Department of Information and Communication Technology

**Session 2021 – 22**

Course Content

**First Year First Semester**

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| **Course Code** | **Course Title** | **Credit** |
| ICT 1101 | Basic Electrical Circuits | 3 |
| ICT 1102 | Basic Electrical Circuits Lab | 1 |
| ICT 1103 | Computer Programming | 3 |
| ICT 1104 | Computer Programming Lab | 1 |
| ICT 1105 | Physics | 3 |
| ICT 1107 | Differential and Integral Calculus | 3 |
| ICT 1109 | Chemistry | 3 |
|  | Total | 17 |

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| **ICT 1101** | | **Basic Electrical Circuits** | | **3** |
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| **Network Circuit and Analysis:** Fundamental electric concepts and measuring units, D.C. voltage, D.C Current, Resistance and power, dependent and independent sources, Series,  Parallel, Series-Parallel circuits, Open and short circuits, Star-Delta conversion. | | | | |
| **Networks Theorems:** Superposition theorem, Thevenins theorem, Norton’s theorem,  Maximum Power Transfer theorem, Millman’s theorem. | | | | |
| **Basic Passive Elements:** Resistor, Capacitor and Inductors in series and parallel, Transient in capacitive network, charging phase and discharging phase, RLC circuits. | | | | |
| **Magnetic circuits:** Introduction to magnetic circuits, Solution of magnetic circuits, Hysteresis  and eddy current losses. | | | | |
| **Fundamental of AC and the basic elements and phasor:** Generation of the ac voltage and current; The sine wave; General format of sinusoidal voltage and currents; Phase and Algebraic representation of sinusoids; Average and RMS value; Frequency Response of the Basic elements; Average Power and Power factor; Complex Numbers: Rectangular and Polar  form; Series and Parallel ac circuits; Series-Parallel ac circuits. | | | | |
| **Resonance:** Series and Parallel resonant circuit, Selectivity, Quality Factor. | | | | |
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| **Reference** | |  | |  |
| 1. | Introductory Circuit Analysis | | Robert L. Boylested | |
| 2. | Fundamentals of Electric Circuits | | Charles K. Alexander, Matthew N. O. Sadiku | |
| 3. | Electrical Circuits | | W. Nilson & S.A. Riedel | |
| 4. | Principles of Electric Circuits | | Thomas L Floyd | |

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| **ICT 1102** | **Basic Electrical Circuits Lab** | **1** |
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| Based on the course contents of ICT 1101, Basic Electrical Circuits. | | |

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| **ICT 1103** | **Computer Programming** | **3** |
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| **Introduction:** Data type, variables, operators, expressions, type-casting; **Control structure:** if- else, switch-case, ternary operator, while/do-while/for loops, nested control structure, break  and continue; | | |
| **Function:** parameter passing, return type; One-dimensional array: searching and sorting with  one dimensional arrays; **Character and string:** basic string operations, string related library functions; | | |
| **Multi-dimensional array:** Matrix operations with multi-dimensional arrays; Recursion;  Bitwise operations; User-defined data types: structure, union, bitfield, enumeration; | | |

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| **Pointers:** pointer to string, array, structure, and function, dynamic memory allocation; **Input/Output (I/O):** console I/O, formatted I/O, file I/O, command line arguments; Header files and preprocessors; Variable argument function; Error handling.  **Reference language:** C. | | | | |
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| **Reference** | |  | |  |
| 1. | The C Programming Language | | Brian W. Kernighan; Dennis M. Ritchie | |
| 2. | C: The Complete Reference | | Herbert Schildt | |
| 3. | C Programming in easy steps | | Mike McGrath | |
| 4. | Head First C: A Brain-Friendly | | David Griffiths; Dawn Griffiths | |

