MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY

Department of
Information and communication Technology (ICT)

Proposed Syllabus:
Session: 2010-2011
Degree: B.Sc (Engg.) in ICT

Santosh,Tangail
February 2011

B.Sc. (Engg.) in Information and Communication Technology (ICT):

The Department of Information and Communication Technology (ICT) offers a 4-year program of Bachelor of Science (Engg.) in Information and Communication Technology (ICT). To become a graduate in this field one has to complete 160 credit hours.

The program is designed to satisfy the growing demand for IT professionals throughout the country. It gives students the opportunity to obtain a broad-based knowledge of Computer Science, Communication Engineering and Information Technology. Moreover there are sufficient number of Mathematics, Electrical Engineering, Communication Engineering, Basic sciences, Commerce and Arts courses.

Program Duration:

MBSTU introduces two semesters (each semester of six months) in an academic year. Therefore, the whole program can be completed in 8 semesters (i.e. 4 years).

Course Structure:

Course Type	No. of Courses	Credit Hours
Core Courses:		
A. ICT Courses		
I. Theory	35	98
II. Lab work	27	27
III. Project Work	02	02
IV. Research Project	02	04
B. Mathematics Courses (MATH)	04	12
C. Physics Courses (PHY)	01	03
D. Chemistry (CHEM)	01	02
E. Industrial Attachment	01	01
Arts and Humanities Courses (HUM)	05	11
Total:	**77**	**160**

Semester wise Credit Hour:

S/N	Year	Semester	No. of Course		Credit Hour		Total
			Theory	Lab	Theory	Lab	
1.	First	First	6	4	15	4	19
2.	First	Second	6	3	17	3	20
3.	Second	First	6	3	16	3	19
4.	Second	Second	6	4	18	4	22
5.	Third	First	6	5	16	5	21
6.	Third	Second	6	5*	16	5	21
7.	Fourth	First	6	3**	16	4	20
8.	Fourth	Second	4	5**	12	6	18
Total:			**46**	**32**	**126**	**34**	**160**

* Including Industrial Attachment.
** Including Research Project.

Mawlana Bhashani Science and Technology University

Santosh,Tangail

Department of Information and communication Technology

Proposed Syllabus for the B.Sc (Engg.) in ICT

Session 2010-2011

Total Credit: 160.00 (1 Credit = 14 Hours)

FIRST YEAR FIRST SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-101	Basic Electrical Circuit	3.00	00.00	3.00
ICT-102	Basic Electrical Circuit Lab	00.00	2.00	1.00
ICT-103	Computer Programming	3.00	00.00	3.00
ICT-104	Computer Programming Lab	00.00	2.00	1.00
ICT-105	Introduction to Information Technology	2.00	00.00	2.00
ICT-106	Introduction to Information Technology Lab	00.00	2.00	1.00
MATH-107	Mathematics-I	3.00	00.00	3.00
ENG-109	English	2.00	00.00	2.00
ED-110	Engineering Drawing	00.00	2.00	1.00
	Option-I	2.00	00.00	2.00
			Total	**19.00**

Option-I (select any one)

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
TES-111	Technology, Environment & Society	2.00	00.00	2.00
SOC-113	Sociology	2.00	00.00	2.00

FIRST YEAR SECOND SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-115	Discrete Mathematics	3.00	00.00	3.00
ICT-117	Electronics-I	3.00	00.00	3.00
ICT-118	Electronics-I Lab	00.00	2.00	1.00
PHY-119	Physics	3.00	0.00	3.00
MATH-121	Mathematics-II	3.00	00.00	3.00
ICT-123	Data Structure	3.00	0.00	3.00
ICT-124	Data Structure Lab	00.00	2.00	1.00
CHEM-125	Chemistry	2.00	00.00	2.00
ICT-100	Project-I	0.00	2.00	1.00
			Total	**20.00**

SECOND YEAR FIRST SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-201	Algorithm Design and Analysis	3.00	00.00	3.00
ICT-202	Algorithm Design and Analysis Lab	0.00	2.00	1.00
ICT-203	Digital Electronics	3.00	00.00	3.00
ICT-204	Digital Electronics Lab	00.00	2.00	1.00
ICT-205	Computer Based Numerical Methods	2.00	00.00	2.00
ICT-206	Computer Based Numerical Methods Lab	00.00	2.00	1.00
MATH-207	Mathematics-III	3.00	00.00	3.00
STAT -209	Statistics	2.00	0.00	2.00
ICT-211	Computer Organization and Architecture	3.00	0.00	3.00
			Total	**19.00**

SECOND YEAR SECOND SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-215	Object Oriented Programming	3.00	00.00	3.00
ICT-216	Object Oriented Programming Lab	00.00	2.00	1.00
ICT-217	Microprocessor and Assembly Language	3.00	00.00	3.00
ICT-218	Microprocessor and Assembly Language Lab	00.00	2.00	1.00
ICT-219	Electronics-II	3.00	00.00	3.00
ICT-220	Electronics II Lab	0.00	2.00	1.00
ICT-221	Database Management Systems	3.00	00.00	3.00
ICT-222	Database Management Systems Lab	00.00	2.00	1.00
MATH-223	Mathematics- IV	3.00	00.00	3.00
AF-225	Financial and Managerial Accounting	3.00	0.00	3.00
			Total	**22.00**

THIRD YEAR FIRST SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-301	Microwave Engineering-I	2.00	00.00	2.00
ICT-302	Microwave Engineering-I Lab	0.00	2.00	1.00
ICT-303	Analog Communication	3.00	00.00	3.00
ICT-304	Analog Communication Lab	0.00	2.00	1.00
ICT-305	Operating System	3.00	00.00	3.00
ICT-306	Operating System Lab	00.00	2.00	1.00
ICT-307	Computer Peripherals and Interfacing	3.00	00.00	3.00
ICT-308	Computer Peripherals and Interfacing Lab	0.00	2.00	1.00
ICT-309	Computer Graphics and Animations	3.00	0.00	3.00
ECON-311	Economics	2.00	00.00	2.00
ICT-300	Project-II	00.00	2.00	1.00
			Total	**21.00**

THIRD YEAR SECOND SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-315	Microwave Engineering-II	2.00	0.00	2.00
ICT-316	Microwave Engineering-II Lab	0.00	2.00	1.00
ICT-317	Theory of Computation	2.00	0.00	2.00
ICT-319	Computer Network	3.00	0.00	3.00
ICT-320	Network Planning and Designing Lab	0.00	2.00	1.00
ICT-321	Digital Communication	3.00	0.00	3.00
ICT-322	Digital Communication Lab	0.00	2.00	1.00
ICT-323	Software Engineering	3.00	0.00	3.00
ICT-324	Software Engineering Lab	0.00	2.00	1.00
	Option-II	3.00	0.00	3.00
ICT-326	Industrial attachment	0.00	0.00	1.00
			Total	**21.00**

Option-II (select any one)

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-327	VLSI Design	3.00	00.00	3.00
ICT-329	Bio-Informatics	3.00	0.00	3.00
ICT-331	Signals and Systems	3.00	00.00	3.00

FOURTH YEAR FIRST SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-401	Telecommunication Engineering	3.00	00.00	3.00
ICT-403	Artificial Intelligence and Expert system	3.00	00.00	3.00
ICT-404	Artificial Intelligence and Expert system Lab	0.00	2.00	1.00
ICT-405	Simulation and Modeling	2.00	00.00	2.00
ICT-407	Optical Communication	3.00	00.00	3.00
ICT-408	Optical Communication Lab	00.00	2.00	1.00
ICT-409	Network Security and Cyber Law	3.00	0.00	3.00
	Option-III	2.00	00.00	2.00
ICT-400	Thesis / Research Project	00.00	4.00	2.00
			Total	**20.00**

Option-III(select any one)

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-411	Data Mining	2.00	00.00	2.00
ICT-413	Management Information System	2.00	0.00	2.00
ICT-414	Geographical Information System	2.00	0.00	2.00

FOURTH YEAR SECOND SEMESTER

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-415	E-commerce and Web Engineering	3.00	00.00	3.00
ICT-416	E-commerce and Web Engineering Lab	0.00	2.00	1.00
ICT-417	Digital Signal Processing	3.00	00.00	3.00
ICT-418	Digital Signal Processing Lab	00.00	2.00	1.00
ICT-419	Wireless and Mobile Communication System	3.00	0.00	3.00
ICT-420	Wireless and Mobile Communication System Lab	0.00	2.00	1.00
	Optional-IV	3.00	00.00	3.00
	Optional-IV Lab	0.00	2.00	1.00
ICT-400	Thesis / Research Project	00.00	4.00	2.00
			Total	**18.00**

Option-IV (select any one pair)

Course Code	*Course Title*	*Class hours/week*		*Credit*
		Theory	*Lab*	
ICT-421	Artificial Neural Network and Fuzzy System	3.00	00.00	3.00
ICT-422	Artificial Neural Network and Fuzzy System Lab	0.00	2.00	1.00
ICT-423	Client-Server Technology	3.00	00.00	3.00
ICT-424	Client-Server Technology Lab	0.00	2.00	1.00
ICT-425	Distributed and Parallel Processing	3.00	00.00	3.00
ICT-426	Distributed and Parallel Processing Lab	0.00	2.00	1.00
ICT-427	Robotics and Computer Vision	3.00	00.00	3.00
ICT-428	Robotics and Computer Vision Lab	0.00	2.00	1.00
ICT-429	Machine Learning	3.00	00.00	3.00
ICT-430	Machine Learning Lab	0.00	2.00	1.00
ICT-431	Digital Image Processing	3.00	00.00	3.00
ICT-432	Digital Image Processing Lab	0.00	2.00	1.00

FIRST YEAR FIRST SEMESTER

ICT-101	**Basic Electrical Circuit**	**Credit: 3.0**

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, Nortons 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.

Coupled circuit: Analysis of inductively coupled and magnetically coupled circuits.

Recommended Books:

1. Robert L. Boylested, "Introductory Circuit Analysis".
2. Tony R. Kuphaldt, "Lesson's in Electrical Circuit"
3. W. Nilson & S.A. Riedel, "Electrical Circuits".
4. Nilson, " Introductory Circuitry for Electrical and Computer Engineering".
5. Alexander, princliples of electrical circuits.

ICT-102	Basic Electrical Circuit Lab	Credit: 1.0

Laboratory based on the course ICT-101.

