Heritage Institute of Technology
Anandapur, Kolkata – 700107

Structures of Syllabus

Department Name: Information Technology

Programme Name: B. Tech.

Release Date: June 2017
B. Tech in (i) Applied Electronics & Instrumentation Engineering
(ii) Computer Science and Engineering
(iii) Electronics and Communication Engineering
(iv) Information Technology

1st Year 1st Semester Syllabus:

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B. Tech in (i) Applied Electronics & Instrumentation Engineering
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1st Year 2nd Semester Syllabus:

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# B Tech in IT: 2nd Year 1st Semester Syllabus:

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**B Tech in IT: 2nd Year 2nd Semester Syllabus:**

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**Professional Elective – I Papers (any one):**

- 6(a) INFO3131 Communication Theory
- 6(b) INFO3132 Compiler Design
- 6(c) INFO3133 Discrete Mathematics
# B Tech in IT: 3rd Year 2nd Semester Syllabus:

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### Professional Elective – II Papers (any one):

- 5(a) INFO3231 E-Commerce & ERP
- 5(b) INFO3232 Computer Graphics & Multimedia
- 5(c) INFO3233 System Software and Administration

### Professional Elective – III Papers (any one):

- 6(a) INFO3241 Artificial Intelligence
- 6(b) INFO3242 Wireless & Mobile Computing
- 6(c) INFO3243 Pattern Recognition

### Professional Elective – II Laboratories (Corresponding to Professional Elective – II theory paper opted for):

- 9(a) INFO3236 E-Commerce & ERP Laboratory
- 9(b) INFO3237 Computer Graphics & Multimedia Laboratory
- 9(c) INFO3238 System Software and Administration Laboratory
# B Tech in IT: 4th Year 1st Semester Syllabus:

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**Total Semester** 32 28

**Free Elective papers offered by the Department of Information Technology:**

1. INFO4181  Cyber Crime & Cyber Security
2. INFO4182  Cloud Computing

**Professional Elective – IV Papers (any one):**

3(a) INFO4141  Distributed Operating System
3(b) INFO4142  Cyber Law & Security Policy
3(c) INFO4143  Fundamentals of Cloud Computing

**Free Elective – I Papers (any one):**

4(a) ECEN4181  VLSI Design Automation
4(b) MATH4181  Operations Research and Optimization Techniques
4(c) AEIE 4182  Introduction to Embedded System
B Tech in IT: 4th Year 2nd Semester Syllabus:

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**Free Elective papers offered by the Department of Information Technology:**

1. INFO4281 Fundamentals of Cryptography
2. INFO4282 Soft Computing Application

**Professional Elective – V Papers (any one):**

2(a) INFO4241 Parallel Computing
2(b) INFO4242 Natural Language Processing
2(c) INFO4243 Cryptography & Network Security
2(d) INFO4244 Soft Computing

**Free Elective – II Papers (any one):**

3(a) AEIE4282 Control System & Application
3(b) BIOT4281 Computational Biology
3(c) ECEN4281 Cellular & Satellite Communication
Structures of Syllabus

Department Name: Information Technology

Programme Name: B. Tech.

Year: 1\textsuperscript{st} Year

Document Release Month & Year: June 2017
1st year 1st Semester:

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<th>Course Name</th>
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Module I – [5L]

Communication Skill
Definition, nature & attributes of Communication
Process of Communication
Models or Theories of Communication
Types of Communication
Levels or Channels of Communication
Barriers to Communication

Module II-[12L]

Business Communication- Scope & Importance
Writing Formal Business Letters
Writing Reports
Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular
Project Proposal
Technical Report Writing
Organizing e-mail messages
E-mail etiquette
Tips for e-mail effectiveness

Module III-[10L]

Language through Literature
Modes of literary & non-literary expression
Introduction to Fiction, (An Astrologer’s Day by R.K. Narayan and Monkey’s Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)

Module IV-[3L]

Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) -to be dealt with the help of the given texts.

References
Module I [10 L]

Thermodynamics & Spectroscopy

Chemical Thermodynamics & Thermochemistry

Concept of Thermodynamic system, Introduction to first law of thermodynamics, Enthalpy Heat Capacity, Reversible and Irreversible processes, Adiabatic changes, Application of first law of thermodynamics to chemical processes, 2nd law of thermodynamics, Evaluation of entropy, Work function and free energy, Phase Changes, Clausius Clapeyron Equation, Chemical Potential, Gibbs Duhem Relation, Activity and Activity coefficient.

Spectroscopy

Electromagnetic Radiation, Basic idea of UV-visible & IR spectroscopy.

Module II [10 L]

Structure & Bonding

Chemical Bonding

Covalent bond, VSEPR Theory, Molecular Orbital Theory, Hydrogen bond, Intermolecular forces-vander Waals forces, Ionization energy, Electronegativity, Electron affinity, Hybridisation, Dipole moment

Solid State Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non–stoichiometric defects (Metal excess and metal deficiency). Role of silicon and germanium in the field of semiconductor.

Ionic Equilibria and Redox Equilibria

Acid Base Equilibria in water, Strength of acids and bases, Hydrogen ion exponent, Ionic product of water, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation, Redox Equilibria,

Structure and Reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals.

Brief study of some addition, eliminations and substitution reactions.

Module III [10 L]

Electrochemistry & Reaction Dynamics

Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance, ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). Kohlrausch’s law of independent migration of ions, transport numbers and hydration of ions. Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs AgNO₃.

Electrochemical Cell

Cell EMF and thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell and calomel half cell (construction, representation, cell reaction, expression of potential, discussion, application) Storage cell, fuel cell (construction, representation, cell
reaction, expression of potential, discussion, application). Application of EMF measurement on a) the change in thermodynamic function (ΔG, ΔH, ΔS) b) the equilibrium constant of a reversible chemical reaction c) the valency of an ion.

Kinetics

Module IV [10 L]

INDUSTRIAL CHEMISTRY & POLYMERIZATION

Industrial Chemistry

Polymerization
Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI). Polymerization processes (addition and condensation polymerization), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of T_m) and amorphicity (Concept of T_g) of polymer.

Preparation, structure and use of some common polymers: plastic (PE: HDPE, LDPE, PVC, Bakelite, PP), rubber (natural rubber, SBR, NBR) and Vulcanization, fibre(nylon 6.6, Nylon 6, Polyester). Conducting and semi-conducting polymers.

Text Books

Reference Books
2. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc
3. Organic Chemistry, Morrison & Boyd, Prentice Hall of India
4. Physical Chemistry, K. L. Kapoor, McMillan
Module I [10L]

Matrix:
Matrices and their basic attributes, Determinant of a square matrix, Minors and Cofactors, Laplace’s method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi’s theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, Orthogonal matrix and its properties, Special Complex Matrices: Hermitian, Unitary, Normal(definition only), Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by :Cramer’s Rule and Matrix inversion method, Consistency and inconsistency of a system of homogeneous and inhomogeneous linear simultaneous equations, Characteristic Equation and computation of eigenvalues and eigenvectors of a square matrix (of order 2 or 3), Cayley-Hamilton theorem and its applications(with special reference to higher power of matrices, e.g. Idempotent and Nilpotent matrices)

Module II [10 L]

Mean Value Theorems & Expansion of Functions:
Rolle’s theorem: its geometrical interpretation and its application, Concavity and Convexity of curves, Mean Value theorems – Lagrange & Cauchy and their application, Taylor’s theorem with Lagrange’s and Cauchy’s form of remainders and its application, Expansions of functions by Taylor’s and Maclaurin’s theorem, Maclaurin’s infinite series expansion of the functions: \( \sin x, \cos x, e^x, \log(1+x), (a + x)^n \)
being an integer or a fraction (assuming that the remainder \( R_n \to 0 \) as \( n \to \infty \) in each case).

Infinite Series:
Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy’s Root test, D’ Alembert’s Ratio test(statements and related problems on these tests), Raabe’s test, Proof of \( e \) being irrational, Alternating series, Leibnitz’s Test (statement, definition) illustrated by simple examples, Absolute convergence and Conditional convergence.

Module III [10 L]

Successive differentiation:
Higher order derivatives of a function of single variable, Leibnitz’s theorem (statement only and its application, problems of the type of recurrence relations in derivatives of different orders and also to find \((y_n)_0\)).

Calculus of Functions of Several Variables:
Recapitulation of some basic ideas of limit and continuity of functions of single variable, Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler’s theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems.
Module-IV  [10 L]

Multiple Integration and Vector Calculus:
Concept of line integrals, Double and triple integrals. Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics, Green’s theorem, Gauss Divergence Theorem and Stoke’s theorem (Statements and applications).

Reduction formula:
Reduction formulae both for indefinite and definite integrals of types:
\[
\int \sin^n x, \int \cos^n x, \int \sin^m x \cos^n x, \int \cos^m x \sin^nx, \int \frac{dx}{(x^2 + a^2)^n}, m,n \text{ are positive integers.}
\]

References
1. Advanced Engineering Mathematics: Erwin Kreyszig by Wiley India
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
3. Higher Engineering Mathematics: John Bird (Elsevier)
8. Linear Algebra(Schaum’s outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)
10. Introduction to Real Analysis: S.K. Mapa (Sarat Book Distributors)
Course Name: BASIC ELECTRICAL ENGINEERING

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Module-I: [12 L]

DC Network Theorem: Kirchhoff’s law, nodal analysis, mesh analysis, Superposition theorem, Thevenin’s theorem, Norton theorem, Maximum power transfer theorem, star-delta conversion.

DC Machines: Construction, EMF equation, Principle of operation of DC generator, open circuit characteristics, external characteristics, Principle of operation of DC motor, Speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of dc motor.

Module-II [8L]

Electrostatics: Gauss’s law and its applications to electric field and potential calculation. Capacitor, capacitance of parallel plate capacitor, spherical capacitor and cylindrical capacitor.

Electromagnetism: Amperes law, Biot-savart’s law, Ampere’s circuitual law and their applications, Magnetic circuits, analogy between magnetic and electric circuits, Faraday’s law, self and mutual inductance. Energy stored in a magnetic field, Hysteresis and Eddy current losses.

Module-III [10L]

AC single phase system: concept of alternating signal, average and RMS values of alternating signal, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, AC series, parallel and series parallel circuits, Active power, Reactive power, power factor, Resonance in RLC series and parallel circuit, Q factor, bandwidth.

Three phase system: balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two wattmeter method.

Module-IV [10L]

Single phase transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, open and short circuit tests, efficiency.

3-phase induction motor: Concept of rotating magnetic field, principle of operation, Construction, equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.

Text Books:
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Hughes

Reference Books:
1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H.Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai
5. Basic Electrical Engineering, Nath & Chakraborti
Course Name : ENGINEERING MECHANICS
Course Code: MECH 1101

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Module-I [10L]

Importance of Mechanics in Engineering; Definition of Mechanics; Concepts of particles & rigid bodies; Vector and scalar quantities; Vector algebra –definition and notation; Types of vectors – equal, equivalent, free, bound, sliding; Addition, subtraction of vectors; Parallelogram law, triangle law, vector polygon; Scalar multiplication of vectors; Resolution of vectors in Cartesian co-ordinate system; Unit vector, unit co-ordinate vectors (\( \hat{\mathbf{e}}, \hat{\mathbf{j}}, \hat{\mathbf{k}} \)); Direction cosines; Addition/subtraction of vectors in components form.

Definition of force vector; Dot product, cross product and the application; Important vector quantities (position vector, displacement vector); Moment of a force about a point and about an axis, moment of a couple; Representation of force and moments in items of \( \hat{\mathbf{e}}, \hat{\mathbf{j}}, \hat{\mathbf{k}} \). Principle of transmissibility of force (sliding vector); Varignon’s theorem for a system of concurrent forces with proof; Resolution of a force by its equivalent force-couple system; Resultant of forces.

Module-II [10L]

Type of forces – collinear, concurrent, parallel, concentrated, distributed; Active and reactive forces, different types of reaction forces; Free body concept and diagram; Concept and equilibrium of forces in two dimensions; Equations of equilibrium; Equilibrium of three concurrent forces -- Lami’s theorem.

Concept of friction: Laws of Coulomb’s friction; Angle of friction, angle of repose, coefficient of friction -- static and kinematic.

Module-III [12L]

Distributed force system; Centre of gravity; Centre of mass & centroid; Centroid of an arc; Centroid of plane areas – triangle, circular sector, quadrilateral and composite area consisting of above figures.

Area moment of inertia: Moment of inertia of a plane figure; Polar moment of inertia of a plane figure; Parallel axes theorem.

Concept of simple stress and strain; Normal stress, shear stress, normal strain, shear strain; Hooke’s law; Poisson’s ratio; stress-strain diagram of ductile and brittle material; Proportional limit, elastic limit, yield point, ultimate stress, breaking point; Modulus of elasticity.

Module-III [16L]

Introduction to dynamics: Kinematics & kinetics; Newton’s laws of motion; Law of gravitation and acceleration due to gravity; Rectilinear motion of particles with uniform & non-uniform acceleration.
Plane curvilinear motion of particles: Rectangular components (projectile motion), normal and tangential components.

Kinetics of particles: D’Alembert’s principle and free body diagram; Principle of work & energy; Principle of conservation of energy.
Impulse momentum theory: Conservation of linear momentum
References:

1. Engineering Mechanics: Statics and Dynamics by Meriam & Kreige, Wiley India
2. Engineering Mechanics: Statics and Dynamics by I.H. Shames, PHI
3. Engineering Mechanics by Timoshenko, Young and Rao, TMH
4. Element of strength of materials by Timoshenko & Young, EWP
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**List of Experiments:**

1. To determine the alkalinity in a given water sample.
2. Estimation of iron using KMnO₄: self indicator.
3. Estimation of iron using K₂Cr₂O₇: redox sensitive indicator.
4. To determine total hardness and amount of calcium and magnesium separately in a given water sample.
5. To determine the value of the rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid.
6. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
Course Name: BASIC ELECTRICAL ENGINEERING LAB.
Course Code: ELEC1011

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List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin’s & Norton’s theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.
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<th>Course Name : Engineering Drawing</th>
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1. Importance of engineering drawing; Acquaintance with different drafting equipment & accessories;
2. Introduction to lines : Practising different types of lines; Basic concepts in Lettering : Practising vertical & inclined letters (Practice Sheet 1)
3. Different systems of dimensioning with practice. Introduction to the concept of scale of drawing. (Practice Sheet 2)
4. Introduction to concept of orthographic projection: 1st angle and 3rd angle projection method; Symbols; projection of points. (Practice Sheet 3)
5. Projection of straight lines for different orientation including inclined to both the planes. (Practice Sheet 4)
6. Projection of plane surfaces inclined to HP and parallel to VP; Inclined to VP and Parallel to HP (Practice Sheet 5)
7. Projection of solids: Cube, rectangular prism, Hexagonal prism, Cylinder, Pyramid, Cone. (Practice Sheet 6)
8. Section of solids and their projections on principal and auxiliary planes for true shape: Cylinder, hexagonal pyramid. (Practice Sheet 7)
9. Isometric projections: Basic concepts, isometric scale; Isometric projection and view.
10. Practice with simple laminar and solid objects. (Practice Sheet 7)

References:

1. “Elementary Engineering Drawing” by Bhatt, N.D; Charotan Book Stall, Anand
Course Name: Communication Practice I Lab [Sessional]

Course Code: HMTS 1112

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Module I [3P]

Introduction to Linguistics (Phonology)
Phonetics-Vowel and Consonant Sounds (Identification &articulation)
Word- stress
Intonation (Falling and rising tone)
Voice Modulation
Accent training

Module II [3P]

Listening Skills
Principles of Listening
Approaches to listening
Guidelines for Effective Listening
Listening Comprehension
Audio Visual (Reviews)

Module III [2P]

Discourse Analysis-
Spoken Discourse
Conversational Skills/Spoken Skills
Analysing Speech dynamics
(Political Speeches
Formal Business Speeches)

Module IV [9P]

Writing Skill-
Descriptive, narrative and expository writing
Writing with a purpose---Convincing skill, argumentative skill/negotiating Skill (These skills will be repeated in oral skills).
Writing reports/essays/articles—logical organization of thoughts
Book review

References
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<th>Extra Curricular Activities</th>
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**Objective:** This course aims at instilling a sense of social responsibility. This objective can be achieved by bringing in awareness about the contemporary issues relevant to the GenX and Gen Y through enlightened discussions and active participation. Since the course has 1 credit detailed planning regarding the area of activities and method of evaluation should be charted at the start of the semester.

**Module I:**

**Project Work**
Development of projects based on integral and holistic developmental models to be implemented in rural areas or underdeveloped areas in the peripheral areas of cities. This could include a wide area of activity – from taking up a research projects to analyse the need of a particular under-developed area to trying to implement a project already formulated. This could also relate to mobilizing funds for a specific project.

**Module II:**

**Action-oriented schemes**
e.g. Organising Blood donation camps
Conducting child healthcare services
Helping the old and sick
(in coordination with NGOs and other institutes)

**Module III:**

**Society and Youth**
Developing Awareness among the youth about social issues both local and global for e.g. Eradication of social evils like drug abuse, violence against women and others.

**Module IV:**

**Youth and Culture**
Generating new ideas and help the participants to be creative and innovative for e.g. Enacting street plays, encouraging creative writing by organizing workshops and competitions. Active participation of the students in the nation building process by making positive changes in the social and individual space.