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| **ICT 1104** | **Computer Programming Lab** | **1** |
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| Based on the course contents of ICT 1103, Computer Programming. | | |
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| **ICT 1105** | | **Physics** | | **3** |
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| **Structure of Matter:** Crystalline and amorphous solids, crystal systems, crystal directions, Miller indices, co-ordinations number, packing factor, Bragg’s law of X-ray diffraction, crystal structure analysis, defects in crystal, bonds in solids, cohesive energy and bonding energy,  free electron theory of metals, band theory of solids, solid state devices; | | | | |
| **Electricity and Magnetism:** Electrostatics: Electric field, Gauss’s law and its applications for various charge distributions, electric potential and equipotential surface, dielectrics and electrostatic energy in capacitors; Magnetostatics: Magnetic field and forces, Hall effect, application of Biot-Savart and Ampere’s laws, electromagnetic induction and inductance, energy in a magnetic field, Electromagnetic oscillations: RC, LR, LC and LRC circuits, working principle of transformers, motors and generators, Magnetic materials and its applications in a computing device; | | | | |
| **Wave Mechanics:** Failure of classical mechanics and historical origins of the quantum mechanics, wave particle duality, uncertainty principle, postulates of quantum mechanics, wave function, operators, Schrödinger equation, expectation value, Ehrenfest theorem, Eigen  function and Eigen values, particle in a box, square well potential, linear harmonic oscillator. | | | | |
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| **Reference** | |  | |  |
| 1. | Fundamentals of Physics | | Halliday, Resnick, Walker | |
| 2. | Physics for Engineers | | Gias Uddin Ahmed | |
| 3. | Concepts of Modern Physics | | Arthur Beiser | |
| 4. | Physics for Scientists and Engineers | | Raymond A. Serway, John W. Jewett | |

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| **ICT 1107** | | **Differential and Integral Calculus** | | **3** |
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| **Differential Calculus:** Continuity and differentiability; Successive differentiation: Leibnitz’s forms; Maxima and minima of functions of single variable: Rolle’s theorem, mean value theorem; Evaluation of indeterminate forms by L’Hospital’s rule; Expansion of functions: Taylor’s and Maclaurin’s theorems, Lagrange’s and Cauchy’s forms of remainders; Partial  differentiation, Euler’s Theorem; Tangent, normal.; | | | | |
| **Integral Calculus:** Definite integrals and its properties; Wallis’ formula; Improper integrals; Beta function and Gamma function; Parametric equations and polar coordinates; Applications of integration: area under a plane curve, area of a region enclosed by two curves and arc 10 lengths in Cartesian and polar coordinates, volume and surface area of solids of  revolution; Multiple integrals. | | | | |
| **Implement in computer program.** | | | | |
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| **Reference** | |  | |  |
| 1. | Engineering Mathematics | | K.A. Stroud | |
| 2. | Advanced Calculus | | M. R. Spiegel | |

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| 3. | Calculus with Analytic Geometry | Earl W. Swokowski |
| 4. | Advanced Engineering Mathematics | Erwin Kreyszig |

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| **ICT 1109** | | **Chemistry** | | | **3** |
|  | |  | | |  |
| Quantum concept in atomic structure, VSEPRT; molecular geometry, Quantum concept in  bonding; VBT and MOT, Frontier MOT and electronic transition; | | | | | |
| Silicon chemistry, Properties of solutions, Colloid and Nanochemsitry, Phase rule and phase diagram; Energy and chemistry; | | | | | |
| Electrochemistry; electrolytic conduction, corrosion, devices for energy storage, Chemistry of  biodegradable and conductive polymer; LED, LCD/touch screens; | | | | | |
| Chemistry of proteins, nucleic acids (DNA, RNA), carbohydrates and lipids; | | | | | |
| Introduction to computational chemistry; Design of new molecules, materials and drug  design. | | | | | |
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| **Reference** | |  | | |  |
| 1. | Modern Chemistry | | | Jerry L. Sarquis and Mickey Sarquis | |
| 2. | Protein Chemistry | | | Lars Backman | |
| 3. | Computational Chemistry | | | Errol G. Lewars | |
| 4. | Nanochemistry | | Ludovico Cademartiri, Geoffrey A Ozin, André Arsenault | | |

**First Year Second Semester**

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| **Course Code** | **Course Title** | **Credit** |
| ICT 1201 | Electronic Devices and Circuit Theory | 3 |
| ICT 1202 | Electronic Devices and Circuit Theory Lab | 1 |
| ICT 1203 | Data Structure | 3 |
| ICT 1204 | Data Structure Lab | 1 |
| ICT 1205 | Discrete Mathematics | 3 |
| ICT 1207 | Matrices and Coordinate Geometry | 3 |
| ICT 1209 | History of the Emergence of Bangladesh | 3 |
| ICT 1211 | English Language and Literature | 3 |
| ICT 1200 | Project - I | 1 |
|  | Total | **21** |