ICT-103	Computer Programming	Credit: 3.0

Introduction: Definition of Software, its classification, Problem solving steps, 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, Recursions, passing arrays to functions, Storage class.

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

Structure: Definition of Structure, Union, Structure union applications, Self-referential Structure, Linked list, Array of structure and some examples.

Pointer: Understanding pointers, Pointers and arrays. Dynamic memory allocation, Pointers and functions, pointers and structures, Some special features of C (Macros, Enumerations), Bitwise operations.

File management: File management concept in C, Defining, opening and closing a file, Input/output operations in file, Error handling and command line arguments, Introduction to graphics, Drawing some geometric objects.

Recommended Books:

1. Byron S. Gottfried : Theory and Problems of Programmin 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. Yashavant Kanetkar, :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.

ICT-104	Computer Programming Lab	Credit: 1.0

Laboratory based on the course ICT-103 using Turbo C.

ICT-105	Introduction to Information Technology	Credit: 2.0

Introduction of computer and its Organization: Historical evolution of computers & classification, Computer generations, Basic organization and functional units of computer, Input/ output/storage/arithmetic logic/control and central processing unit, Internal structure of CPU.

Number Systems, Computer Codes and Arithmetic: Non-positional/positional number system, different number systems & their conversion, Fractional numbers, Numeric/alphanumeric data, BCD/EBCDIC/ASCII code, Binary arithmetic (Addition, subtraction, multiplication and division).

Computer Memory & I/O devices: Memory location and address, RAM, ROM, PROM, and EPROM, cache memory, Sequential/Direct/Random access device, Magnetic tape and disk, hard disk, floppy disk, CDROM, optical disk, Printers, Keyboard, Mouse, Scanner, and other devices.

Computer program, software and language: Program planning, algorithms, flow charts, pseudo code, Software and firmware, types of computer software, types of computer language, translator, interpreter, compiler.

Operating System and Data processing: Evolution of OS, Multiprogramming, Multiprocessing, Time sharing system, Real time system, types of data processing, database concept, database management system, SQL, Data mining.
Data Communication and Computer Network: Basic elements of a communication system, Types of communications among computers, characteristics of communication channels, Computer Networks, LAN, MAN, WAN, network security, Network topologies.

Others: Management Information system, office Automation, Multimedia concepts and components, WWW, WAP, E-commerce, E-governance, Internet, Internet services.

Recommended Books:

1. Peter Norton, McGraw-Hill, Introduction to computers.
2. Dr. M. Lutfar Rahaman : Computer Fundamentals
3. P. K. Sinha: Computer Fundamentals Concepts, Systems and Applications
4. N. Subramanian: Introduction to Computers
5. V. Rajarcman : Fundamentals of Computers
6. Peter Norton: Introduction to Computer

ICT-106	Introduction to Information Technology Lab	Credit: 1.0

Laboratory based on the course ICT-105.

MATH-107	Mathematics-I (Differential and Integral Calculus)	Credit: 3.0

Differential Calculus:
Limits, continuity and differentiability; Successive differentiation of various types of functions; Leibniz's Theorem; Rolle's Theorem; Mean value Theorem in finite and infinite forms; Lagrange's form of remainders; Cauchy's form of remainder; Expansion of functions; Evaluation of indeterminate forms by L'Hospital's rule; Partial differentiation; Euler's Theorem; Tangent and Normal, Subtangent and subnormal in cartesian and polar co-ordinates; Maximum and minimum values of functions of single variable; Points of inflexion; Curvature, radius of curvature, center of curvature; Asymptotes, curve tracing.

Integral Calculus:
Definitions of integration; Integration by the method of substitutions; Integration by parts; Standard integrals; Integration by the method of successive reduction; Definite integrals and its properties and use in summing series; Walli's formula, Improper integrals, Beta function and Gamma function; 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; Trapezoidal rule, Simpson's rule. Arc lengths of curves in cartesian and polar co-ordinates, parametric and pedal equations; Intrinsic equation; Volume of solids of revolution; Volume of hollow solids of revolution by shell method. Area of surface of revolution; Jacobian, multiple integrals and their application.

Recommended Books:

1. B.C. Das & B. N. Mukherjee :Differential and Integral Calculas
2. Howard Anton and Stephen Devis : Calculas A New Horizon
3. K.A. Stroud :Engineering Mathmatics
4. M. R. Spiegel : Advanced Calculas
5 .Earl W. Swokowski :Calculus with Analytic Geometry
6. Erwin Kreyszig : Advanced Engineering Mathematics
7. P. K Bhattacharjee :Integral Calculus

ENG-109	English	Credit: 2.0

English phonetics: The place and manners of articulation of the English sounds, Vocabulary.
English grammar: construction of sentence, some grammatical problems; preposition, phrasal verbs, idioms, derivatives, Comprehension; Paragraph writing, Prices writing, Amplification, Report writing, Business communication and tenders, Short stories written by some well known classic writers.

Recommended Books:

1. Wishon, G.E and Burks, J.M. : Let's Write English
2. Wren & Martin : High School English Grammar and Composition
3. Murphy : Intermediate English
4. Maurice Imhoof and Herman Hudson: From Paragraph to Essay
5. Jupp and Milne : Guided Course in English Composition
6. Houghton Mifflin English : Grammar and Composition
7. Longhead, Lin : Business Correspondence

ED-110	Engineering Drawing	Credit: 1.0

Identification of drawing instruments and their uses; Measuring scales and units; Paper sizes; Lettering; Free hand sketching; Alphabet of lines; Geometrical construction of tangents, ellipse, involutes & spiral; Dimensioning; Isometric, Orthographic and Oblique Projection; Sectioning; Conventional representation of some common features & abbreviation; Deployment of surfaces and cams; Computer aided engineering; Some modern engineering design software's and their applications.

TES-111	Technology, Environment & Society	Credit: 2.0

Definition of terminology – technology, environment and society; Interdependence of technology , environment and society; Growth of technologies and its contribution to human development; Technology and competitiveness; Technical change and worker's skills – effect of innovation on labor and employment's – the human element;
Current state of technology and its future use as an instrument of change in twenty first century; Environment, Concept of environment, concept of environmental impact, impact of technology and human upon the environment, impact of the environment upon human, change in the global climate; Water – its use and abuse; waste water, air pollution – past, present and future;

Solid waste –types, collection, disposal, potential uses for solid wastes; System for resource and energy recovery – renewable energy – scientific principle, technical implications and social implications Radiation hazards – radioactivity in human environments, disposal of under wastes.
Society factors leading to the growth of a society, rights of a citizen; Urban growth and decay; human impact on wildlife; Maintaining human habitat on earth; Population control-policies and prospects.

SOC-113	Sociology	Credit: 2.0

What is Sociology? Nature & Scope of Sociology. Development of Sociology, Relation with ICT. Primary Concept: Society, Community, Association, and Institution. Culture: Components of Culture, norms, values, folkways, mores, custom, fashion etc., Culture & Civilization Types of Society: Orientate & Occidental Society. Social Institution: Family, Religion. Social Stratification & Mobility: functionalist & Conflict Perspective. Social change: Theories of social change. Social Structure: Components of social Structure. Ethics of Bhashani. Bureaucracy as a organ of modern state, Marxism, Power Authority, Pressure Group.

Recommended Books:

1. P.B. Horton, C.L. Hunt : "Sociology".
2. R.T. Schaefer : "Sociology".
3. B.B. Hess, E.W.Markson : "Sociology"

FIRST YEAR SECOND SEMESTER

ICT-115	Discrete Mathematics	Credit: 3.0

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.

Recommended Books:

1. Kenneth H.Rosen :Discrete Mathematics and its Applications
2. Olympia Nicodemi : Discrete Mathematics.
3. Knuth :Concrete Mathematics
4. Seymour Lipschutz & Marc Laris Lipson :Theory and Problems of Discrete Math.
5. Donald F. Stanat & David F. McAllister :Discrete Mathematics in Computer Science
6. B. Kolman, R.C. Busby and S. Ross : Discrete Mathematical Structures.
7. C. L. Liu : Elements of Discrete Mathematics.

ICT-117	Electronics-I	Credit: 3.0

Theory of semiconductor: Energy band diagram of conductor, insulator and semiconductor, intrinsic and extrinsic semiconductor, effects of temperature on extrinsic semiconductors, Drift, Diffusion and other carrier theory.
Semiconductors diodes: Theory of p-n junction as diode, Junction diode characteristics and applications, Zener diodes and its application, Schottky Barrier Diodes, Varactor Diodes, Photo Diodes, Tunnel diodes, PIN diode, LCD,Half wave and full wave rectification with filtering and voltage regulators and power supply design.

Bipolar Junction Transistor (BJT): PNP and NPN transistors, principles of operation, biasing and thermal stability, characteristics in different configurations, small signal analysis, BJT amplifiers, π-model, T-model, transistor switching time, equivalent circuits using transconductance parameter for low, medium and high frequency operation of BJT.

Field Effect Transistor (FET): Construction of JFET and MOSFET, characteristics and principles of operation, FET biasing, small signal analysis, introduction to CMOS and its application. Application of FETs as amplifier and switches, load line analysis, equivalent circuits using transconductance parameter for low, medium and high frequency operation of FETs, Ebers-Moll model view; design and analysis of single/multistage amplifiers, power amplifiers, differential amplifiers.

Industrial Semiconductor Device: Structure and basic operation of LED, SCR, UJT, DIAC, TRIAC, photo diodes, phototransistor, solar cells, Concept on vacuum devices.

Recommended Books:

1. Sedra & Smith, “Microelectronic Circuits”.
2. Millman & Halkias , ”Electronic Devices & Circuits”
3. Bapat K N, ”Electronic Devices & Circuits”
4. Ramanan,” Functional Electronics”
5. Millman & Taub, “Pulse Digital and Switching Waveforms”
6. Allan Mottorshed, ” Electronic Devices & Circuits”
7. Millman & Halkias , ”Integrated Electronics”
8. Boylestead & Neshelsky ,”Electronic Devices & Circuit Theory
9. Schilling & Belove “Electronic Circuits ,Discrete & Integrated” TMH
10. V. K Metha, “Priciples of Electronics”.

ICT-118	Electronics-I Lab	Credit: 1.0

Laboratory based on the course ICT-117.

