New Syllabus For B.E
Department of Information Technology

1st Year 1st semester

1st Year 1st semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/111	Introduction to Programming	3	0	0	3	100	
IT/PHY/T/112	Physics-IA	3	0	0	3	100	
IT/IEE/T/113	Basic Electronics	3	0	0	3	100	
IT/MATH/T/114	Mathematics I (Modules 1 and 2)	3	0	0	3	100	
IT/PE/T/115	Engineering Mechanics	3	0	0	3	100	
IT/PE/T/116	Electrical Circuits	3	0	0	3	100	
IT/IEE/S/111	Basic Electronics Laboratory	0	0	3	3		100
IT/ S/112	Programming Laboratory	0	0	3	3		100
IT/PE/S/113	Engineering Drawing	0	0	3	3		100
IT/PE/S/114	Workshop	0	0	3	3		100
	Sub- Total	18	0	12	30	600	400
	Total	30				1000	

1st Year 1st semester

1. (IT/T/111) Introduction to Programming

Introduction to Computer Systems: Levels of programming languages

Basics of Problem Solving: Flowchart & Algorithms

Program development: Editing a program, Compiling a program, Executing a program

Fundamentals of Programming: Built in Data Types, Constants and Variables, operators & Expressions, Assignment Statements, Conditional Statements, Iterative Statements.

Functions and Procedures: Block Structured Languages, Scope & Life time of variables. Parameter Passing. Recursion

Sub-range and Enumerated Data Types: Array, Definition and list implementation using single dimensional arrays. Operations on lists such as searching, insertion, deletion, finding maximum, minimum, simple sorting. Character Arrays and String Operations

Multi-dimensional arrays: Matrix Manipulations (Addition, Multiplication, Transpose)

Record data types: Assignment on record data type, Arrays of record data types, Use of operators on record data

Pointers: Address arithmetic, Arrays and Pointers, Linked Lists as examples of using Pointers

Files: Opening , Closing , reading , writing operations. Binary Files.

Miscellaneous topics: Command line argument, function pointers, Variable length argument.

2. (IT/PHY/T/112) Physics-I

Module 1 A as provided by the department of Physics.

Physics-IA (42 Lecture hours in semester + help room)

l. Scalar and vector fields, Gradient of a scalar field, Physical interpretation of gradient, Divergence and curl of a vector field, Conservative vector fields and their potential functions- gravitational and electrostatic examples. (4)

2. Simple harmonic motion, free vibration, clamped and forced vibration, resonance. Wave motion, Superposition principle, phase velocity and group velocity. (4)

3. Motion of fluid, Bemoulli's theorem, Poiseuille's equation for the flow of liquid through' a narrow tube, Motion of a body through a viscous medium: Stokes' law. (4)

4. Overview of Coulomb"s law, Gauss"'s law, dielectric polarization, Displacement vector, Overview of Biot Savart law and Ampere's Circuital law. (4)

5. Time-varying field, Faraday's law of electromagnetic induction, Transient phenomena in electric circuits (series L-R, series C-R), Electrical oscillations in L-C circuit. Alternating voltage applied to series L-C-R circuit and the idea of electrical resonance . (5)

6. Macroscopic and microscopic description, Thermal equilibrium, Zeroth law of thermodynamics, Heat and Work, First law of thermodynamics and some applications, Reversible and irreversible processes, Carnot cycle, Second law of Thermodynamics, Concept of entropy. (6)

7. Interference of light waves, Young's experiment, Spatial and temporal coherence, Interference in thin film, Newton's rings, Diffraction of light waves, Fraunhoffer

diffraction due to single slit and plane diffraction grating, Polarisation of light waves, Polarisation by reflection, Brewster's law. (9)

8. Wave particle duality, dc Broglie waves and uncertainty principle, Concept of wave function and its physical interpretation. Nonnalisation, l-D Schrodinger equation - l-dimensional (infinite) potential well. (6)

3. (IT/IEE/T/113) Basic Electronics

Semi Conductors, Diodes and Applications: P-N Junction Diode. Characteristics and Parameters. The Diode Current Equation & Forward-Reverse Bias Characteristics. Diode Approximations. D.C Load Line. Temperature Dependence of V-I Characteristics. A.C Equivalent Circuits. Zener Diode. Half-Wave Diode Rectifier. Full-Wave Rectifier. Approximate Analysis of Capacitor Filter. Power Supply Performance. Zener Diode Voltage Regulators. Performance-Conventional Approach.

Transistors: The Bipolar Junction Transistor. Unbiased PNP and NPN. Principal of Operation of a PNP and NPN Transistor. Early Effect. Transistor Voltages and Currents. Amplification. Common Base, Common Emitter and Common Collector Characteristics.

Transistor Biasing Methods: Bias Circuit Design. Thermal Stability of Bias Circuits.

Other Devices: Silicon Controlled Rectifies (SCR). SCR Characteristics and Parameters. Phase Control of an SCR. Field Effect Transistor (FET). FET Amplification. MOSFET.

Amplifiers & Oscillators: Half-Power Points. Single Stage CE Amplifier. R-C Coupled Amplifier. General feedback theory and topologies; Some typical examples of feedback amplifiers. Barkhausen Criterion. RC Phase Shift Oscillator. Hartley Oscillator.

Operational Amplifiers: The Ideal Operational Amplifier. Saturation Property of an Op-Amp. The Inverting Op-Amp Circuit. The Non-Inverting Op-Amp Circuit. Other Op-Amp Applications

4. (IT/Math/T/114) Mathematics - I

Module 1 & Module 2 as provided by the department of Mathematics

Module: I
Differential Calculus of Single Variable: (Marks: 30)

Sequence; Infinite series and their convergence and divergence; Cauchy‘s general principle of convergence; Comparison test; D"Alembert‘s ratio test and Cauchy‘s root (statement and their applications only); Successive differentiation; Rolle"s thcorcm*; Mean value theorems; Taylor’s theorem*; Maclaurin’s theorem*; Expansion of elementary functions; Indeterminate form; Curvature and Asymptote; Concavity, convexity and points of inflexion.

Differential Calculus of Several Variables: (Marks: 20)

Limit; Continuity and Differentiability; Directional derivatives; Partial derivatives; Differentials; Euler's theorem on homogeneous functions; Implicit function; Jacobian; Taylor's theorem*;Maxima; Minima and Lagrange's method of undetermined multipliers. *Proof not required

Module: II
Integral Calculus: (Marks: 50)

Riemann integration (Definition and properties); Fundamental theorem of integral calculus; First mean value theorem of integral calculus; Improper integrals (Definitions and examples); Gamma and Beta functions; Multiple integrals; Rectification; Quadrature; Volume and surface areas of solids of revolution; Numerical integration by trapezoidal and Simpson's l/3 rule.

5. (IT/PE/T/115) Engineering Mechanics

STATICS: Mechanics, Quantities, Units, Dimensions; Fundamental of vector algebra, Application of vector algebra, Notion of equilibrium, Newton's law of motion.

Force: Types of forces acting on a body, Co-planner forces and moments, Forces and moments in space, Equations of equilibrium of a rigid body, Free body diagram for planner systems of rigid bodies.

Friction: Laws of coulomb friction, problems involving large and small contact surfaces, Belt friction, Equilibrium of a belt, Bearing friction.

DYNAMICS : Dynamics of particle: dynamics in rectangular co-ordinate, cylindrical co-ordinate, and path co-ordinate.

Kinetics of rigid body: Product of inertia and moment of inertia of a rigid body, Angular moments of rigid bodies.

Loads: Concept of stress: normal stress, shear stress. Concept of Strain: normal strain, shear strain, Hooke's law, Poisson ratio, Transformation of stress and strain. Shear force and bending moment diagrams for beams.

6. (IT/PE/T/116) Electrical Circuits

Fundamental Concepts: Units and dimension in electrical engineering, Concept of resistance, inductance, capacitance, impedance and admittance, General structure of electrical power system, Power transmission and distribution via overhead and underground cables.

DC Networks: Passive circuit parameters and their equilibrium conditions – Kirchoff's law, Differential equations for passive circuits and their solutions, node voltage, mesh current methods, delta-star and star-delta conversion, superposition, Thevnin's and Norton's theorem, maximum power transfer theorems, Fourier series and transform, Laplace transform, convolution theorem.

Single Phase AC Circuits: EMF generation, frequency domain analysis of RLC circuits, the j operator, impedance, reactance, power factor, solutions of parallel and series-parallel circuits.

Three Phase AC Circuits: EMF generation, Y-DELTA connection, solution of three phase circuits, phasor diagram, Power measurement in three phase circuits.

Filters: Low pass, high pass, band pass and band elimination, basic idea of impedance, matching, attenuation, and phase distortion in transmission lines.

7. (IT/IEE/S/111) Basic Electronics Laboratory

Familiarization with Electronic Components like R,L,C and active devices. Familiarization with Electronic Workshop Tools and their use. Soldering Practice. Studies on the Characteristic of PN-Junction Diode, Clipper, Clamper, Rectifier circuits Zener regulators.
Characteristics of BJT (CE mode) and FET. (CS mode)
Studies on the properties of Amplifiers - BJT / FET.
Studies on the Application of Operation Amplifier-Summing, Voltage Follower, Differentiator, Integrator, Filter.
Timer-555 : Monostable and astable multesbrators using 555

8. (IT/S/112) Programming Laboratory

Familiarity with program development environment (including DOS/UNIX commands that may be necessary for program development and execution).
Assignments involving Simple Programs, Functions and Procedures, Recursion, use of various Data Types, Files. [There would be a list of 25-30 graded programming problems as assignments, which must be solved by the students in the laboratory].

9. (IT/PE/S/113) Engineering Drawing

Use of drafting Equipment and Instruments: Exercises in Instrumental drawing, learning drafting codes as per ISO and IS. Preparation and use of Scales.