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| **ICT 1201** | | **Electronic Devices and Circuit Theory** | | **3** |
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| **Introduction:** Ideal device characteristics of Diode, Bipolar Junction Transistor (BJT), Metal-  Oxide-Semiconductor Field Effect Transistor (MOSFET); | | | | |
| **Wave shaping circuits:** Diode wave shaping techniques, clipping and clamping circuits,  comparator circuits, switching circuits; BJT and MOSFET amplifiers; | | | | |
| **Linear Integrated Circuits:** Op-amps, linear applications of OpAmps; Oscillators: Timers (555),  function generators. | | | | |
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| **Reference** | |  | |  |
| 1. | Electronic Devices & Circuits | | Allan Mottorshed | |
| 2. | Integrated Electronics | | Millman & Halkias | |
| 3. | Electronic Devices & Circuit Theory | | Boylestead & Neshelsky | |

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| **ICT 1202** | **Electronic Devices and Circuit Theory Lab** | **1** |
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| Based on the course contents of ICT 1201, Electronic Devices and Circuit Theory. | | |
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| **ICT 1203** | | **Data Structure** | | **3** |
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| **Introduction to Data Structures:** Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function,  Recursion; | | | | |
| **Arrays, Pointers and Strings:** Introduction to Arrays, Definition, One Dimensional Array and  Multidimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings; Introduction to Strings, Definition, Library Functions of Strings; | | | | |
| **Stacks and Queue:** Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular  Queue, De-queue and Priority Queue; | | | | |
| **Linked Lists:** Introduction, Representation and Operations of Linked Lists, Singly Linked List,  Doubly Linked List, Circular Linked List, And Circular Doubly Linked List; | | | | |
| **Searching, Sorting and Hashing:** Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms; **Searching and Sorting:** Searching, Types of Searching, Sorting, Various Types of Sorting; **Hashing:** Hash Function, Types of Hash Functions, Collision and its Resolution Techniques, Application of Hashing: Perfect Hashing. | | | | |
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| **Reference** | |  | |  |
| 1. | Fundamentals of Data structures in C | | E.Horowitz, S.Sahni | |
| 2. | Data structures and Algorithm Analysis in C | | M. A. Weiss | |

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| 3. | Data Structures and Algorithms | Granville Barnett, Luca Del Tongo | |
| 4. | Data Structures and Algorithms Made Easy | | Narasimha Karumanchi |

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| **ICT 1204** | **Data Structure Lab** | **1** |
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| Based on the course contents of ICT 1203, Data Structure. | | |
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| **ICT 1205** | | **Discrete Mathematics** | | **3** |
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| **Introduction:** Set theory-Set operation, Representation of Sets, Algebraic Properties of set,  computer representation of set, Logic-Prepositional Calculus, Logic and bit operation, Predicate and quantifier, Translating sentence into logical expressions | | | | |
| **Function:** Introduction of function, some important function, Properties of function, Sequence and summation, Relation- Representation of Relation, Properties of Relation, Some  important Relations, Closures of relation. | | | | |
| **Number Theory:** Fundamental Theorem of Arithmetic, Modular Arithmetic; GCD, LCM, Prime Number, Congruence, Application of Congruence, Linear Congruence, Application of Number Theory, Mathematical Induction, Methods of Proof, First and Second principle of  Mathematical induction. | | | | |
| **Counting Principle:** Basic Counting principle, Inclusion-Exclusion principle, Application of Sum rule and Product rule, Pigeon hole principle, Permutation Combination, Binomial Theorem. | | | | |
| **Definition of Graph:** Types of graphs, Representation of graph, Euler and Hamilton path,  circuit, necessary and sufficient conditions. | | | | |
| **Graph coloring:** Isomorphism of graph, Tree- Comparison of tree and Graph, Spanning tree,  algorithm of several trees, Application of trees, Tree Traversal, Trees and sorting. | | | | |
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| **Reference** | |  | |  |
| 1. | Discrete Mathematics | | Olympia Nicodemi | |
| 2. | Discrete Mathematics in Computer Science | | Donald F. Stanat, David F. McAllister | |
| 3. | Discrete Mathematical Structures | | B. Kolman, R.C. Busby and S. Ross | |
| 4. | Elements of Discrete Mathematics | | C. L. Liu | |