PHY-119	Physics	Credit: 3.0

Solids and Semiconductors:
Solids, Crystalline Solids, Amorphous Solids, Crystal lattice, Basis, Unit cell, Lattice Parameters, Single Crystals, Polycrystals, Crystal Systems and Bravais lattices, Energy Bands in Solids, Conductors, Insulators and Semiconductors, Charge Carriers in Semiconductors, Intrinsic and Extrinsic Semiconductors, Doping, N-type and P-type semiconductors, Electron and Hole Concentrations in Intrinsic Semiconductor in Thermal Equilibrium, Fermi Levels in N-type and P-type Extrinsic Semiconductors, Electrical Conductivity, diffusion Current.

Wave and Oscillation:
Simple harmonic motion, Combination of S.H.M. and Lissajous figures, Damped Oscillations, Forced Oscillations, Resonance.
Traveling waves, the principle of superposition, Wave velocity, Group velocity and phase velocity, Power and intensity in wave motion, Interference of waves, Diffraction of waves, Standing waves.

Audible, Ultrasonic, Infrasonic and Supersonic waves; Propagation and speed of longitudinal waves, Traveling longitudinal waves, Standing longitudinal waves, Beats, The Doppler effect.

Electricity & Magnetisms:
Electronics: Charge & Matter, Column's Law, The Electric Field, The electric field strength, Line of force, A dipole in an electric field, Gauss's Law, Gauss's law and Coulomb's law, Electrical Potential, Capacitance & Resistance, Ohmic & non Ohmic material. Electromagnetism: Magnetic fields, Magnetic Force on a current, The Hall effect.

Recommended Books:

1. Modern Physics : R. Murugeshan and Kiruthiga Sivaprasath
2. Concepts of Modern Physics : A. Beiser
3. Modern Engineering Physics : A. Vasudeva
4. Solid State Physics : R. P. Singhal
5. Electricity and Magnetism : R. Murugeshan
6. A Textbook of Optics : N Subrahmanyam and Brij Lal
7. Optics and Spectroscopy : R. Murugeshan and Kiruthiga Sivaprasath
8. Waves and Oscilation : Brij Lal

ICT-1207	Mathematics-II	Credit: 3.0

Matrix: 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.

Geometry: Transformation of co-ordinates axes and its uses; Equation of conics and its reduction to standard forms; Pair of straight lines; Homogeneous equations of second degree; Angle between a pair of straight lines; Pair of lines joining the origin to the point of intersection of two given curves, circles; System of circles; 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,Directiones cosines, Equation's of planes and Lines.

Recommended Books:

1. Md. Abdur Rahman : Co-Ordinate Geometry
2. K.A. Stroud : Engineering Mathematics
3. Richard Bronson : Liner Algebra
4. Earl W. Swokowski : Calculus with Analytic Geometry
5. P. N. Chatterjee : Matrices
6. Thomas, Finey :Calculus and analytic geometry
7. P. K. Bhattacharjee :Co-ordinate geometry & vector analysis
8. M. L. Khanna Solid geometry:
9. JT bell Coordinate Geometry
10. K Stein Calculus and Analytic Geometry

ICT-123	Data Structure	Credit: 3.0

Introduction: Concept of data types, abstract data types.

Array: Insertion, Deletion, Matrix representation of arrays, Multidimensional arrays, Pointers arrays, Record structures, Representation of records in memory; parallel arrays. Sparse matrices. Usefulness of sparse matrices.

Stack and Queue: Push and Pop operations. Arithmetic expression: polish notation implementation using stack Queue: Insert and Delete operations. Double ended queue, Priority queue.

Recursion: Direct and indirect recursion, Simulation of recursion, Depth of recursion, Removal of recursion. Towers of Hanoi using recursion. Linked lists: One way and two way linked lists. Traversing, Searching, Insertion and Deletion operations. Concept of algorithm analysis.

Sorting and Searching: Bubble sort, Quick sort Merge sort, Selection sort, Inserting sort, Radix sort, Shell sort, linear searching, binary searching.

Tree: Binary Trees, Binary Search Trees: Traversing (inorder, preorder, postorder). Insertion and deletion operations in Binary search trees. Threaded Binary Tree, Application of trees. Set representation, decision trees, game trees and counting binary trees. B-tree and basic operations on B-tree. Binomial tree and binomial heap, operation on binomial heaps. Fibonacci heaps and operations. Heap sort. Huffman codes and compression algorithm. Disjoint set and operations and disjoint set forests forests. Red black tree and operations. General trees.

Graphs: Graph representation, Adjacency matrix, Path matrix, Linked representation. Shortest paths: Warshall 's algorithm. Operations on graphs: Insertion of an edge or a node. Deletion of an edge or a node. Traversing a graph: Breadth first, Depth first. Posets: Topological sorting. Spanning trees and connected component. Finding minimum cost spanning tree using Prim's algorithm. Critical paths, enumerating all paths.

Symbol tables: Static and dynamic tree tables. Hashing: Hash function and overflow handling, Open hashing (Separate chaining) Close hashing (Open addressing), Linear probing, Quadratic probing, Double hashing.

Files: File queries sequential organization. Indexing Technique: Clinder + surface indexing, Hash indexes trees, Indexing-Btrees, Tree indexing.

Recommended 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. Seymour Lipschetz : Data Structure
6. Y. Langsam, Augenstein, A. M. Tanenbaum : Data Structures Using C and C++

ICT-124	Data Structure Lab	Credit: 1.0

Laboratory based on the course ICT-123.

CHEM-125	Chemistry	Credit: 2.0

Atomic Structure: Fundamental particles, Rutherford's atom model, Bohr's theory of hydrogen atom, Planck's quantum theory, emission spectrum of hydrogen, de Broglie equation, Heisenberg uncertainty principle, Schrödinger wave equation, quantum number, atomic orbitals-their shapes and orientation, Pauli's exclusion principle, Hund's rule, Aufbau prinzip.

Chemical Bonds: Ionic bonds and the properties of ionic compounds, Covalent bond: brief study of Valence Bond Theory (VBT) and Molecular Orbital Theory (MOT), Coordination bond, Metallic bond, Hydrogen bond, Van der Waals forces, elements and compounds of Si, Ge, B, Al. Structure and bonding of coordination compounds.

Spectroscopy: Quantization of energy, region of spectrum, representation of spectrum, principles, instrumentation and concise study of Infrared (IR), Raman, Microwave and Electronic (UV) spectroscopy, correlation of spectral features with structures of simple compounds.

Electrochemistry: Mechanism of electrolytic conductance, Kohlrauch's law, Ionic mobility and conductance, transport number, electrode potential, cell emf, electrochemical cell.

Biological Chemistry: A brief study of amino acids and peptides, properties of amino acids, N and C terminal amino acid residues, end group analysis, the covalent structure of protein, protein isolation and purification, amino acid sequencing of proteins, protein domain and subunit, DNA chemistry, central dogma, DNA replication, transcription and translation.

Recommended Books :

1. Introduction to modern inorganic chemistry, S.Z. Haider, Student Publication.
2. Concise inorganic chemistry, J.D. Lee, Blackwell Science, UK.
3. Basic inorganic Chemistry, Cotton, Wilkinson and Gaus,2nd Ed., John Willey &
4. Fundamentals of molecular spectroscopy-Banwell, McGraw Hill, NY.
5. Spectroscopy of organic compound, P.S. Kalsi, New Age Internationsl (P) Ltd,
6. Essential of Physical Chemistry, B.S. Bahl, G.D. Tuli & Arun Bahl, S. Chand
7. Poromanur Gothon abong Porjay Saroni- Kalipada Kundu, Bangla Academy.
8. Rasayonic Bondhon abong Onur Aakrity-Kalipada Kundu, Bangla Academy.
9. Biocoordination Chemistry, D.E. Fenton, Oxford Science Publication, USA.
10. Lehninger Principles of Biochemistry, D.L. Nelson, M. M. Cox, Freeman, NY.
11. Advanced Inorganic Chemistry, 6th Edition by F. Albert Cotton
12. Chemistry of the Elements, Second Edition by A. Earnshaw
13. Basic Inorganic Chemistry, 3rd Edition by F. Albert Cotton

ICT-100	Project-I	Credit: 1.0

Students will develop a project work on Information and Communication Technology.

SECOND YEAR FIRST SEMESTER

ICT-201	Algorithm Design and Analysis	Credit: 3.0

Algorithm and Data structure: Algorithm, Properties of good algorithm, Data Structure, 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.

Recommended 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++.

ICT-202	Algorithm Design and Analysis Lab	Credit: 1.0

Laboratory based on the course ICT-201.

ICT-203	Digital Electronics	Credit: 3.0

Number System: Review of Number system, Binary, Octal, Hexadecimal, BCD, ASCII.
Basic Logic Circuits: Gates; Boolean Algebra; De Morgan's Theorem; Half and Full Adders, Sub tractor, Sum of products and Product of sums; Mapping technique; Karnaugh map; Minimization of Logic circuits.
Combinational Circuits: Encoders & Decoders; Comparator; Parity generator, ALU; Multiplexer, Demultiplexers.
Silicon integrated Logic Families: AND, OR, INVERTER, other logic families with TTL, DTL, RTL, RCTL, TIL, ECL, IIL, SOS, FET, & CMOSTL families
Sequential Circuits: S-R, M/S, JK, D and T Flip-flops and Latches, Registers and Counters; Asynchronous and Synchronous counters, Different types of Registers; Counter application: Frequency and Digital Clock.
Memory Circuit & System: Introduction to memories; SAM; ROM; Static and Dynamic RAM, Flash memories, Charge coupled device and magnetic bubble memories. A/D Converter, D/A Converter.

Recommended Books:

1. Taub & Schilling, "Digital Integrated Electronics", Mc Graw Hill
2. Samuel C Lee, "Digital Circuits and Logic Design", Prentice Hall
3. A P Malvino ,"Digital Computer Electronics", Tata Mc Graw Hill
4. Morris & Miller, "Design with TTL Integrated Circuit", Mc Graw Hill
5. Peatman , "Digital Hardware Design", Mc Graw Hill
6. Ronald J Tocci , "Digital Systems, Principles and Applications ", Prentice Hall
7. Dr. V. K. Jain, "Switching Theory"
8. William I Fletcher, "An engineering approach to Digital Design", Prentice Hall
9. Zvi Kohavi "Switching and Finite automata Theory"TMH
10. Hayes, "Digital system Design and Microprocessors" Mc Graw Hill
11. John B Peatman, " Digital Hard Ware Design", Mc Graw Hill
12. William H. Gothman, "Digital Electronics"

ICT-204	Digital Electronics Lab	Credit: 1.0

Laboratory based on the course ICT-203.