Engineering Geometry with examples. Geometric Configuration and Evolving solids, Single plane projections of product features, Orthographic and Isometric Projection of Simple Objects; Sectional and Auxiliary Views.

10. (IT/PE/S/114) Mechanical Workshop

Practical Carpentry: Type of wood and identification of Indian wood for engineering purpose. Defects of wood. Introduction to Carpenter's tools and working mechanical shaping of wood.
Practical fitting: Introduction to different type of fitting tools, their use and care such as vice, hammer, chisel, punch, file, hacksaw, drill, tap etc. Their use and care. Use of fitter instruments such as calipers, marking blocks, V-Block, Steel rule, micrometer calipers etc. Simple jobs in marking, punching, chip.; ping, sawing, chilling tapping.
Machine shop -Demonstration of drilling and Lather work.

1st Year 2nd semester

1st Year 2nd semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/121	Data Structures & Algorithms	3	0	0	3	100	
IT/ MATH/T /122	Mathematics II (Modules 5 and 6)	3	0	0	3	100	
IT/IEE/T/123	Digital Logic & Digital Circuit	3	0	0	3	100	
IT/ PE /T/124	Electrical Measurements	3	0	0	3	100	
IT/PHY/T/125	Physics II A	3	0	0	3	100	
IT/Hum/T/126	English For Communication & Social Studies	3	0	0	3	100	
IT/ S/121	Data Structure Laboratory*	1	0	3	3		100
IT/IEE/S/122	Digital Logic Laboratory	0	0	3	3		100
IT/PE/S/123	Electrical Technology Laboratory	0	0	3	3		100
	Sub- Total	19	0	9	27	600	300
	Total				28	900	
* Laboratory has to be allocated in continuous 4 periods							

1st Year 2nd semester

1. (IT/T/121) Data Structures & Algorithms

Introduction: Algorithms, Order Notation: Time and Space Analysis of Algorithms

Sequential Representations of lists: Arrays and Lists, Linked Representation - Linear linked lists. Circular linked lists. Doubly linked lists. Operations on all types of lists. Applications.

Special Lists: Stacks, Queues and their applications.

Recursion: Design of recursive algorithms, Recursion vs. Iteration, Removal of Recursion

Trees - Binary Trees, Traversals of binary trees, Structural properties of binary trees. Representation of binary trees in terms of pointers and arrays. General trees

Binary Search Trees: Search, Insertion and Deletion algorithms, Structural properties. Threaded Binary trees.

Balanced Binary Search Trees: AVL tree, B-trees, B+- trees.

Graphs: Representations, Breadth-first and Depth-first Traversals, Shortest Path algorithms, Minimal Spanning Tree Algorithms

Sorting and Searching Algorithms: Bubble sort, Selection Sort, Insertion Sort, Quick sort, Merge Sort, Heap sort and Radix Sort, Binary Search, Interpolation Search.

Hashing: Hashing Functions, Collision Resolution Techniques.

2. (IT/Math/T/122) Mathematics – II

Module 5 & Module 6 as provided by the department of Mathematics

Module: V
Fourier Series and Integral Transforms: (Marks: 50)

Fourier series; Periodic functions; Trigonometric series of sine and cosines; Euler"s formula; Even and odd functions; Diricltlet‘s conditions; Half range sine and cosine series; Fourier transform, definitions and properties; Inverse Fourier transform; Convolution; Laplace transform, properties; Inverse Laplace transform; Convolution; Z transform and properties.

Module: VI
Ordinary Differential Eguation (ODE) and Series Solutions: (Marks: 30)

First order exact differential equation and first order linear differential equation; Second and higher order linear differential equations with constant coefficients; Euler and Cauchy equation; Method of variation of parameters; Ordinary point and regular singularity of a second order linear differential equation; Seriés solutions; Solution of Legendre and Bessel"s equations; Generating functions; Recurrence relations and their Orthogonal properties.

Partial Differential Eguation (PDE): (Marks: 20)

I order PDE; Lagrange method; Second order PDE with constant coefficients and their classification to Elliptic, Parabolic and Hyperbolic type. Solution of PDE by method of separation of variables; Solution of one-dimensional wave and diffusion equation; Laplace equation of two dimensions.

3. (IT/IEE/T/123) Digital Logic & Digital Circuit

Various number systems ,codes and their conversion techniques:. Representation of signed binary number in fixed and floating point. Binary Arithmetic

Boolean algebra-postulates and fundamental theorems: Representation of Boolean functions using Venn diagram, truth tables etc., Basic Boolean gates AND , OR, NOT and universal gates NAND, NOR and also XOR. Parity Checkers & generators

Boolean expression minimization techniques through fundamental theorems: Karnaugh map techniques and Quine McClauskey's tabular method.

Common combinational circuits: Adder, subtractor, encoder, decoder, comparator, multiplexer, parity generators etc.

Sequential Circuits and Flip-Flops: State Table and State Transition Diagram. Study of different types of flip-flops e.g. R-S, D-type, J-K etc. Registers, Counters and Asynchronous Counters. Race condition.

Programmable Logic Device, Gate Arrays, ROM, RAM, EPROM, EEPROM etc.

Different A/D and D/A conversion techniques.

Introduction to different logic families TTL, ECL, COMS etc. and their comparison

4. (IT/PE/T/114) Electrical Measurements

Introduction: Nature of measurements, standards, units and symbols, direct and indirect measurement methods, definition of accuracy, precision, least count, drift, sensitivity, resolution, loading effect

Measurement Instruments: Calibration for electrical measuring instruments, classification of instruments, general feature of indicating instruments: controlling, damping, balancing. Basics of PMMC instrument, their error and compensation.

Moving coil: damper, bearing suspension, Linear and non-linear scales, ammeter, voltmeter, ohm meter, single phase dynamometer, dynamometer for voltage and current measurement.

Moving Iron ammeters and voltmeters, shunt, multiplier and potentiometer for AC and DC, Principles of thermal and induction type instruments.
General theory of simple and bridge AC circuits, Kelvin double bridge, Maxwell's bridge, Schering bridge.

5. (IT/Phy/T/115) Physics – II

Module 2 A as provided by the department of Physics

Physics-2A (42 lecture hours in semester + help room)

l. Generalization of "Ampere‘s circuital law, “Maxwell’s equations, Poynting theorem, Poynting vector. Maxwell's wave equation in free space and its solution. (8)

2. Time dependent Schrodinger equation for a. free particle, Stationary states, Postulates of quantum mechanics, expectation values of physical observables, energy eigen values and eigen functions for particle in a box, Square well potential, reflection and transmission coefficient in potential barriers. (10)

3. Statistical description of a system of particles, Phase space, Microstates and macrostates, Boltzmann's formula for the entropy, Boltzmann distribution function (derivation not reqd.) Classical ideal gas, Equipattition theorem and its applications. (9)

4. Origin of magnetism, Comparison of Dia, Para and Ferromagnetic materials, Classical theory of diamagnetism, classical / quantum theory of paramagnetism. (9)

5. Crystal physics: crystal lattice, Crystal planes and Miller indices, Simple crystal structures: fcc, bcc, sc. Brag’s law and determination of lattice constant. (6)

6. (IT/Hum/T/116) English For Communication & Social Studies

English

I. Basic writing skills: based on Sections I and 2 of English for All = 8 classes (4 weeks).

2.Communication skills.
i) Report writing = (4 classes) 2 weeks
ii)4- Précis writing == (4 classes) 2 weeks

iii)CVs and resumes = (4 classes) 2 weeks
iv)Reading scientific papers: Scholarly conventions = (4 classes) 2 weeks

3. Two prose extracts from English for All (may be changed from time to time: proposal for this year, JBS Haldane, “Scientific Research For Amateurs" and Rabindranath Tagore “The Religion of the Forest”)=(4classes) 2 weeks.

4. One short story from English for All (may be changed from time to time: proposal for this year, James Thurber, “The Secret Life of Walter Mitty") = (4 classes) 2 weeks.

Group presentations in class to be encouraged.

Society, Culture and Technology

1. Understanding technology historically
i) Emergence and growth of technology in response to collective needs
i) Commodity production and expansion of trade; economic imperatives for technological advancement.

2. Technology and work
i) Technology and industrial production: fordism and post-Fordism
ii) Division of labour and social identities: race, ethnicity, gender.

3. Technology, cultural globalization and global consumerisms
i) Computer, Media and Culture.
ii)Information and Communication Technology. Role of communication technology: five components communication, pyramid of communication
iii) Global television and American cultural imperialism.

4. Internet and Community
i) Understanding of Community in the Information Age
ii) The virtual individual and the virtual social
iii) Power and cyberspace

5. The Ecology Approach
i) The natural world and the built environment; nature, man and science: eco-system and eco-feminism.
ii) Technology and sustainable development

6. The gender question
i) Sex and gender; science and Technology; the malestream
ii) Women and technology. Domestic technology: persistence of gender roles

7. (IT/S/121)

Programming exercises for implementing linear and non-linear data structures taught in the Theory course IT/T/121.
Programming exercises for implementing various sorting and searching algorithms.

8. (IT/IEE/S/122) Logic & Circuit Design Laboratory

Experiments on building circuits for adder, subtractor, encoder, decoder, comparator, multiplexer, parity generator, counters, shift register.