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| **ICT 1207** | | **Matrices and Coordinate Geometry** | | | **3** |
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| **Matrices:** Definition of matrix; Different types of matrices; Algebra of matrices; Adjoint and inverse of a matrix; Elementary transformations of matrices; Determinants: Matrix polynomials; Calay-Hamilton theory with uses of rank and nullity; Normal and canonical  forms; Solution of linear equations; Eigenvalues and eigenvectors. | | | | | |
| **Co-ordinate Geometry:** Change of axes; Pair of Straight line & 2nd Degree General Equation; Shortest Distance; Coordinates of a point in space in different systems; Orthogonal circles; Radical axis, radical center, properties of radical axes; Coaxial circles and limiting points; Equations of parabola, ellipse and hyperbola in Cartesian and polar co-  ordinates; | | | | | |
| **Co-ordinate Geometry of three dimensions:** System of co-ordinates, Distance of two points,  Section formula, Projections, Directional cosines, Equation’s of planes and Lines. | | | | | |
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| **Reference** | |  | | |  |
| 1. | Geometry (Shaum Series) | | Barnett Rich, Christopher Thomas | | |
| 2. | A TEXT BOOK ON COORDINATE GEOMETRY | | A.F.M Abdur Rahman & PK battacharjee | | |
| 3. | Theory and Problems of Matrix Operations (Schaum series) | | | Richard Bronson | |
| 4. | Fundamentals of Matrix Algebra | | | Gregory Hartman | |

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| **ICT 1209** | **History of the Emergence of Bangladesh** | **3** |
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| Primitive Bengal: Gaura, Pala, Sena Dynasties | | |
| Medieval Period and Muslim's Rule: Independent Muslim rulers, Mughal Empire and Bengal, | | |

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| Twelve Bhuyians, Battle of Plassey; | | | | |
| British Colonial Rule: East India Company, early resistance movements, great rebellion of  1857 and its consequences, Partition of Bengal; | | | | |
| Renaissance in Bengal: Mohammedan Literary Society, Indian National Congress, Bengali  Muslim won election in Bengal province, Sher-e Bangla's role; | | | | |
| Lahore resolution and creation of Pakistan: Lahore resolution, Partition of India in 1947, great exodus in Bengal and Punjab | | | | |
| Bengali Identity and Bangla Language Movement: Mother Language movement, Bangla as a  state language, cultural impact, Rise of Bengali Nationalism | | | | |
| Pakistan Regime: Structure of Pakistan state, Socio-cultural disparities, Economic and job  sector inequlity, political policy and instability; | | | | |
| Six points Movements: Basic points in the Six-point program, Mass Uprising in 1969, economic monopoly, Agartala conspiracy case, Sheikh Mujibur Rahman becomes One Leader as Bangabandhu; | | | | |
| Fall of Ayub Khan: Reasons, Rise of Yahya Khan, Student movement, various demands from  people, aspiration for independence; | | | | |
| Election of 1970 and Non-cooperation movement: Campaign and result of the 1970 General Election, stalled discussion, historical speech on 7th March, Non-cooperation movement;  Genocide as Operation Seach Light on 25th March; | | | | |
| Liberation war of Bangladesh: Declaration of Independence, Provisional Government, Mukti Bahini and Sectors, Role of Major powers - UN, USA, USSR, China, India, Joint Forces Command in December 1970, Surrender at Dhaka; | | | | |
| Political Actors toward the emergence of Bangladesh: Abul Kasem Fazlul Huq, Maulana Abdul Hamid Khan Bhashani, Huseyn Shaheed Suhrawardy, Sheikh Mujibur Rahman, National Four  Leaders of Bangladesh; | | | | |
| Post-Liberation Bangladesh: Return of the Father of the Nation Bangabandhu Sheikh Mujibur Rahman, Presidential Orders and formation of the Constitution, The Cabinet of Ministers, Elections in 1973 and return to the Parliamentary Democracy, Turmoil and natural calamities, Sanctions on Bangladesh, Foreign policy, Reconstructions of was devasted country, The Bangladesh Collaborators (Special Tribunals) Order, 1972, Reforms in all sectors: Social,  Political, Economic, Government Services. | | | | |
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| **Reference** | |  | |  |
| 1. | History of Bangladesh | | Abdus Samad | |
| 2. | The Birth of Bangladesh | | Abdus Samad | |

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| **ICT 1211** | | **English Language and Literature** | | **3** |
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| **Introduction:** Issues of technical writing and effective oral presentation in Information and  Communication Technology (ICT); | | | | |
| **Writing styles of definitions:** propositions, theorems and proofs; Preparation of reports, research papers, theses and books: abstract, preface, contents, discussion on experimental  results, bibliography and index; | | | | |
| **Review Writing:** Writing review articles, Book reviews and referee reports; **Writing tools:**  LATEX, open source editors etc.; Diagram drawing software; presentation tools; | | | | |
| **Introduction to Creative Writing:** Expressing own thought, Discussion on contemporary  English Literature. | | | | |
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| **Reference** | |  | |  |
| 1. | Technical Writing | | John M. Lennon | |
| 2. | Writing Scientific English | | J. Swales | |
| 3. | Contemporary English Literature | | Multiple Writers | |
| 4. | Norton Anthology of English Literature | | Edited book | |