ICT-205	Computer Based Numerical Methods	Credit: 2.0

Introduction: 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: Derivates using Newton's forward backward and Stirling's formula.

Numerical Integration: General quadrature formula for equidistant ordinates. Trapezoidal 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

Recommended Books:

1. G. Shanker Rao :Numerical Analysis, New Age International (P) Limited.
2. Mathus : Numerical Methods
3. Steven C Chapra : Numerical methods for Engineer.
4. Webb Miller :The Engineering of Numerical Software.
5. K. R. Jackson :Simplified Fortran Guide.

ICT-206	Computer Based Numerical Methods Lab	Credit: 1.0

Laboratory based on the course ICT-205 using Matlab.

MATH-207	Mathematics-III	Credit: 3.0

Ordinary Differential Equation (ODE): Degree and order of ordinary differential equations; Formation of differential equations; Solution of first order differential equations by various methods; Solution of first order but higher degree ordinary differential equations; Solution of general linear equations of second and higher orders with constant coefficients; Solution of homogeneous linear equations and its applications; Solution of differential equations of higher order when dependent and independent variables are absent; Solution of differential equation by the method based on factorization of operators.

Partial Differential Equations(PDE): Introduction. Linear and non-linear first order equations. Standard forms. Linear equations of higher order. Equations of the second order with variable coefficients. Wave equations. Particular solution with boundary and initial conditions.

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.

Recommended Books:

1. K.A. Stroud :Engineering Mathematics
2. F. Ayres :Differential Equation
3. K.A.Stroud :Further Engineering Mathematics
4. B. D. Havog :Differential Equation
5. M. R Spiegel :Vector Analysis
6. H. K. Das :Advanced Engineering Mathmatics
7. Bhu Dev Sharma : Differential Equation
8. Gupta and Sharma : Differential Equation
9. Matiur Rahman : Applied Vector Analysis

STAT-209	Statistics	Credit: 2.0

Preliminaries: 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 Theory: Linear Correlation Its measures and significance, Rank Correlation, Theorems & Problems.

Regression Analysis: Linear and non-linear regression, Least-square method of curve fittings, Theorems & Problems.

Probability: 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.

Probability Distributions: Binomial distribution, Poisson distribution and Normal distribution – Their properties, uses, Theorems & Problems.

Reccommended 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
7. Dr Manindra Kumar Roy :An Introduction to the theory of Probability
8. S.P. Gupta :Advanced Practical Statistics.
9. M.K. Roy :Fundamentals of Probability and probability Distribution

ICT-211	Computer Organization and Architecture	Credit: 3.0

Computer abstraction and technology: Introduction, Below Your Program, Under the Covers, Integrated Circuits: Fueling, Innovation. The roll of performance: Introduction, Measuring Performance, Relating the Metrics, Choosing Programs to, Evaluate Performance, Comparing and Summarizing Performance.

Language of the Machine: Introduction, Operations of the Computer Hardware, Operands of the Computer Hardware, Representing Instructions in the Computer, Instructions for Making Decisions, Supporting Procedures in Computer Hardware, Beyond Numbers, Other Styles of MIPS Addressing.

Arithmetic of Computers: Introduction, Signed and Unsigned Numbers, Addition and Subtraction, Logical Operations, 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.
Enhancing performance with pipelining: An Overview of Pipelining, A Pipelined Data path, Pipelined Control, Data Hazards and Forwarding, Data Hazards and Stalls, Branch Hazards. Multiprocessors: Introduction, Programming Multiprocessors, Multiprocessors Connected by a Single Bus, and Multiprocessors Connected by a Network, Clusters, and Network Topologies.

Memory Organization: Introduction, Characteristics of memory systems, Main memory design, Memory hierarchy, Cache memory, Virtual memory and memory management concepts.

Recommended 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
5. Shafwat Zaky : Computer Architecture

ICT-215	Object Oriented Programming	Credit: 3.0

C++: 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. Object oriented programming: Concepts of object oriented programming, objects, polymorphism, inheritance, OPP with C++, Classes, parameterized constructors, friend functions, multiple inheritance, passing object to functions, arrays of objects, pointer to objects. Function and operator overloading, overloading constructor functions, references, Inheritance, virtual functions and polymorphism, C++'s I/O class library, C++ streams, creating insertors and extractors, formatting I/O, file I/O, Dynamic allocation using new and delete, Static class members, 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.

JAVA: Introduction to Java, Concept of classes and objects, Features of Object Oriented Programming, Java Applications, Java Applets, Control Structures and Arrays, Methods, Object Based Programming, Object-Oriented Programming: Encapsulation, Inheritance, Polymorphism, Overriding, Overloading. Graphics, Graphical User Interfaces, Data structure, Multimedia: Images, Animation, and Audio Exception Handling, Multithreading, Files and Streams, Java Database Connectivity (JDBC).

Recommended Books:

1. Robert Lafore : "Object Oriented Programming in C++"
2. Herbert Schildt : "Teach yourself C++"
3. Deitel &Deitel :Java How to Program
4. E Balagurusamy : "Object-Oriented Programming with C++"
5. Irvine : "C++ Object Oriented Programming"
6. P. Naughton and H. Schildt, :*The Complete Reference Java 2*,
7. Patrick Naughton, Herbert Schildt :The Complete Reference, Java-2
8. E. Balagurusamy :Programming with Java
9. SAMS publications :Teach Yourself Java-2 in 21 days
10. A primer, E Balagurusamy : Programming with Java.
11. Deitel & Deitel. :How to Program Java
12. Naughton Schildt, :The Complete Reference Java 2

ICT-216	Object Oriented Programming Lab	Credit: 1.0

Laboratory based on the course ICT-215.

ICT-217	Microprocessor and Assembly Language	Credit: 3.0

Introductory Concept: Evaluation of microprocessor, Types of microprocessor, system bus, hardware of a microprocessor, memory-addressing technique.

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; 386 programming model; 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.

Assembly Language: Hardware of Microprocessor, Registers, assembler, Assembly language syntax, variables, Directives, Basic Instructions and their formats, The FLAG register, JMP, LOOP, CMP instructions, Conditional jump instruction, programming with high level structure.

Logic instructions, Shift instructions, Rotate instruction, the stack and stack related instructions, Procedure and procedure related instructions, Multiplication and Division instructions-MUL, IMUL, DIV, IDIV, CBW, CWD, arrays, addressing modes, XLAT instructions. String instructions, Macro definition, Parameters in Macro, Macro directives, Nested macros, Interrupt, Interrupt vector and routine, Bios Interrupt, Dos Interrupt, The IN, OUT, INS and OUTS instructions.

Recommended Books:

1. Ytha Yu; Charles Marut : Assembly Language Program & Organization of the IBM PC
2. V. Hall : Microprocessors and Interfacing.
3. Kip r. Irvine : Assembly Language for the IBM-PC.
4. Peter Abel : IBM PC Assembly Language and Programming;
5. Mohamed Rafiquzzaman : Microprocessor and Microcomputer Based System Design.
6. T. Hanley : Microprocessor and microcomputer
7. John F. wakerly : Micro Computer architecture and programming
8. John P. Hayes : Compute architecture and organization
9. Bary B Brey : The INTEL Microprocessors 8086/8088
10. Ramesh Gaonker : Microprocessor Interfacing

ICT-218	Microprocessor and Assembly Language Lab	Credit: 1.0

Laboratory based on the course ICT-217.

ICT-219	Electronics-II	Credit: 3.0

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.

Timing Circuits: Bi-stable, monostable and astable multivibrators, sweep and staircase generator, IC 555 and its application. Application of Op-Amp in timing circuits.VCO, PLL, blocking oscillators, practical op-amp ICs and advanced ICs.

Recommended Books:

1. Op amps and Linear Integrated circuits : R F Coughlin
2. Design with operational Amplifiers Analog Ics :Sargio Franko
3. Microelectronics : Millman & Grabel TMH
4. Op-amps and Linear integrated Circuits : Gaykwad
5. Integrated circuits : K R Botkar
6. Analog Integrated Citcuits : Gray John
7. Micro Electronics : Horstian
8. Microelectronic circuit : Sedra & Smith
9. Opamps and Linear integrated Circuits : D A Bell

ICT-220	Electronics-II Lab	Credit: 1.0

Laboratory based on the course ICT-219.

ICT-221	Database Management Systems	Credit: 3.0

Introduction: Database, data, 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.

Entity-Relationship Model: Entity sets, Relationship sets, Mapping Cardinalities, Keys, Attributes, Entity relationship diagram, Weak entity sets, Specialization, Generalization, Structure of Relational databases, Database Schema.

The Relational Algebra and SQL: 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.

Integrity and Security and Relational Database Design: Domain constraint, Integrity, Assertions, Triggers, Authorization, Authentication, Security, Privileges, Roles, Audit trails, Encryption-Decryption Algorithm, Normalization, Decomposition, Functional Dependencies, Closure of a set of Functional dependencies.

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.

Recommended Books:

1. H. F. Korth : "Database System Concept"
2. Ivan Bayross : SQL,PL/SQL
3. Litwin,Paul :Access 2000 Developers Handbook.
4. Oracle : "SQL Star International Limited"
5. BOU : "Database Management Systems"
6. Ramez E. Marsi : "Fundamentals of Database Systems"
7. Jeffry : "Fundamentals of Database"
8. Kock and Loney : "Oracle 8i the Complete Reference"
9. Kelvin Loney : "Oracle DBA Handbook"

ICT-222	Database Management Systems Lab	Credit: 1.0

Laboratory based on the course ICT-221.

MATH-223	Mathematics- IV	Credit: 3.0

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.

Recommended Books:

1. Glyn James :Advanced Modern Engineering Mathematics
2. Michael D. Greenberg :Advanced Engineering Mathematics
3. K.A.Stroud :Further Engineering Mathematics
4. H. K Das :Advanced Eng. Mathematics
5. M. R Spigel :Advanced Calculus
6. M. R. Spigel : Complex Variable
7. Schaum Out Line Series :Lap laces Transformation
8. Rajput : Engineering Mathematics
9. M. L. Khanna : Complex Variable
10. Schaum's Outlines Series : Laplace Transform
11. Abdur Rahman : Mathematical Method (Vol-I & Vol-II)

AF-225	Financial and Managerial Accounting	Credit: 3.0

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.