**Mode of Evaluation**
Total marks allotted -100. In a semester each student should take part in at least four activities. Group activity method is to be followed.
1st year 2nd Semester:

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<tr>
<th>Course Name</th>
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**Learning Objective:** Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

**Module I:** [13L]

**Fundamentals of Computer**


Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Assembly language, high level language, compiler and assembler (basic concepts).

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1’s and 2’s complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double-64 bit). Binary Arithmetic & logic gates. Boolean algebra – expression, simplification, Karnaugh Maps.

Basic concepts of operating systems like MS WINDOW, LINUX. How to write algorithms & draw flow charts.

**Module II:** [5L]

**Basic Concepts of C**

*C Fundamentals:*  
The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

*Operators & Expressions:*  
Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

**Module III:** [8L]

**Program Structures in C**

*Flow of Control:*  
Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables.

C preprocessor (macro, header files), command line arguments.
Module IV: [14L]

Data Handling in C

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage—using malloc(), calloc(), free(), realloc(). Array pointer duality.

String and character arrays; C library string functions and their use.

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), scanf(), printf(), fgets(), fputs();

Text Books

1. Schaum’s outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books

1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan
Module I: [22 L]

Optics

1. Interference:

The principle of superposition of waves. Superposition of waves: Two beam superposition, Multiple-beam superposition, coherent and incoherent superposition. Two source interference pattern (Young’s double slit), Intensity distribution. Interference in thin films, wedge shaped films and Newton’s rings, applications of interference. Newton’s rings: Determination of wavelength of light, refractive index of liquid.

2. Diffraction:

Diffraction of light waves at some simple obstacles. Fraunhofer diffraction through double slit and diffraction grating, grating spectra, resolving power of grating.

3. Polarisation & Fibre Optics:

Elementary features of polarization of light waves. Production and analysis of linearly, elliptic and Circularly polarized light, polaroids and application of polarizations. fibre optics - principle of operation, numerical aperture, acceptance angle.

4. Laser


Module II: [8L]

Waves & Oscillation

Superposition of two linear SHMs (with same frequency), Lissajous’ figures. Damped vibration - differential equation and its solution, Critical damping, Logarithmic decrement, Analogy with electric circuits. Forced vibration - differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance and Quality factor. Progressive wave- Wave equation and its differential form, Difference between elastic (mechanical) and electromagnetic waves.
Module III: [9L]

Quantum Mechanics


Module IV: [6L]

Introduction of Crystallography


Text Books

1. Atomic Physics Vol 1 – S.N. Ghoshal
2. Optics – Ajoy Ghak
3. Waves & Oscillation – N.K. Bajaj

Reference Books

1. Introduction to Special Relativity – Robert Resnick
2. Prespective on Modern Physics - Arthur Beiser
3. Optics – Jenkins and White
5. Introduction to modern Physics – Mani and Meheta
6. Optics – Brijlal and Subrahmanyam
Course Name: Mathematics II  
Course Code: MATH1201

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Module I [10 L]

**Ordinary differential equations (ODE)-**
First order and first degree: Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear and non-linear differential equation, Bernoulli’s equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut’s equation).

**Second order and first degree:**

Module II:[10L]

**Basics of Graph Theory**
Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph.; Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.

**Tree:**
Definition and properties, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra’s Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal’s and Prim’s algorithms.

Module III [10L]

**Improper Integral:**
Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations.

**Laplace Transform:**
Introduction to integral transformation, functions of exponential order, Definition and existence of LT (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations, Evaluation of sine, cosine and exponential integrals using LT, LT of periodic and step functions Definition and properties of inverse LT Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Module IV [10L]

**Three Dimensional Geometry**
Canonical equation of the line of intersection of two intersecting planes. Angle between two lines. Shortest distance between two lines. Condition of coplanarity of two lines. Length of the perpendicular from a point to a given line.

References:

2. Graph Theory: V. K. Balakrishnan, (Schaum’s Outline, TMH)
3. A first course at Graph Theory: J. Clark and D. A. Holton (Allied Publishers LTD)
4. Introduction to Graph Theory: D. B. West (Prentice-Hall of India)
5. Graph Theory: N. Deo (Prentice-Hall of India)
10. Introductory Course in Differential Equations: Daniel A. Murray (Longmans & Green).
12. Analytical Geometry And Vector Algebra- R M Khan
Course Name: Basic Electronics Engineering
Course Code: ECEN1001

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Module I [10 L]

Semiconductors:

Crystalline material, Energy band theory, Fermi levels; Conductors, Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Diodes and Diode Circuits:

Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener Diode and its Application, Zener and Avalanche breakdown.

Simple diode circuits, load line, piecewise linear model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

Module II [10 L]

Bipolar Junction Transistors:

Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off, active and saturation modes of operation, transistor action, input & output characteristics, load line & amplifier operation and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor.

Module III [9 L]

Field Effect Transistors:

Junction field effect transistor (JEET): Principle of operation, JFET parameters, eqv. Circuit, JFET biasing, self bias, design of bias circuits, load line, amplifier characteristics.

MOSFETs:

Construction & principle of operation of p- & n-channel enhancement & depletion mode MOSFETs, drain & transfer characteristics, threshold voltage & its control.

Cathode Ray Oscilloscope:

Construction and working principle of CRO, Lissajous pattern.

Module IV [9 L]

Feed Back Amplifier:

Concept-block diagram, properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, condition of oscillation, Barkhausen criteria.
Operational Amplifier:

Introduction to integrated circuits, operational amplifier and its terminal properties; Application of operational amplifier; Concept of op-amp saturation, inverting and non-inverting mode of operation, Adders, Subtractors, Voltage follower, Integrator, Differentiator, Basic Comparator Circuit.

References:

2. R.A Gayakwad: Op Amps and Linear IC’s, PHI
3. D. Chattopadhyay, P. C Rakshit: Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
Module I [10 L]
Basic concepts of Thermodynamics:

Introduction; Macroscopic and microscopic concept; Definition of Thermodynamic systems; Surrounding, universe; Open, closed and isolated systems; Concept of control volume; Thermodynamic properties: intensive, extensive & specific properties; state.

Thermodynamic equilibrium; Change of state; Thermodynamic processes and cycles; Quasi-static processes; Reversible processes; Zeroth law of Thermodynamics -concept of temperature.

Heat & Work:

Definition of Thermodynamic work; Work transfer-displacement work for a simple compressible system, path function, PdV work in various quasi-static processes(isothermal, isobaric, adiabatic, polytropic, isochoric); Free expansion; Indicated diagram (P-V diagram). Definition of heat; Heat transfer-a path function; Similarities and dissimilarities between heat and work.

Module II [8 L]

First law of Thermodynamics: Statement; 1st law for a closed system executing a cycle; Concept of stored energy; Energy as a property, different forms of stored energy, internal energy, first law for a non-flow process; Flow work; Definition of enthalpy, C_p, C_v; Energy of an isolated system; Flow energy; First law for an open system - steady flow energy equation; Examples of steady flow devices(nozzle and diffuser, turbine, pump, compressor, boiler, condenser and throttling device); PMM-I

Module III [10 L]

Second law of Thermodynamics:

Qualitative difference between heat and work; Definition of source & sink: cyclic heat engine, heat pump and refrigerator, thermal efficiency of heat engine, C.O.P of heat pump and refrigerator; Kelvin-Plank and Clausius statements of second law; Equivalence of the two statements.

Reversible process; Irreversible process; Factors for irreversibility; Carnot cycle and Carnot efficiency; Reversible heat engine and heat pump; PMM-ll

Entropy: Mathematical statement of Clausius Inequality: Entropy as a property; Entropy principle; T-s plot for reversible isothermal, adiabatic, isochoric & isobaric processes.

Air standard Cycles:

Otto cycle & Diesel cycle, P-V & T-s plots, Net work done and thermal efficiency.

Module IV [10 L]

Properties & Classification of Fluid:

Definition of fluid; Concept of Continuum; Fluid properties- density, specific weight, specific volume, specific gravity; Viscosity : definition , causes of viscosity , Newton’s law of viscosity, dimensional formula and units of viscosity, kinematic viscosity; Variation of viscosity with
temperature. Ideal and Real fluids; Newtonian and Non-Newtonian fluids; No-slip condition. Compressibility and Bulk modulus of elasticity. Difference between compressible and incompressible fluids.

**Fluid Statics:**

Introduction; Pascal’s Law--statement and proof; Basic Hydrostatic Law and its proof; Variation of pressure with depth in incompressible fluid, piezometric head, pressure head; Unit and scales of pressure measurement. Measurement of fluid pressure: Piezometer, Manometers -Simple and Differential U-tube manometer, Inverted tube manometer, Inclined tube manometer. Characteristics and choice of manometric fluid.

**Module V [10 L]**

**Fluid Kinematics:**

Definition; Flow field and description of fluid motion(Eulerian & Lagrangian method), steady and unsteady flow, uniform and non-uniform flow-examples. Acceleration of a fluid particle-local acceleration, convective acceleration. Stream line, Stream tube, Path line and Streak line; Laminar and Turbulent flow, Reynolds Number. Equations of streamlines and path lines. Continuity equation for unidirectional flow and for differential form in 3-D Cartesian coordinate system.

**Dynamics of Ideal fluids:**

Introduction, Euler’s equation of motion along a streamline; Bernoulli’s equation-assumptions and significance of each term of Bernoulli’s equation. Application of Bernoulli’s equation-problem on pipe line. Measurement of flow rate: Venturimeter and orificemeter. Static pressure, Dynamic pressure, Stagnation pressure-measurement of velocity by Pitot tube.

**References:**

1. Engineering Thermodynamics- Nag, P.K. - T. M.H
2. Fundamentals of Thermodynamics- Sonntag, Borgnakke & Van Wylen, Wiley India
3. Thermodynamics- an Engineering approach - 6e, Cengel & Boles, TM
| Course Name : Introduction to Computing Lab |  
|-------------------------------------------|---------------------------------|
| Course Code: CSEN1211                    |                                 |
| Contact hrs per week:                    | L | T | P | Total | Credit points |
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**Basic Computation & Principles of Computer Programming Lab**

**Software to be used:** Cygwin and notepad++, Tiny C

Day 1: LINUX commands and LINUX based editor
Day 2: Basic Problem Solving
Day 3: Control Statements (if, if-else, if-elseif-else, switch-case)
Day 4: Loops - Part I (for, while, do-while)
Day 5: Loops - Part II
Day 6: One Dimensional Array
Day 7: Array of Arrays
Day 8: Character Arrays/ Strings
Day 9: Basics of C Functions
Day 10: Recursive Functions
Day 11: Pointers
Day 12: Structures and Unions
Day 13: File Handling
1. Determination of Young’s modulus by Flexure Method and calculation of bending moment and shear force at a point on the beam.
3. Determination of thermal conductivity of a good conductor by Searle’s Method.
4. Determination of thermal conductivity of a bad conductor by Lee’s and Chorlton’s Method.
5. Determination of dielectric constant of a given dielectric material.
6. Use of Carey Foster’s bridge to determine unknown resistance.
8. Determination of wavelength of light by Fresnel’s biprism method.
10. Determination of dispersive power of the material of a given prism.
11. Determination of co-efficient of viscosity of a liquid by Poiseulle’s capillary flow method.
Course Name: Basic Electrical Engineering Lab
Course Code: ELEC1011

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List of Experiments
1. Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
2. Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and
**Course Name:** Workshop Practice  
**Course Code:** MECH1011

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**Job 1:** General awareness of a typical workshop.

**Theory requirements:** Workshop definition, various shops in a typical workshop, Carpentry, Fitting, Foundry; Sheet Metal Shop, Welding and Brazing Shop, Machine Shop, Forging & Blacksmithy, Safety precautions to be followed in a workshop, Familiarization of Various safety devices and their uses.

**Job 2:** Making of a wooden pattern.


**Job 3:** Making of a matched profile form MS plate.

**Theory requirements:** Work Bench, Fitting Tools (Bench Vice, Chisel, Hammer), Different types of Files, (Rough, Bastard, Second Cut, Half Round, Triangular File), Saw (Hack saw etc.), Siberc, Punch, Try Square, Angle Plate, caliper (outside & inside), Universal Surface Gauge, Centre Punch, Prick Punch, Drill (Flat, straight fluted, taper shank twist drill). Fitting Operations, Fileing, Marking, Drilling, Tapping (Rougher, Intermediate, Finisher taps), Tap Drill size (D=T-2d), Sawing, Dieing. Safety precautions in Fitting Shop.

**Job 4:** Making of an internal and external thread.

**Theory requirements:** Thread standards and thread classifications, Internal Thread, External Thread, Thread Nomenclature (Major dia, Minor dia, Pitch dia, pitch, Lead, TPI, Metric, BSP, Nominal size), Specifications of threaded fasteners (in Metric System). Safety precautions in Dieing and Tapping.

**Job 5:** Making of a green sand mould using the pattern made under Job no. 2.

**Theory requirements:** Mould making, Preparation of sand, (silica, clay, moisture, and misc items and their functions), Properties of a good sand mould, General procedure for making a good sand mould, Different tools used for preparation of a mould, Explanation of various terms, Cope and Drag Box, Runner, Riser, Gating and its utility, Parting sand, Vent holes.

**Job 6:** Demonstration of metal melting and casting

**Theory requirements:** Metal melting furnaces: Ladles, Using of Tongs, Molten metal pouring procedure, Safety precautions in pouring molten metal in a mould.

**Job 7:** Making of a stepped pin in a centre lathe.  
(2 Classes)

**Theory requirements:** Machining and common machining operations, Lathe M/c and its specifications, Head stock, Tailstock, Chuck-Self centering chuck, 4 jaw chuck, Bed, Carriage, Feed mechanism, Screw cutting mechanism, various lathe operations like turning, facing, grooving, chamfering, taper turning, Thread cutting, Knurling, Parting, Cutting speed, Feed, Depth of cut, Different types of cutting tools-Safety precautions in a machine shop.

**Job 8:** Making of square prism from a round shaft by Shaping Machine

**Theory requirements:** Description of a Shaping machine, Base, Column, Saddle, Clapper box, Quick return mechanism, Feed Mechanism, Table, Rotation of table, Adjustment of stroke length, Adjustment of starting point of cut. Safety Precautions while working in Shaping Machine.
Job 9: Making of square prism from a round shaft by Milling Machine


Job 10: Arc Welding practice and making of a welded joint

**Theory requirements:** Welding, Weldability, Types of Welding, MMAW, Gas Welding, Electrode, Functions of Flux, Equipment for MMAW, Different types of Flames in Gas Welding and Gas Cutting (Neutral-Oxidising-Reducing Flames), Different types of welding joints, AC Welding, DC Welding; Safety precautions in Welding Shop.

Job 11: Sheet Metal forming & Brazing

**Theory requirement:** Specification of sheet metal, SWG vs. mm, HR sheet, CR sheet, GI Sheet, Stainless Steel Sheet, Aluminum sheets, Tin Plates, Sheet metal working Tools, Micrometer, Chisels, Punches, Hammers, Mallets, Hand Shear or Snippets, Various sheet metal forming operations, Shearing, Marking, Punching, Drilling, Bending, Drawing, Brazing, Safety precautions in Sheet Metal Working Shop.

**References:**

Heritage Institute of Technology
Anandapur, Kolkata - 700107

Structures of Syllabus

Department Name: Information Technology

Programme Name: B. Tech.

Year: 2nd Year

Document Release Month & Year: June 2017
2nd Year 1st Semester:

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<tr>
<th>Course Name</th>
<th>HUMAN VALUES AND PROFESSIONAL ETHICS</th>
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**Detailed Syllabus:**

**Module-I:**
Human society and the Value System
Values: Definition, Importance and application.
Formation of Values: The process of Socialization
  - Self and the integrated personality
  - Morality, courage, integrity
Types of Values:
Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values & their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life
Value Crisis in Contemporary Society
Value crisis at---
  - Individual Level
  - Societal Level
  - Cultural Level
Value Crisis management --- Strategies and Case Studies

**Module II**
Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism, Utilitarianism, Kant's theory and other non-consequential perspectives
Ethics of care, justice and fairness, rights and duties
Ethics-- Standardization
  - Codification
  - Acceptance
  - Application
Types of Ethics---Ethics of rights and Duties
  - Ethics of Responsibility
  - Ethics and Moral judgment
  - Ethics of care
  - Ethics of justice and fairness
  - Work ethics and quality of life at work
Professional Ethics
Ethics in Engineering Profession;
Moral issues and dilemmas, moral autonomy (types of inquiry)
Kohlberg's theory, Giligan's theory (consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE, IEEE, Institute of Engineers, Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership
Conflict between business demands and professional ideals
Social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies
Ethics and Industrial Law
Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module-III:
Science, Technology and Engineering
Science, Technology and Engineering as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non-renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization
Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and safety engineering
Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk
Technology Transfer: Definition and Types
The Indian Context

Module-IV:
Environment and Eco-friendly Technology
Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation
Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment
Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends
Appropriate technology movement by Schumacher and later development
Reports of Club of Rome.