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| **ICT 2101** | **Operational amplifiers and Integrated Circuits** | **3** |
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| **Operational amplifiers and applications**: Linear application of op-amp,Feedback, gain, input and output impedances, Properties of an ideal Op-Amp, non-inverting and inverting amplifiers, integrator, differentiator, weighted summer and other applications of Op-Amp circuits, frequency response and bandwidth. | | |
| **Oscillators circuits and wave generators**: Phase shift oscillator, Wine Bridge, Crystal, Tune collector oscillators, Sinusoidal. Feedback, Comparators and Converters, Schmitt trigger. | | |
| **Active Filters:** Butterworth filters, Band-pass filters, Band Reject Filters, All pass Filters. | | |
| **Linear wave shaping:** Linear and non-linear wave shaping. Diode Wave Shaping Techniques, Clipping and Clamping circuits. Non-linear function circuits. Negative resistance switching, Voltage regulators, Pulse generation. | | |

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| **ICT 2102** | **Operational amplifiers and Integrated Circuits Lab** | **1** |
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| Based on the course contents of ICT 2203, Digital Logic Design. | | |
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| **ICT 2103** | **Computer Based Numerical Methods** | **3** |
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| **Introduction:** Computer architectures, Significant figure, Rounding off numbers, Error in Numerical Calculation. Solution of Algebraic and Transcendental Equation, Interpolation with equal and unequal intervals – Missing values, Newton’s binomial expansion formula, Newton’s forward and backward interpolation formula. Central difference interpolation formulae, inverse interpolation. | | |
| **Numerical Differentiation:** Derivate using Newton’s forward backward and Stirling’s formula. | | |
| **Numerical Integration:** General quadrature formula for equidistant ordinates. Trapezoidal | | |

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| rule, Simpson’s one-third rule, Simpson’s three-eight rules, Weddle’s rule. | | | | |
| **Numerical solution of ordinary differential equations:** Taylor’s series method, Euler’s  method, Adams Bashforth Moulton method, Runge-Kutta method. | | | | |
| **Solution of linear equations:** Gauss-elimination method, Iteration methods. Gauss-Seidel  method, Gauss-Jordan method. | | | | |
| **Curve Fitting:** objective of fitting a curve, fitting a straight line, fitting a parabola | | | | |
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| **Reference** | |  | |  |
| 1. | Numerical Methods Using MATLAB | | JH Mathews, KD Fink | |
| 2. | Numerical Methods for Engineers | | Steven C. Chapra, Raymond P. Canale | |

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| **ICT 2104** | **Computer Based Numerical Methods Lab** | **1** |
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| Based on the course contents of ICT 2203, Digital Logic Design. | | |
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| **ICT 2105** | | **Digital Logic Design** | | **3** |
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| **Introduction:** Boolean algebra, theorems and properties, logic gates and their truth tables,  canonical and standard forms, Boolean functions, minimization techniques; | | | | |
| **Combinational logic:** arithmetic and data handling logic, error detection, decoder and encoders, multiplexer and demultiplexers;  **Asynchronous and synchronous logic design:** flip-flops and latches, CMOS master-slave. race around problems, modes of asynchronous sequential circuits, clocked sequential circuits, state diagram, Mealy and Moore machines; state minimizations and assignments; Registers;  Counters; Pulse mode logic, state decoding; Fundamental mode design; | | | | |
| **Memory and Programmable logic:** Internal construction of RAM and ROM, DRAM, Flash memories, Charge coupled device and magnetic bubble memories. A/D Converter, D/A Converter; address multiplexing, PLA and PAL design; Serial Peripheral Interface, Inter-  Integrated Circuit interface, Data Scrambling, Cycling Redundancy Check. | | | | |
| **Arithmetic of Computers:** Constructing an Arithmetic Logic Unit, Multiplication, Division, Floating Point. The Processor: Data path and Control: Introduction, Building a Data path, A Simple Implementation Scheme, A Multicycle Implementation, Microprogramming:  Simplifying Control Design. | | | | |
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| **Reference** | |  | |  |
| 1. | Digital Design and Computer Architecture | | D.M. Harris, S.L. Harri | |
| 2. | Digital Design: principles and practices | | J. Wakerly | |
| 3. | Digital Systems Principles and Applications | | Ronald Tocci | |
| 4. | Digital Design with an introduction to the Verilog HDL | | Moris Mano | |