Recommended 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

THIRD YEAR FIRST SEMESTER

ICT-301	Microwave Engineering-I	Credit: 2.0

Introduction: Overview of vector analysis, orthogonal co-ordinate systems- rectangular, cylindrical, spherical transformations, Divergence, gradient, curl, stokes theorem,

Static Electric Field : Coulomb's law, scalar potential, electric field, electric flux, Gauss's law for electric flux, capacitance of sphere, coaxial cable and two wire transmission line, electric dipole, polarization, boundary relations, divergence of the flux density, Laplace equation, uniqueness theorem, Poisson's equation .

Static Magnetic Field: Magnetic flux, Biot-Savart law, Ampere's law, Gauss's law for magnetic flux, boundary conditions, inductance of a coaxial cable, two wire transmission lines, Magnetic vector potential

Time varying Electric and Magnetic Fields:- Faraday's law, Stokes's theorem, eddy current, displacement current. Maxwell's Equations integral & differential form, General solution of wave equation in free space - uniform plane waves - TEM waves –relation between electric and magnetic fields, Plane waves in a lossy medium, Skin depth, solutions of wave equations. Poynting theorem – real and complex Poynting vector, application of pointing theorem - power flow in transmission lines, uniform plane waves.

Transmission lines: Analogy between circuit theory & EM theory. Uniform transmission line – Voltage and Current solution - characteristic impedance. Terminated uniform transmission line VSWR –impendence matching quarter wave and half wave length transformer, stub matching -single stub matching, double stub matching and tuning - pulses on a transmission line- smith chart –Impedance matching using Smith Chart, Transmission line transformers.

Waveguides: Rectangular wave guide- modes of wave propagation- TE_{mn}, TM_{mn} waves, cut off wavelengths, derivation - dominant modes -Cylindrical Wave guides.

Recommended Books:

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

ICT-302	Microwave Engineering-I Lab	Credit: 1.0

Laboratory based on the course ICT-301.

ICT-303	Analog Communication	Credit: 3.0

Introduction to analog communication: Necessity and Types of modulation, transmitters, transmission channels and receivers.

Spectral Analysis: Preview of Fourier transform theory, energy, power, Parseval's theorem, Power Spectral Density Functions (PSDF), Analog Spectrum Analyzers, Auto Correlation Function, Relationship between the PSDF and the Auto Correlation Function, PSDF's of harmonic signals and un-correlated (white) signals. Review of signal transfer in linear systems, ideal Lowpass Filters.

Continuous Wave linear Modulators: Amplitude modulation (AM), Time Domain Expression and Modulation Index, Frequency Domain (Spectral) representations, and Transmission bandwidth for AM. AM for a single Tone Message, Phasor Diagram of an AM signal, Illustration of the Carrier and Side Band Components.

Double Side Band (DSB) Modulation: Time and Frequency Domain Expressions, Square Law Modulators, Balanced Modulators, Ring Modulators, Single Side Band Modulation (SSB), Generation of SSB using a Side Band filter, Indirect Generation of SSB, Vestigial Side band Modulation (VSB).

Demodulation for Linear Modulation: Demodulation of AM signals, Square Laws and Envelop Detectors, Super heterodyne Receiver for Standard AM Radio, Synchronous demodulation of AM, DSB and SSB.

Frequency and Phase modulation: Instantaneous Frequency and phase, Time Domain Representations for FM and PM, Phasor Diagram for FM and PM. FM and PM Signals for a Single Tone Message, Modulation Index and Phasor Diagrams. Spectral representation of FM and PM for single tone message. Transmission bandwidth for FM, Carson's rule, Narrow band and Wide Band FM and PM signals. Generation of FM, Commercial FM requirements. Demodulation of FM and PM signals, Limiter, discriminator, Commercial and Stereo FM Radio.

Frequency division multiplexing (FDM) Systems: FDM in Telephony, Telephone Hierarchy and examples of Group and Super group Generation. Filters and Oscillator requirement in FDM.

Representation of Random Signals and Noise in Communication System: Signal Power and Spectral Representations, White noise, Thermal noise, PSDF of White Signals. Input and Output Relationship for Random Signals and Noise Passed Through a Linear Time Invariant System, Band Limited White Noise, ARC Filtering of White Noise.

Noise performance of Analog Communication Systems: Signal-to-Noise Ratio in Linear Modulation, Synchronous Detection of DSB. Signal-to-Noise Ratio for AM and SSB, FM, Effect of Noise in Envelope and Square Law Detection of AM, Threshold Effects in Nonlinear Detectors

Recommended Books:

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

ICT-304	Analog Communication Lab	Credit: 1.0

Laboratory based on the course ICT-303.

ICT-305	Operating System	Credit: 3.0

Principle of operating systems and Operating system structure
Definition of operating system, Different kinds of operating systems (Desktop, Multiprocessor, Distributed, Clustered, Real time, Handheld systems), Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines.

Process: process management, inter- process communication, Process scheduling, Process Concept, Operations on Processes, Inter process Communication, Communication in Client-Server Systems, Basic Concepts of Process Scheduling, Scheduling Criteria and Scheduling Algorithms.

Multiprocessing and time sharing, Process coordination, Deadlocks
Multiple-Processor Scheduling, Thread Scheduling, Algorithm Evaluation, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock.

Control and scheduling of large information processing systems, Resource allocation; Dispatching; Processor access methods; Job control languages

Memory management
Background, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Demand Paging, Page Replacement, Thrashing, Demand Paging, Page Replacement.

File systems
File Concept, Access Methods, Directory Structure, File-System Mounting, File Sharing, File-System Implementation, Directory Implementation, Allocation Methods

Protection and security
Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Revocation of Access Rights, The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication, Implementing Security Defenses, Fire walling to Protect Systems and Networks.

Advanced topics: Distributed operating system, distributed file system, synchronization, real time systems, multimedia operating system.

Recommended 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

ICT-306	Operating System Lab	Credit: 1.0

Laboratory based on the course ICT-305.

ICT-307	Computer Peripherals and Interfacing	Credit: 3.0

Computer peripherals:
Input devices: Keyboard; Key switching mechanism and coding techniques; Static encoder; Lockout and rollover; Scanning encoder; Keyboard without key.
Modern data-entry devices: Scanners overview; Bar code reader; Optical mark reader (OMR); Optical Character Reader (OCR); Digitizer: Reading technique, Capacitive Electrostatic scanning digitizer.
Display devices: CRT; Basic CRT operations; Timing and frequencies; CRT controller ICs; LCDs; LCD technologies; Passive and active matrix; Guest-host techniques; Twisted-pneumatic LCDs; LCD reliability; Electroluminescent display.
Printers: Impact printers; Dot matrix printer, niddle principal; Laser printing; Ink-Jet printing; Color printing; Plotters.
Storage devices: Floppy disk; Floppy disk controller; Position control with stepping actuators; Magnetic hard disk and controller; Compact disk.

Introductory Concept of Interfacing: I/O interface, memory interface, interfacing components and their characteristics.

Serial and parallel Interface: Characteristics of memory and I/O interface, Synchronous and asynchronous communication, Serial I/O interface, RS232, 8251A communication interface, RS-232 interface, 8155A Programmable peripheral Interface, Parallel adapter, parallel port.

Interfacing components: 8284A Programmable timer, Bus architecture, Bus Timing, Bus Controller, analog and digital interface, Interrupt sources, types of interrupt, 8259A priority interrupt controller, Daisy chain.

I/O Controller: 8237A DMA Controller, Floppy and Hard disk Controller.

Recommended Books:

1. Yu Cheng Liu, Glenn A. Gibson: Microcomputer System: The 8086/8088 Family.
2. Klilkinm, Computer Peripherals.
3. Douglas V. Hall: Microprocessor and Interface.
4. Microprocessor Data handbook.
5. Mohamed Rafiquzzaman:Microprocessor and Microcomputer Based System Design.
6. Artwick : Microprocessor and Interfacing
7. Ramesh Gaonker : Microprocessor Interfacing,

ICT-308	Computer Peripherals and Interfacing Lab	Credit: 1.0

Laboratory based on the course ICT307.

ICT-309	Computer Graphics and Animations	Credit: 3.0

Introduction to Computer Graphics: History, Applications of computer graphics (Computer Aided Design, Animation), A survey of graphics I/O devices and types.

Graphics Software Design: survey of desired functions, toward a universal graphic language, Display files, Data bases for pictorial applications.

Graphics Techniques: Point-plotting techniques, Line drawing, Geometric Transformations, windowing and clipping, Raster graphics.

Hardware for Computer Graphics: Typical small and large system, Graphic terminals, plotters, graphic display processors, Device independent graphics systems.

Graphics Software: A simple graphic package, Segmented display files, Geometric models, Picture structure.

Interactive Graphics: input techniques, Event handling, three-dimensional graphics, Curves and surfaces, 3-D transformation. Hidden surface problem: Back face removal, Hidden-Line removal, Curved surfaces.

Animations: it is based on the course teacher.

Recommended Books:

1. Introduction to Computer Graphics, Author: Foley J D
2. Multimedia: Computing, Communications & Applications, Author: Ralf Steinmetz and Klara Nahrstedt

ECON-311	Economics	Credit: 2.0

Introduction: Definition of economics, Scope and utility of studying economics.

Micro-economics: The theory of demand and supply and their elasticity, Price determination, Nature of an economic theory, applicability of economic theories to the problems of developing countries. Indifference curves technique, Marginal utility analysis,

Production: Production function, types of productivity, The nature of Isoquants and Isocosts, Rational region of production of an engineering firm. Euler's theorem.

Market: Concepts of market and market structure. Cost analysis and cost function. Small scale production and large-scale production, Optimization, Theory of distribution.

Macroeconomics: Savings, investment, employment, National income analysis, Inflation, Monetary policy, Fiscal policy and trade policy with reference to Bangladesh.

Economics of development: Dimensions of development, Relevance of theory, the employment problem, Human resource development

Economics of planning: Planning and market, Policy models, Planning experience

Recommended Books:

1. Richard Leftwich- :The Price System and Resource Allocation
2. P.A. Samuelson- :Economics
3. P.A. Samuelson & Nordhaus :Economics
4. G.J. Stigler- : The Theory of Price.

ICT-300	Project-II	Credit: 1.0

Students will develop a project work on Information and Communication Technology.

THIRD YEAR SECOND SEMESTER

ICT-315	Microwave Engineering-II	Credit: 2.0

Microstrips: Structures and characteristics. Rectangular resonant cavities: Energy storage, losses and Q. impedance transformer, filters, isolator.

Microwave Devices: Semiconductor Microwave devices, Transit time effect velocity Modulation, Microwave amplifier and oscillator; Klystron (Multicavity and reflex), Magnetron, TWT, other microwave tubes.