References:
1. Tripathi, A.N., Human Values, New Age International, New Delhi, 2006
Course Name: PHYSICS II
Course Code: PHYS2001

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Course Outcome:

Students undertaking this course should develop a basic understanding of quantum mechanics with thorough knowledge of operator functions and solution and applications of Schrödinger equation; they should acquire the concepts of basic solid state physics and classification of solids; the students must develop an idea of the different types of statistical distributions and be able to understand semiconductor behavior by application of statistical methods. They will also get a thorough understanding of different dielectric materials, physical interpretation of magnetic properties of matter, and basic understanding of superconductivity. In all cases they must build an ability of addressing related problems and explore the applications of the different theories.

Detailed Syllabus:

Module-I: [10L]

Lagrange and Hamiltonian:
Generalised coordinates, constrains, Lagrange’s Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamiltonian formulation, Hamilton’s Equation of motion. Course should be discussed along with physical problems of 1-D motion.

Quantum Mechanics:
Concept of probability and probability density, operator, Commutator, Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger’s equation, formulation of time independent Schrödinger’s equation by method of separation of variables, Physical interpretation of wave function \( \Psi \) (normalization and probability interpretation), Expectation values, Application of Schrödinger equation - Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels.

Module-II: [10L]

Statistical Mechanics:
Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (no deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics. Fermi distribution at zero and non–zero temperature.

Applications of Statistical Mechanics:
Planck’s Black body radiation, Fermi Level in Intrinsic and Extrinsic Semiconductors, Intrinsic Semiconductors and Carrier Concentration, Extrinsic Semiconductors and Carrier Concentration, Equation of Continuity, Direct & Indirect Band Gap Semiconductors

Module-III: [10L]

Dielectric Properties:
Magnetic Properties:

Module-IV: [10L]
Band Theory of Solids:

Super Conductivity:

References:

Quantum Physics
1. Atomic Physics – S.N. Ghoshal – S Chand
2. Quantum Physics– Eisberg and Resnick – Wiley

Classical Mechanics

Solid State Physics
1. Atomic Physics – S.N Ghoshal
4. Introduction to Solid state Physics – C.Kittel

Statistical Mechanics
1. Thermodynamics, Kinetic Theory, and Statistical Mechanics–Sears and Salinger–Narosa
Course Name: NUMERICAL AND STATISTICAL METHODS
Course Code: MATH2002

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After successful completion of this course the students will be able to:

- Apply numerical methods to obtain approximate solutions to mathematical problems where analytic solutions are not possible.
- Develop algorithmic solutions for problems like system of linear equations, integration, ordinary differential equations which are pertinent to many physical and engineering problems.
- Apply probabilistic methods to engineering problems where deterministic solutions are not possible.
- Analyze probability distributions required to quantify phenomenon whose true value is uncertain.
- Find numerical solutions to algebraic and transcendental equations appearing in a vast range of engineering problems e.g in the study of Ideal and non ideal gas laws, pipe friction, design of electric circuits.
- Apply numerical methods to find solutions to linear system of equations appearing in spring-mass systems, resistor circuits, steady state analysis of a system of reactors.
- Solve problems in data analysis, least-cost treatment of wastewater where the knowledge of interpolation will be required.
- Compute numerical solution to integrals to find root mean square current.

Detailed Syllabus:

Module-I: [8L] - Numerical Solution to Linear and Non-Linear Equations
Solution Of Non-Linear Algebraic Equations And Transcendental Equations:
Bisection Method, Newton-Raphson Method, Regula-Falsi Method.
Solution of Linear System of Equations:
Gauss elimination method, Gauss-Seidel Method, LU Factorization Method.

Module-II: [8L] - Numerical Solution to Integration and Ordinary Differential Equations
Interpolation and Integration:
Newton’s Forward and Backward Interpolation Method, Lagrange’s Interpolation, Trapezoidal and Simpson’s 1/3rd Rule.
Solution of Ordinary Differential Equations:
Euler’s and Modified Euler’s Method, Runge-Kutta Method of 4th order.

Module-III: [5L] - Fundamentals of Probability
Random experiment, Sample space, Events, Definition of Probability, Addition law of probability, Multiplication law and Conditional Probability. Bayes’ Theorem (Statement only)

Module-IV: [15L] - Probability Distributions And Statistics
Random Variables:
Special Distributions:
Binomial, Poisson, Uniform, Exponential and Normal. Measures of Central Tendency and Dispersion – Mean, Median, Mode and Standard Deviation for grouped and ungrouped frequency distribution. Simple Correlation and Regression.
References:

5. A First course in Probability, Sheldon Ross, Pearson
Course Name : BASIC ENVIRONMENTAL ENGINEERING & ECOLOGY
Course Code: CHEM2001

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After successful completion of this course the students will be able to:

- Understand fundamental physical and biological principles that govern natural processes.
- Understand fundamental concepts from the social sciences and the humanities underlying environmental thought and governance.
- Integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
- Communicate integrated perspectives on complex environmental problems in the form of written and oral argument to both professional and lay audiences.
- Design and conduct independent research that contributes to environmental thought and/or problem solving.
- Demonstrate an in-depth understanding of one of the sub-disciplines within environmental science (i.e. biology, chemistry, or geology)
- Collect and interpret scientific data in both field and laboratory settings
- Integrate information from across the scientific disciplines and apply these concepts to complex environmental problems
- Identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment
- Communicate scientific information to both professional and lay audiences

Detailed Syllabus:

Module-I: [9L]

Environment & Ecology (General discussion):
Basic ideas of environment and its component 1L
Mathematics of population growth: exponential and logistic and associated problems, definition of resource, types of resource, renewable, non-renewable, potentially renewable, Population pyramid and Sustainable Development 2L
General idea of ecology, ecosystem – components, types and function. 2L
Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain [definition and one example of each food chain], Food web. 2L
Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphorus, Sulphur]. 2L
Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 1L

Module-II: [9L]

Air pollution and control:
Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause 1L
Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Acid rain: causes, effects and control. Earth’s heat budget, carbon capture, carbon footprint 2L
Lapse rate: Ambient lapse rate, adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion, Maximum mixing depth 2L
Definition of pollutants and contaminates, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN 1L
Smog: Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other greenhouse gases, effect of ozone modification

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Module-III: [9L]

Water Pollution and Control:
Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides.

River/Lake/ground water pollution: River: DO, 5 day BOD test, Unseeded and Seeded BOD test, BOD reaction rate constants, COD.
Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds]

Water pollution due to the toxic chemicals effects: Lead, Mercury, Cadmium, Arsenic

Noise Pollution:
Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]. Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, \( L_{10} \) (18hr Index), effective perceived noise level. Noise pollution control.

Module-IV: [9L]

Land Pollution:
Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, electronic waste


Social Issues, Health and Environment:
Environmental disasters: Bhopal gas tragedy, Chernobyl disaster, Three Mile Island disaster, cancer and environment: carcinogens, teratogens and mutagens (general aspect)

Environmental impact assessment, Environmental audit, Environmental laws and protection act of India.

Energy audit, Green building, Green sources of energy, Concept of Green Chemistry, Green catalyst, Green solvents (replacement of VOC)

References:
3. Asim K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd
4. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
5. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.
Course Name : DATA STRUCTURE AND BASIC ALGORITHMS
Course Code: CSEN2001

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Learning outcome:

Ideally this course should act as a primer/pre-requisite for CS 503 (Design and Analysis of Algorithms). On completion of this course, students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in C, how their drawbacks can be overcome and what the applications are and where they can be used. Students should be able to learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program to enhance the efficiency (i.e. reduce the running time) or for better memory utilization, based on the priority of the implementation. Detailed time analysis of the graph algorithms and sorting methods are expected to be covered in CS503 but it is expected that the students will be able to understand at least the efficiency aspects of the graph and sorting algorithms covered in this course. The students should be able to convert an inefficient program into an efficient one using the knowledge gathered from this course.

Detailed Syllabus:

Module–I: [8L] Linear Data Structure I
Introduction: Why we need data structure? 2L

Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.
Array:
Different representations – row major, column major. Sparse matrix - its implementation and usage.
Array representation of polynomials.
Linked List:
Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module-II: [7L] Linear Data Structure II
Stack and Queue:
Stack and its implementations (using array, using linked list), applications.
Queue, circular queue, deque. Implementation of queue- both linear and circular (using array, using linked list), applications. Implementation of deque- with input and output restriction.
Recursion:
Principles of recursion – use of stack, differences between recursion and iteration, tail recursion.

Module-III: [13L] Nonlinear Data structures
Trees:
Basic terminologies, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only).
Graphs:
Graph representations/storage implementations – adjacency matrix, adjacency list, Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS)

Module-IV: [12L] Searching, Sorting, Hashing:
Sorting Algorithms:
Bubble sort, insertion sort, shell sort, selection sort, merge sort, quicksort, heap sort, radix sort.
Searching:
Sequential search, binary search, Interpolation Search

Hashing:
Hashing functions, collision resolution techniques (Open and closed hashing).

References:
Course Name: DIGITAL ELECTRONICS
Course Code: INFO2101

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After successfully completing this course the students will be able to:

3(a) Assess the utility of combinational logic circuit and sequential logic circuit.
3(b) Develop Boolean expression applying the knowledge of logic gates and De Morgan’s theorem.
3(c) Design logic circuits of corresponding Boolean function applying the minimization technique of Karnaugh map Quine-Mc Cluskey methods and MOD-N counter.
3(d) Compare between different types of Flip Flops.
3(e) Apply their knowledge of number system to convert a number of any given base to another number of required base.
3(f) Describe different types of counters such as Ring Counter, Johnson counter.
3(g) Explain A/D and D/A conversion techniques.

Detailed Syllabus:

Module-I: [7L]
Number Systems: Review of number systems, BCD codes and arithmetic, Gray code, self-complimenting codes, Error detection and correction principles.
Digital Circuits: Switching algebra & simplification of Boolean expressions. De Morgan’s Theorem. Implementations of Boolean expressions using logic gates.

Module-II: [14L]
Combinational Logic Circuit: Combinational circuit analysis and synthesis, Techniques for minimization of Boolean functions such as Karnaugh map Quine-Mc Cluskey methods. Multiplexers, de-multiplexers, encoders, decoders, comparators, adder, BCD. Parity generators and checker.
Sequential Logic Circuit: Need for sequential circuits, Binary cell, Latches and flip-flops. RS, JK, Master-Slave JK, D & T flip flops.

Module-III: [8L]
Synchronous Sequential Circuit: Registers (SISO, SIPO, PIPO, PISO), Ring counter, Johnson counter, Basic concept of Synchronous and Asynchronous counters, Shift register, Design of Mod N Counter, Timing issues in synchronous circuits.

Module-IV: [7L]
A/D and D/A conversion techniques – Basic concepts A/D: successive approximation. Logic families-TTL, ECL, MOS and CMOS - basic concepts.

References:
After successfully completing this course the students will be able to:

- **Justify** the necessity of using pipeline architecture over non pipeline architecture.
- **Compare** between different page replacement algorithms.
- **Design** memory unit with the help of decoder, multiplexer, and register.
- **Construct** ALU considering basic arithmetical problems (addition, subtraction, multiplication, division) and logical problems.
- **Design** 4 bit ripple carry adder and carry look ahead adder.
- **Formulate** different solution strategy for different type of instructions.

3(g) **Analyze** the difference between Von Neumann architecture and Harvard architecture.
3(h) **Demonstrate** different mapping techniques (Associative, direct, set associative).
3(i) **Define** stored program concept.

**Detailed Syllabus:**

**Module-I: [8L]**

*Introduction to Computers:*

Instruction format, Addressing Modes.

**Module-II: [12L]**

*Computer Arithmetic:*

Addition & Subtraction with Signed-Magnitude, Half Adder, Full Adder Ripple carry adder, Carry look-ahead adder, Multiplication Algorithm, Division Algorithm, Floating point number representation, IEEE 754 standard, ALU design.

**Module-III: [10L]**

*Memory Organization:*

Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory, Virtual Memory, Data path design for read/write access, Address Space and Memory Space, Associative Memory, Page Table, Page Replacement.

**Module-IV: [6L]**

*Input Output Organization:*

Modes of transfer, Concept of handshaking, interrupt.

**Pipelining:**

Basic concept, Different types of pipeline, and Different types of Hazards.

**References:**

Course Name: NUMERICAL AND STATISTICAL METHODS LABORATORY

Course Code: MATH2012

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After successful completion of this course the students will be able to:

- Reproduce customized programs to solve problems based on Numerical Methods.
- Develop algorithms to handle large systems of equations appearing in physical and engineering problems.

**Detailed Syllabus:**

Development of computer programs in C for the following problems:

1. Regula-Falsi Method
2. Newton-Raphson Method
3. Gauss-elimination Method
4. Gauss-Seidel Method
5. Newton’s Forward Interpolation
6. Lagrange’s Interpolation
7. Trapezoidal and Simpson’s 1/3rd rule
8. Euler’s and Modified Euler’s Method
9. Runge-Kutta method of 4th order
10. Computation of Mean, Median, Mode and Standard Deviation for grouped and ungrouped frequency distribution
11. Computation of Correlation coefficient and Regression equation for Bivariate data.
Course Name: PHYSICS II LABORATORY
Course Code: PHYS2011

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Course Outcome:

After taking this course, which is a laboratory paper students will be able to apply theoretical knowledge of electricity and magnetism, quantum physics and semiconductor physics to perform various experiments that will help them determine some very important material constants viz. dielectric constant, Hall coefficient, band gap of semiconductors etc., as well as some universal constants of great importance like Stefan’s constant, Planck’s constant etc. They will develop skills of result analysis and graph plotting along with operational skills of the different experimental apparatus.

Detailed Syllabus:

Group 1: Experiments on Electricity and Magnetism
1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
3. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
4. Determination of specific charge (e/m) of electron.

Group 2: Quantum Physics
6. Determination of Planck’s constant.
7. Determination of Stefan’s radiation constant.
8. Verification of Bohr’s atomic orbital theory through Frank-Hertz experiment.
9. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics
10. Determination of Hall co-efficient of semiconductors.
11. Determination of band gap of semiconductors.
12. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Note: A candidate is required to perform at least 5 experiments taking one from each group. Emphasis should be given on the estimation of error in the data taken.
Course Name: DATA STRUCTURES LABORATORY  
Course Code: CSEN2011

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Course Outcome:

Ideally this course should act as a primer/pre-requisite for CS 503 (Design and Analysis of Algorithms). On completion of this course, students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in C, how their drawbacks can be overcome and what the applications are and where they can be used. Students should be able to learn about the data structures/methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/method/algorithm in a program to enhance the efficiency (i.e. reduce the running time) or for better memory utilization, based on the priority of the implementation. Detailed time analysis of the graph algorithms and sorting methods are expected to be covered in CS503 but it is expected that the students will be able to understand at least the efficiency aspects of the graph and sorting algorithms covered in this course. The students should be able to convert an inefficient program into an efficient one using the knowledge gathered from this course.

Detailed Syllabus:

1. Implementation of array operations.
3. Evaluation of expressions operations on Multiple stacks & queues.
4. Implementation of linked lists: inserting, deleting, inverting a linked list.
5. Implementation of stacks & queues using linked lists:
6. Polynomial addition, Polynomial multiplication.
7. Sparse Matrices: Multiplication, addition.
8. Recursive and Non-recursive traversal of Trees.
9. Threaded binary tree traversal.
10. DFS and BFS.
11. Application of sorting and searching algorithms.
Course Name: DIGITAL ELECTRONICS & COMPUTER ORGANIZATION LABORATORY

Course Code: INFO2112

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After successfully completing this course the students will be able to:

- **Analyze** the utility of vertical expansion of RAM and Horizontal expansion of RAM.
- **Apply** their knowledge of basic gates, Multiplexer to **design** adder, subtractor, Flip Flop, encoder, decoder.
- **Design** and **explain** the use of 16 bit odd even parity checker/generator using IC74180.

**Detailed Syllabus:**

1. Realization of AND, OR, NOT, NAND, XOR gates using respective chips. Design AND, OR gates using basic design elements (Diod, Resistance, Transistor etc.)
2. Implementation of AND, OR, NOT, XOR gates using NAND Gate as a Universal Gate. Realize the following equation using only minimum number of NAND gates. 
   \[ Y = AB'C' + A'BC \]
3. Design Half Adder & Full Adder Circuits using basic Gates.
5. Design Adder-Subtractor Composite unit using 1 bit Full Adder Chip (LS 7483).
6. Design and implementation of 16 bit odd/even parity checker / generator using IC74180.
7. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147
10. Design and implementation of 3-bit synchronous up/down counter
11. Horizontal expansion of RAM.
12. Vertical expansion of RAM.
2nd Year 2nd Semester:

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<th>Course Name : INDIAN CULTURE &amp; HERITAGE</th>
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Detailed Syllabus:

**Module-1:**
Indian Religion & Philosophy
1. Orthodox Indian Philosophy:
2. Unorthodox Indian philosophy:
3. Essentials of Hinduism
4. An overview of Jainism, Buddhism, Sikhism, Islam, Christianity religions

**Module-II:**
Values and Personality
1. Aspects of Indian Values
2. Essentials of Personality Building
3. Ethics at workplace
4. Aspects of Leadership qualities

**Module-III:**
Indian Scriptures
1. Selections from the Vedas
2. Select verses from Upanishad
3. An overview of Gita
4. XVIth chapter of Gita

**Module-IV:**
Indian Psychology
1. Aspects of Yoga Philosophy
2. Mind and its workings according to Yoga
3. Law of Karma
4. Selections from Manusmriti

References:
1. Indian Philosophy by S.C. Chatter and D. M. Dutta, Calcutta University Press
2. Spiritual Heritage of India, Swami Prabhanananda, Sri Ramakrishna Math, Chennai
3. Raja Yoga by Swami Vivekananda, Advaita Ashrama, Mayavati
4. Vedic Selection, Calcutta University Press
5. Gita by Swami Swarupananda, Advaita Ashrama, Kolkata
6. Upanishads by any press
7. Carving a Sky (MSS) by Samarpan
8. Essentials of Hinduism (MSS) by Samarpan
9. The Call of the Vedas — Bharatiya Vidya Bhavan
Course Name: GRAPH THEORY AND ALGEBRAIC STRUCTURES
Course Code: MATH2203

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After successful completion of this course the students will be able to:

1. **Conceive** basic knowledge on Graph Theory and Abstract Algebra which is the prerequisite of different topics of Computer Science and Information Technology, e.g. Information Theory, Cryptography, Algorithms, Networking etc.
2. **Apply** algebraic thinking which is deeply embedded in the design of programming languages.

