepts of online commerce environment,
- Know a substantial number of basic payment methods,
- Know the tools for implementing the rules of better governance in online,
- Select and implement different internet shopping strategies.

Course Contents:

Introduction and Concepts: Networks and commercial transactions – Internet and other novelties; networks and electronic transactions today, Model for commercial transactions; Internet environment – internet advantage, worlds wide web and other internet sales venues; Online commerce solutions.

Security Technologies: Insecurity of Internet; A brief introduction to Cryptography; Public key solution; Key distribution and certification.

Electronic Payment Methods: Updating traditional transactions; Secure online transaction models; Online commercial environments; digital currencies and payment systems; Offline secure processing; private data networks.

Protocols for Public Transport of Private Information: Security protocols; Secure hypertext transfer protocols; Secure sockets layers; Integrating security protocols into the web; Non-technical provide.

Electronic Commerce Providers: On-line Commerce options: Company profiles.

On line Commerce Environments: Servers and commercial environments; Netscape product line; Netscape commerce server; Microsoft internet explorer and servers; open market.

Digital Currencies: Operational process of Digicash, Ecash Trail; Using Ecash; Smart cards; Electronic Data Interchange; Its basics; EDI versus Internet and EDI over Internet.

Strategies, Techniques and Tools: Internet strategies; Internet Techniques, Shopping techniques and online selling techniques; Internet tools.

References & Books:

1. Developing E-commerce sites, Sharma & Sharma

2. Frontiers of Electronic Commerce, Kalakota

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Course Title: Artificial Intelligence and Expert System
Course Code: ICT-803 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: This course will introduce the basic principles in artificial intelligence research. It will cover simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics will be explored. The LISP
programming language will also be introduced.
Objectives: Specifically, course objectives are to:

- Provide you with understanding of the role of Artificial Intelligence, Expert Systems and Decision Models in managerial decision-making
- Develop abilities to apply, build and modify decision models to solve real problems
- Explore the issues involved in the design and development of Artificial Intelligence Based Decision Support Systems and discuss the role these systems play in the business environment
- Gain an In-Depth Knowledge of a particular type of Artificial Intelligence Technique, namely Genetic Algorithms
- Gain the knowledge to build a prototype Artificial Intelligence Based Decision Support System

Learning Outcomes: Upon successful completion of this course, the student will be able to:

- Represent knowledge using propositional calculus and predicate calculus.
- Use inference rules to produce predicate calculus expression.
- Solve problems using search techniques: depth-first, breadth-first, forward chaining, backward chaining, best-first, branch-and-bound, and-or-graph, and heuristic search
- Analyze and design a fuzzy logic system using fuzzy logic tool box
- Analyze and design a neural network system using neural network toolbox
- Analyze and design a rule-based expert system
- Design a machine vision system application

Course Contents:

Concepts of Artificial Intelligence: Overview of AI, The History of AI, AI technique, Conventional computing vs Neural computing, Human vs Computer, Turing test, Scopes, Possibilities, Goals and Applications of AI.

Knowledge Acquisition and Representation: Knowledge and its properties, Types of knowledge, Knowledge acquisition, Knowledge representation, Knowledge representation issues, Knowledge representation schemes: Knowledge representation using Predicate logic, Rules, Frames, Scripts, Semantic nets, Conceptual graphs, etc.

Problem Solving through search: Agents and environments, Nature of environments, Structure of agents, Agent types, Problem solving agents, Problem formulation, Problem solving performance, Uninformed search strategies, Breath-first search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Informed search strategies, Hill Climbing, Greedy best-first search, Memory-bounded heuristic search, Heuristic functions, Local search algorithms and optimization problems, Constraint satisfaction problems.

Propositional and First-Order logic: Knowledge Representation, Reasoning and Logic; Propositional Logic: Syntax, Semantics, Validity and Inference, Rules of Inference for Propositional logic; First-Order Logic: Syntax and Semantics, Using first-order logic.

Inference in first order ogic: Inference Rules Involving Quantifiers, Example Proof, Generalized Modus Ponens, Forward and Backward Chaining, Completeness, Resolution.

Uncertain Knowledge and Reasoning: Uncertainty, Review of probability, Probabilistic Reasoning, Representing knowledge in uncertain domain, Bayesian networks, Inferences in Bayesian networks, Probabilistic Reasoning over time, Temporal models, Hidden Markov models, Dynamic Bayesian networks.

Natural language processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.

Expert Systems: Expert system architecture, Rule-based system Architectures, Representation and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Overview of AI Programming Language: Prolog, Visual Prolog, LISP etc.

Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach
2. E. Ritch and K. Knight, Artificial Intelligence
3. Carl Townsend, Introduction to Turbo Prolog
4. D. W. Patterson, Introduction to AI

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Course Title: Network Security and Cyber Law

Course Code: ICT-805 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: Network security is one of the most important network criteria, which can be vulnerable by many ways. So, the necessary part is to make it more secure and the purpose of this course includes attack types, security measurement, cryptographic technique, intellectual property
laws and so on.
Objectives: The objectives of this course are:

- To gather knowledge about the threats of a network
- To understand the security principles and properties
- To realize the basic concepts of technology and cyber law.

Learning Outcomes: Upon successful completion of this course a student will be able to:

- Learn the basics of security, approaches and principles,
- Understand the cryptographic techniques and authentication mechanism,
- Differentiate between cyber-crimes and cyber laws,
- Summarize digital copyright issue, illegal duplication of software and international cyber law,
- Know the intellectual property issues in cyber spaces.