9. (IT/PE/S/123) Electrical Technology Laboratory

Calibration of Ammeter and Voltmeter
Measurement of High Resistance
Volt-ampere characteristics of Lamps
Power and Power factor of a single-phase load
Measurement of resistance by Voltmeter and Ammeter
Characteristic of AC series and parallel circuits
Voltage and power characteristic of single-phase load
Coil connection of a single-phase transformer.
Balanced three-phase circuit
Measurement of Low resistance by Kelvin double bridge
Study of DC motor starter
Owen bridge network
EMF included in DC Machine
Calibration of single-phase Watt-hour meter
External characteristic of DC generator
Schering bridge network

2nd Year 1st semester

2nd Year 1st semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/211	Object Oriented programming	3	0	0	3	100	
IT/ MATH/T /212	Mathematics – III (Modules 3 and 10)	3	0	0	3	100	
IT/T/213	Database Management Systems	3	0	0	3	100	
IT/T/214	Principles of Communication Engineering	3	0	0	3	100	
IT/T/215	Computer Graphics	3	0	0	3	100	
IT/T/216	Computer Architecture	3	0	0	3	100	
IT/ S/211	Object Oriented programming Laboratory	0	0	3	3		100
IT/ S/212	Database Management Systems Laboratory	0	0	3	3		100
IT/ S/213	Programming Practice laboratory*	1	0	3	3		100
	Sub- Total	19	0	9	27	600	300
	Total	28			27	900	
* Laboratory has to be allocated in continuous 4 periods							

2nd Year 1st semester

1. (IT/T/211) Object Oriented programming

Basic Concepts of Object Oriented Programming (OOP) – Objects, Classes and Message Passing. Differences between conventional and Object-Oriented programming, advantages and disadvantages of OOP.

Enhancements over Procedural Languages: New data types. Function Overloading and its resolution. New dynamic allocation and de-allocation methods.

Classes and Objects: Notions of abstraction, encapsulation, information hiding and modularity. Instantiation and initialization of objects; constructor and destructor. Access Specification. Functions and methods; self reference of objects. Copy Constructor. Static Members. Nested Classes.

Inheritance and Polymorphism: Basic concept of IS-A relationship. "protected" access specification. Initialization and de-initialization of derived objects. Polymorphic method calls and dynamic binding. Abstract methods and classes. Examples. IS-A versus IMPLEMENTED-IN-TERMS-OF relationship. Multiple Inheritance. The problem of multiple occurrence of the same base and its solution.

Operator Overloading (C++): Fundamental ideas. Examples of overloading with arithmetic, relational operators. Overloading of unary operators. Overloading of "new" and "delete" operators.

Basic I/O and File I/O.

Exception handling: The idea of exception handling and its superiority over traditional error handling. Semantics of *try-catch* blocks and *throw*.

Generic Programming: Templates in C++. Function Template definition and instantiation. Class Template definition and instantiation. Template Specialization. Class Template Inheritance. Standard Template Library in C++.

Runtime Type Identification

Namespace

2. (IT/Math/T/212) Mathematics – III

Module 3 & Module 10 as provided by the department of Mathematics

Module: III

Linear Algebra: (Marks: 30)

Matrix and Determinant; Inverse of a square matrix; Elementary row and column operations; Echelon form; Rank of a matrix; Solution of system of linear equations; Cramer"s rule; Matrix inversion method. Characteristic equations; Eigenvalues and Eigenvectors; Cayley-Hamilton theorem.

Geometry of Three Dimensions: (Marks: 20)

Cartesian co-ordinates in three dimension; Direction cosines; Angle between two lines; (Equation of Planes and Straight lines; Skew lines; Shortest distance between skew lines; Condition of coplanarity; Standard equation of spheres.

Module: X
Abstract Algebra: (Marks: 50)

Groups; Subgroups; Normal subgroups; Cyclic groups; Lagrange's theorem; Hornomorphism; Isomorphism theorems; Permutation groups; Rings; Ideals; Prime ideals; Maximal ideals; Fields; Polynomial rings; Factorization in polynomial rings; Extension of fields; Splitting field of a polynomial; Constructions of Galois fields (Finite fields) and their properties.

3. (IT/T/213) Database Management Systems

Introduction: History of Evolution of DBMS and advantages over traditional file system, Three-schema architecture of DBMS and Data Independence. Introduction to DDL and DML. Ideas about different kind of users of DBMS and available databases in market.

Data Model: Introduction to Relational data model and object oriented data model; Keys, Entity-Relationship Model, Relational Algebra , Tuple and Domain Relational Calculus

Database Design: Conceptual database design, Different types of dependencies, Theory of normalization, preservation of dependencies, Lossless decomposition, Armstrong's axioms, Views, Database security,

SQL: Introduction to SQL, Stored Procedures and Triggers, Application development using SQL and embedded SQL programming

Data Storage and Querying: Physical data structure ,Evaluation of Relational Algebra expressions; Query equivalence and Query Optimization, Join algorithm(s)

Transaction Management: Transaction Processing, Concurrency control and Recovery management ,Transaction Model Properties and State , Serializability, Lock-based and Time-stamped based Protocols, Two-phase Locking

Advanced Topics: Brief introduction to Distributed database systems, Temporal databases, Object oriented and object-relational database, Data warehousing, Data mining

4. (IT/T/214) Principles of Communication Engineering

Signal model and classification, generalized Fourier series, Fourier series, Fourier transform, properties of Fourier transform, transmission of signals through linear system Distortion-less transmission and signal distortion over channel. Inverse Fourier transforms. Power spectral density, Correlation & convolution.

Amplitude, Frequency and Phase Modulation – their generation and detection. Bandwidth requirements. Low Power and High Power Modulators and Modulated amplifiers. Superheterodyne detection. Signal to Noise ratio of A.M., F.M. and P.M. transmission.

A/D, D/A Converters. Shannon's sampling Theorem. Nyquist Signaling Rate, Shannon's Channel Capacity, Transmission Impairments, Attenuation and Attenuation distortion,

Delay Distortion, Noise, Transmission Media, Twisted Pair Cable, Coaxial cable, Optical Fiber, Their Characteristics

PAM, PWM, PPM, PCM, DM and ADM. Their generation and detection.

Data Encoding: NRZ-L, NRZ-I, Bipolar-AMI, Pseudo-ternary, Manchester, Differential Manchester, B8ZS, HDB3 etc..

Digital Modulation : ASK, FSK, PSK, DPSK, MSK, QPSK. Performance evaluation. Time Division and Frequency Division Multiplexing and Demultiplexing.

Modems, Channel capacity. Data Transmission Synchronization, Synchronous and Asynchronous Transmission, Interfacing:EIA-232-D, RS-422-A etc., Data protection.

5. (IT/T/215) Computer Graphics

Introduction: Use of computer graphics

Overview of graphics system: Video Display Devices, Raster-Scan and Random-Scan Systems, Graphics Monitors and Workstations, Input and Hard Copy Devices, Graphics Software

Output Primitives: Line Drawing algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Other curves, Filled area primitives

Two Dimensional geometric transformations: Basic transformations, Matrix representations and Homogeneous Coordinates, Composite transformations, other transformations, Affine transformation, Transformation between co-ordinate systems, Two Dimensional Viewing Window-to-view port Coordinate transformation, Line clipping, polygon clipping, text and exterior clipping

Three Dimensional object representations: Polygon surfaces, Curves lines and Surfaces, Spline representations, Bezier Curves and Surfaces, B-Spline Curves, Beta Splines, Relational Splines, Convection between Spline representations, Displaying Spline Curves, Octrees, BSP trees

Object Hierarchy

Three Dimensional geometric and modeling Transformations

Three Dimensional Viewing: Viewing Pipeline, Viewing Coordinates, Transformation from World to Viewing Coordinates, Projections: Parallel Projections, Perspective Projections, Clipping, Normalized View Volumes, View port Clipping, Clipping in Homogeneous Coordinates

Visible-Su dace Detection Methods: Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, Depth-Sorting Method

Illumination Models & Surface Rendering Methods

Color Models

6. (IT/T/216) Computer Architecture

Computer structure: Processor, memory, i/o, Secondary storage, buses, clocks, sequential operation, Fetch-Execute cycle.

Data representation: Binary and hex integer representations and conversions, Fixed-length arithmetic, 2's complement representation, IEEE FP representation, Analogue versus digital.

Memory organization: Addresses, Memory organisation into bytes, words, longs, Memory-mapped i/o

The processor or CPU: Simple internal structure, Registers, program counter etc. The execution cycle.

Instructions: The CPU instruction set: syntax and semantics, Addressing modes, Encoding and decoding.

Simple I/O: Handling simple devices: the interface and the peripheral, Device registers and polling, Interrupts and hardware interrupt vectors.

More complex devices: Programmable devices, Block-mode devices, DMA: system structure and operation

Magnetic and Optical Storage: Basic bit storage, Tapes and disks: structure and operation of discs, Organisation of disc blocks into files.

Performance enhancements: Pipelining, caches memory, RISC vs CISC architectures, superscalar architectures, Flynn's Classification of multiprocessor machines, Introduction to some interconnection network e.g. mesh, cube, cycle, hyper-cubes, pyramid, Omega etc, multi-core architectures.

7. (IT/ S/211) Object Oriented Programming Laboratory

Assignment involving object-oriented program development to implement dynamic memory allocation, constructors, destructors, friend function, inheritance, abstract classes

and other concepts taught in the theory course IT/T/211 using an object oriented language such as C++; Use of class libraries.

8. (IT/ S/212) Data Base Management Systems Laboratory

Laboratory exercises using SQL on a free and open source database such as mySQL or Post Grace.
Use of host language inter-race with embedded SQL.
Use of user interfaces and report generation utilities typically available with RDBMS products.

9. (IT/ S/213) Programming Practice laboratory

Programming exercises including programming problems and applications of various data structures taught in the Theory courses IT/T/111 and IT/S/122.