**Detailed Syllabus:**

**Module-I: [12L]**

*Graph Theory:*
Tree, Binary Tree, Spanning Tree, Walk, Path, Cycle, Hamiltonian Graph, The Travelling Salesman Problem, Euler Graph, The Chinese Postman Problem, Planar Graph, Euler’s Formula for Planar Graph and Related Problems, Matchings and Augmenting Paths, Hall’s Marriage Theorem and Related Problems, Vertex and Edge Colouring, Chromatic Number and Polynomial.

**Module-II: [12L]**

*Group Theory I:*
Cartesian product, Binary operation, Composition Table. Group, Elementary theorems on groups, Quasi group and Klein’s 4 group. Permutations, Product of permutations, Group property of permutations, Cyclic permutation, Transposition, Even and Odd permutations, Proposition regarding permutations, Alternating Groups, Dihedral groups. Discussion on some physical examples e.g. the motion group of a cube.

**Module-III: [12L]**

*Group Theory II:*
Order of an element of a group, Properties of the order of an element of a group, Subgroups, some basic theorems on subgroups, Cyclic group, Cosets, Lagrange’s theorem, Fermat’s Little Theorem (statement only). Normal subgroup, some basic theorems on Normal subgroup, Quotient group, some applications in algebraic coding theory e.g. Block codes, Linear codes, Coset decoding etc.

**Module-IV: [12L]**

*Morphisms, Ring and Field:*
Homomorphism and Isomorphism of groups, some basic theorems. Rings, some elementary properties of a ring, Ring with unity, Characteristic of a ring, Ring with zero divisors, Subring, Integral domain, Field, Division Ring or Skew Field. (Emphasis should be given on examples and elementary properties.)

**References:**

1. Higher Algebra, S.K. Mapa, Sarat Book Distributors
3. A First course in Abstract Algebra, J.B. Fraleigh, Narosa
4. Algebra, M. Artin, Pearson
7. Introduction to Graph Theory and Applications, F. Harary, Addison Wesley Publishing Company
8. Topics in Algebra, I.N. Herstein, Wiley India
9. Advanced Algebra, Samuel Barnard and James Mark Child, Macmillian
After successfully completing this course the students will be able to:

3(a) Define a system and recognize the behavior of a system as well as will be able to minimize a system and compare different systems.

3(b) Convert Finite Automata to regular expression and check equivalence between regular linear grammar and FA.

3(c) Minimize context free grammar and to check equivalence of CFL and PDA

3(d) Design Turing Machine

### Detailed Syllabus:

**Module-I: [11L]**

*Fundamentals:*
Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state mode

*Finite state machine:*
Definitions, capability & state equivalent, kth-equivalent concept
Minimization of FSM, Equivalence between two FSM’s, Limitations of FSM
Merger graph, Merger table, Compatibility graph
Finite memory definiteness, testing table & testing graph.
Information lossless and Inverse machine

**Module-II: [13L]**

Deterministic finite automaton and non deterministic finite automaton.
Transition diagrams and Language recognizers.

*Finite Automata:*
NFA with \( \lambda \) transitions - Significance, acceptance of languages.

*Conversions and Equivalence:*
Equivalence between NFA with and without \( \lambda \)-transitions. NFA to DFA conversion.

*Regular Language:*
Regular sets
Regular expressions, identity rules. Arden’s theorem state and prove
Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA
Pumping lemma of regular sets, Closure properties of regular sets (proofs not required).

**Module-III: [11L]**

Grammar Formalism: Regular grammars-right linear and left linear grammars.
Equivalence between regular linear grammar and FA.
Inter conversion, Context free grammar.
Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only)
Context Free Grammars, Ambiguity in context free grammars.
Normal forms for Context Free Grammars.
Chomsky normal form and Greibach normal form.
Pumping Lemma for Context Free Languages.
Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden’s lemma & its applications
Module-IV: [8L]

**Push Down Automata:**

Push down automata, definition.  
Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence.  
Equivalence of CFL and PDA, interconversion. (Proofs not required).  
Introduction to DCFL and DPDA.  

**Turing Machine :**

Turing Machine, definition, model  
Design of TM, Computable functions  
Universal Turing Machine, Halting problem (proofs not required)  

**References:**

3. “Formal Languages and Automata Theory”, C.K.Nagpal, Oxford
8. “An Introduction to Formal Languages and Automata”, Peter Linz, Jones & Bartlett Learning
Course Name: DESIGN & ANALYSIS OF ALGORITHMS

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After successfully completing this course the students will be able to:

1. **Demonstrate** how the worst-case time complexity of an algorithm is defined and compare the efficiency of algorithms using asymptotic complexity;
2. **Argue** the correctness of algorithms using inductive proofs and invariants.
3. **Explain** the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.
4. **Describe** the (divide-and-conquer, Dynamic programming and Greedy) paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize the above algorithms and analyze them.
5. **Explain** what amortized running time is and what it is good for. Explain what an approximation algorithm is, and the benefit of using approximation algorithms.

**Detailed Syllabus:**

**Module-I: [9L]**

*Introduction:*

*Divide and Conquer:*
Basic method, Binary Search, Merge Sort, Quick Sort and their complexity

*Matrix Manipulation Algorithm:*
Strassen’s matrix manipulation algorithm

*Heapsort:*
Heaps, Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues

*Lower Bound Theory:*
O(nlgn) bound for comparison sort. Set manipulation algorithm like UNION-FIND.

**Module-II: [12L]**

*Graph traversal algorithm:*
Introduction of Graph, Breadth First Search(BFS), Depth First Search(DFS), Best First Search, Bidirectional Search

*Network Flow:*
Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

*Backtracking:*
Basic method, 8 queens problem, Graph coloring problem.

**Module-III: [12L]**

*Greedy Method:*
Basic method, Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim’s and Kruskal’s algorithm.

*Dynamic Programming:*
Basic method, All pair shortest paths, Single source shortest path, Matrix Chain Manipulation, Travelling salesperson problem

**Module-IV: [8L]**

*Branch and Bound:*
Basic method, 15 puzzles problem

*Notion of NP-completeness:*
P class, NP class, NP hard class, NP complete class – their interrelationship, Cook’s theorem (Statement only), Satisfiability problem, Clique decision problem, Non-deterministic Algorithm

**Approximation Algorithms:**

- Necessity of approximation scheme, Polynomial time approximation schemes, Travelling salesman problem.

**Reference:**

2. A. Aho, J. Hopcroft and J. Ullman “The Design and Analysis of Algorithms”
4. Jon Kleinberg and Eva Tardos, "Algorithm Design"
Course Name: INFORMATION THEORY & CODING
Course Code: INFO2203

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**Detailed Syllabus:**

**Module I: [14 L]**
*Source Coding:* Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.*

*Channel Capacity and Coding:* Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

**Module II: [15 L]**
*Linear And Block Codes For Error Correction:* Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

*Cyclic Codes:* Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

**Module III: [8 L]**
*BCH Codes:* Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

**Module IV: [8 L]**
*Convolutional Codes:* Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

**References:**

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
Course Name: OBJECT ORIENTED PROGRAMMING
Course Code: INFO2204

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After successfully completing this course the students will be able to:
1. Design an Object Oriented software system.
2. Arrange real world entity to sketch (architecture) for real life problems (UML) and will be able to
   generalize the problems into number of objects. Finally test, debug and solve them separately.
3. Reduce the complexity of procedural language by using package, Inheritance.
4. Implement some user-friendly GUI interface support application.

Detailed Syllabus:

Module-I: [6L]
Properties of object oriented programming language, Major and minor elements, Object, Class, relationships among objects. Aggregation, Association, using, Generalization, meta-class. Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism

Module-II: [16L]
Class & Object proprieties:
Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts, concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.

Reusability properties:
Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages. Implementation of different relationships in OOPs.

Module-III: [6L]
Exception handling and I/O:
Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.
Input Output stream structure, Wrapper class, File copy programming using command line arguments.

Module-IV: [10L]
Multithreading and Applet Programming:
Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads. Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets.

References:
1. Rambagh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH
Course Name: LANGUAGE PRACTICE LABORATORY

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Detailed Syllabus:

**Module-I:**
Formal verbal communication:
- Introduction to formal verbal communication, Interpersonal Skills & Public Speaking: Building Positive Relationships, Focusing on Solving Problems, Time Management, Dealing with Criticism: Offering Constructive Criticism, Responding to Criticism – Managing Conflict: Approaches to Conflict, Resolving Conflict
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

**Module-II:**
Presentation skills
- Speech Purposes - General: Informative Speeches, Persuasive Speeches, Entertaining Speeches, Methods of Speaking: Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organizing the Presentation: the Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium, Post-presentation Discussion

**Module-III:**
Group Discussion
- Introduction to Group Communication

**Module-IV:**
Job Application and Personal Interview
- Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of Well-Written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

Interviewing

Marks: 100
Module I - 20 marks
Module II- 30 marks
Module III- 20 marks
Module IV- 30 marks
References:

Course Name: DESIGN & ANALYSIS OF ALGORITHMS LABORATORY
Course Code: INFO2212

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After successfully completing this course the students will be able to:

1. Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.
2. Reconstruct the solution to a problem to achieve optimum solution in terms of time complexity and memory utilization.
3. Implement, empirically compare, and apply fundamental algorithms and data structures to real-world problems

**Detailed Syllabus:**

*Programming Language used: C*

**Lab :1**: Divide and Conquer:
- Implement Binary Search using Divide and Conquer approach
- Implement Merge Sort using Divide and Conquer approach

**Lab :2**: Divide and Conquer:
- Implement Quick Sort using Divide and Conquer approach
- Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

**Lab :3**: Dynamic Programming:
- Find the minimum number of scalar multiplication needed for chain of matrix

**Lab :4**: Dynamic Programming:
- Implement all pair of Shortest path for a graph (Floyd-Warshall Algorithm)
- Implement Traveling Salesman Problem

**Lab :5**: Dynamic Programming:
- Implement Single Source shortest Path for a graph (Dijkstra, Bellman Ford Algorithm)

**Lab :6**: Brunch and Bound:
- Implement 15 Puzzle Problem

**Lab :7**: Backtracking:
- Implement 8 Queen problem

**Lab :8**: Backtracking (implement any one of the following problem):
- Graph Coloring Problem
- Hamiltonian Problem

**Lab :9**: Greedy method (implement any one of the following problem):
- Knapsack Problem
- Job sequencing with deadlines

**Lab :10**: Greedy method (implement any one of the following problem):
- Minimum Cost Spanning Tree by Prim's Algorithm
- Minimum Cost Spanning Tree by Kruskal's Algorithm

**Lab :11**: Graph Traversal Algorithm:
- Implement Breadth First Search (BFS)
- Implement Depth First Search (DFS)
After successfully completing this course the students will be able to:

- **Analyze** a problem and design a solution for the problem, following an algorithmic design paradigm.
- **Reconstruct** the solution to a problem to achieve optimum solution in terms of time complexity and memory utilization.
- **Implement**, empirically compare, and apply fundamental algorithms and data structures to real-world problems.

**Detailed Syllabus:**

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces - multiple inheritances, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming
Heritage Institute of Technology
Anandapur, Kolkata – 700107

Structures of Syllabus

Department Name: Information Technology

Programme Name: B. Tech.

Year: 3rd Year

Document Release Month & Year: June 2017
3rd Year 1st Semester:

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<th>Course Name : Economics for Engineers</th>
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Detailed Syllabus:

**Module 1:**
**Market:** Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market.
The basic concept of economics – needs, wants, utility.
Inflation: meaning, reasons, etc. (6L)

**Module 2:**
**Business:** Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.
Banking: role of commercial banks; credit and its importance in industrial functioning. Role of central bank: Reserve Bank of India.
International Business or Trade Environment. (4L)

**Module 3:**

**Module 4:**

**Module 5:**
**Time Value of Money:** Present and Future Value, Annuity, Perpetuity. Equity and Debt, Cost of Capital. (4L)

**Module 6:**
**Capital Budgeting:** Methods of project appraisal - average rate of return - payback period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return. Depreciation and its types, Replacement Analysis, Sensitivity Analysis. (8L)

**Evaluation:** Max marks-100
Internal Test-30
Semester Test-70

**References:**
After successfully completing this course the students will be able to:

1. Analyze and differentiate between different types of operating systems (namely, batch, multi-programmed, time-sharing, real-time, distributed, parallel processing system) based on their application domains and evolution.
2. Demonstrate and describe system operations, internal structure of computer system and operating system.
3. Design multiprocessing and multithreading environments based on inter-process/thread communication and synchronization.
4. Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.
5. Demonstrate the operations of IO devices and how they are governed by the operating system.
6. Discuss the activity and impact of threat, virus, worm and how the system could be protected from them.

Detailed Syllabus:

**Module - I (10L)**
- **Introduction [4L]**: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, timesharing, real-time, distributed, parallel.
- **System Structure [3L]**: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, and system calls.
- **Process and Threads (3L)**:
  - **Processes [1L]**: Concept of processes, operations on processes.
  - **Threads [2L]**: overview, benefits of threads, user and kernel threads.

**Module - II (14L)**
- **Process Scheduling[2L]**: Process scheduling, co-operating processes, inter process communication.
- **CPU scheduling [3L]**: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.
- **Process Synchronization [5L]**: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
- **Deadlocks [4L]**: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

**Module III (11L)**
- **Memory Management [5L]**: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.
- **Virtual Memory [3L]**: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.
- **Disk Management [3L]**: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks.
Module IV(12L)

File Systems [4L]: 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 [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Protection & Security [4L]
Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

References:
4. Dhamdhere: Operating System TMH
<table>
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<th>Course Name : Computer Architecture</th>
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**After successfully completing this course the students will be able to:**

1. Review of basic computer architecture, Quantitative techniques in computer design, measuring and reporting performance.
2. Classify different kinds of pipeline, pipeline hazards and suggesting suitable remedial techniques to handle the hazards. Discussing different kinds of parallel architectures (Flynn’s Classification), types of Multiprocessor architectures (UMA, NUMA, COMA and NORMA), types of Interconnection (Bus, Hypercube and Omega) network and Memory Consistency models. Explaining the concepts of Centralized shared memory architecture and Distributed shared memory architecture.
3. Compute performance parameters of pipelines (Speed-up, Efficiency and Throughput) and deduce derivations to demonstrate the performance parameters when branching effect is introduced. Pipeline optimization techniques needs to be illustrated. Preparing numerical module based on pipeline concepts.
4. Differentiate between different Memory technologies (Primary, Secondary and Cache) and helping students to compute different kinds of numerical based on the memory technologies.
5. Collecting knowledge about Superscalar, Super pipelined and VLIW processor architectures, Array and vector processors. Constructing the concepts of ILP.
6. Comparing different techniques of ILP (Loop Unrolling, Dynamic Scheduling and Software Pipelining) and concluding with concepts of Data Flow architecture, RISC, CISC and Systolic architecture.

**Detailed Syllabus:**

**Module – 1: [12 L]**

**Introduction:** Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (4L)

**Pipelining:** Basic concepts, Instruction pipeline, Arithmetic pipeline, processor pipeline, Data hazards, Control hazards and Structural hazards, Techniques for handling hazards, Static scheduling vs Dynamic scheduling, Pipeline optimization technique. (8L)

**Module – 2: [8L]**

**Hierarchical memory technology:** Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, Mapping and management techniques, Memory replacement policies.

**Module – 3: [8L]**

Instruction-level parallelism: Basic concepts, techniques for increasing ILP, Superscalar, Super-pipelined and VLIW processor architectures. Array and vector processors. Design of Control Unit.

**Module – 4: [12 L]**

Multiprocessor architecture: Taxonomy of parallel architectures; Centralized shared- memory architecture, Memory consistency models, Interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L)

Non von Neumann architectures: Data flow computers, RISC and CISC architecture, Systolic architectures. (4L)

**References:**

Course Name: Software Engineering & Project Management

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After successfully completing this course the students will be able to:

1. At the end of the course student should gather the knowledge of the system development lifecycle;
2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, health and manufacturability.
3. Acquire Knowledge of the principles of object-oriented software construction.
4. Acquire knowledge to manage a project including planning, scheduling and risk assessment.