Antennas: Small current element, radiation resistance, radiation pattern and properties, Hertzian and half wave dipoles, Mono pole, horn, rhombic and parabolic reflector, array, and Yagi- Uda antenna.

Radar and Electronic Navigation Systems: Radar principles; Civil, military and weather applications, Radar equation, Transmitters and radiators, Factor influencing maximum range; Moving target indicator(MTI), Tracking Radar system and search systems; Electronic navigation systems, LORAN, ILS, SONAR

Recommended Books:

1. Fields and Waves in Communication Electronics: S.Ramo. J.R.Whinnery
2. Microwave Devices & Circuits : Samuel Y Liao ,
3. Field and Wave Electromagnetics, :D.K.CHENG
4. Elements of Engineering Electromagnetics, :N. RAO
5. Electromagnetics, :JOHN D. KRAUS.
6. Foundations for Microwave Engineering, :R.E.COLLIN.
7. Microwave Engineering. :D.M. POZAR.
8. Antennas - :J D Krauss MGH
9. Antennas for all applications - :J D Krauss TMH
10. Introduction to Electromagnetic Field and Waves :Nasar and Paul

ICT-316	Microwave Engineering-II Lab	Credit: 1.0

Laboratory based on the course ICT-316.

ICT-317	Theory of Computation	Credit: 2.0

Finite automata: Deterministic finite automata (DFA). Non-deterministic finite automata (NDFA). Equivalence and conversion of DFA and NDFA. Pushdown automata.

Context free languages: Context free grammars, push down automata; context free languages

Turing machines: Basic machines. Configuration. Computing with Turing machines. Combining , Turing machines.

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Recommended Books:

1. Theory of Computation : Michael Sipser
2. Introduction to Automata theory, Languages and Computation : Hopcroft and Ullman
3. Automata and Algebras : Adamek, Kluwer.
4. Automata Theory : Trembly and Sorensen

ICT-319	Computer Network	Credit: 3.0

Introduction: 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.

Recommended Books:

1. Andrew S. Tanenbaum, :Computer Networks
2. Sharam Hekmat, :Communication Networks.
3. Behrouz A. Fourouzan , :Data Communications and Networking,
4. Stallings :Data and Communication
5. S. Keshav, :An Engineering Approach to Computer Networking
6. William A Shay, :Understanding communication and networks
7. Leon-Garcia and I. Widjaja, :Communication Networks
8. Bertsekas and Gallagar, :Data Networks
9. Douglas Comer & D. L. Stevens :Internetworking with TCP/IP
10. Richard Stevens :TCP/IP Utilities - Vol. I, The protocols
11. Sidnie Feit, :TCP/IP, Architecture, Protocols and implementation
12. Miller, :Data & Network Communications, Vikas Thomson

ICT-320	Network Planning and Designing Lab	Credit: 1.0

Laboratory based on the course ICT-319.

ICT-321	Digital Communication	Credit: 3.0

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.

Recommended Books:

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

ICT-321	Digital Communication Lab	Credit: 3.0

Laboratory based on the course ICT-321.

ICT-323	Software Engineering	Credit: 3.0

Software Engineering Paradigms: Definition of S/W Eng.; The classical life cycle; prototyping fourth generation technique; The product and the process, measurement, matrices.

Software Project Planning: Project planning objectives; S/W slope; Resources; Metrics for S/W productivity and quality; S/W project estimation; Decomposition techniques; Empirical Estimation Models; Automated Estimation tools; S/W project scheduling.

Requirements Analysis Fundamentals: Analysis principle; Software Prototyping Specification; Requirement Analysis Methodologies; Structured and object oriented analysis; Data Flow-oriented Analysis methods.

Software Design Fundamentals: Design process; Design fundamentals: S/W architecture, program structure, Data structure, S/W procedure, Modularity, abstraction; Effective modular design; Procedural design; Data flow-oriented Design; Top-down and bottom-up design; Design Process considerations; Transform analysis; Transaction analysis; Data structure-oriented design: Logical construction of programs and systems, Data structured systems development; object-oriented design; Design concepts; Methods; strategy. Real-time Design; Coding style: Code documentation, Data declaration, statement construction, Input/output.

Software reliability and availability models: Software quality factors; software review; software quality metrics; Software reliability; Software quality assurance approach.

Software Testing Techniques: Testing fundamentals; White box testing; Basis path testing; Loop testing; Black Box testing.

Software Testing Strategies: Verification and validation; Organization for software testing; Unit testing; Integration testing; Validation testing; System testing; The art of debugging.

Software Maintenance and configuration management: Definition; Maintenance Characteristics; Maintainability; Maintenance tasks; Software configuration management.

Recommended Books:

1. Ian Sommerville :Software Engineering
2. Roger S. pressman :Software Engineering
3. Elias M. Awad :Systems Analysis and Design
4. Ian Sommerville. :Software Engineering
5. Simon Binott, Ray Farmer :Object Oriented Systems Analysis & Design using UML

ICT-324	Software Engineering Lab	Credit: 1.0

Laboratory based on the course ICT-323.

ICT-326	Industrial Attachment	Credit: 1.0

Industrial training program will be organized by MBSTU during the session break in between 3rd year 2nd semester and 4th year 1st semester compulsory for all the students of B. Sc. (Engg.) in ICT. Duration of the training program will be about 2 weeks.

ICT-327	VLSI design	Credit: 3.0

Introduction: Introduction to MOSFETs; Enhancement and Depletion type NMOSFET, MOSFET Equivalent Circuits, GaAs MOSFETs.

MOSFET Logic Circuits: NMOS Inverter, CMOS inverter, CMOS Processing Technology, Overview of Silicon Semiconductor Technology, Basic CMOS Technology, CMOS Power Dissipation, Packaging, Scaling of MOS Transistor Dimensions Yield and Reliability. Process Enhancement, Layout Design Rules Latch up, CAD Tools for VLSI Design

MOSFET Logic Gates: NMOS, CMOS, Dynamic and Domino Logic Gates, Clocked CMOS Logic, Pass-Transistor Logic, Transmission Gates, CMOS Combinational, Sequential Logic Circuits, Bi-CMOS Logic Circuits, GaAS-MOSFET Logic Circuits, Interfacing CMOS & Bipolar Logic Families. Circuit Characterization and Performance Estimation, Resistance, Capacitance Estimation, Switching Characteristics, Delay Models, Power Dissipation, Packaging, Scaling of MOS Transistor Dimensions Yield and Reliability

CMOS Testing: Fault Models, Design Strategies.

CMOS Subsystem Design: Data-path Operations, Addition, Multiplication, Counters, Shifters, Memory Elements

Recommended Books:

1. Perry, Douglas L :HDL
2. Fabricius, :Introduction to VLSI Design
3. Charles H Roth Jr :Fundamentals of Logic Design
4. Navabi, Zainalabedin. :HDL analysis and modeling of Digital System

ICT-329	Bio-Informatics	Credit: 3.0

Introductory Concept

Basics of Biology, Molecular Biology and Bioinformatics, The central Dogma, DNA, transcription, Translation, Genomics, Amino acids, Proteomics and Genomics, Humana Computer Interaction and Bioinformatics.

Genome Analysis and Gene Mapping

Genome analysis, genome mapping, sequence Alignment, pair wise sequence alignment, Multiple sequence alignment, local and global alignment, sequence alignment techniques: dot matrix, dynamic algorithms, Popular algorithms: Needleman and Wunsch, Smith-Waterman, Scoring methods: PAM, BLOSUM, Phylogenetic analysis. Tools for similarity search, BLAST, Phi-BLAST, Psi-BLAST, FASTA.

Classification and Analysis of Protein

Overview of protein structure, protein structure Database, Data Capture, capturing micro array data, protein structure visualization tools, protein structure alignment, protein classification approaches, Alpha and beta structure analysis, structure comparison, protein structure analysis and prediction, motif, profiles, patterns and fingerprint search, protein evolution, Methods of 2D structure prediction, 2-D Gel Electrophoresis, 2-D Gel Electrophoresis image analysis, tools: CAROL, PiKA, Z3, PDQuest.

Multiple sequence alignment, Functional annotation of sequences, Gene Identification and Prediction, Gene Expression and Microarray, Hidden Markov Model, Navigation the NCBI web site. Genbank, EMBL, OMIM, Pubmed, Navigation other genome database sites (Ensembl, Celera).

Bionic Arm

Introduction of bionic devices, working principle of bionic arm, first bionic man and woman, prospect of bionic devices, latest bionic componets.

Recommended Book:

1. Bioinformatics Methods and Applications: Genomics, Proteomics and Drug Discovery- S.C. Rastogi, N. Mendiratta, P. Rastogi; PHI
2. *Fundamental Concepts of Bioinformatics,* D.E. Krane and M.L. Raymer, Benjamin Cummings, ISBN: 0-8053-4633-3 (2003);
3. *Genetics, a Molecular Approach*, T.A.Brown, Chapman & Hall, ISBN: 0412447304;
4. *Introduction to Computational Molecular Biology*, J.Setubal and J.Meidanis, PWS Publishing Company, ISBN: 0534952623;
5. *Bioinformatics: The Machine Learning Approach*, P. Baldi and S. Brunal, MIT Press, ISBN: 0-262-02442-X;
6. *Introduction to Computational Biology: Maps, Sequences, Genomes*, M.S.Waterman, Chapman & Hall, ISBN: 0412993910;

ICT-331	Signals and Systems	Credit: 3.0

1. An introduction to signals and systems: Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system analysis from these examples.

2. Formalizing signals: energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals.

3. Formalizing systems: system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

4. Continuous time and discrete time Linear shift-invariant (LSI) systems in detail: the impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.

5. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases of signals.

6. The Laplace Transform for continuous time signals and systems: the notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem.

7. The z-Transform for discrete time signals and systems: eigen functions, region of convergence, system functions, poles and zeros of systems and sequences, z-domain analysis. Generalization of Parseval's Theorem.

8. System realization through block-diagram representation and system interconnection. State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role.

9. The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

10. Applications of signal and system theory: modulation for communication, filtering and so on.

11. Advanced topics: time-frequency representation and the uncertainty principle, Short-time Fourier Transforms and wavelet transforms.