2nd Year 2nd semester

2nd Year 2nd semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/221	Object Oriented Systems	3	0	0	3	100	
IT/ MATH/T/222	Mathematics – IV (Modules 8 and 12)	3	0	0	3	100	
IT/T/223	Software Engineering	3	0	0	3	100	
IT/ T/224	Microprocessors	3	0	0	3	100	
IT/T/225	Computer Networks	3	0	0	3	100	
IT/T226	Numerical Methods & Optimization Techniques	3	0	0	3	100	
IT/ S/211	Object Oriented Programming Laboratory – II	0	0	3	3		100
IT/ S/212	Microprocessor Laboratory*	1	0	3	3		100
IT/ S/213	Numerical Analysis Laboratory	0	0	3	3		100
	Sub- Total	19	0	9	3	600	300
	Total	28			27	900	
* Laboratory has to be allocated in continuous 4 periods							

2nd Year 2nd semester

1. (IT/T/221) Object Oriented Systems

Relevance of Java in Distributed Programming Environment: Object Oriented Programming language suitable for use in distributed environments. Concept of The Virtual Machine to facilitate portability, data types, expressions, statements, arrays

Classes, Objects, Interface, Inheritance: Access Specification, Instantiation, Initialization, Finalization, Methods, Static Members, String and String Buffer Classes, Derived classes, Abstract classes, Interfaces

Input/Output: Stream Classes, Reader Classes, Writer Classes, File Input, File Output, Formatted Data Input and Output

Package and Nested Classes: package and package access specification, inner classes, local inner classes, anonymous classes.

Thread Programming: Thread creation; mutual exclusion implementation, Synchronization primitives.

Introspection as a capability to develop software component: Java Reflection, Java Beans

Distributed Software Development: Remote Method Invocation using Java RMI

Introduction to UML: Use case diagrams, Sequence and Collaboration Diagrams, State chart diagrams, Activity Diagrams etc. Forward engineering (Code and Test case generation) and Reverse Engineering using UML diagrams.

Object Oriented Design and Analysis

Software Re-usability: Introduction to Design Patterns.

2. (IT/Math/T/222) Mathematics – IV

Module 8 & Module 12 as provided by the department of Mathematics

Module: VIII
Probabilig and Statistics - 1: (Marks: 50)

Definition of probability; Conditional probability and independence; Bayes‘ theorem; Statistical data: mean, median, mode, standard deviation; Random variables; Discrete and Continuous distribution; Poisson, Normal and Binomial distribution; Correlation and Regression; Expectation and Variance; Chebysheffs inequality.

Module: XII
Discrete Mathematics: (Marks: 20)

Mathematical logic: Operations and statements; Connectives; Truth table; Tautology; Logic gates etc. Lattices and Boolean algebra: Lattices; Principle of Duality, Distributive and complemented lattices; Boolean Algebra; Boolean Functions; Boolean Expressions; DNF and CNF; Switching circuits etc.

Real Analysis: (Marks: 30)

Sets; Countable and uncountable sets and their properties; Ordered sets; Algebraic and Order properties of R; Absolute value and the Real line; Completeness properties of R; Archimedean properties of R; Rational numbers and Irrational numbers; Density property of rational numbers in R; Intervals; Nested Intervals; Decimal expansion of real numbers; Uncountability of real numbers; Neighbourhoods; Interior point; boundary point; limit point; open and closed sets; Compact sets; Continuous functions and their properties; Differentiable functions and their properties.

3. (IT/T/223) Software Engineering

Introduction to SDLC: Evolution of software, Definition of Software Engineering, Software Production Process and life Cycle models-Build and fix, Waterfall, Rapid prototyping, incremental, evolutionary, Reuse oriented Development and sprial models, comparative analysis of models. Software Prototyping.

Requirements Engineering: Definition of Requirements engineering and its importance. Analysis Heuristic-abstraction, partitioning, view points. Tools of structured analysis, namely, data flow diagrams, data dictionary, data structure analysis, entity relation diagrams, state transition diagram, standard requirement analysis methodologies.

Software Design: Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements, features, classification and use of a CASE tool. Different flavors of architectural representations. Cohesion, coupling and Modularity.

Definition and overview of data oriented design methods. Using Entity Relationship analysis in system design, Entity-life-cycle modelling.

Coding Standards and Guidelines.

Software Testing and Verification:. Black box and white box testing. Unit testing, integration testing, system testing. Techniques to generate test plans. Mathematical methods of software verification. Alpha and Beta testing. Verification and Validation.

Software Measurements and Metrics.

Software configuration management: A SCM scenario, elements of a configuration management system, software configuration items, SCM repository, SCM process

Software quality assurance: Quality, quality control, quality assurance, cost of quality

Standards: Capability Maturity Model Integration, ISO 9001

4. (IT/T/224) Microprocessors

Introduction: Microprocessor architecture and microcomputer Systems. 8086 Hardware specifications, Addressing Modes.

Assembly Language Programming: Instruction sets, machine Language, assembly Language programming-Symbolic addressing, mnemonic, pseudo op-codes, macros.

Timing: Timing Diagram, Signals and timing details.

Microcomputer buses along with interfacing techniques: Memory Interface, basic I/O Interface, Interrupts.

Contemporary Supporting chips: Programmable Peripheral Interface (PPI), Programmable Interrupt Controller, DMA Controller, Programmable keyboard Controller, ADC and DAC with their interfacing techniques.

Coprocessor: The Arithmetic Coprocessor, MMX Technology, SIMD Technologies.

Introduction to Intel family of Microprocessors: 186 and 286 microprocessors, Comparison and contrasting with 8086/8088 microprocessors.

Introduction to 386 and 486 microprocessors : Special 80386 registers, Moving to protected Mode, The memory paging mechanism.

Introduction to Pentium: Pentium II, Pentium III, and Pentium 4 microprocessors: Pentium Memory management, Pentium II software changes.

5. (IT/T/225) Computer Networks

Introduction: Communication Tasks, Communication Model, Network Architecture, ISO/OSI Reference Model, Switching, TCP/IP Model

Error Detection and Correction Techniques: One and Two Dimensional Parity Checks, CRC, Hamming code, Framing: Bit and Character Stuffing,

Flow control: Delays in Point-to-Point links, Stop-and-Wait Flow Control, Effect of Propagation Delay and Transmission Rate on Performance, Sliding Window Protocol, Error Control- ARQ: Stop and Wait, Go-back-N, Selective Reject etc. Transmission Efficiency of ARQ Protocols.

Data Link Control protocols: HDLC, Point-to-Point Protocol. MAC and LLC Sublayers: Channel Allocation Problem, Static and Dynamic Channel Allocation, Pure and Slotted ALOHA, Persistent and non-persistent CSMA,
Collision Free Protocols: Bit-Map protocol, Binary Countdown, Limited Contention protocols, Adaptive Tree Walk protocols,

IEEE 802 Standards for LAN and MANs: Ethernet, Token Bus, Token Ring, DQDB, FDDI, LAN Bridges: IEEE 802.x to IEEE 802.y Bridges, Transparent Bridge, Source Routing Bridge, Mixed Media Bridge etc.

Network Layer: Services, Packet Switching, Congestion
Network Routing: Routing Characteristics, Routing Algorithms-Shortest Path algorithm: Dijkstra's Algorithm, Bellman-Ford Algorithm, Fixed Routing, Flooding, Random Routing,

Adaptive Routing: Flow based Routing, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast and Multicast Routing: Multi-destination routing, Spanning Tree Routing, Reverse Path Forwarding,

Congestion: General principles. Congestion Prevention Policies, Traffic Shaping, Leaky-Bucket Algorithm, Token Bucket Algorithm.

Network Layer Protocols: IPV4 Datagram Formats, IPV4 Packet Forwarding

Unicast and Multicast Routers

Transport layer Protocols

UDP, TCP: Services; TCP Flow Control, TCP Error control, TCP congestion control, TCP timers

6. (IT/T/226) Numerical Methods & Optimization Techniques

Roots of Equations: Iterative Methods - Bisection Method, False Position Method, Newton-Raphson Method, Solution of polynomial equations.

Solution of Simultaneous Linear Equations: Gaussian elimination, Pivoting, Pre-conditioning, Gauss-Seidel iterative method, Comparison of direct and iterative methods.

Interpolation: Finite differences, Polynomial interpolation, Spline interpolation.

Differentiation and Integration: Differentiation by polynomial fit, Trapezoidal and Simpson Rules, Gaussian Quadrature.

Numerical Solution of Differential Equations: Solution by Taylor Series, Euler's method, Predictor-Corrector method, Runge-Kutta method.

Linear programming (LP): Formulation and graphic solution Models of mathematical operations research, art of modeling, construction of the LP model, graphical LP solution

The Simplex method: Standard LP form, basic solution, The Simplex method, the M-method, the two-phase method, degeneracy, alternative optimal solution, unbounded solution, infeasible solution

Sensitivity analysis and dual problem: Definition of the dual problem, the relationship between the optimal primal and dual solution, economic interpretation of duality, the dual Simplex method, primal-dual computations, sensitivity analysis
Transportation, assignment, and transshipment models: Definition of the transportation model, determination of a starting solution, the transportation algorithm, definition of the assignment problem, the Hungarian method, the transshipment model

Network models: Network definition, minimal spanning tree algorithm, shortest route problem, shortest route algorithm, maximal flow model, enumeration of cuts, maximal flow algorithm, CPM, PERT

7. (IT/ S/221) Object Oriented Programming Laboratory – II

Programming practice for problems involving the content of course IT/T/221

8. (IT/ S/222) Microprocessor Lab

1. Introduction to single board microcomputer system.
2. Writing and running simple programs to get familiar with the instruction set.
3. Writing some arithmetic programs, addition, BCD subtraction, multiplication.
4. Writing some programs for processing data arrays like sorting, finding maximum and minimum numbers.
5. Programs using subroutines and usage of stack.
6. Simple input output programs using peripheral interface.
7. Programs using keyboard and display.
8. Timing methods lock determining the clock period, real time clock etc.
9. String handling and string manipulation.
10. Interface to ADC and DAC.
11. Simple programs using interrupt.