Detailed Syllabus:

Module-I: [10L]
Principles and Motivations:
Definitions and need for engineered approach to software development; software Development process models from the points of view of technical development and project management: waterfall, rapid prototyping, incremental development, spiral model.
Design of Software Systems: System Design: Context diagram and DFD, Cohesion, Coupling, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object-Oriented approach.

Module-II: [10L]
Software Testing:

Module-III: [10L]
Software Project Management:
Principles of software projects management; organizational and team structure; project planning; project scheduling, project initiation and project termination; technical, quality, and management plans; Software Quality Assurance, Software Configuration Management ,Risk analysis and Management ,project control; cost estimation methods - function points and COCOMO.

Module-IV: [10L]
Object Modeling and Design:
UML Fundamentals, Structural Diagram, Behavioral Diagram, Classes, objects, relationships, key abstractions, class diagrams, message, Sequence diagrams, use cases, use case diagrams, activity diagrams, States, Events, Actions, State Chart Diagram.

References:
1. Roger pressman; software engineering - a practitioner’s approach, McGraw hill, New York.
2. Ian sommerville; software engineering, addison-wesley publishing company, England
3. Pankaj Jalote; an integrated approach to software engineering, Narosa publishing House, New Delhi.
**Course Name:** DBMS  
**Course Code:** INFO3104  

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**After successfully completing this course the students will be able to:**

1. **Evaluation:** Justify the need of DBMS over traditional file system and analyze the overall database description, at three levels, namely, internal, conceptual, and external levels.

2. **Evaluation:** Deduce the constraints, i.e., the candidate keys, superkeys, that exists in a given real world problem and design the entity relationship diagram to graphically represent entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems.

3. **Synthesis:** Formulate a mathematical tool using relational algebra that operates on one or more relational tables and outputs a relational table as result, and design a normalized Database based on real-world situations, maintaining all constraints and manipulate database relations using SQL and PL/SQL.

4. **Evaluation:** Prove if a schedule A is conflict serializable with schedule B then it is also view serializable with schedule B but vice versa is not true.

5. **Evaluation:** Compare the number of block access required for searching a particular record in a data file having (primary index, secondary index, multilevel index.).

**Detailed Syllabus:**

**Module 1: Introduction and Conceptual Modeling** [7L]

**Database Model, Schema and architecture:** [2L]
- Concept & Overview of database and DBMS, Advantages of using DBMS approach, Database Users, Database Administrator, Database applications. Data Models and its categories, Schema, Instances, Database Languages, Three Schema architecture of DBMS, Data independence, Centralized and client server architecture for DBMS. Classification of DBMS. Introduction to big data.

**Entity-Relationship Model:** [5L]
- Basic concepts, Design Issues, Cardinality, SuperKeys, Candidate keys, Entity types, Entity sets, attributes and keys. Relationship types, Relationship sets, Attributes of relationship types, Weak Entity Sets, ER diagram design issues, Extended E-R modeling: generalization, specialization, aggregation.

**Module 2: Relational Model: Languages and query processing** [13L]

**Introduction to relational model:** [1L]
- Concepts of domains, attributes, tuples, relations. Transformation of ERD model to relational model.

**Relational Algebra and Calculus:** [5L]
- Operators in relational algebra: select, project, rename, cartesian product, different types of join, Division, Intersect, Union, Minus. Tuple relational calculus, Domain relational calculus.

**Introduction to Database languages** [4L]
- SQL: Concept of DDL, DML, DCL, TCL, DQL. Query structure, concept of subquery, group functions. View. PL/SQL basic structure, Control structure, Cursor, Triggers.
Module 3: Relational Database Design

Database integrity:
Domain constraints, entity integrity, referential integrity constraints. Concept of null and not null constraint.

Functional Dependencies:
Basic concept of functional dependency, Axioms, Closure, Attribute closure, Equivalent set of FD, Cover, Canonical cover.

Normalization:

Module 4: Transaction Processing, Data Storage

Transaction processing concepts
Transaction properties, states, serial vs. concurrent execution, Serializability, Concurrency control techniques, and Recovery Management

File Organization & Index Structures
File & Record Concept. Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

References:
6. Jain: Advanced Database Management System CyberTech
Course Name: Communication Theory
Course Code: INFO3131

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After successfully completing this course the students will be able to:

1. The students will have concepts about communication – wireless and line.
2. Will be able to differentiate between AM, FM.
3. Will form ideas about data rate, bandwidth, and channel.
4. Will practically see and measure the key parameters like deviation, clock rate etc.

Detailed Syllabus:

Module1: [Elements of communication system] [12]
The elements of a communication system, origin of noise and its effect, Importance of SNR in system design. Basic principle of linear (AM) modulation, Generation of AM waves, Demodulation of AM wave. Basic principle of nonlinear (FM, PM) modulation. Generation of FM waves. Demodulation of FM waves. Sampling theorem, sampling rate, impulse sampling, reconstruction from samples, Aliasing. Analog pulse modulation-PAM (natural & flat topped sampling), PWM, PPM. Basic concept of Pulse code modulation, Block diagram of PCM, Multiplexing-TDM, FDM.

Module2: [Digital transmission] [7]
Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer, A-law and μ-law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, Nyquist criterion for distortion-less base band binary transmission, Signal power in binary and digital signal.

Module3: [Digital carrier modulation & demodulation technique] [10]
Bit rate, Baud rate, Information capacity, Shanon’s limit, Introduction to the different digital modulation techniques-ASK, FSK, PSK, BPSK, QPSK. Introduction to QAM, Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.

Module4: [Introduction to coding theory] [6]

References:
1. An Introduction to Analog and Digital communication, Simon Haykin, Wiely India.
2. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
4. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford University press
After successfully completing this course the students will be able to:

1. Describe the theory and practice of compilation, in particular the lexical analysis, syntax, and semantic analysis, code generation and optimization phases of compilation.
2. Create lexical rules and grammars for a programming language.
3. Use Flex or similar tools to create a lexical analyzer and Yacc/Bison tools to create a parser.
4. Design a compiler for a concise programming language.
5. Implement a lexer without using Flex or any other lexer generation tools.
6. Implement a parser such as a bottom-up SLR parser without using Yacc/Bison or any other compiler-generation tools.
7. Implement semantic rules into a parser that performs attribution while parsing.

Detailed Syllabus:

Module I: [9L]
Introduction to Compiling [3L]
Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.
Lexical Analysis [6L]
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, Design of a lexical analyzer generator (Lex).

Module II: [14L]
Syntax Analysis [9L]
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.
Syntax directed translation [5L]
Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Module III: [13L]
Type checking [4L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions
Run time environments [5L]
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.
Intermediate code generation [4L]
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).
Module IV: [9L]

*Code optimization [5L]*
Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

*Code generations [4L]*
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

References:
2. Holub - “Compiler Design in C” - PHI.
Course Name: Discrete Mathematics
Course Code: INFO3133

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**After successfully completing this course the students will be able to:**

This course introduces the applications of discrete mathematics in the field of computer science. It covers sets, logic, proving techniques, combinatorics, functions, relations, graph theory and algebraic structures. These basic concepts of sets, logic functions and graph theory are applied to Boolean Algebra and logic networks, while the advanced concepts of functions and algebraic structures are applied to finite state machines and coding theory.

**Detailed Syllabus:**

**Module I [10L]:**
Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Biconditional statements with truth table, Logical Equivalence, Tautology, Normal forms-CNФ, DNF; Predicates and Logical Quantifications of propositions and related examples.

**Module II [10L]:**

**Module III [10L]:**
Counting Techniques: Permutations, Combinations, Multinomial Theorem, Binomial coefficients, Pigeon-hole Principle, Principles of inclusion and exclusions; Recurrence relations: Formulation/Modelling of different counting problems in terms of recurrence relations. Solution of linear recurrence relations with constant coefficients (upto second order) by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.; Ramsey Problem on Counting techniques.

**Module IV [6L]:**
Dual Graph and its construction, Planar Graph & Testing for Planarity of a Graph, Cut Set & Cut Vertices; Graph Coloring: Chromatic Numbers and its bounds, Independence and Clique numbers, Perfect Graphs-Definition and examples, Chromatic polynomial and its determination, Applications of Graph Coloring Matchings: Definitions and Examples of Perfect Matching, Maximal and Maximum Matching, Hall’s Marriage Theorem (Statement only) and related problems.
References:
4. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI.
5. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
7. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
8. J.K. Sharma, Discrete Mathematics, Macmillan
9. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
14. Douglas B. West, Introduction to graph Theory, PHI.
Course Name: UNIX & Operating Systems Laboratory
Course Code: INFO311

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**After successfully completing this course the students will be able to:**

1. Develop shell scripts to manage the system memory, user, files, and devices.
2. Develop multi-processing and multi-threading environment capable of performing multiple tasks or sub-tasks simultaneously.
3. Apply system calls and signals for user defined purposes
4. Design a synchronized multi-threaded system capable of resource sharing
5. Develop C programs to share information between two process using concepts of IPC.

**Detailed Syllabus:**

1. **Managing Unix/Linux Operating System [8P]:**
   Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the initab file, Run-levels, Run level scripts, Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

2. **Process [4P]:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. **Signal [4P]:** signal handling, sending signals, signal interface, signal sets.

4. **Semaphore [6P]:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. **POSIX Threads [6P]:** programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. **Inter-process communication [6P]:** pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

**References:**

After successfully completing this course the students will be able to:

1. Discuss HDL introduction and explain the working of VHDL Simulator.
2. Demonstration of the following Lab Assignments are undertaken in the lab:
   - Adder (Full & Half), Subtractor (Full & Half), Code Conversion (Binary to Gray & Gray to Binary), Decoder (3:8), Mux (4:1 & 8:1), Flip-flops (T, SR, JK & D), ALU design (8 bit), and Asynchronous Binary Up/Down Counter.
3. Designing Truth table, KMap and Timing Diagram for all lab assignments.

Detailed Syllabus:

Lab 1: Data flow approach:
   - Write vhdl code for and, or, not, nand, xor, xnor, nor gates using data flow approach.

Lab 2: Behavioral flow approach:
   - Write vhdl code for and, or, not, nand, xor, xnor gates using behavioral flow approach.

Lab 3: Adder and subtractor:
   - Write vhdl code for half adder, full adder, half subtractor and full subtractor using data flow approach & behavioral approach.

Lab 4: Structural approach:
   - Write vhdl code for half adder, full adder, half subtractor and full subtractor using structural approach.

Lab 5: Array:
   - Write vhdl code to implement 2’s complement and excess three of a four bit number using array.

Lab 6: Binary-gray converter:
   - Write vhdl code for binary to gray code and vice-versa by data flow approach & behavioral approach.

Lab 7: Decoder and multiplexer:
   - Write vhdl code to implement 3-8 line decoder and 2:1 mux using data flow approach & behavioral approach.

Lab 8: Flipflop:
   - Write vhdl codes for d-flipflop, t-flipflop and sr-flipflop using data flow approach and behavioral approach.

Lab 9: ALU design:
   - Design and implement 4 bit alu and 8 bit alu using behavioral approach.

Lab 10: Counter and seven segment display:
   - Write vhdl code for asynchronous binary up/down counter.
   - Write vhdl code for bcd up/down counter
   - Write vhdl code for seven segment display.
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**After successfully completing this course the students will be able to:**

1. Ability to design the document according to functionality  
2. Ability to learn the object oriented design.  
3. Develop software applications in a development environment that makes use of commonly supported tools.  
4. Develop and apply testing strategies for software applications;  

**Pre-requisite:** For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.  

**Detailed Syllabus:**

1. Preparation of requirement document for proposed project in standard format.  
5. Design Test Script/Test Plan (both Black box and WhiteBox approach) for a small component of the proposed project.  
6. Generate Test Result and perform defect root cause analysis using Pareto or Fishbone diagram.  

Following projects can be used as dummy projects:  
- Library Management System  
- Railway Reservation System  
- Employee Payroll System  
- Online Banking System  
- Online Shopping Cart  
- Online Examination System
After successfully completing this course the students will be able to:

1. Analyze, design and implement business problems as practiced in industry.
2. Familiarize with popular RDBMS software tools like Oracle.
3. Familiarize with administrative and security aspects of database.
4. Implement management principles/practices for handling projects under various business constraints.
5. To apply appropriate methodologies, techniques and software for designing and conducting experiments in order to analyze and interpret data using suitable data mining paradigms

Detailed Syllabus:

Structured Query Language
1. Introduction to server architecture
2. Creating database objects
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Column Aliases
   - DROP, ALTER statements
   - Creating an object structure from another existing structure
3. Table and Record Handling
   - INSERT statement
   - DELETE, UPDATE, TRUNCATE statements
   - Populating data from other tables using insert and select together
4. Retrieving Data from a Database
   The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries
5. Database Management
   Creating Views
   Creating Database Users
   Granting and revoking Privileges (GRANT, REVOKE)
   Granting object privileges

Basics of Programming Language/Structured Query Language (PL/SQL)
- Conditional/Iterative Statements
- Introduction to Functions and Stored procedures
- Exception Handling
- Cursor and its application
- Triggers
3rd Year 2nd Semester:

Course Name: Principles of Management  
Course Code: HMTS3201

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After successfully completing this course the students will be able to:

Detailed Syllabus:

Module I  
Self-Growth
  i) Self Growth- Maslow’s Hierarchy of Needs Theory  
  ii) Anger, Stress & Time Management- Theories and application  
  iii) SWOT Analysis

Module II  
Stepping Up  
  i) Growth & Environment  
  ii) Competitive Spirit  
  iii) Responsibility Factor

Module III  
Professional Communication
  i) Impression Management- theory on social psychology  
  ii) Employability Quotient  
  iii) Cross-cultural communication

Module IV  
Leadership & Team Playing
  i) Leadership & Team Playing: Theories, Styles, Stages  
  ii) Motivation, Negotiation Skills, Conflict Management  
  iii) Planning & Envisioning: Initiative and Innovation in the Work Environment- De Bono’s Six Thinking Hats

Evaluation:
  Max.Marks-100(sessional)  
  25 marks/module

Methodology: Assignment and project

References:
  1. Personality Development and Soft Skills by Barun K. Mitra, Oxford University, 2011  
After successfully completing this course the students will be able to:

1. Discuss the role of data warehousing and enterprise intelligence in industry and government.
2. Summarize the dominant data warehousing architectures and their support for quality attributes.
3. Recognize and describe at least three computational approaches to data clustering, taking cognizance of the contribution of paradigms from the fields of Artificial Intelligence and Machine learning.
4. Compare and contrast the dominant data mining algorithms.
5. Construct a lightweight prototype or simulation that supports the concept of data mining.
6. Analyze the results generated from the constructed artifact to determine if patterns of clusters were detected in the data sets.
7. Demonstrate an appreciation of the importance of paradigms from the fields of Artificial Intelligence and Machine Learning to data mining.

Detailed Syllabus:

Module I [10]
**Introduction:** Data warehousing – definitions and characteristics, Multi-dimensional data model, Warehouse schema.
**Data Marts:** Data marts, types of data marts, loading a data mart, metadata, data model, maintenance, nature of data, software components; external data, reference data, performance issues, monitoring requirements and security in a data mart.
Online Analytical Processing: OLTP and OLAP systems, Data Modeling, LAP tools, State of the market, Arbor Essbase web, Microstrategy DSS web, Brio Technology, star schema for multi dimensional view, snowflake schema; OLAP tools.
**Designing the Data Warehouse:** Star Schemas, Dimensional Modeling, Metadata, Data Warehouse Design Examples.

Module II [8]
**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 industry.
**Association Rules:** A priori algorithm, Partition algorithm, Dynamic inset counting algorithm, FP – tree growth algorithm; Generalized association rule.

Module III [9]
**Classification methods:** Bayesian Classification, Neural Network, CBR, Genetic Algorithms.
**Clustering Techniques:** Clustering paradigm, Partition algorithms, K means, Fuzzy C menas CLARANS; Hierarchical clustering, DBSCAN; Categorical clustering, STIRR, ROCK.
**Decision Trees:** Tree construction principle, Best split, Splitting indices, Splitting criteria, Decision tree construction with presorting.

Module IV [9]
**Web Mining:** Web content Mining, Web structure Mining, Web usage Mining, Link Analysis Text Mining.
**Big Data Handling:** Introduction, Challenges, data storage (Hadoop), retrieval (Script languages) and computing for Big Data (Map reduces)
**Dimensionality Reduction:** PCA, Supervised Dimension Reduction.
References:

1. Prabhu: Data Warehousing –Concepts, Techniques, products, application; PHI.
2. K. Pujari: Data Mining Techniques, Universities Press.
3. Alex Berson and Stephen J Smith: Data Warehousing, Data Mining and OLAP, TMH.
4. Anahory: Data Warehousing in the real world, Pearson Education.
5. Dunham: Data Mining Introductory & Advanced Topic, Pearson Education.
6. Foster Provost & Tom Fawcett: Data Science for Business: What you need to know about data mining and data-analytic thinking, O'Reilley.
7. Russell Jurney: Agile Data Science: Building Data Analytics Applications with Hadoop, O'Reilley.
Course Name: Computer Network
Course Code: INFO3202

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After successfully completing this course the students will be able to:

1. Analyze the pieces of hardware (hub, bridge, switch, router) to make networks more efficient, faster, more secure, easier to use, able to transmit several simultaneous messages, and able to interconnect with other networks.
2. Specify and identify importance of existing protocols (DNS, DHCP, FTP, WWW, HTTP) are running in application layer.
3. Compare the various techniques (open loop and close loop) are used for congestion control and quality of service (traffic scheduling and shaping).
4. Analyzing why network needs flow control and error control and how subnetting is used to divide the large network.
5. Evaluate the performance of the different routing protocol (RIP, OSPF) based on routing cost, convergence rate and complexity to find the shortest path.