Course Contents:
Introduction to Security: Security Definition, Security approaches, Principles of security, Types of attacks.
Cryptographic Techniques: Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.
User Authentication Mechanism: Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall.
Cyber law: Digital copyrights issues, Illegal duplication of software, human rights and data encryption, International cyber law, Information sharing, Cyber squat erring.
Basic Concepts of Technology and Law: Understanding the Technology of Internet, Scope of Cyber Laws, Cyber Jurisprudence, Cyber Crimes and Cyber Laws.
Law of Digital Contracts: The Essence of Digital Contracts, The System of Digital Signatures, The Role and Function of Certifying Authorities, The Science of Cryptography,
Intellectual Property Issues in Cyber Space: Domain Names and Related issues, Copyright in the Digital Media, Patents in the Cyber World.

References & Books:
1. William Stallings, Cryptography and Network Security

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Course Title: Satellite Communication and Radar

Course Code: ICT-807 **Course Credit: 3.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Rationale: The course goal is to provide the student with the basic understanding of the unique challenges of designing, developing, fielding, maintaining, and operating satellite communications systems. This will enable the students to know how to place a satellite in an orbit and about the earth & space segment. The emphasis is also on modern radar systems and signal processing techniques, for both civilian and defense applications.

Objectives: The objectives of this course are:

- To understand the Satellite fundamentals and types of satellite along with their applications.
- To provide them with a sound understanding of how a satellite communication system along with its other subsystems operates to successfully transfer information from one earth station to another.
- To expose them to examples of applications and tradeoffs which typically occurin engineering system design, and to ask them to apply the knowledge indesign problems.
- Understand the working principle of different RADAR systems and their applications.
- Study different RADARs and its supporting system.
- Understand and model the characteristics of radar echoes from different types of targets and clutter.
- Understand and identify theoretical accuracy of radar measurements and pulse compression techniques.

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

- Determine the azimuth and elevation angles and visibility of a geostationary satellite from an earth station
- Create link budgets for an uplink and a downlink, and determine carrier to noise ratio (C/N) at an earth terminal receiver
- Calculate the baseband signal-to-noise ratio or bit error rate for a satellite link
- Design a communications satellite system to meet specified objectives for signal to noise ratio (S/N) in an analog baseband or BER in a digital link using appropriate multiple access techniques
- Able to discriminate different Radars, find applications and use of its supporting systems.
- Calculate and simulate receiver noise and losses.
- Design and analyze radar optimal receivers.

Contents:

Introduction to Satellite Communication: Different types of satellites, Satellite orbit, station keeping, orbital mechanics, equation of orbit, orbital elements, look angle determination, limits of visibility, eclipse, sub satellite point, sun transit outage, space craft technology- power, attitude and orbit control, thermal, propulsion, telemetry, tracking and command, communication and antenna subsystems, launching procedures and launch vehicles.

Satellite Link Design: Basic transmission theory, satellite uplink and down link analysis and design, Transponders, Uplink and downlink power budget, Overall link budget link budget and Eb / No calculation, performance impairments, system noise, inter modulation and interference, propagation characteristics and frequency consideration- system reliability and design life time

Satellite Access: Types- FDMA concepts- inter modulation and back off- SPADE system- TDMA concept- frame and burst structure- satellite switch TDMA- CDMA concept- DS & FH CDMA system- comparison of multiple access scheme.

Earth Station Technology: Earth Station Design for Low System Noise Temperature, Large Earth Station Antennas.

RADAR: The radar equation, CW, Pulsed Doppler Radar and MTI, Tracking radar, Receiver noise and losses, Radar clutter, Matched filters, Radar detection and parameter estimation in clutter and noise background, pulse compression and coding techniques, Radar signal choice and ambiguity function, introduction to polarimetric radar and synthetic aperture radar, Radar applications.

Books:

1. T. Pratt, C. W. Bostian, Satellite Communications, second edition, Wiley-India, 2006
2. D.C. Agarwal, Satellite Communication, Khanna Publishers, 2008
3. Merrill Skolnik, Introduction to RADAR Systems, third edition, McGraw Hill, 2001

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Course Title: Artificial Intelligence and Expert System Lab
Course Code: ICT-804 **Course Credit: 1.00** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

Learning Outcomes: Upon successful completion of this course, the student will be able to:

- Learn about the role and place of Prolog in the area of Artificial Intelligence (AI), and in programming-language research more in general
- Learn the basic principles of Prolog by doing a number of exercises
- Solve problems using search techniques: depth-first, breadth-first, forward chaining, backward chaining, best-first, branch-and-bound, and-or-graph, and heuristic search
- Analyze and design a fuzzy logic system using fuzzy logic tool box
- Analyze and design a neural network system using neural network toolbox
- Analyze and design a rule-based expert system
- Design a machine vision system application

Course Contents:

AI and programming languages; PROLOG under Windows and Unix; PROLOG exercises: Meet The Dutch Royal Family: facts, queries and rules, Lists and recursion, Unification and matching, Backtracking, Tracing and spying, Variation of input-output parameters, The order of clauses and conditions, Fail and cut, A finite automaton, Sorting, A relational database in PROLOG ,Natural language processing.

Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach
2. E. Ritch and K. Knight, Artificial Intelligence
3. Carl Townsend, Introduction to Turbo Prolog
4. D. W. Patterson, Introduction to AI

Course Title: Resource Project
Course Code: ICT-806 **Course Credit: 2.0** **Full Marks: 100** Hours/Week:3
(Final: 60, Before Final:40)

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