9. (IT/ S/223) Numerical Laboratory

Programming practice for implementing the solution of numerical problems taught in course IT/T/226

3rd Year 1st semester

3rd Year 1st Semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/311	Multimedia Coding & communications	3	0	0	3	100	
IT/T/312	Wireless Networks	3	0	0	3	100	
IT/T/313	Graph Theory	3	0	0	3	100	
IT/T/314	Web Technologies – I	3	0	0	3	100	
IT/T/315	Principles of Compiler Design	3	0	0	3	100	
IT/T/316	Operating Systems	3	0	0	3	100	
IT/ S/311	Multimedia Laboratory	0	0	3	3		100
IT/ S/312	Systems Programming Laboratory*	1	0	3	3		100
IT/ S/313	Operating System Laboratory	0	0	3	3		100
	Sub- Total	19	0	9	27	600	300
	Total	28			27	900	
* Laboratory has to be allocated in continuous 4 periods							

3rd Year 1st semester

1. (IT/T/311) Multimedia Coding & Communications

Multimedia Overview: Introduction, Multimedia presentation and production, Multimedia and hypermedia, Hardware and software requirements, Uses of multimedia, Multimedia Authoring, Editing and authoring tools.

Components of Multimedia: Text – types, Unicode standard on file format; Image and graphics, data types, file formats, color science and color model; Audio- digitization, midi, quantization and transformation of audio; Video- types of video signals, analog and digital video, television broadcast standards, pc video; animation- types, principals and techniques, 3D animation, camera, special effects, rendering.

Lossless Compression Techniques: Introduction, Run-length coding, Variable length coding (Shannon-Fano, Huffman, adaptive Huffman), Dictionary based coding, Arithmetic coding, Lossless image compression.

Lossy Compression Techniques: Introduction, Distortion measure, Quantization, Transform coding, Wave-let based coding, Wavelet packets.
Elements of Image Compression System and Standards: JPEG standard, JPEG-2000 standard, JPEG-LS standard, Bi-level Image Compression standard.

Video Coding and Compressing Standards: Introduction, Motion estimation, MPEG-1, MPEG-2, MPEG-4, MPEG-7 etc.

Audio compression Standards: ADPCM, psychoacoustics, MP3, MPEG.

Multimedia communication and Retrieval: Basics of networks, multiplexing technologies, LAN, WAN, ATM, quality of multimedia data transmission, multimedia over IP (RTP, RTCP, RSVP, RTSP), multimedia over ATM networks.

Multimedia architecture: User interface, distributed multimedia application, Play back architecture, temporal relationship, synchronization, multimedia database system, feature extract of image, audio, video.

Reference Book :

i) Fundamentals of Multimedia By Ze-Nian Li & Mark S. Drew
ii) Multimedia Computing communications & Applications By Ralf Stiemetz
iii) Multimedia Communications: Applications, Networks, Protocols and Standards By Fred Halsall

2. (IT/T/312) Wireless Network: Protocols & Systems

Wireless Transmission: Transmission Fundamentals, Frequencies and regulations, Signals, Antennas and Signal propagation, Propagation Models, Fading, Multiplexing, Modulation Techniques, Spread Spectrum modulation(FHSS, DSSS), CDMA Wireless Link Improvement Technique, Equalization , Diversity, Error detection, Block Error correction codes, RLP, Convolutional codes.

Wireless Media Access Control: Motivation, Wireless Issues, FDMA, TDMA, CDMA, SDMA, Fixed ALOHA, CSMA-CA, MACA, Multiple Accesses with Collision Avoidance, Packet Radio Access.

Wireless Networking Standards: WLAN: IEEE 802.11 Architecture and services, 802.11 MAC, Physical layer WMAN, Bluetooth, WPAN.

Cellular Network: Mobile communication concepts, Cellular Architecture: cellular concepts, frequency allocation, spectrum efficiency, Handoffs in Cellular networks, Location Management in cellular networks, speech coding, error control coding for mobile channel, call routing in cellular networks.

Mobility Management: MIPv4, MIPv6, Cellular IP, HAWAI, HiMIPv6 protocols

Security Issues in Mobile and wireless networks computing: Security Framework for Mobile environment.

Satellite Network: Satellite Parameters and configurations, capacity allocation with FDM, TDM. Signal and noise calculations.

Other Topics: Introduction to Wireless Sensor networks, MANET, VANET, Cognitive Radio Network.

3. (IT/T/313) Graph Theory & Combinatorics

Introduction: Different examples, (dis)connected graph, subgraph, isomorphism, labeled graph, Euler graph, Hamiltonian graph.

Trees: definitions, center, radius, diameter, rooted tree; spanning tree, spanning forest, rank & nullity of a graph, fundamental circuit, tree graph, number of spanning tree in complete graph: Prufer sequence.

Operations on graph: deletion of vertex/edge, fusion, union, intersection, ring sum, decomposition of a graph.

Connectivity/ cutest: definition of cutset, edge connectivity, vertex connectivity, cut vertex, relation with edge connectivity and vertex connectivity, k-connected graph, separable graph, 1-isomorphism, 2-connected graph, 2-isomorphism.

Planar graph: definition with examples, non-planar graph, Euler theorem, planarity detection, geometric dual graph, uniqueness of dual, dual of a subgraph, combinatorial dual, self dual, maximal planar graph.

Graph Coloring: definition, chromatic number, chromatic partition, independent set, dominating set, chromatic polynomial.

Graph Matching: definition, complete matching. Covering: minimal covering, perfect matching, vertex cover.

Graph representation: incidence matrix, adjacency matrix, – Submatrices – Circuit Matrix – Path Matrix

Directed Graphs: Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Adjacency Matrix of a Digraph.

Basic counting rules: sum rule, subtraction principle, product rule, division principle, permutations, r-permutation, combinatorics, sampling problem {with replacement}, occupancy problem, binomial coefficient, binomial theorem, multinomial coefficient

Pigeonhole principle: the principle (simple and its generalization), application of the principle.

Principle of inclusion and exclusion: Concept of Venn diagram and counting by Venn diagram, inclusion and exclusion principle, applications of the principle to solve different problems like Occupancy problem, Chromatic polynomial, Derangement problem, Rook polynomials, etc.

Generating functions: power series and its properties, (ordinary) generating function, generating function for a sequence and conversely. Operations on generating function, application of generating function in counting problem, exponential generating function and its application to counting problem.
Recurrence relation: definition with examples, recurrence with more than one sequences, simplification of recurrence relation by: characteristic roots (in case of linear homogenous recurrence relation), generating function.

4. (IT/T/314) Web Technology – I

Introduction to Web: Web Architecture, Web Applications ¸Web servers, Web Browsers, Internet standards.

Web Protocols: HTTP, DNS, SMTP etc.

HTML: Elements, Attributes, Tags, Forms, Frames, Tables.

Cascading Style Sheets: Advantages, Rules, CSS and page Layout

JavaScript and DHTML: Regular Expression, Event Handing, W3C Event Handing Model, HTML DOM, JavaScript and HTML DOM, JavaScript and HTML Forms, AJAX.

XML Technologies: XML, Namespace, DTD, W3C XML Schema, XPath, XQuery, Parsing XML, XML DOM, XSLT, XSL-FO.

Applets: Client-side Java, Life Cycle, Writing an Applet, Compiling an Applet, The Applet Tag, Security, Utility Methods, Using Status Bar, AppletContext Interface, Document Base and Code Base, Passing Parameter, Event Handling, Communication between Two Applets, Loading Web Pages.

5. (IT/T/315) Principles of Compiler Design

Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, tool based approach to compiler construction.

Lexical analysis: interface with input, parser and symbol table, token, lexeme and patterns, Difficulties in lexical analysis, Error reporting, Implementation, Regular Expression, Transition diagrams, LEX.

Syntax analysis: CFGs, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC.

Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

Intermediate code generation: intermediate representations, translation of declarations, assignments, control flow, Boolean expressions, procedure calls, records, arrays, Implementation issues.

Type checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run time system: storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.

Code generation and instruction selection: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine.

Code optimization: source of optimizations, optimization of basic blocks, loops, global dataflow analysis, solution to iterative dataflow equations.

6. (IT/T/316) Operating Systems

Introduction: Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure: Different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication. Threads: overview, benefits of threads, user and kernel threads.

CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, and priority), and algorithm evaluation, multi-processor scheduling.
Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores, examples (producer-consumer, readers-writer, dining philosophers, etc.).

Deadlock: Deadlocks system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging. Virtual

Memory: background, paging and segmentation, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: Blocking and non-blocking I/O, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance. Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks.

7. (IT/ S/311) Multimedia Laboratory

Assignment on: Image editing using Photoshop
Audio editing using Sound Forge
Animation using Flash
Video editing using Premier
Authoring using Director
Advanced Animation using 3D Max.

8. (IT/ S/312) System Programming Laboratory

Assignments using LEX;
Assignments on Language transformation using YACC;
Design & development of a two-pass assembler;
Design & development of macro processor;
Design of a linking loader.

9. (IT/ S/313) Operating System Laboratory

Case study: UNIX;
Assignments on Shell Scripting;
Assignments on Inter Process Communication – Shared Memory, Semaphores, Message Queue etc;
Assignments on Multithreading, using mutex, conditional mutex etc;
Assignments on Signal Handling.