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| **ICT 2106** | **Digital Logic Design Lab** | **1** |
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| Based on the course contents of ICT 2203, Digital Logic Design. | | |
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| **ICT 2107** | **Object Oriented Programming** | **1.5** |
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| Philosophy of object-oriented programming (OOP); Basic principles of OOP: abstraction, encapsulation, polymorphism, inheritance; Advantages of OOP over structured programming; | | |
| **C++:** Classes and objects: specifying a class, access specifiers; Functions: inline functions, friend functions; Constructors and destructors; Operator overloading and type conversions; Inheritance: single inheritance, multilevel inheritance, multiple inheritance; Polymorphism: function overloading, virtual functions, pure virtual functions; Templates: class templates,  function templates, introduction to the standard template library (STL); | | |
| **Java:** Nested and Inner classes; Local variable type inference; Strings: String, StringBuffer, StringBuilder; Inheritance: abstract class and anonymous subclasses, object class; Access protection with package; Interface; Exception; Thread: multithreading, Introduction to Java concurrency utilities; Generics and collections; Stream API and lambda expressions;  Networking: ServerSocket, Socket. | | |
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| **Reference** |  |  |

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| 1. | Head First Object-Oriented Analysis and Design | McLaughlin, G. Pollice, D. West |
| 2. | Clean Code | Robert C. Martin |
| 3. | Programming: Principles and Practice Using C++ | Bjarne Stroustrup |
| 4. | Effective Java 3rd Edition | Joshua Bloch |

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| **ICT 2108** | | | **Object Oriented Programming Lab** | | | **1** | |
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| Based on the course contents of ICT 2203, Digital Logic Design. | | | | | | | |
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| **ICT 2109** | | | **Database Management System** | | | **3** | |
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| Concepts of database systems; Introduction to the relational model; Database design using  the Entity-Relationship model; | | | | | | | |
| **Indexing:** primary and secondary indices, B+ tree index, hash indices; Query processing and optimization; Transaction management; Concurrency control; Recovery system;  **Data Model:** Basic building blocks, Business rules, The evolution of data models, Degrees of  data abstraction, E-R diagrams, | | | | | | | |
| **Relational dBMS:** Introduction, Logical view of data, keys, integrity rules, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, keys; grouping and ungrouping, relational comparison, atomic domain and normalization, multi- valued dependency and Join dependency;  **Relational Calculus:** Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities; data storage structures; | | | | | | | |
| Introduction to parallel and distributed databases; Introduction to Big data analytics; NoSQL  databases. | | | | | | | |
| Focus on Program: SQL | | | | | | | |
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| **Reference** | | |  | | |  | |
| 1. | | Database Management Systems | | | Carlos Colonel, Steven Morris | | |
| 2. | | Readings In Database Systems | | | Joseph M. Hellerstein, Michael Stonebraker | | |
| 3. | | Fundamentals of Database Systems | | | Ramez Elmasri, Sham Navathe | | |
| 4. | | Practical SQL: A Beginner's Guide to  Storytelling with Data | | | Anthony DeBarros | | |

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| **ICT 2110** | **Database Management System Lab** | **1** |
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| Based on the course contents of ICT 2207, Database Management System. | | |
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| **ICT 2111** | | **Differential Equations and Vector Calculus** | | **3** |
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| **Partial Differential Equations (PDE):** Introduction and formation of PDE; Solution of linear  and non-linear PDE of order one; Second order linear PDE: classifications to standard forms; Parabolic, elliptic, hyperbolic; Solution of second order linear PDE by separation of variables; | | | | |
| **Ordinary Differential Equations (ODE):** Definition. Formation of differential equations, Solution of first order differential equations by various methods with applications. Solution of general linear equations of second and higher orders with constant coefficient, Solution of  Euler’s homogeneous linear equations; | | | | |
| **Series Solution:** Solution of differential equations in series by the method of Frobenius; Bessel’s functions, Legendre’s polynomials and their properties | | | | |
| **Vector Algebra:** Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars; Scalar and vector product of two vectors and their geometrical interpretation; Triple products and multiple products; Linear dependence and  independence of vectors. | | | | |
| **Vector Calculus:** Differentiation and integration of vectors together with elementary applications; Definition of line, surface and volume integrals; Gradient, divergence and curl of  point functions, various formulae, Gauss’s theorem, Stoke’s theorem, Green’s theorem. | | | | |
| **Reference** | |  | |  |
| 1. | Advanced Engineering Mathematics | | Erwin Kreyszig | |
| 2. | Vector Analysis | | Murray R Spiegel | |