Textbooks/ Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. A. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons (SEA) Private Limited, c1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", Tata Mc Graw Hill Edition, 2003.
9. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2001.
10. Ashok Ambardar, "Analog and Digital Signal Processing", Second Edition, Brooks/ Cole Publishing Company (An international Thomson

FOURTH YEAR FIRST SEMESTER

ICT-401	Telecommunication Engineering	Credit: 3.0

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; Composite video signals; Channel Bandwidth; Sequential and simultaneous Color transmission system; Introduction to PAL, SECAM and NTSC systems; Generation of TV signals ; I and Q signals; Optical and Magnetic recording Magnetic video discs and slow motion; Introduction to CATV and CCTV.

Television Receiver: Monochrome and color TVs; Color fundamentals and Colorimetry; Color picture tube; RF and IF circuits and operation; Video amplifier; Composite video signal analysis; Horizontal sweep and High-voltage system; Vertical sweep and raster geometry circuits;

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.

Recommended Books:

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

ICT-403	Artificial Intelligence and Expert System	Credit: 3.0

Concepts of Artificial Intelligence: Introduction, The Foundations of AI, The History of AI, AI technique, The State of the Art**;**

Problems and Problem Solving: Problems, Example of Problems, Problem Formulation, Problem-solving methods**.**

Various Searching Techniques: Search Strategies, Uninformed (blind) search strategies like Breadth-First search, Uniform cost search, Depth-First Search etc. and Informed or Heuristic Search Strategies like Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-End Analysis etc.

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 logic: Inference Rules Involving Quantifiers, Example Proof, Generalized Modus Ponens, Forward and Backward Chaining, Completeness, Resolution.

Game playing: Introduction, Perfect Decisions, Imperfect Decisions, Alpha-Beta Pruning; **Natural language processing:** Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.

Planning: Basic Plan-Generating Systems, Forward Production System, Representation for Plans, Backward Production System, STRIPS, Examples with problem domain;

Learning: Introduction to Learning, Inductive Learning, Learning Decision Trees, Neural Net Learning;

Probabilistic Reasoning: Probability and Bayes' Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Fuzzy Logic**;**

Expert Systems: Expert system architecture, Representation and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition**.**

Recommended Books:

1. Elaine Rich and Kevin Knight :*Artificial Intelligence*, 2nd Edition, Tata McGraw-Hill Publishing Company Limited.
2. Stuart Russell and Peter Norvig :*Artificial Intelligence A Modern Approach*, Pearson Education asia.
3. Nils J. Nilsson :*Principles of Artificial Intelligence*, Narosa Publishing House.
4. L. H. Tsoukalas and R. E. Uhrig :*Fuzzy and Neural Approches in Engineering.*

ICT-404	Artificial Intelligence and Expert System Lab	Credit: 1.0

Laboratory based on the course ICT-403.

ICT-405	Simulation and Modeling	Credit: 2.0

Basic Simulation Modeling: The Nature of Simulation Systems, Models, and Simulation Discrete-Event Simulation Simulation of a Single-Server Queueing Alternative Approaches to Modeling and Coding Simulations, Parallel and Distributed Simulation ,Simulation across the Internet and Web-Based Simulation ,Steps in a Sound Simulation

Study ,Other Types of Simulation : Continuous Simulation ,Combined Discrete-Continuous Simulation.

Modeling Complex Systems : Introduction, List Processing in Simulation, Approaches to Storing Lists in a Computer Linked Storage Allocation, A Simple Simulation Language: simlib. Single-Server Queueing Simulation with simlib Time-Shared Computer Model Job-Shop Model Efficient Event-List Manipulation.

Simulation Software : Comparison of Simulation Packages with Programming Languages Classification of Simulation Software General-Purpose Simulation Packages Object-Oriented Simulation, Building Valid, Credible, and Appropriately Detailed Simulation Models Experimental Design, Sensitivity Analysis, and Optimization Simulation of Manufacturing Systems.

Simulation: Partial Differential Equations, Random Signals, Hybrid Simulation, Digital Simulation; Simulation Language-GPSS, SIMSCRIPT, CSMP, etc.

Recommended Books:

1. J. Banks, J. S. Carson : Discrete Event System Simulation
2. Raj Jain : The art of Computer Systems Performance Analysis.
3. Averill M. Law, W. D. Kelton : Simulation and Modeling Analysis
4. Law Kelton :Simulation Modeling and Analysis

ICT-407	Optical Communication	Credit: 3.0

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, WDM.

Recommended Books:

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

ICT-408	Optical Communication Lab	Credit: 1.0

Laboratory based on the course ICT-409.

ICT-409	Network Security and Cyber Law	Credit: 3.0

Introduction To Security: Need for security, Security approaches, Principles of security, Types of attacks.

Crytographic Techniques : Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

Symmetric & Assymetric Key Cryptography : Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Assymetric key together, Digital signature, Knapsack algorithm.

User Authenticattion Mechanism : Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall .

Case Studies Of Cryptography : Deniel of service attacks, IP spoofing attacks, Secure inter branch payment transactions.

Cyber law: digital copyrights issues, illegal duplication of software, human rights and data encryption, international cyber law, information sharing, cyber squaterring .

Basic Concepts of Technology and Law: Understanding the Technology of Internet, Scope of Cyber Laws, Cyber Jurisprudence.

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,

Rights of Netizens and E-Governance: Privacy and Freedom Issues in the Cyber World, E-Governance, Cyber Crimes and Cyber Laws.

Information Technology Act, International Scenario in Cyber Laws, Cyber Law Issues for Management, Security Perspective, Internet Security Issues, Digital Signatures for Securing Information Assets, Security Policies.

Recommended Book:

1. William Stallings : Cryptography and Network Security

ICT-411	Data mining	Credit: 2.0

Data Mining : Definitions; KDD(Knowledge Discovery database) versus Data Mining; DBMS versus Data Mining, Data Mining Techniques; Issues and challenges; Applications of Data Warehousing & Data mining in Government.
Association Rules: A priori algorithm, Partition algorithm, Dynamic inset counting algorithm, FP – tree growth algorithm; Generalized association rule.
Clustering Techniques : Clustering paradigm, Partition algorithms, CLARA, CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; Categorical clustering, STIRR, ROCK, CACTUS.
Decision Trees : Tree construction principle, Best split, Splitting indices, Splitting criteria, Decision tree construction with presorting.
Web Mining : Web content Mining, Web structure Mining, Web usage Mining, Text Mining.
Temporal and Spatial Data Mining : Basic concepts of temporal data Mining, The GSP algorithm, SPADE, SPIRIT, WUM.

Recommended Books

1. Data Mining Techniques; A. K. Pujari; Universities Press.
2. Data Warehousing, Data Mining and OLAP; Alex Berson and Stephen J Smith; TMH.
3. Data Mining Introductory & Advanced Topic; Dunham; Pearson Education.

ICT-413	Management Information System	Credit: 2.0

Topics covered include computer-based management information systems and their application to a range of common business functions; data management; managing system development and current development in business computing.

Recommended Books:

1. Introducing Computers–concepts, systems and Applications
   Author: Blissmer R H, John Wiley, 1995-1996
2. Management Information Systems
   Author: Cheung Y P, Monash Mt Eliza School of Business, 1996

ICT-414	Geographical Information System	Credit: 2.0

Basic principles and techniques used in the development of geographical information systems. It has a particularly strong focus on the application of GIS in practice and the evolution of approaches to their development and use. The main topics addressed include introduction to GIS concepts, basic hardware, software and data requirements for GIS development, evolution of GIS technology, key areas of application of GIS in practice, issues in the management of GIS, the organizational role of GOIS, and emerging trends in GIS development and usage.

ICT-400	Research Project	Credit: 2.0

Students will perform a research project work on Information and Communication Technology. It is a continuing course, that is 2-semester-long, will be evaluated with the courses of 4th year 2nd semester.

FOURTH YEAR SECOND SEMESTER

ICT-415	E-commerce and Web Engineering	Credit: 3.0

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 Internet; A brief introduction to Cryptography; Public key solution; Key distribution and certification; prominent cryptographic applications.

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 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.

Electronic Payment Systems: Digital payment systems; First virtual internet payment system; cyber cash model.

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.

Recommended Books:
1. Developing E-commerce sites : Sharma & Sharma
2. Frontiers of Electronic Commerce : Kalakota

ICT-416	E-commerce and Web Engineering Lab	Credit: 1.0

Laboratory based on the course ICT-415.

ICT-417	Digital Signal Processing	Credit: 3.0

Introduction to discrete time systems, Sampling of signals in time and frequency domain; Convolution, Correlation, Hillbert Transform, Discrete Fourier Transform , Fast Fourier Transform; Bilinear Transformation; Z-Transforms, Flow graph and Matrix representation of digital network, Stability, FR and IIR filters; Structure of digital filters ;Windows, Effect of finite word length in digital filters; algorithms for optimization and design of digital filters.

Recommended 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.

ICT-418	Digital Signal Processing Lab	Credit: 1.0

Laboratory based on the course ICT-417.

ICT-419	Wireless and Mobile Communication System	Credit: 3.0

History and Evolution of Mobile Radio Communication: Principle of Conventional Mobile Radio Systems, Limitations of Conventional Mobile Radio System.

Radio Paging: Introduction, Paging Receiver Types, On Site Paging, Transmitter Specifications, Wide Area Paging, Transmission Specifications, Paging Receivers Architecture.

Cellular Radio Systems: Basic Elements of a Cellular Radio System/Network, Principles of Operations, Frequency Spectrum and its Management, Radio Planning, Overview of Cellular Standard Systems, Digital Cellular Systems, Details of TACS and GDSM Architecture. 1G, 2G, 3G and the Forthcoming 4G Cellular Mobile Systems.

Mobile Communications by Satellite Service Systems in Operation, INMARSAT, MSAT, LEO and MEO Satellite, GMPCS Mobile Telephone and Data Sensing System using LEO and MEO Satellites (Iridium, Teledesic).

Satellite Communication. : Overview of Satellite System, **Spacecraft:** Introduction to Spacecraft Subsystem. (AOCS), Telemetry, Tracking and Command (TT&C), Spacecraft Antennas, Basic Antenna Types and Relationships Spacecraft, Antennas in Practice, Frequency Reuse, Equipment Reliability and Space Qualification, Reliability Redundancy, Multiple Access.

Earth station Technology. : Earth Station Design, Earth Station Design for Low System Noise Temperature, Large Earth Station Antennas, Satellite Television Broadcasting Networks, VSAT Technology.