3rd Year 2nd semester

3rd Year 2nd Semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/321	Design & Analysis of Algorithm	3	0	0	3	100	
IT/T/322	Cryptography & Network Security	3	0	0	3	100	
IT/T/323	Distributed Systems: Algorithms	3	0	0	3	100	
IT/T/324	Web Technologies – II	3	0	0	3	100	
IT/T/325	Formal language & Automata Theory	3	0	0	3	100	
IT/T/326	Elective – I	3	0	0	3	100	
IT/ S/321	Web Application Laboratory	0	0	3	3		100
IT/ S/322	Software Laboratory – I*	1	0	3	3		100
IT/ S/323	Software Laboratory – II	0	0	3			100
	Sub- Total	19	0	9	9	600	300
	Total	28			27	900	
* Laboratory has to be allocated in continuous 4 periods							

Elective I: Computational Geometry, Mathematical Methods, Artificial Intelligence

3rd Year 2nd semester

1. (IT/T/321) Design & Analysis of Algorithm

Introduction to analysis: Notion of algorithm, fundamental of analysis frameworks - Asymptotic Notations, worst-case and average-case complexity.

Quick review of basic data structures and algorithms: Analysis of recursive/ non-recursive algorithm; Introduction to amortized analysis of algorithms.

Sorting and Selection algorithms: finding minimum and maximum, kth order statistics, tournament and heap sort, lower bound for sorting.

Hashing: introduction, collision resolution, hash functions, analysis of hashing with chaining and with open addressing.

Union-Find problem: tree representation of a set, weighted union and path compression-analysis.

Design Techniques: dynamic programming: Fibonacci series, matrix chain multiplication; greedy-method: Huffman code, Knapsack problem; divide-and-conquer:

quick sort, multiplying large number, matrix multiplication; backtracking: n-queen problem; Branch and bound technique: integer programming, traveling sales man.
String processing: string searching and pattern matching, KMP algorithm and its analysis
Analysis of graph algorithms: shortest path algorithms, minimum spanning tree algorithms, network flow problems.

Complexity classes: P, NP, NP-hard and NP-complete, some NP-complete problems, Approximation algorithms.

2. (IT/T/322) Cryptography & Network Security

Overview and Security Attacks: Security Approaches, Principals of security, Types of attacks: Active attack - interruption, modification, fabrication; Passive attack – release of message contents, traffic analysis; Viruses, Worms, Trojan horse

Symmetric Ciphers: Classical Encryption Techniques, Block Ciphers and the Data Encryption Standard, Introduction to Finite Fields, Advanced Encryption Standard, RC4, Confidentiality Using Symmetric Encryption

Public-Key Encryption and Hash Functions: Introduction to Number Theory, Public-Key Cryptography and RSA, Key Management; Diffie-Hellman, ECC,

Message Authentication and Hash Functions: Hash and MAC Algorithms, Digital Signatures and Authentication Protocols

Network Security Application: Authentication Applications, Electronic Mail Security, IP Security, Web Security

System Security: Intruders, Malicious Software, Firewalls

3. (IT/T/323) Distributed Systems: Algorithms

Introduction to Distributed Systems: Definition, Characterization, Goals, Hardware and Software Concept;

Protocols: The Model: Transition Systems and Algorithms, Providing properties of Transition Systems, Casual order of event and logical clocks, Additional assumptions, Complexity; Communication Protocols: The balanced sliding-window protocol, A timer-based protocol;

Routing Algorithms: Destination-based routing, The all-pair shortest-path problem, The Netchange algorithm, Routing with compact routing tables, Hierarchical Routing; Deadlock-free packet switching: Introduction, Structured solution, Unstructured solution, Further issues;

Fundamental Algorithms: Wave and Traversal Algorithms: Definition and use of wave algorithms, A collection of wave algorithms, Traversal algorithms, Time complexity-Depth first search; Election algorithms: Introduction, Ring Networks, Arbitrary networks, The Korach-Kutten-Moran Algorithm;

Termination Detection: Preliminaries, Computation Trees and Forests, Wave-based solutions, Other solutions;

Anonymous Networks: Preliminaries, Deterministic Algorithms, A probabilistic algorithm, Computing the network size;

Snapshots: Preliminaries, Two snapshot algorithms, Using snapshot algorithms, Application-Deadlock detection;

Sense of Direction and Orientation: Introduction and definition, Election in ring and chordal rings, Computing in hypercubes, Complexity-related issues; Synchrony in Networks: Preliminaries, Election in Synchronous Networks, Synchronizer algorithm, Application-Breadth first search, The Archimedean Assumption;

4. (IT/T/324) Web Technologies – II

Server-side Programming: Common Gateway Interface (CGI)—Internet Programming paradigm, anguages for CGI, Applications, Server Environment, Environment Variables, CGI Building Blocks, CGI Scripting Using C, Shell Script, Writing CGI Programs, CGI Security, Alternatives and Enhancements to CGI

Servlets: Server-side Java, Advantages Over Applets, Alternatives, Strengths, Architecture, Life Cycle, GenericServlet and HttpServlet, Passing and Retrieving Parameters, Server-Side Include, Cookies, Filters, Problems with Servlet, Security Issues

Java Server Pages: JSP and HTTP, JSP Engines, How JSP Works, JSP and Servlet, Anatomy of a JSP Page, JSP Syntax, JSP Components, Beans, Session Tracking, Users Passing Control and Data between Pages, Sharing Session and Application Data, Database Connectivity, JDBC Drivers, Basic Steps, Loading a Driver, Making a Connection, Execute an SQL Statement, SQL Statements, Retrieving Result, Getting Database Information, Scrollable and Updatable ResultSet, ResultSetMetadata

Overview of J2EE—Introduction to JavaBeans, Bean Builder, Advantages of JavaBeans. BDK Introspection, Properties, BeanInfo Interface, Persistence, Customizer, JavaBeans API, EJB, Introduction to Struts Framework, MVC Framework

Advanced Topics: Web Services, SOA, SOAP, Cloud Computing

5. (IT/T/325) Formal language & Automata Theory

Mathematical preliminaries: Sets, functions, relations, graphs, trees, languages, proof techniques.
Finite Automata (FA): DFA, NFA, NFA with ε-move, equivalence of NFA and NFA ε-move, equivalence of NFA and DFA, minimization of FA, equivalence between two FA, FA with output (Moore and Melay machine).

Regular language: Regular set, regular expression, identity rules, equivalence of regular expression and finite automata, closure properties of regular languages, pumping lemma for regular language, proving non-regularity, decision problem for regular languages.

Context free grammar: Definition of grammar, derivation, parse tree, language of a grammar, ambiguous grammar, Chomsky classification of grammar (or language), languages and their relationship, language and automata, regular grammar- left liner & right linear grammar, regular grammar & FA. Ambiguity in context-free grammar, minimization of CFG, Normal forms: Chomsky normal form, Greiback normal form, pumping lemma for CFG, closure properties of CFL (or CFG), proving some languages are not context-free.

Push Down Automata (PDA): Push down automata, PDA string acceptance by empty stack and by final state, equivalence of two methods of PDA acceptance, equivalence of PDA and CFG, introduction to DPDA & DCFL.

Turing machines: Turing machine, Church- Turing thesis, computable functions, methods for Turing machine construction, variations of basic Turing model: multiple tapes, multi tracks, non-deterministic TM, universal TM, TM as enumerator.

Recursively enumerable languages: Definition of recursive & recursively enumerable language, closure properties of recursive & recursively enumerable languages, context sensitive language, linear bounded automata

(Un)Decidability: Decidability, undecidability, halting problem, undecidability of halting problem, other unsolvable problems.

Complexity theory: Measuring complexity, class P, class NP, NP-hard, NP-complete, Cook's theorem, NP complete problems.

6. (IT/T/326) Elective – I

(a) Artificial Intelligence

Introduction , Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Expert Systems: Representing and using domain knowledge, expert system shells, knowledge acquisition.

(b) Computational Geometry

Historical perspective: complexity notions in classical geometry. Towards computational geometry, geometric preliminaries, models of computation.

Geometric searching: point location problems, location of a point in a planar subdivision, the slab method, the chain method, range - searching problems.

Triangulation: Polygon Triangulation, Polygon Partitioning and Intersection of polygons.

Convex hulls: problem statement and lower bounds. Graham's scan, Jarvis's march, quick hull technique, convex hulls in two and higher dimensions, extension and applications.

Proximity: divide and conquer approach, locus approach; the Voronoi diagram, lower bounds, variants and generalizations. Intersections, hidden-line and hidden surface problem.

The geometry of rectangles: application of the geometry of rectangles, measure and perimeter of a union of rectangles, intersection of rectangles and related problems.

(c) Mathematical Methods

Review of Probability Theory: Discrete Random Variable:- The p.m.f., distribution functions, anlysis of program MAX, probability generating functions, independent random variables; Continuous Random Variable:- The p.d.f., exponential distribution, functions of a random variable, distribution of sums; Expectation:- definition, moments, transform methods, moments and transforms of some important distribution, mixture distribution, conditional expectation, random sums, analysis of structured control statements.
Reliability Analysis: Definition, causes and types of failures, reliability expressions for constant, increasing and decreasing hazard rates, probability plots of various distributions (exponential, weibull, normal and gamma), computation of mean-time-to-failure, series, parallel, series-parallel, and standby modeling, system reliability evaluation techniques, including methods of bounds, decomposition, and transformation techniques, inequalities and limit theorems, imperfect fault coverage and reliability.
Stochastic process: Classification, bernoulli process, poisson process, renewal process, renewal model of program behavior, availability analysis.
Discrete Parameter Markov Chain: Introduction, n-step transition probability, state classification, analysis of a uni-programmed system, irreducible markov chain with aperiodic states, memory interference in multiprocessor systems, models of program paging behavior, independent reference model, LRU-stack model, birth-death process, analysis of a linear list.
Continuous Parameter Markov Chain: Introduction, the birth-death process, M/M/1, M/M/m queues, non birth-death process.
Networks of Queues: Introduction, open and closed queuing networks, non product form networks.

7. (IT/ S/321) Web Application Lab

Assignments involving client side programming using HTML, Java Applet etc.
Assignments on programming using scripting languages such as JavaScript
Assignments involving server side programming using JSP, Servlet etc.