Detailed Syllabus:

Module – I [10L]


Data link Layer: Types of Errors, Error Detection – Parity, CRC & Checksum, Error Correction – Hamming Code,

Module – II [10L]
Data link Layer: Flow Control – Stop-n-Wait & Sliding Window Protocol, ARQ Techniques – Stop-n-Wait, Go-Back- N & Selective Repeat, Framing, Bit & Byte Oriented Protocol, HDLC, Point to Point Protocol (PPP), Token Ring, FDDI and Ethernet Protocols, Reservation, Polling, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA

Module – III [10L]

Module – IV [10L]
Transport Layer: Process to Process delivery; UDP, TCP; Congestion Control - Open Loop, Closed Loop, Quality of service, Techniques to improve QoS - Leaky bucket & Token bucket algorithm.

Application Layer Protocols: DNS, SMTP, FTP & DHCP.

References:
Course Name: Advanced Java & Web Technology
Course Code: INFO3203

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After successfully completing this course the students will be able to:
1) Analyze and apply several kind of client side scripting (e.g : HTML, CSS and JavaScript).
2) Analyze and apply server side scripting using JSP.
3) Practice EJB, RMI and XML to implement J2EE at application level.

Detailed Syllabus:

Module-I: [8L]
Static Web Pages: Web Pages - types and issues, tiers; comparisons of Microsoft and java technologies, WWWBasic concepts, web client and web server, http protocol (frame format), universal resource locator (URL), HTML different tags, sections, image & pictures, listings, tables, frame, frameset, form.
Dynamic Web Pages: The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation.
Active Web Pages: Need of active web pages; java applet life cycle, Java Swing.

Module-II: [7L]
JavaScript: Data types, variables, operators, conditional statements, array object, date object, string object.
Java Servlet: Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

Module-III: [12L]
JSP: JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

Module-IV: [13L]
J2EE: An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs. Java Beans, basics of RMI, JNI.
XML: Extensible Markup Language (XML), basics of XML, elements and attributes, document type definition, XML parsers, sequential and tree approach.

References:
1. Web Technologies - Godbole A. S. & Kahate A., TMH.
3. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers
Course Name : E-Commerce & ERP  
Course Code: INFO3231

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After successfully completing this course the students will be able to:

1. Convert an e-commerce based business model into a live e-commerce system.
2. Choose right kind of hardware and software platforms for the e-commerce system they are building.
3. Evaluate and justify the system by testing it from different aspects.
4. Understand the importance of ‘integration’ of different systems within an organization.
5. Understand the basic concepts of ERP systems for manufacturing or service companies, and the differences among MRP, MRP II, and ERP systems.
6. Employ the thinking in ERP systems: the principles of ERP systems, their major components, and the relationships among these components.
7. Define the major ERP components, including material requirements planning, master production scheduling, and capacity requirements planning.
8. Realize the importance of project management in an ERP implementation project.
9. Understand what to expect, and not to expect, from a consultant implementing an ERP system.

Detailed Syllabus:

Module 1:  

**Electronic Data Interchange (EDI)**: Meaning, Benefits, Concepts, Application, EDI Model, EDIFACT standard, Internet EDI.

Module 2:  

**E – strategy**: Overview, Strategic Methods for developing E – commerce.

**B2B E-commerce**: Collaborative Commerce

**Supply Chain Management**: E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, effect of different technologies on Supply Chain Management.

Module 3:  
**E – Payment Mechanism**: Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections.

**E – Marketing**: Home -shopping, E-Marketing, Tele-marketing


Module 4:  
**Enterprise Resource Planning (ERP)**: Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Modules: Finance, Manufacturing (Production), Human Resources, Materials Management, Quality Management, Sales & Distribution ERP Package,

**ERP Market**: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation.
ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP

References:
1. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
2. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH
3. E-Commerce through ASP by W Clarke- BPB
Course Name: Computer Graphics & Multimedia
Course Code: INFO3232

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After successfully completing this course the students will be able to:
(1) Demonstrate activities and applications of device dependant and independent color models, image representation techniques (raster and random graphics), activities of active and passive graphics devices and computer graphics software.
(2) Compare effectiveness of DDA algorithm, Bresenham’s line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm, Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method.
(3) Implement 2D and 3D transformation techniques (translation, rotation, scaling, shearing, reflection)
(4) Analyze and implement curve and surface representation techniques using Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves algorithms
(5) Describe hidden surface representation using Z-buffer algorithm, Back face detection, BSP tree method, the Painter’s algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal – geometry
(6) Demonstrate activities and applications of device dependant and independent color models, image representation techniques (raster and random graphics), activities of active and passive graphics devices and computer graphics software.
(7) Compare between image (.bmp, .jpg, .gif, .tiff), audio (.wav, .midi, .mp3), text (.txt, .doc, .pdf) and video (.mpeg, .wmv, .swf) formats according to their way of representing data, merits and demerits.
(8) Demonstrate image, video, text analysis tools and techniques.

Detailed Syllabus:

Module I (8 Lectures)
Introduction to computer graphics & graphics systems, Overview & use of computer graphics & Multimedia, Image, Image Processing, representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing; Color Models, lookup table, Histogram; Image representing hardwares: Cathod Ray Tube, LCD & LED Display devices, Scanner, Digital Camera. Gamma, Interlacing, properties of display devices, different image formats.
Scan Conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham’s line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II (10 Lectures)
2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.
Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method
Overview of 3D Transformation and Viewing

Module III (8 Lectures)
Curves [3L]: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.
Hidden surfaces [3L]: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter’s algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal -
geometry.
Color & shading models [2L]: Light & color model; interpolative shading model; Texture.

Module IV (10 Lectures)
Text: Different types of text representation, Hypertext, text representation formats.
Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI
Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture
Animation: Techniques of 2D & 3D animation, formats of Animation
Image and Video Database:Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing.

References:
5) Fred Halsall , Multimedia Communications , Pearson Ed.
6) Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
7) Ranjan Parekh, “Principles of Multimedia”, TMH
Course Name: System Software and Administration
Course Code: INFO3233

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**After successfully completing this course the students will be able to:**

1. To understand the basics of system programs like editors, compiler, assembler, linker, loader, interpreter, debugger how linker and loader create an executable program from an object module created by assembler and compiler.
2. To understand the various phases of compiler and compare its working with assembler.
3. Use multiple computer system platforms, and understand the advantages of each.
4. Protect and secure users' information on computer systems.
5. Install and manage disks and file systems.

**Detailed Syllabus:**

**Module – I [10L]**

**System Software:**

- Assemblers - General design procedures, Design of two pass assemblers, Cross Assemblers, Macro Processors – Features of a macro facility, (macro instruction arguments, conditional macro expansion, macro calls within macros), Implementation of a restricted facility - A two pass algorithm; Macro Assemblers.
- Loader schemes - Compile and go loaders, absolute loaders, relocating loader, Linking, Reallocation – static & dynamic linking, Direct linking loaders, Binders, Overlays, dynamic binders; Working principle of Editors, Debuggers.

**Module - II [10]**

**System Administration** - Duties of the Administrator, Administration tools, Overview of permissions.

**Processes** - Process status, Killing processes, process priority.

**Starting up and Shut down** - Peripherals, Kernel loading, Console, The scheduler, init and inittab file, Run-levels, Run level scripts.

**Managing User Accounts** - Principles, password file, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users.

**Managing Unix File Systems** - Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making filesystems, Superblock, I-nodes, Filesystem checker, Mounting filesystems, Logical Volumes, Network Filesystems, Boot disks

**Module – III [10]**

**Configuring the TCP/IP Networking** - Kernel Configuration; Mounting the /proc Filesystem, Installing the Binaries, Setting the Hostname, Assigning IP Addresses, Creating Subnets, Writing hosts and networks Files, Interface Configuration for IP, ifconfig, netstat command, Checking the ARP Tables; Name service and resolver configuration.

**TCP/IP Firewall** - Methods of Attack, Firewall, IP Filtering, A Sample Firewall Configuration using iptables.

**Module IV [10]**

**IP Accounting** - Configuring the Kernel for IP Accounting, Configuring IP Accounting, Using IP Accounting Results IP Masquerade and Network Address Translation, Configuring the Kernel for IP Masquerade, Configuring IP Masquerade.


**Network file system** - Preparing NFS, Mounting an NFS Volume, The NFS Daemons, The exports File.

**System Backup & Recovery** - Log files for system and applications; Backup schedules and methods (manual and automated).
References:
4. Maxwell – “Unix system administration” – TMH
5. Limoncelli –“The Practice of System & Network Administration”-Pearson
After successfully completing this course the students will be able to:

1. Define the different problems of AI, different search techniques, Heuristic search strategies, Adversarial search technique etc.
2. Analyze the behavior of intelligent agents, the nature of environment, and the structure of agents and then differentiate among different intelligent agents: goal based agents, utility based agents, learning agents.
3. Solving problems by Searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search etc.
5. Differentiate between Heuristic search strategies and Adversarial Search strategies.
6. Construct different planning technique: Goal stack planning, Hierarchical planning, other planning technique.
7. Discuss different Forms of learning: inductive learning, Learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Detailed Syllabus:

Module-I: [10L]
Introduction:

Module-II: [10L]

Module-III: [10L]
Module-IV: [10L]
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. Basic knowledge of programming language like Prolog & Lisp.

References:
1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
Course Name: Wireless & Mobile Computing
Course Code: INFO3242

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**After successfully completing this course the students will be able to:**
1. Identify the basic concept of wireless networks;
2. Analyse traffic theories, mobile radio propagation, channel coding, and cellular concepts;
3. Compare and contrast multiple division techniques, mobile communication systems, and existing wireless networks;
4. Classify network protocols, ad hoc and sensor networks, wireless MANs, LANs and PANs.

**Detailed Syllabus:**

**Module-I: [8L]**

**Fundamentals of wireless communication and computer networking:** Electromagnetic spectrum; Characteristics of wireless channel; Modulation techniques; Multiple access techniques; Voice coding; Computer network architectures (reference models)

**Module-II: [14L]**

Fundamentals of wireless LANs, PANs, WANs, MANs and Wireless Internet: IEEE 802.11, HIPERLAN standards; Bluetooth; HomeRF; Cellular concept and architecture; First, second, and third generation cellular networks; Wireless in local loop systems, standards, and future trends; Mobile IP; TCP over wireless; Wireless application protocol; Optimizing Web over wireless.

**Module-III: [8L]**

**Ad hoc wireless networks:** Issues and challenges in infrastructure-less networks; MAC protocols; Routing protocols; Multicast routing protocols; Transport and security protocols; Quality of service provisioning; Energy management.

**Module-IV: [10L]**

**Hybrid wireless networks and wireless sensor networks:** Architectures and routing protocols for hybrid wireless networks; Load balancing schemes; Pricing schemes for multi-hop wireless networks; Issues and challenges in wireless sensor networks: Architectures and routing protocols; MAC protocols; Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

**Recent advances in wireless networks:** Wide Band (UWB) communication; Issues and challenges in UWB communication; Applications of UWB communication; Wireless Fidelity (Wi-Fi) systems; Issues in Wi-Fi Systems.

**References:**

2. Jochen Schiller, Mobile Communications, Person Education.
Course Name : Pattern Recognition
Course Code: INFO3243

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After successfully completing this course the students will be able to:

2. Design and compare the machine learning models (nearest-neighbor rule, linear discriminant functions, NN and SVM) and which model is appropriate for a problem or why it is not appropriate.
3. Analyze the performance of different clustering algorithm (k-means, Fuzzy C means and EM) on big data set based on classification rate.

Detailed Syllabus:

Module – I [10L]
Introduction: Basics of pattern recognition, Design principles of pattern recognition system, Metric and Non-Metric Proximity Measures: Distance between Pattern Collections.
Bayes Decision Theorem: Bayes Classifier, Linear and non-linear Discrimination functions, Minimum error rate classification, Error probability.

Module – II [10L]
Parameter Estimation: Maximum-Likelihood estimation, Gaussian mixture models, Expectation-maximization method, Bayesian estimation, Hidden Markov model
Nonparametric Techniques: Parzen-window method, Nearest Neighbor method

Module – III [10L]
Nonlinear Classifier: Learning - Supervised and Unsupervised, Perceptron, Decision Tree.
Clustering: Process, Algorithms (basic hierarchical, Agglomerative, Partitional, K-means and Fuzzy C-means)

Module – IV [10L]
Feature selection: class Separability Measures – Divergence, Chernoff Bound & Bhattacharyya Distance, Scatter Matrices, Dimensionality reduction, similarity measures, feature selection criteria and algorithms, principal component analysis.

References:
3. Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press.
**Course Name:** Data Analysis Laboratory  
**Course Code:** INFO3211  

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After successfully completing this course the students will be able to:

1. Demonstrate the importance of preprocessing the given datasets.
2. Design and implement classification algorithm to classify given problems using modern tools.
3. Design and implement clustering algorithm to group the given attributes in a dataset using modern tools.
4. Demonstrate to find association rules for the given datasets using modern tools.
5. Develop skills to design data warehouse for an enterprise.

**Detailed Syllabus:**

**Introduction:**
Setting up R and/or python with NumPy, mlpy/mdp.

**Assignment 1:**
Based on Data Acquisition, Cleaning and feature extraction. Obtain a dataset which has features in text instead of numbers. Generate a csv from it which contains only numeric fields.

**Assignment 2:**
K-Means on a dataset: Observe the effects on variation of the number of centroids and different centroid selection algorithms.

**Assignment 3:**
Creating a perceptron and learning until stability; learn different other models of ANN

**Assignment 4+5:**
Using libSVM dataset: Compare libsvm values (obtained using libsvm’s exe distributed free on the site) against your own SVM. (In the industry, DA is used mainly to generate reports. Hence it is very essential to understand how comparative charts are created and read)

**Assignment 6:**
Hadoop Set-up for big data.
**Course Name:** Computer Network Laboratory  
**Course Code:** INFO3212  

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**After successfully completing this course the students will be able to:**

1. Develop the C programs to send the message among the computers using datagram and internet socket.
2. Compare the time complexity of the stop-n-wait, go-back-N and selective repeat ARQ.

**Detailed Syllabus:**

1. NIC Installation & Configuration  
2. TCP/UDP Socket Programming – Introduction  
3. Sockets – Operation, Socket types, Domains, Closing Sockets  
4. Client/Server Models - Usage  
5. Connection Based Services - Client and Server actions  
6. Connectionless Services - Client and Server actions  
7. Access Network Database - Host Information, Network Information, Protocol Information
After successfully completing this course the students will be able to:
1) Experiment and analyze several kind of client side scripting (e.g.: HTML, XML, and JavaScript) and server side scripting (e.g.: Servlet and JSP) languages.
2) Practice and apply EJB, RMI and XML to implement J2EE application.

Detailed Syllabus:

1. HTML
2. CSS [Inline, External]
3. JavaScript Control Structure JavaScript Events and Functions
4. JavaScript Validation and implementation in HTML Form
5. Servlet
6. JSP
7. JDBC for Database Connectivity using JSP
8. Java Applet and its implementation through JSP
9. Java Bean Creation
10. Basic Concepts of EJB and RMI and its implementation by creating Bean
11. XML Document Creation, DTD, Schema
Course Name: E-Commerce & ERP Laboratory
Course Code: INFO3236

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After successfully completing this course the students will be able to:
(1) Create web pages using HTML, DHTML and Cascading Styles sheets.
(2) Create dynamic web pages using JavaScript and VBScript.
(3) Create interactive web applications using ASP.NET.
(4) Build web applications using PHP.
(5) Integrate standard database applications like Oracle, SQL Server to a web site.
(6) Convert an e-commerce based business model into a live e-commerce system.
(7) Choose right kind of hardware and software platforms for the e-commerce system they are building.
(8) Evaluate and justify the system by testing it from different aspects.

Detailed Syllabus:

1. Following E-Commerce experiments are to be implemented using either VB, ASP, SQL or JAVA, JSP, SQL.


4. E-Commerce Applications : Online Store, Online Banking, Credit Card Transaction Processing
After successfully completing this course the students will be able to:

(1) Apply the concept of Scan conversion algorithms to draw geometrical without help of graphics.h
(2) Compare efficiency of different computer graphics algorithms.
(3) Apply and Combine different Adobe Photoshop tools to edit images.
(4) Design Animation videos using Adobe Flash software.
(5) Develop web pages using HTML, DHTML and Java Script

Detailed Syllabus:

1) Implementation of line drawing algorithms
2) Implementation of circle & ellipse drawing algorithms
3) Implementation of area filling algorithms
4) Implementation of 2D transformation algorithms
5) Implementation of line clipping algorithms
6) Familiarization of image editing softwares and performing image editing using them
7) Familiarization of animation softwares and creating 2D animations using them
8) Web page design using HTML
9) Use of CSS and Java Script in Web designing
Course Name : System Software and Administration Laboratory
Course Code: INFO3238

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After successfully completing this course the students will be able to:
(1) To understand and configure different servers in linux system.
(2) Use multiple computer system platforms, and understand the advantages of each.
(3) configure firewall to Protect and secure users' information on computer systems.
(4) Install and manage disks and file systems.