Recommended Books:

1. Wireless Communication Principle and Practice By T.S. Rappaport
2. Fundamentals of Wireless Communications, David Tse, Pramod Viswanath
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
8. Fundamentals of Satellite Communication – K. N. Rao
9. Satellite Communications – Dr. D. C. Agarwal
10. Wireless Telecommunications Networking with ANSI 4 – Randall A Snyder & Michael.

ICT-420	Wireless and Mobile Communication System Lab	Credit: 1.0

Laboratory based on the course ICT-419.

ICT-400	Research Project	Credit: 2.0

Students will perform a research project work on Information and Communication Technology. It is a continuing course, that is 2-semester-long, will be evaluated with the courses of 4th year 2nd semester.

ICT-421	Artificial Neural Network and Fuzzy System	Credit: 3.0

Introductory Concept: History of neural network, human brain, biological neural network, synapses and their weights, pre- and post-synaptic signals, activation potential and activation function. Excitatory and inhibitory synapses, biasing input, characteristics of neural network, limitation of neural network, application of neural network

Fundamental concept of ANN: Basic models of artificial neuron, activation function, network architecture, neural network viewed as directed graph, Basic learning rules, supervised and unsupervised learning, Competitive learning.

Perceptrons: Overview of perceptrons, Single layer of perceptrons, mathematical model of single layer perceptrons, perceptrons learning algorithm, Delta learning rule, Multi-layer perceptrons, Back propagation learning algorithm, mathematical model of MLP network.

Function Approximation: Basis function network, Radial Basis function networks (RBF), MLP vs. RBF networks, Support vector machine (SVM), Hebbian learning and PCA, Linear Associative Memories (LAMs)

Competitive Network: Simple competitive network: Winner-take-all network, Adaptive Resonance Theory (ART), ART-1 architecture and algorithm, Kohonen Self-organizing Maps (SOMs), Counter Propagation Network (CPNs), HMM

Associative memory network: Linear Feedforward Associative memory network, Recurrent associative memory network, Bidirectional Associative memory network (BAM), Brain-State-in-a-Box (BSB) network, Hopfield networks, Boltzmann machine, Travelling salesman problem

Fuzzy system: Introduction to Fuzzy system, Fuzzy relations, fuzzy numbers, Linguistic description and their analytical form, fuzzy control.

Recommended Books:

1. Simon Haykin : Neural Networks -- a Comprehensive Foundation
2. LiMin Fu: Neural Network in Computer Intelligence.
3. Beale and Jackson: Neural Computing
4. Zurada, Jacek M.: Introduction to Artificial Neural Systems,

5. S. Rajasekaran,G.A. Vijayalakshmi Pai,: Neural Networks, Fuzzy Logics & Genetic Algorithm
6. Stamations V. Kartalopoulas : Understanding Neural Networks and Fuzzy Logic,
7. Bart Kosko :*Fundamentals of artificial neural networks*

ICT-422	Artificial Neural Network and Fuzzy System Lab	Credit: 1.0

Laboratory based on the course ICT-422.

ICT-423	Client-Server Technology	Credit: 3.0

Introduction, components of client server architecture, middleware, socket, Remote Procedure Call (RPC), Distributed Computing Environment (DCE), Common Object Request Broker Architecture (CORBA), Java Remote Method Invocation (RMI), Enterprise Java Beans (EJB), distributed data management, client-server application development, storage management, security and user management, backup and recovery, performance tuning.

Recommended Books:
1.TCP/IP : Behrouz A. Forouzan

ICT-424	Client-Server Technology Lab	Credit: 1.0

Laboratory based on the course ICT-423.

ICT-425	Distributed and Parallel Processing	Credit: 3.0

Distributed System Concepts, Communication, Distributed Models, Invocation Semantics, Remote Procedure Calls, Naming, File System, Security, Concurrency control and recovery, local area network, distributed languages and communication primitives, case studies of distributed systems.

Computational demands, advantages of parallel systems. Flynn's classification, controlled parallelism and scalability. Topologies: Mesh, binary tree, Hyper tree, Cube Connected cycles, shuffle-Connected Exchange; Uniform Memory Access (UMA & Non uniform Memory Access (NUMA) Multi processor System.

PARAM Model of Parallel Computation, PARAM Algorithms; Parallel Reductions, Prefix sum, List Ranking, Merging of Two Sorted List.

Parallel Processing: Importance, architecture, Hardware and software issues; Architectures for parallel processing - Classifications,

Comparative Study of Different Architectures: hardware issues in parallel processing, parallel programming;

Distributed Processing: Definition, Impact of distributed processing on organizations, pitfalls in distributed processing.

Distributed Applications: Abstract Syntax Notation One (ASN.1), Network Management - SNMPv2, Electronic mail - SMTP and MIME, Uniform Resource Locator (URL) and Universal Resource Identifier (URI), Hypertext Transfer Protocol (HTTP).

Mapping and Scheduling; mapping of Data from Topology to other (Ring to 2-D Mesh, Binomial trees to 2-D mesh, Rings & mesh into 2-D Mesh, Ring & Mesh into Hypercubes), Load balancing, Static scheduling on UMA multi processor systems.

Applications of parallel computing: Matrix Multiplication, Sorting (bitonic Merge sort, parallel quick sort, hyper quick sort), Searching a Graph (P-depth search, Breadth-Depth Search, Breath first search) , parallel Brach and bound algorithms

Books and References:

1. Michel J. Quinn, " Parallel Computing: Theory and Practice," McGraw-Hill
2. Kai Hwang, "Advanced Computer Architecture," McGraw-Hill.
3. G. Couloris, "Distributed System, Concept & Design," Addison Wesley 1994.
4. Tanenbaum, "Distributed Systems," PHI
5. P. K. Sinha, "Distributed Operating Systems," PHI.
6. A. Grama, A. Gupta, G. Karypis and V. Kumar. Introduction to Parallel Computing
7. H. El-Rewini and T.G. Lewis. Distributed and Parallel Computing, Manning
8. I. Foster. Designing and Building Parallel Programs, Addison Wesley
9. Kai Hwang and Zhiwei Xu. Scalable Parallel Computing, McGraw Hill

ICT-426	Distributed and Parallel Processing Lab	Credit: 1.0

Laboratory based on the course ICT-425.

ICT-427	Robotics and Computer Vision	Credit: 3.0

Introduction to robotics: Robot configurations, types and applications to different range of industrial applications. Kinematics and Dynamics of robots. Analysis, synthesis and design of robot mechanisms. Control systems design. Motion and trajectory planning and control. Sensor fusion in trajectory planing and control. AI based systems in trajectory and motion planing and control. Integration of vision with various functions of the robot. Advances in Robotics viz, Humanoid robot, toy /pet robots, service and health care robot systems.

Computer vision: Introduction to computer vision and perception; Image generation, Physics of image and sensors, statistical, estimation, binary vision and industrial vision systems, monocular and stereo vision, various vision processing algorithms and techniques for identification, feature extraction, tracking, representations of the visual world; Two-dimensional systems, common recognition problems;

Recommended Books:

1. John J. Craig :Introduction To Robotics Machines and Control
2. R. Paul : Robot Manipulators
3. Ballard and Brown : Computer Vision.
4. Duda and Hart. :Pattern Classification and Scene Analysis.
5. Rangachar and Jain. "Computer Vision." Los Alamitos, Calif.
6. Horn, B. "Robot Vision." Cambridge, Mass. : MIT Press ; New York : McGraw-Hill,
7. Charniak and McDermott. "Introduction to Artificial Intelligence." Addison Wesley

ICT-428	Robotics and Computer Vision Lab	Credit: 1.0

Laboratory based on the course ICT-427.

ICT-429	Machine Learning	Credit: 3.0

Introduction: Basic concepts; Supervised learning: Supervised learning setup. LMS, Logistic regression. Perceptron, Exponential family, Generative learning algorithms. Gaussian discriminant analysis, Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting, ECOC, Evaluating and debugging learning algorithms; Learning theory: Bias/variance tradeoff; Union and Chernoff / Hoeffding bounds, VC dimension, Online learning, Practical advice on how to use learning algorithms.

Unsupervised learning: Clustering. K-means, EM. Mixture of Gaussians, Factor analysis, PCA. MDS; pPCA; Independent components analysis (ICA); Reinforcement learning and control: MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic

regulation (LQR), LQG, Q-learning. Value function approximation, Policy search. Reinforce. POMDPs.

Recommended Books:

1. Christopher M. Bishop (2006) Pattern Recognition and Machine Learning.
2. David J.C. MacKay (2003) Information Theory, Inference, and Learning Algorithms,

ICT-430	Machine Learning Lab	Credit: 1.0

Laboratory based on the course ICT-429.

ICT-431	Digital Image Processing	Credit: 3.0

Introduction: Introduction of Digital Image Processing and Pattern Recognition, Application areas, Fundamental steps of Digital Image Processing, Components of Digital Image Processing, Image & Video, Image & Human eyes, Color TV scheme.

Analog and Digital Image: Analog and Digital Image, Image Acquisition and acquisition devices, Spatial and amplitude quantization, Pixels, Resolution, Aspect Ratio, Gray levels, Relationship color and gray levels.

Image Enhancement: Different types of Image Enhancement operations, Spatial domain and frequency domain processing, Different types of filtering.

Image Compression: Fundamental concepts of Image Compression and Data Compression, Data Redundancy, Image Compression models, Error free and Lossy compression, Image Compression Standards.

Morphological processing & Segmentation: Image Segmentation, Different types of Segmentation, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Morphological Image Processing, Dilation, Erosion, Opening, Closing, Hit and Miss etc.

Image Representation: Object representation and description algorithms, Run Code, Chain Code, Signature, Skeleton, Boundary detection, Feature Extraction few case studies.

Pattern Recognition: Fundamental concepts of Pattern Recognition, Pattern, Pattern Classes, Types of Pattern Recognition, Decision Theoretic methods, Structural method, Statistical method, Neural Network, Few case studies like speech recognition, fingerprint recognition, character recognition etc.

Multimedia applications: Tele-Conferencing, Virtual Reality, Authoring Tools, Multimedia Documents, Games.

Recommended Books:

1. R. C. Gonzalez, R. E. Woods : Digital Image Processing .
2. Earl Gose : Pattern Recognition and Image Analysis.
3. Related Papers from Journals and Conferences
4. I.T. Young, J.J. Gerbrands, L.J. van Vliet :Image Processing Fundamentals
5. Russ, J.C. :The Image Processing Handbook.

ICT-432	Digital Image Processing Lab	Credit: 1.0

Laboratory based on the course ICT-431.