8. (IT/ S/322) Software Laboratory - I

General assignments on IT/T/322 & IT/T/323

9. (IT/ S/323) Software Laboratory – II

General assignments on IT/T/326

4th Year 1st semester

4th Year 1st Semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/411	Elective – I	3	0	0	3	100	
IT/T/412	Elective – II	3	0	0	3	100	
IT/T/413	Image Processing	3	0	0	3	100	
IT/T/414	Economics	3	0	0	3	100	
IT/ S/411	Image Processing Laboratory	0	0	3	3		100
IT/ S/312	Project Laboratory*	1	0	3	4		100
IT/ S/313	Seminar	0	0	3	3		100
	Sub- Total	13	0	9	22	400	300
	Total	21			22	700	
* Laboratory has to be allocated in continuous 4 periods							

4th Year 1st semester

1. (IT/T/411) Elective – II

i) Parallel Algorithms and Architectures

Introduction: The need for parallel computers, Models of computation, Analyzing parallel algorithms, Expressing parallel algorithms

The Computational Power of The PRAM model: Comparison between RAM and PRAM models, Graph coloring on PRAM, Parallel computation thesis, NC and P-complete classes

Selection: Sequential algorithms, Desirable properties for parallel algorithms, An EREW algorithm for parallel selection

Merging: A network for merging, Merging on the CREW model, Merging on the EREW model, A better algorithm for the EREW model,

Sorting: A network for sorting, Sorting on a linear array, Sorting on the CRCW model, Sorting on the CREW model, Sorting on the EREW model,

Searching: Searching a sorted sequence (EREW, CREW, CRCW), Searching a random sequence (EREW, CREW, CRCW, Tree, Mesh),

Fourier Transforms: DFT and convolution theorem, Algorithms for FFT, Inverse DFT, Computing the DFT in parallel

Decision and Optimization

ii) Fuzzy Logic & Neural Computing

Fuzzy Logic : Brief overview of crisp set; Introduction to Fuzzy Logic, The notation of fuzziness; what, why and when to apply fuzzy set; Classical set To fuzzy Sets, Propabilities & Fuzzy Sets, Operations on fuzzy sets; Types of Fuzzy Sets, Properties of Fuzzy Set, Fuzzy numbers, Membership Functions, Extension Principle.

Relations : Crisp relations, fuzzy relations, operations on fuzzy relations, Fuzzy Relational Equations, Linguistic Variables.

Fuzzy Arithmetic: Theories & Examples

Approximate reasoning: Different methods of Rule Aggregation , Fuzzy Inference Rules, Formalization of Fuzzy Conditional Inference.

Fuzzy logic based control system: Difference with conventional control systems,

fuzzifier, Fuzzy rule base, Defuzzifier, Inference Engine.

Applications of Fuzzy Sets: Selected application on Control and/or Pattern Recognition.

Neural Computing:

Introduction to Artificial Neural networks: History and inspiration from neuroscience for the development of artificial neural networks (ANN), Overview of Biological Neural System, Structure and function of the nerve cell , Mathematical model of Neurons. ANN Architecture.

Introduction to the learning process: Mc-Culloch Plts model of neuron , Learning rules, Learning Paradigms ,Supervised, Unsupervised and Reinforcement learning, , ANN training Rules.

The Perceptron Learning Rule: Perceptron Architecture, Perceptron Learning Rule, Proof of the Perceptron convergence algorithm, Multilayered Perceptron Model , Delta Rule, The Back propagation Algorithm with theory & examples, variations on Backpropagation.

Hopfield Network: Model, Pattern Retrieval process, Application to optimization problems

Learning Networks: Kohonen's Learning, Competitive Learning, Hebbian Learning Self organizing networks

Associative learning : Simple Recall Networks

Application of ANN: Neuro Fuzzy Systems

2. (IT/T/412) Elective – III

i) Data Mining

Introduction: History of Data Mining, Definition, Knowledge Discovery Vs. Data mining, Issues in data mining.

Data Mining Functionalities: Class Description, Characterization & Discrimination, Mining Frequent Patterns, Associations and Correlations, Cluster Analysis, Outlier analysis, Evolution Analysis.

Data Preprocessing: Data Summarization, data Cleaning, data Integration and Transformation, data Reduction, Data Discretization and Concept Hierarchy Generation.

Mining Frequent Patterns: Scalable Frequent Itemset Mining Methods, The Apriori Algorithm, Mining various Kinds of Association Rules, From Association mining to Correlation Analysis, Constraint based Association Mining.

Classification and Prediction: Issues Regarding Classification and Prediction, Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Association, K-Nearest Neighbor Classifier.

Cluster Analysis: Types of data in Cluster Analysis, Partitioning methods, Partitioning Methods in Large databases- From K Medoids to CLARANS, Hierarchical methods, Grid based Methods, Clustering High Dimensional Data- CLIQUE.

Mining in different types of data: Mining data streams, Mining Time Series Data, Mining Sequence patterns in Biological Data.

Application and Trends in data Mining: Data Mining Applications, Data mining System Products and Research Prototypes, Social Impacts of Data mining.

Data Warehouse and OLAP technology: An Overview.

ii) Real-Time and Embedded System

Introduction: Definition, Classification and Characterization; Challenges for Embedded Systems; Exemplary Embedded System.

Hardware Overview: Terminologies; Fundamental Components.

Interrupt & Interrupt Routines: Interrupt Basics; Shared Data between Interrupt Routines and Main Program; Interrupt Latency.

Real-Time Operating Systems: Introduction; Real-Time Operating system architecture; Task & Task States; Semaphore and Shared Data; Message Queue, Mailbox & Pipes; Timer & Events; Memory & Interrupt Management in RTOS environment.
Design Consideration: Encapsulating Semaphores and Queues; Saving Memory & Power; Hard Real-Time Scheduling Considerations; Scheduling Real-Time Tasks in Multiprocessors and Distributed Systems; Hardware Software Co-Design in an Embedded Systems.

Commercial Real-Time Operating Systems: Unix or Windows as Real-Time Operating Systems; Real-Time POSIX Standard; A survey of Real-Time Operating Systems- PSOS, VRTX, VxWorks, QNX, microC/OS-II, RT Linux, Lynx, Windows CE.

Development Tools For Embedded Systems: Host and Target Machines; Compilers, Linker & Locaters; Transferring Firmware into the Target Systems; Debugging in Host Machine & Target Machines.

Real-Time & Embedded Systems Case Study: Smart Card (SOC-System On Chip); Digital Camera; Mobile Phones.

3. (IT/T/413) Image Processing

Fundamentals: Overview of Image Processing System, image digitization (sampling and quantization), basic relationship between pixels, Fundamentals of Color image and Color Models,

Image Transform: Fourier transform (1D, 2D) and its properties, FFT, DCT, Hadamard transform, Karhunen – Loeve transforms.

Image Enhancement: Spatial Domain methods- Contrast Intensification (linear and non-linear stretching), Histogram equalization, Histogram specification, Spatial filtering: Smoothing (liner, order-statistic), sharpening filters (Laplacian), Frequency domain filters : Smoothing, Sharpening filters, Homomorphic filtering.

Image Segmentation: Detection of discontinuities (point, line & edge), Edge Linking and Edge Following by Local Processing, Hough Transform, Region Extraction by Pixel based Approach (Thresholding, Choice of Feature, Optimum Threshold etc.), Region Extraction by Region based Approach (Region Growing, Splitting, Merging, Split and Merge).

Image representation & description: Representation: Chain Codes, Polygonal Approximation, Skeletons, medial axis transform, thinning, Descriptor: shape number, Fourier descriptor, statistical moments, Geometrical Attributes (perimeter, area, etc.), Texture Descriptor (GLCM).

Image Compression: Objective, Feasibility, performance measure, lossy/lossless compression, Huffman coding, Arithmetic coding, block truncation coding, vector quantization, JPEG.

4. (IT/T/414) Economics

Definition of Economics - various definitions, nature of economic problem, production possibility curve, economic laws and their nature, relation between science, engineering and economics.
Concepts and measurement on utility, Law of diminishing Marginal Utility, law of qui-marginal utility –its application and importance.
Meaning of demand, individual and market demand schedule, law of demand, shape of demand curve, elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of demand.
Meaning of production and factors of production, law of variable proportion, return to scale, internal & external economics and diseconomics of scale. Various concept of cost, - fixed cost, variable cost, average cost, marginal cost, money cost, real cost, opportunity cost. Shape of average cost, marginal cost, total cost etc., in short run and long run.
Meaning of market, types of market - perfect competition, monopoly, oligopoly, monopolistic competitions (main features of these markets).
Supply and law of supply, role of demand & supply in price determination and effect of changes in demand and supply on prices.
Nature and characteristics of Indian economy (brief and elementary introduction), privatization – meaning, merits and demerits. Globalization of Indian economy – merits and demerits. Elementary concepts of VAT, WTO, GAIT & TRIPS agreements.

5. (IT/S/411) Image Processing Lab

Some assignments on the following topics using C/MTLAB/Open, etc:
Zooming/Shrinking; Basic gray level transformation; Image enhancement; forward/inverse transformation; filtering (smoothing, gradient, etc); Segmentation; Image coding.

6. (IT/S/416) Project

Each student will have to carry out a project work for one year based on a suitable topic chosen in consultation with a teacher (the supervisor) concerned. This work will continue for two semesters in the final year. The marks for this subject will be awarded at the end of the second semester along with the marks obtained in (IT/S/422).

7. (IT/S/417) Seminar

In this subject, each student will have to present a seminar on a topic in consultation with a teacher concerned and will be evaluated based on the content and format of his/her presentation. The marks for this subject will be awarded at the end of the second semester along with the marks obtained in (IT/S/423). The topic must be related to the broad domains of study in this course but the topic must not be chosen such that it is wholly contained in the syllabus of some subject in this course.