Detailed Syllabus:

1. Packet Monitoring software - tcpdump, snort, ethereal, Trace route, Ping, Finger, Nmap
2. Server configuration - FTP, DHCP, NFS, NIS, SMTP, DNS, SAMBA
3. IP Accounting
4. Firewalls, Security and Privacy - iptables
5. System Startup and Operation
6. Disk Partitioning and Filesystem Installation
7. Filesystem and Device Manipulation
8. Process and Log Analysis
9. Startup Scripts and Configuration Files
10. User/Group Security and Permissions
11. Backup
12. Scheduling Maintenance Functions
13. Implement assembly language instructions using C.
Course Name: Personality Development  
Course Code: HMTS3221

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Detailed Syllabus:

Module 1
Self-Growth:
   i) Self Growth- Maslow’s Hierarchy of Needs Theory
   ii) Anger, Stress & Time Management - Theories and application
   iii) SWOT Analysis

Module II
Stepping Up:
   i) Growth & Environment
   ii) Competitive Spirit
   iii) Responsibility Factor

Module III
Professional Communication:
   i) Impression Management - theory on social psychology
   ii) Employability Quotient
   iii) Cross-cultural communication

Module IV
Leadership & Team Playing:
   i) Leadership & Team Playing: Theories, Styles, Stages
   ii) Motivation, Negotiation Skills, Conflict Management
   iii) Planning & Envisioning: Initiative and Innovation in the Work Environment - De Bono’s Six Thinking Hats

Evaluation:
   Max. Marks 100 (sessional)
   25 marks/ module

Methodology: Assignment and project

Suggested Reading
1. Personality Development and Soft Skills by Barun K. Mitra, Oxford University, 2011
Heritage Institute of Technology
Anandapur, Kolkata - 700107

Structures of Syllabus

Department Name: Information Technology

Programme Name: B. Tech.

Year: 4th Year

Document Release Month & Year: June 2017
4th Year 1st Semester:

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After successfully completing this course the students will be able to:

**Detailed Syllabus:**

Module I-[10L]

**Overview of JavaScript:**

Module II-[10L]

**jQuery:**

**Javascript Context, Closures & Higher-order Functions:**

Module III-[10L]

** TypeScript :** Introduction to TypeScript, From TS to JS, Types and Type Inference, Classes, Interfaces, Modules, Internal Modules, External Modules, TypeScript Definition files (TSD)

**Node.js & Backbone.js:** Server-side scripting. Threaded vs event-based server models. Working with callbacks. The Express web framework, Backbone.js

**TBD & HTML 5 APIs:** Anatomy of a javascript module, design, layout and components of a typical javascript library, HTML 5 APIs

**d3.js :** Data visualization. Drawing graphics using SVG. Selections with select and selectAll. Adding and deleting elements with enter and exit, Binding data with data, Animation with transition.

Module IV-[10L]

**MVC and Angular in HTML:** Angular, MVC, MVW, Survey

**Angular Form:** Controllers, ng-model, Survey, Testing Controllers

**Angular Services:** Services, Survey, Testing Services

**Angular Directives:** Directives, Survey

**Angular Routes:** $http, Routes
References:
1. JavaScript: The Good Parts by Douglas Crockford, O'Reilly Media
2. JavaScript: The Definitive Guide by David Flanagan, O'Reilly Media
3. Dive Into HTML5 by Mark Pilgrim
4. Learning Advanced Javascript by John Resig by Apress
5. Angular JS by Green and Brad, O'Reilly
6. Professional AngularJS by Valeri Karpov, Diego Netto (WROX)
After successfully completing this course the students will be able to:
1) Compare the performance of the Roberts, Sobel and Prewitt edge detection operators.
2) Design the different spatial domain filters such as max, min, median and box filter.
3) Evaluate the performance of different transforms like DFT, DCT and DWT.
4) Describe the image formation model in digital computer.
5) Find the distance between two pixels using Euclidean Distance, City-block distance and Chessboard distance.

Detailed Syllabus:

Module-I: [9L]
Introduction: Overview of Image Processing, Application area of image processing, Digital Image Representation, Sampling & quantization. Spatial and Intensity resolution, interpolation, Relationship between pixels – Neighbors, Adjacency, connectivity, Regions, Boundaries and Distance,

Image Enhancement in Spatial Domain: Image Quality and Need for image enhancement, Intensity transformation – negative, log, power-law and contrast stretching (linear and non-linear) Histogram based techniques, Spatial Filtering concepts, Spatial Convolution and Correlation, Image smoothing and Sharpening spatial filters,

Module – II: [9L]
Image Enhancement in Frequency Domain: Properties of 1-D and 2-D Discrete Fourier Transform (DFT), Basic of filtering in the frequency domain. Image smoothing and sharpening in frequency domain.

Image Restoration: Introduction to degradation, Types of Image degradations, image degradation models, noise modeling, Estimation of degradation functions, Image restoration in presence of noise only – spatial filtering, Periodic noise and band – pass and band reject filtering.

Module – III: [10L]
Image Compression: coding redundancy, Image compression model, Compression Methods – Huffman coding, Arithmetic coding, LZW coding, Run-length coding, Predicative coding and Vector quantization

Module – IV: [10L]

References:
5. Bhabatosh Chanda, Dwijesh Dutta Majumder, Digital Image Processing and Analysis, Prentice Hall of India
Course Name : DISTRIBUTED OPERATING SYSTEM

Course Code: INFO4141

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After successfully completing this course the students will be able to:

1) Find out the way in which several machines orchestrate to correctly solve problems in an efficient, reliable and scalable way.
2) Understand key mechanisms and models for distributed systems including logical clocks, causality, vector timestamps, distributed hash tables, consistent global states, election algorithms, distributed mutual exclusion, consistency, replication, fault tolerance, distributed deadlocks, recovery, agreement protocols.
3) Learn how to design and implement distributed algorithms.
4) Practice with mechanisms such as client/server and P2P algorithms, remote procedure call (RPC/RMI), multicasting.
5) Exposed to various areas of research in distributed systems.
6) Learn to design the fault tolerant distributed systems.

Detailed Syllabus:

Module-I: [9L]

Introduction to Distributed System: Introduction, Examples of distributed system, Resource sharing, Challenges.
Communication: Inter-process communication, Remote Procedure Call, Remote Object Invocation, Tasks and Threads. Examples from LINUX, Solaris 2 and Windows NT.

Module-II: [10L]

Distributed Deadlock Detection: Deadlock handling strategies in distributed systems. Control organizations for distributed deadlock detection. Centralized and Distributed deadlock detection algorithms: Completely Centralized algorithms, path pushing, edge chasing, global state detection algorithm.

Module-III: [10L]

Protection and Security: Requirements for protection and security regimes. The access matrix model of protection. System and user modes, rings of protection, access lists, capabilities. User authentication, passwords and signatures. Use of single key and public key encryption.

Module-IV: [7L]

Distributed Scheduling: Issues in Load Distributing: Load, Classification of Load Distribution, Load Balancing vs Load Sharing, Preemptive vs Nonpreemptive; Components of a load distribution; Stability.
References:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems Principles and Paradigms, PHI
Course Name: CYBER LAW & SECURITY POLICY

Course Code: INFO4142

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After successfully completing this course the students will be able to:

1) Defining the concept of Cybercrime, Forgery, Hacking, Software Piracy and Network Intrusion.
2) Discuss the concept of Cyber Stalking and different methods of Active attack and Passive attack with examples.
3) Analyze the security challenges posted by mobile devices, specify the attacks on mobile/Cell phones and differentiate between different viruses on laptop. Outline the concepts of Trojan Horses, Backdoors; DOS & DDOS attacks; SQL injection and Buffer Overflow.
4) Compare different methods of Phishing, ID Theft and conclude with Legal aspects, Indian laws, IT act and Public key certificate.

Detailed Syllabus:

Module-I: [10L]
Category of Cybercrime: How criminals plan attacks, Passive attack, Active attacks, Cyberstalking.

Module – II: [10L]

Module-III: [10L]
Tools and Methods used in Cyber crime: Proxy servers, password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection, Buffer over flow.

Module-IV: [10L]
Phishing & Identity Theft: Phising methods, ID Theft; Online identity method.

References:
1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
Course Name: FUNDAMENTALS OF CLOUD COMPUTING
Course Code: INFO4143

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After successfully completing this course the students will be able to:
learn cloud computing models, techniques, and architectures. Cloud computing has evolved as a very important computing model, which enables information, software, and other shared resources to be provisioned over the network as services in an on-demand manner. Students will be exposed to the current practices in cloud computing. Topics may include distributed computing models and technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), virtualization, security and privacy issues, performance and systems issues, capacity planning, disaster recovery, challenges in implementing clouds, data centers, cloud hosted applications, and other advanced and research topics in cloud computing.

**Detailed Syllabus:**

**Module-I: [7 L]**


**Introduction to Cloud Computing:** Cloud Computing definition, Deployment Models: private, public, hybrid, community cloud. Service Models: IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds

**Module-II: [13 L]**

**Cloud Virtualization:** Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM). Resource Virtualization: Server, Storage, Network

**Cloud Computing Architecture:** Assumptions, Recommendations and fundamental requirements for cloud application architecture. SOA for cloud applications. Open-Source Eucalyptus Cloud Architecture.

**Module-III: [11 L]**

**Service Management in Cloud Computing:** IT Infrastructure Library based Service Management: Service Strategy, Service Design, Service Transition, Service Operation, Continual Service Improvement Concept of SLA. SLA aspects and requirements

**Cloud Risk and Security:** Type of Risk in cloud, Risk management, cloud security services(Confidentiality, Integrity, Availability), application security in IaaS, PaaS, SaaS environment.

**Module-IV: [11 L]**

**Cloud Cost:** Direct and Indirect Cost, Chargeback Models, Methodology, Tools and Solution

**Cloud Applications:** Microsoft Cloud Services, Google cloud Applications, Amazon Cloud Services, Mobile Cloud

References:

1. *Cloud Computing Black Book*, Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, dreamtech Press
Course Name : VLSI Design Automation
Course Code: ECEN4181

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After successfully completing this course the students will be able to:

**Detailed Syllabus:**

**Module-I: [12L]**

**VLSI Circuits & Physical Layout:**
Unit1: MOS Transistor Characteristics, MOS as Digital Switch, NMOS Logic Family, CMOS Logic Family, CMOS Inverter Characteristics (VTC), Inverter Delay & Noise, NAND and NOR gates, Complex Logic Circuits, Pass Transistor Logic & Transmission Gate, CMOS Sequential Circuits, CMOS D-Latch and D-Flip-Flop

**Module-II: [8L]**

**VLSI Design Methodology:**
Unit1: Moore’s Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI), Technology growth and process Node

**Module-III: [8L]**

**EDA Tools: High level Synthesis and HDL:**
Unit1: High level Synthesis EDA Flow, Control and Data Flow Graph, Scheduling, Allocation, Binding, RTL
Unit2: Why HDL ?, Frontend Design Flow using HDL (Behavioral, RTL and Gate Level), Verilog Modeling: Behavioral, Data-Flow, Structural and Mixed, Test Bench, FSM

**Module-IV: [12L]**

**EDA Tools: Logical Synthesis and Physical Design Automation:**
Unit1: Combinational Logic Optimization: BDD: Binary Decision Diagram, OBDD, ROBDD, Technology Mapping: Pattern DAG, Subject DAG, Sequential Logic Optimization

**References:**
6. VLSI Design and EDA TOOLS, Author: Angsuman Sarkar, Swapnadip De, Chandan Kumar Sarkar, SCITECH PUBLICATIONS (India) Pvt. Ltd., 2011
After successfully completing this course the students will be able to:

**Detailed Syllabus:**

**Module-I: [10L]**

*Linear Programming Problem (LPP)-I*

Formulation of an LPP; Graphical Method of solution of an LPP; Convex Combination and Convex Set; Convex Hull and Convex Polyhedron; Canonical and Standard form of an LPP; Basic Solution of a system of linear equations; Simplex Method; Big-M Method; Concept of Duality; Mathematical formulation of duals; Dual Simplex Method.

**Module-II: [10L]**

*Linear Programming Problem (LPP)-II and Game Theory*

Transportation Problems (TP) ; Representation of Transportation Problems as LPP; Methods of finding initial basic feasible solution of TP: North-West Corner Rule, Matrix Minima Method, Vogel’s Approximation Method; Optimality test of the basic feasible solution; Assignment Problems; Hungarian Method; Travelling Salesman Problem. Strategies; The Minimax and Maximin Criterion; Existence of Saddle Point; Games without a Saddle Point; Mixed Strategies; Symmetric Games; Dominance Principle; Two-Person Zero-Sum Game; Graphical Method of Solution; Algebraic Method of Solution.

**Module-III: [10L]**

*Non-Linear Programming Problem (NLPP)-I*

Single-variable Optimization; Multivariate Optimization with no constraints: Semidefinite Case, Saddle Point; Multivariate Optimization with Equality Constraints: Method of Lagrange Multipliers; Multivariable Optimization with inequality constraints: Kuhn-Tucker Conditions.

**Module-IV: [10L]**

*Non-Linear Programming Problem (NLPP)-II*


**References:**

1. Linear Programming and Game Theory by J. G. Chakraborty and P. R. Ghosh, Moulik Library.
Course Name : INTRODUCTION TO EMBEDDED SYSTEM
Course Code: AEIE4182

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After successfully completing this course the students will be able to:
1. Acquire knowledge in the area of embedded system using AVR microcontroller.
2. Justify the selection criteria of microcontrollers needed to adopt in industrial environment for a particular application.
3. Explain the role of operating system in various embedded systems used in industrial applications.
4. Do interfacing of peripherals with AVR microcontrollers and their programming.

Detailed Syllabus:

Module-I: [10L]
*Introduction to an embedded system*
Different types of microcontrollers: embedded microcontrollers, introduction to AVR, PIC, ARM and Arduino based systems; processor Architectures: Harvard V/S Princeton, CISC Vs RISC; microcontroller memory types; microcontroller features: clocking, input/output pins, interrupts, timers and peripherals.

Module-II: [10L]
*Overview of AVR microcontroller*
Introduction to AVR (ATmega 328p-pu) microcontrollers, architecture and pipelining, program memory considerations, addressing modes, CPU registers, ADC registers, instruction set, simple operations, basics of communication, overview of RS232, I²C Bus, UART, USB, ATmega 328p-pu connections to RS-232, ATmega 328p-pu serial communication programming, ATmega 328p-pu interrupts, programming of timer interrupts, programming of external hardware interrupts, programming of the serial communication interrupts, interrupt priority in the ATmega 328p-pu

Module-III: [8L]
*Embedded operating systems*
Operating system basics, types of operating systems, tasks, process and threads, Multiprocessing and multitasking, task scheduling, task communication: shared memory, message passing, remote procedure call and sockets, task synchronization: task communication/synchronization issues, task synchronization techniques, device drivers, how to choose an RTOS.

Module-IV: [8L]
*Hardware Interfacing and Programming with ATmega 328p*
Interfacing of LCD, interfacing with analog sensors (i.e LM35, ADXL 335 accelerometer), interfacing of stepper motor, interfacing with a keyboard and MPU6050 (MEMS Accelerometer and Gyroscope) using I²C bus.