**Second Year Second Semester**

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| **Course Code** | **Course Title** | **Credit** |
| ICT 2201 | Operating System | 3 |
| ICT 2202 | Operating System Lab | 1 |
| ICT 2203 | Microprocessor and Embedded Systems | 3 |
| ICT 2204 | Microprocessor and Embedded Systems Lab | 1 |
| ICT 2205 | Communication Engineering | 3 |
| ICT 2206 | Communication Engineering Lab | 1 |
| ICT 2207 | Algorithm Analysis and Design | 3 |
| ICT 2208 | Algorithm Analysis and Design Lab | 1 |
| ICT 2211 | Complex Variables and Fourier Analysis | 3 |
| ICT 2213 | Financial and Managerial Accounting | 3 |
| ICT 2200 | Project - II | 1 |
|  | Total | **23** |

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| **ICT 2201** | | **Operating System** | | **3** |
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| **Operating system concepts:** its role in computer systems, operating system structures,  multiuser and multitasking OS; | | | | |
| **Process:** process concepts, user and kernel threads, synchronization, inter-process  communication, communication in client-server systems; **CPU scheduling:** scheduling criteria and algorithms, thread scheduling; | | | | |
| **Process synchronization:** critical-section problem, semaphores, monitors; **Deadlock:**  resource allocation and deadlock, deadlock detection, prevention and recovery; | | | | |
| **Memory management:** swapping, paging, segmentation, virtual memory; **Input/Output:**  hardware, software, disk, terminals, clocks; | | | | |
| **File Systems:** files, directories, security, protection; **Multi Processor System:** Multiprocessor  OS types, multiprocessor synchronization and scheduling, case study of a multiprocessor system; Case study of some operating systems | | | | |
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| **Reference** | |  | |  |
| 1. | Operating System Concepts | | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | |
| 2. | Modern Operating Systems | | Andrew S. Tanenbaum | |
| 3. | Distributed Operating Systems | | Andrew S. Tanenbaum | |
| 4. | Mastering LINUX | | Denis | |

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| **ICT 2202** | **Operating System Lab** | **1** |
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| Based on the course contents of ICT 2201, Operating System. | | |
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| **ICT 2203** | **Microprocessor and Embedded Systems** | **3** |
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| **Introduction to embedded systems:** microprocessors and microcontrollers, applications; | | |
| **Microprocessors and computers:** architecture, addressing modes, x86 instruction set,  arithmetic co-processor, evolution of microprocessors, multitasking, virtual memory; | | |
| **Microcontrollers:** Architecture, ARM/AVR instruction set, single-board microcontrollers;  Assembly language programming; | | |
| **Memory architectures:** von Neuman and Harvard architecture, memory hierarchy, DMA;  I/O modes: memory mapped I/O, general purpose I/O; Interfaces and peripherals; Interrupts and timers; | | |
| **Bus interfaces:** UART, SPI, I2C, USB; Sampling and pulse width modulation (PWM); Interfacing with stepper motor, liquid-crystal display (LCD), analog-to-digital converter (ADC), digital-to-  analog converter (DAC), sensors and actuators; Wireless communication; | | |
| **Embedded Systems Design:** design flow, specifications and modeling; Power management; | | |

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| Distributed embedded systems and the Internet of Things (IoT); Embedded and real time OS. | | | | |
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| **Reference** | |  | |  |
| 1. | Compute architecture and organization | | John P. Hayes | |
| 2. | Microprocessor and microcomputer | | T. Hanley | |
| 3. | Embedded Microprocessor Systems: Real World Design | | Stuart R Ball | |
| 4. | Embedded System Design: A Unified Hardware/Software  Introduction | | Frank Vahid, Tony Givargis | |

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| **ICT 2204** | **Microprocessor and Embedded System Lab** | **1** |
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| Based on the course contents of ICT 2203, Microprocessor and Embedded System. | | |
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| **ICT 2205** | | **Communication Engineering** | | **3** |
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| **Introduction:** Fundamental noise processes, Brightness and antenna noise, Polarization-wave  and antenna, Wave propagation, Channel impairment effects, Receiver system noise, Receiver types and sub-assembly survey, | | | | |
| **Antenna Design issues:** Low noise antenna design; Signal power budgets and system design  techniques; Interference and frequency reuse; | | | | |
| **System- and circuit-level design and implementation of communication hardware:** Mixers, RF amplifiers, filters, oscillators and frequency synthesizers, modulators and detectors, carrier and symbol timing recovery subsystems; Issues in software-defined radio transmitter and receiver implementation. | | | | |
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| **Reference** | |  | |  |
| 1. | Communication Engineering Principles | | Ifiok Otung | |
| 2. | Communication Engineering | | Sanjay Sharma | |
| 3. | Communication Systems: An Introduction to Signals and Noise in  Electrical Communication | | A. Bruce Carlson | |