4th Year 2nd semester

4th Year 2nd Semester							
Code	**Subject**	**Pds / week**			**Credit**	**Marks**	
		L	**T**	**S**		**Exam**	**Sessional**
IT/T/421	Distributed System & Applications	3	0	0	3	100	
IT/T/422	Management	3	0	0	3	100	
IT/T/423	Elective – IV	3	0	0	3	100	
IT/T/424	Digital Signal Processing	3	0	0	3	100	
IT/ S/421	Comprehensive Viva Voce	0	0	3	3		100
IT/ S/422	Project	0	0	3	4		100
IT/ S/423	Seminar	0	0	3	3		100
	Sub- Total	12	0	9	22	400	300
	Total	21			22	700	

4th Year 2nd semester

1. (IT/T/421) Distributed System: Applications

Recapitulation: Revisit to Distributed Systems preliminaries, Protocols, and Fundamental Algorithms;

Communication: Client-server architecture, Remote procedure call, Remote object invocation, Message oriented communication, Stream oriented communication;

Naming: Naming entities, Name services, Domain name systems, Directory and Discovery services, Case study of Global Name Service;

Consistency and Replication: Data-centric consistency models, Client-centric consistency models, Distribution protocols, Consistency protocols, Casually-consistent Lazy Replication, Highly available services;

Fault Tolerance: Fault Tolerance in Distributed Systems; Fault Tolerance in Asynchronous systems: Impossibility of consensus; Fault Tolerance in Synchronous systems; Failure Detection; Stabilization;

Distributed Object-Based Systems: CORBA, DCOM, GLOBE, Comparison of the different distributed object based systems.

Distributed File System: SUN VFS, V-3, V-4, Google file systems, Comparison of the different file systems;

Distributed Databases

Distributed Transactions: The Management of Distributed Transactions, A Framework for Transaction Management , Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions;

Distributed Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control, Execution schedules;

2. (IT/T/422) Management

Principles of managements: Concepts of management, development of scientific management, principles of Frederick Taylor & Henry Favol, functions such as planning, organizing staffing leading, motivating communicating controlling decision making span of control.

Personal Management: Meaning, functions of personal management, manpower planning, collective bargaining, wages & salary administration, labor welfare, training, trade unions, Industrial Factories Act, Industrial Boils Act, Trade Union Act.

Plant Management: Plant location, plant layout, types of maintenance such as break down, predictive & preventive maintenance, stores management, industrial safety, causes & cost of accidents, safety programs, production planning & control job, batch & process type of production.

Marketing Management: Definition & scope, selling & modem concepts of marketing, market research, new product development, product life cycle, product lunching, sales promotion, pricing, channels of distribution, advertising market segmentation, marketing mix.

Material Management: Importance of Materials Management, Classification, Codification, Forecasting, Necessity of Inventory.

Financial Management: Sources of finance, financing organization, types of capital, elements of costs & allocations of indirect expenses, cost control, break even analysis, budges & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement.

3. (IT/T/423) Elective IV

i) Cluster and Grid Computing

Parallel Programming Paradigms: Shared memory, Message passing, Workflows, peer-to-peer, broker-based

Development of parallel and distributed applications: Design phases, Common parallel patterns, Performance metrics and profiling, Optimizations techniques, Mapping and scheduling, State-of-the-art on parallel and distributed systems and applications

Overview of Cluster Computing: The Role of Clusters, Definition and Taxonomy, Distributed Computing , Limitations

Programming: Parallel Programming with MPI, Resource management and scheduling, Project

Cluster Planning: Architecture and Cluster Software, Design Decisions, Network Hardware, Network Software, Protocols, Virtualization technologies, Benchmarks

Introduction to Grid Computing: Definition of a grid, Infrastructure of hardware and software, Main Projects and Applications, The Open Grid Forum, International Grid Trust Federation, Grid Architecture, Overview of Resource Managers, Overview of Grid Systems,

Applications in Grid: Application Management, Grid Application Description Languages, Application Partitioning, Meta-scheduling, Mapping, Monitoring

Web Services, Grid Portals, Clouds

ii) Bio Informatics

Introduction: Definition. Basic concepts: protein and amino acid, DNA & RNA, Biological Sequence, structure and function, Genomes; Pattern recognition and prediction, Homology and Analogy.

Bioinformatics databases: Introduction, Type of databases, Nucleotide sequence databases: Primary nucleotide sequence databases, Secondary nucleotide sequence databases; Protein sequence databases, Sequence motif databases, Protein structure databases.

Functional proteomics and genomics: Mapping and Sequencing Genomes, Genetic Interactions, Protein profiling.

Sequence alignment and database searching: Introduction to database search, Algorithms issues in database search, Sequence database search, Single sequence alignments, Pair wise alignments: Scoring matrix, PAM, BLOSUM; Dynamic Programming, Heuristic methods: FASTA, BLAST; Multiple Sequence Alignments.

Pattern Analysis: Feature extraction, Classification: Linear classification, linear classification function and artificial neural, artificial neural networks, Support vector machines; Clustering: K-means clustering, hierarchical clustering; Dimensionality Reduction & Principal Component analysis: SDV, geometric interpretation of SDV, PLS method; Parametric Transformations: Hough transform, Generalized Hough transforms, geometric hashing;

Evolutionary trees: phylogeny: Ultrasonic trees, parsimony, Ultrametric problem, perfect phylogeny, phylogenetic alignment, connection between multiple alignment and tree construction

Some advanced topics: DNA Mapping and sequencing, Map alignment, Large scale sequencing and alignment, Shotgun, DNA sequencing, Sequence assembly, Gene predictions, Molecular predictions with DNA strings

Markov chains and applications: Machine Learning Methods, Hidden Markov models, Applications of HMM in gene identification

iii) Pattern Recognition

Introduction and General Pattern Recognition Concerns: Overview of Pattern Recognition and Pattern Recognition Applications, Structure of a PR system, Patterns, Class, Feature, Feature vector, Feature extraction, Feature space, classifier, decision region and boundaries, discriminant function.

Mathematical foundations: Liner algebra, random vector, probability distribution and density function of a random variable, expectation, covariance, characteristic function, Normal distribution, multivariate normal distribution, diagonalization of matrices.
Bayesian Decision Theory: Introduction, minimum error rate classification, zero-one loss function, compound decision theory.

Parameter Estimation: Maximum likelihood estimation, Bayesian parameter estimation-- Gaussian case, dimension reduction method—PCA, Fisher Linear Discriminant Analysis, Gaussian mixture model.

Non-parametric Technique: Parzen Window, K—nearest neighbor estimation, Nearest neighbor rule.

Unsupervised learning and clustering: Concept of clustering, error partial clustering, K-means clustering, hierarchical clustering, cluster validation.

Feature Selection: Introduction, preprocessing—outlier removal, data normalization, missing data; Feature selection based on Hypothesis testing, ROC curve, class separability measures, feature subset selection, optimal feature generation.

Neural network approach for pattern recognition: Activation functions, perceptron concept, neural network types, multi-layer perceptrons, performance of neural networks, radial basis functions, support vector machines, Kohonen network, Hopfield network, modular neural network.

4. (IT/T/424) Digital Signal Processing

Introduction: Introduction, signal processing: elementary operations, applications of DSP, signals & systems: discrete-time signals: representation, different types of sequence, operations on sequence; discrete-time system: classification of discrete time systems, liner time invariant system; Convolution & correlation of signals.

Transform Domain analysis of Discrete Time Signals: Discrete-Time Fourier Transform (DTFT), DTFT properties, IDTFT, DFT, DFT properties, relationship between DTFT and DFT, reconstruction of DTFT from DFT, linear convolution using DFT, Linear filtering methods based on DFT , FFT, z-Transform, inverse z-transform, properties of z-transform, z-transform to solve difference equation.

Digital Filter Structure and design: Introduction, digital network, FIR digital filter structure: direct form, cascade form, linear phase filters, symmetric filter, FIR design using windows/frequency sampling method.

Structure of IIR filters: direct form, cascade form, parallel structure, transposed structure, allpass filter, IIR filter design by impulse invariance, bilinear transformation, Butter worth filter, Chebyshev filters and Elliptic filters. Frequency selective filters: Ideal filter characteristics, low pass, high pass and bandpass filters, Notch filters, Comb filters.

Digital processing of continuous-time signals: Introduction, sampling: analog-to-digital conversion, digital-to-analog conversion, sampling rate conversion.

Multirate Digital Signal Processing: Introduction, Decimation by factor D, Interpolation by factor I, sampling rate conversion by rational factor I/D, Application of Multirate signal processing, Design of Phase shifters, interfacing of digital systems with different sampling rates, Subband coding of speech signals, over sampling A/D and D/A conversion.

Time Frequency expansion: Introduction, short time Fourier Transform (STFT), Gabor transform, wavelet transform, multiresolution decomposition.

5. (IT/S/421) Comprehensive Viva Voce)

Each student will have to attend a viva-voce examination before a panel of experts drawn from people inside and outside Jadavpur University. Questions will be asked from any topic taught as a part of this curriculum.

6. (IT/S/422) Project

Each student will have to carry out a project work for one year based on a suitable topic chosen in consultation with a teacher (the supervisor) concerned. This subject is in continuation to the project work started in the fist semester of the final year in the subject (IT/S/416). The marks for this subject will be awarded at the end of the second semester along with the marks obtained in (IT/S/422).

7. (IT/S/423) Seminar

In this subject, each student will have to present a seminar on a topic in consultation with a teacher concerned and will be evaluated based on the content and format of his/her presentation. The topic must be related to the broad domains of study in this course but the topic must not be chosen such that it is wholly contained in the syllabus of some subject in this course.