References:
Course Name: INTERNET TECHNOLOGY LABORATORY
Course Code: INFO4111

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After successfully completing this course the students will be able to:

**Detailed Syllabus:**

- JavaScript
- jQuery
- Javascript Context, Closures & Higher-order Functions
- TypeScript
- Node.js & Backbone.js
- TBD & HTML 5 APIs
- d3.js
- Modularization (RequireJS)
- Testing and TDD/BDD (Jasmine)
- Test Running (Karma)
- NPM and Task Running (Gulp)
- Dependency Management (Bower)
- MVC and Angular in HTML
- Angular Forms
- Angular Services
- Angular Directives
- Angular Routes
- Node and APIs
- Node Express

**References:**

1. Angular JS by Green and Brad, O'Reilly
2. Professional AngularJS by Valeri Karpov, Diego Netto (WROX)
3. JavaScript: The Good Parts by Douglas Crockford, O'Reilly Media
4. JavaScript: The Definitive Guide by David Flanagan, O'Reilly Media
Course Name: IMAGE PROCESSING LABORATORY
Course Code: INFO4112

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After successfully completing this course the students will be able to:

1) Apply different MATLAB library functions such as imread, imresize, size, imshow, fft and imhist to process an image.
2) Develop different image processing algorithms like filtering, noise removal and segmentation in MATLAB language.
3) Evaluate the performance of the spatial mask based on their size (3x3, 5x5, 7x7)

**Detailed Syllabus:**

1. Introduction – MATLAB image processing toolbox
2. Transformation – negative, log, power-law
3. contrast stretching - linear and non-linear
4. Histogram of an image and Histogram Equalization
5. Spatial Filters – Box, mean, max and median etc.
6. Fourier Transformation of an image
7. Implement high-pass, low-pass and band-pass filters
8. Remove the noise from the input images
9. Point Detection, Line Detection and Edge Detection
10. Thresholding – Local, Global, Optimum, Multiple and Variable,
11. Implement region growing, splitting and merging algorithms.
12. Project on image processing
4th Year 2nd Semester:

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<th>Course Name: ORGANIZATIONAL BEHAVIOR</th>
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After successfully completing this course the students will be able to:

**Detailed Syllabus:**

**Module-I: [5L]**
Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities (1L)
Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris
Immaturity to Maturity Continuum Impact on organization. (2L)
Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys. (2L)

**Module-II: [6L]**
Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception,
Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast
Effects, Impact on Organization. (2 L)
Motivation-Definition, Theories of Motivation-Maslow’s Hierarchy of Needs Theory, McGregor’s
Theory X&Y, Herzberg’s Motivation-Hygiene Theory, Alderfer’s ERG Theory, McClelland’s Theory of
Needs, Vroom’s Expectancy Theory. (4L)

**Module-III: [8L]**
Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies,
Blake & Mouton Managerial Grid; Contingency Theory: Fielder Theory. (4L)
Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal & Informal; Stages of
Group Development, Group Decision making, Group Decision MakingVs Individual Decision Making. (4L)

**Module-IV: [5L]**
Organizational Design-Variouss organizational structures and their pros and cons.
Concepts of organizational climate and culture, Organizational Politics-Concept, Factors influencing
degree of Politics (2L)
Conflict management- Concept, Sources of conflict, Stages of conflictprocess, Conflict resolution
techniques, Tools-Johari Window to analyse and reduce interpersonal conflict, Impact on organization. (3L)

**Evaluation:**
Max. Marks-100
Internal Test-30
Semester End Test-70

**Suggested Readings:**

1. Organization Behaviour by Stephen Robbins
2. Organization Behaviour by Luthans
3. Organization Behaviour by L.M. Prasad
4. Organization Behaviour: Text, Cases & Games by AswathappaK.
After successfully completing this course the students will be able to:

**Detailed Syllabus:**

**Module-I: [8L]**

*Foundations Of Parallel Programming:* Introduction.-Parallel Processing Environment- Pipelining and Data Parallelism, Scalability, Flynn’s Taxonomy


**Module-II: [8L]**

*Analytical modeling of program performance:* speedup, efficiency, scalability, cost optimality

*Linear system of equations:* Gaussian Elimination, Gauss-Seidel algorithm, Jacobi algorithm

*Sorting:* Enumeration sort, Odd-even transposition sort, Bitonic merge, Ellis’s Algorithm

**Module-III: [9L]**

*Message Passing Paradigm:* Basic MPI programming – MPI_Init and MPI_Finalize - message passing – MPI_Send and MPI_Recv - message matching - remote memory access – dynamic process management – MPI for grids – performance evaluation of MPI programs

*Shared Memory Paradigm: OPENMP*


**Module-IV: [9L]**

*Shared Memory Paradigm: PTHREADS*


*Graphical Processing Paradigms: OPENCL*

Introduction to OpenCL – OpenCL programming examples – Programs and Kernels – Buffers and Images – Event model – OpenCL case study

**References:**

2. Design and Analysis of Parallel Algorithms- S.G. Akl (PH)
Course Name: NATURAL LANGUAGE PROCESSING
Course Code: INFO4242

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After successfully completing this course the students will be able to:
1. Learn the techniques in natural language processing.
2. Be familiar with the natural language generation.
3. Be exposed to machine translation.
4. Understand the information retrieval techniques.

### Detailed Syllabus:

#### Module-I: [13L]

*Overview and language modeling* [6L]

**Overview:** Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval.

*Word level and syntactic analysis* [7L]


**Syntactic Analysis:** Context-free Grammar- Constituency-Parsing-Probabilistic Parsing.

#### Module-II: [11L]

*Semantic analysis and discourse processing*

**Semantic Analysis:** Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation.

**Discourse Processing:** cohesion-Reference Resolution- Discourse Coherence and Structure.

#### Module-III: [12L]

*Natural language generation and machine translation*

**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations-Application of NLG.

**Machine Translation:** Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

#### Module-IV: [12L]

*Information retrieval and lexical resources*

**Information Retrieval:** Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – evaluation

**Lexical Resources:** World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

### References:

Course Name: CRYPTOGRAPHY & NETWORK SECURITY
Course Code: INFO4243

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After successfully completing this course the students will be able to:

1) Defining the concepts of Network security and identifying different types of attack on Network security. Recall the principles of security.

2) Classify different kinds of Substitution techniques and Transposition techniques and discuss the concepts of Symmetric key cryptography and Asymmetric key cryptography. Explaining in detail DES, RSA, IDEA and RC5 algorithm.

3) Prepare and practice numerical module based on DES and RSA. Illustrating the concept of SSL, PGP, Authentication token, Digital Signature, Message Digest and Hash function in accordance with the prescribed syllabus.

4) Analyze Biometric Authentication and differentiate between different types of Authentication tokens.

5) Concluding with concepts of Firewall (including types of Firewall), DMZ Network and comparing between different Firewall Configurations.

Detailed Syllabus:

**Module-I: [10L]**

*Network Security and Cryptography- Concepts and Techniques*


**Module-II: [10L]**

*Symmetric Key Algorithms*

Algorithm types & Modes, Overview of Symmetric Key Cryptography, Diffie-Hellman key exchange algorithm, Digital Envelope, DES(Data Encryption Standard) algorithm & its variant, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

**Module-III: [10L]**

*Asymmetric Key Algorithms, Digital Signature and User Authentication*

Overview of Asymmetric key Cryptography, RSA algorithm, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required), HMAC algorithm. Authentication Basics, Password, Authentication Token, Certificate based Authentication and Biometric Authentication.

**Module-IV: [10L]**

*Electronic mail security, SSL and Firewall*

Basics of mail security, PEM, PGP, S/MIME, Secure Socket Layer (SSL) protocol. Introduction to Firewall, Types of firewall, Firewall Configurations and DMZ Network.
References:

Course Name: SOFT COMPUTING  
Course Code: INFO4244

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After successfully completing this course the students will be able to:

1) Identify the Intractable problems like NP – complete, NP- hard problems and reproduce the optimal solution instead Optimum.
2) Determine the complexity of computation and reduce the complexity to interpret the real problems.
3) Assemble different techniques to sketch a hybrid system for better result.
4) Able to interpret the problem in terms time and space.
5) Justify the optimal solution and able to predict the running time of the program.

Detailed Syllabus:

Module-I: [9L]  
Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.  
Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm

Module-II: [8L]  
Fuzzy sets and Fuzzy logic systems:  
Classical Sets and Fuzzy Sets and Fuzzy relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.  
Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods.  
Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods.  
Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication  
Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules  
Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances

Module-III: [9L]  
Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Hebb’s learning rule/Delta rule, ADALINE, MADALINE  
Introduction of MLP: Different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA, Hopfield/ Recurrent network, configuration, stability constraints

Module-IV: [9L]  
Associative Memory and characteristics, limitations and applications. Hopfield v/s Boltzman machine.  
Adaptive Resonance Theory: Architecture, classifications, Implementation and training.  
Applications of Neural Networks: Pattern Recognition and classification  
Other Soft Computing Approaches: Ant Colony Optimization (ACO) and Particle Swarm Optimization (PSO)  
Hybrid Approaches: Nuro-Fuzzy modeling, ANN-GA Modeling
References:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
Course Name: CONTROL SYSTEMS & APPLICATIONS
Course Code: AEIE 4282

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After successfully completing this course the students will be able to:
1. Develop mathematical model of physical and simulated systems.
2. Investigate the time and frequency response of systems and calculate performance indices.
3. Analyze stability of linear systems using different available methods.
4. Understand the concept and utility of control action and its usage.

Detailed Syllabus:

Module-1: [10L]
Concepts of control systems: open loop and closed loop control systems, effect of feedback in control system; mathematical model of physical system - differential equation representation of physical systems, transfer function models, block diagram models, signal flow graphs, standard test signals, concept of system sensitivity.

Module-II: [6L]
Time response analysis:- transient response of first order and second order with standard test signals, steady state error coefficients, effect of pole –zero addition in system response; time domain performance criteria.

Module- III: [12L]
Introduction to frequency domain analysis: Bode plot - minimum and non minimum phase system, concept of phase margin and gain margin, procedure for drawing bode plots, assessment of relative stability: Gain margin and phase margin.

Module –IV: [10L]
Models of control devices and systems: dc servomotors, ac servomotors, dc motor speed and position control, synchro.
Basic control actions: introduction to conventional controllers (P, PI, PD and PID) and application.

References:

2. Kuo B. C., Automatic Control Systems, 8th Ed., Wiley India
4. Dorf R. C. and Bishop R. H., Modern Control Systems; Pearson Education.
Course Name: COMPUTATIONAL BIOLOGY
Course Code: BIOT4281

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After successfully completing this course the students will be able to:

**Detailed Syllabus:**

**Module-I: [10L]**

*Introduction to Biomolecules*
Introduction to biochemistry and molecular biology; Biomolecules: structure, function and metabolic pathways.

**Module-II: [10L]**

*Scope of Computational Biology*
Definition of computational biology; origin and development of computational biology; Nature and Types of biological data; Data Structures: Sequences (GENbank files), Secondary structures, Super-secondary structures (Motifs), Tertiary structures (Pubchem and PDB structure files); Interaction Networks, Photographic Data: Fingerprints (DNA and MS), Microarray data; Biological databases.

**Module-III: [10L]**

*Preferred Algorithms, Programming languages and Operating systems*
Principles of Pattern recognition: Use of Hidden Markov Model and Artificial Neural Networks in computational biology; Significance of Python and C/C++; Operating system: Bio-Linux (Selected Bioinformatics packages)

**Module-IV: [10L]**

*Applications of Computational biology*
Molecular Modeling and Dynamics: introduction to Open MM library; GROMACS as an example of GUI in the public domain; computer based drug design (public domain and proprietary); Mathematical modeling of cell growth kinetics; Embedded systems for computational biology: High throughput data collection, processing and analysis; LC-MS, DNA microarrays and other applications (e.g. mobile microscopy and high throughput micro-PCR); Systems biology and Metabolic Engineering.

**References:**

Course Name: CELLULAR & SATELLITE COMMUNICATION
Course Code: ECEN4281

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*Detailed Syllabus:*

*Available in B. Tech. in ECE Syllabus*
Detailed Syllabus

of

Free Elective Papers

offered by

the Dept. of IT
4th Year 1st Semester:

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<th>Course Name : CYBER CRIME &amp; CYBER SECURITY</th>
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After successfully completing this course the students will be able to:
1) Defining the concept of Cybercrime, Forgery, Hacking, Software Piracy and Network Intrusion.
2) Discuss the concept of Cyber Stalking and different methods of Active attack and Passive attack with examples.
3) Analyze the security challenges posted by mobile devices, specify the attacks on mobile/Cell phones and differentiate between different viruses on laptop. Outline the concepts of Trojan Horses, Backdoors; DOS & DDOS attacks; SQL injection and Buffer Overflow.
4) Compare different methods of Phishing, ID Theft and conclude with Legal aspects, Indian laws, IT act and Public key certificate.

Detailed Syllabus:

Module - I: [7L]
**Introduction of Cybercrime:** Cybercrime- Definition & Concepts, Cybercriminals, Classification of Cybercrimes.

**Category of Cybercrime:** How criminals plan attacks? Passive attack, Active attacks, Cyberstalking.

Module - II: [8L]
**Cybercrime Mobile & Wireless devices:** Techniques of Credit card Fraud, Security challenges posted by mobile devices, Cryptographic security for mobile devices, Attacks on mobile/cell phones, Keyloggers & Spyswares, Virus & Worms.

Module - III: [10L]
**Tools and Methods used in Cyber crime:** Stages of Network attack, Proxy servers & Anonymizers, Strong, Weak & Random password, Trojan Horse and Backdoors; DOS & DDOS attacks, Blended Threat and PDoS attack.

Module - IV: [10L]
**Phishing & Identity Theft:** Phishing methods, Phishing Techniques, Homograph attack, Spear Phishing & Whaling, Phishing Scams ID Theft: Types & Techniques, Geotagging.

References:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
After successfully completing this course the students will be able to:

learn cloud computing models, techniques, and architectures. Cloud computing has evolved as a very important computing model, which enables information, software, and other shared resources to be provisioned over the network as services in an on-demand manner. Students will be exposed to the current practices in cloud computing. Topics may include distributed computing models and technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), virtualization, security and privacy issues, performance and systems issues, capacity planning, disaster recovery, challenges in implementing clouds, data centers, cloud hosted applications, and other advanced and research topics in cloud computing.

**Detailed Syllabus:**

**Module-I: [7L]**


**Module-II: [11L]**

**Cloud Computing Architecture:** Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services

**Service Models (XaaS):** Infrastructure as a Service (IaaS), Platform as a Service(PaaS), Software as a Service(SaaS)

**Deployment Models:** Public cloud, Private cloud, Hybrid cloud, Community cloud

**Infrastructure as a Service(IaaS):** Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM)

**Resource Virtualization:** Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service), Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers

**Module-III: [11L]**

**Platform as a Service(PaaS):** Introduction to PaaS, What is PaaS, Service Oriented Architecture (SOA)

**Cloud Platform and Management:** Computation, Storage, Examples: Google App Engine, Microsoft Azure

**Software as a Service(SaaS):** Introduction to SaaS, Web services. Web 2.0, Web OS

**Module-IV: [12L]**

**Service Management in Cloud Computing:** Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing

**Cloud Security:** Infrastructure Security, Network level security, Host level security, Application level security: Data security and Storage, Data privacy and security Issues: Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations
References:
4th Year 2nd Semester:

Course Name: FUNDAMENTALS OF CRYPTOGRAPHY
Course Code: INFO4281

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After successfully completing this course the students will be able to:

1) Defining the concepts of Network security and identifying different types of attack on Network security. Recall the principles of security.

2) Classify different kinds of Substitution techniques and Transposition techniques and discuss the concepts of Symmetric key cryptography and Asymmetric key cryptography. Explaining in detail DES, RSA, IDEA and RC5 algorithm.

3) Prepare and practice numerical module based on DES and RSA. Illustrating the concept of SSL, PGP, Authentication token, Digital Signature, Message Digest and Hash function in accordance with the prescribed syllabus.

4) Analyze Biometric Authentication and differentiate between different types of Authentication tokens.

5) Concluding with concepts of Firewall (including types of Firewall), DMZ Network and comparing between different Firewall Configurations.

Detailed Syllabus:

Module-I: [7L]


Module-II: [8L]

Symmetric Key Algorithms: Algorithm types & Modes, Overview of Symmetric Key Cryptography, Diffie-Hellman key exchange algorithm, DES (Data Encryption Standard) algorithm & its variant, IDEA (International Data Encryption Algorithm) algorithm.

Module-III: [10L]

Asymmetric Key Algorithms, Digital Signature and User Authentication: Overview of Asymmetric key Cryptography, RSA algorithm, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required), HMAC algorithm. Authentication Token, Certificate based Authentication and Biometric Authentication.

Module-IV: [8L]

Electronic mail security, SSL and Firewall: PEM, Secure Socket Layer (SSL) protocol. Introduction to Firewall, Types of firewall, Firewall Configurations and DMZ Network.

References:

Course Name: SOFT COMPUTING APPLICATIONS
Course Code: INFO4282

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After successfully completing this course the students will be able to:

1) Identify the Intractable problems like NP – complete, NP-hard problems and reproduce the optimal solution instead Optimum.
2) Determine the complexity of computation and reduce the complexity to interpret the real problems.
3) Assemble different techniques to sketch a hybrid system for better result.
4) Able to interpret the problem in terms time and space.
5) Justify the optimal solution and able to predict the running time of the program.

**Detailed Syllabus:**

**Module-I: [8L]**

*Soft Computing*: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

*Genetic algorithm*: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross-over & mutation operator, Schema Theorem, Multi-objective Genetic Algorithm (MOGA).

*Applications of Genetic Algorithm*: genetic algorithms in search and optimization

**Module-II: [8L]**

*Fuzzy sets and Fuzzy logic systems*: Classical Sets, Fuzzy Sets and Fuzzy relations: Properties and operations on Classical sets, Fuzzy set and fuzzy relations.

*Membership functions*: Features of membership functions, standard forms and boundaries, different fuzzification methods.

*Fuzzy to Crisp conversions*: Lambda Cuts for fuzzy sets, fuzzy Relations, De-fuzzification methods.

**Module-III: [9L]**

*Classical Logic and Fuzzy Logic*: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication

*Applications of Fuzzy Logic*: How Fuzzy Logic is applied in Home Appliances

*Neural Network*: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Hebb’s learning rule/Delta rule, ADALINE, MADALINE

**Module-IV: [9L]**

*Introduction of MLP*: Different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA, Hopfield/ Recurrent network, configuration, stability constraints, XOR network.

*Adaptive Resonance Theory*: Architecture, classifications, Implementation and training.

*Applications of Neural Networks*: Pattern Recognition and classification

**References:**

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.