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| **ICT 2206** | **Communication Engineering Lab** | **1** |
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| Based on the course contents of ICT 2205, Communication Engineering. | | |
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| **ICT 2207** | **Algorithm Analysis and Design** | **3** |
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| **Introduction:** Some Representative Problems, Stable Matching, Few Representative Problems;  **Basics of Algorithm Analysis:** Computational Tractability, Asymptotic Order of Growth,  Implementing the Stable Matching Algorithm Using Lists and Arrays, A Survey of Common Running Times, A More Complex Data Structure: Priority Queues; | | |
| **Graphs:** Graph Traversal, Graph in Queues and Stacks, Few Searching models, Connectivity in  Directed Graphs, Directed Acyclic Graphs, Topological Ordering, Graph Coloring; | | |
| **Greedy Algorithms:** Interval Scheduling: The Greedy Algorithm Stays Ahead, Scheduling to Minimize Lateness: An Exchange Argument, Optimal Caching: A More Complex Exchange Argument, Shortest Paths, The Minimum Spanning Tree Problem, Implementing Kruskal’s Algorithm: The Union-Find Data Structure, Clustering, Huffman Codes and Data Compression, A Multi-Phase Greedy Algorithm; | | |
| **Divide and Conquer:** A First Recurrence: The Mergesort Algorithm, Further Recurrence Relations, Counting Inversions, Finding the Closest Pair of Points, Integer Multiplication,  Convolutions and the Fast Fourier Transform; | | |
| **Dynamic Programming:** Weighted Interval Scheduling: A Recursive Procedure; Principles of Dynamic Programming: Memorization or Iteration over Subproblems, Segmented Least Squares: Multi-way Choices, Subset Sums and Knapsacks: Adding a Variable, RNA Secondary | | |

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| Structure: Dynamic Programming over Intervals, Sequence Alignment, Sequence Alignment in  Linear Space via Divide and Conquer, Shortest Paths and Distance Vector Protocols. | | | | |
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| **Reference** | |  | |  |
| 1. | Algorithm Design | | Kleinberg and Tardos | |
| 2. | Introduction to Algorithms | | Thomas Cormen, Charles Leiserson | |

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| **ICT 2208** | **Algorithm Analysis and Design Lab** | **1** |
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| Based on the course contents of ICT 2207, Algorithm Analysis and Design. | | |
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| **ICT 2211** | | **Complex Variables and Fourier Analysis** | | **3** |
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| **Complex Variable:** Complex number system; General functions of a complex variable; Limits and continuity of a function of complex variable and related theorems; Complex differentiation and the Cauchy–Riemann Equations; Mapping by elementary functions; Line integral of a complex function; Cauchy’s Integral Theorem; Cauchy’s Integral Formula; Liouville’s Theorem; Taylor’s Theorem and Laurent’s Theorem. Singular points; Residue; Cauchy’s Residue Theorem. Evaluation of residues; Contour integration; Conformal mapping; | | | | |
| **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 Transforms:** 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. | | | | |
| **Focus on computer based mathematical programs: Mathematica, Octave.** | | | | |
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| **Reference** | |  | |  |
| 1. | Complex Variable - Schaum’s Outline Series | | Murray R. Spiegel, Seymour Lipschutz | |
| 2. | Schaum's Outline of Fourier Analysis | | Murray Spiegel | |

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| **ICT 2213** | | **Financial and Managerial Accounting** | | **3** |
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| **Preliminaries:** Introduction to Accounting, History and development of accounting thought, types of accounting, Accounting Principles & ethics, 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:** 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. | | | | |
| **Budget:** Capital budgeting; Planning, evaluation & control of capital expenditures. | | | | |
| **Focus on Computer based accounting / actuarial programs.** | | | | |
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| **Reference** | |  | |  |
| 1. | Cost Accounting Planning & Control | | Adolph Matz & Milton F. Usry | |
| 2. | Accounting Principles | | Jerry J. Weygandt, Donald E. Kieso | |

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| 3. | Intermediate Accounting | Jay M Smith & K Fred Skousen |
| 4. | Cost Accounting | Adolph Matz& Milton F. Usry |