Syllabus

for

B.TECH. INFORMATION TECHNOLOGY

of

Second Year

(Effective from the Session: 2014-15)
## B.TECH INFORMATION TECHNOLOGY

### STUDY & EVALUATION SCHEME

#### 2nd Year

#### SEMESTER III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Evaluation Scheme</th>
<th>Subject Total</th>
<th>Credit</th>
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### PRACTICAL/DESIGN/DRAWING

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**TOTAL**: 18 | 5 | 10 | 1000 | 25

### Science Based Open Elective:

- **NOE031**: Introduction to Soft Computing (Neural Network, Fuzzy Logic and Genetic Algorithm)
- **NOE032**: Nano Sciences
- **NOE033**: Laser Systems and Applications
- **NOE034**: Space Sciences
- **NOE035**: Polymer Science & Technology
- **NOE036**: Nuclear Science
- **NOE037**: Material Science
- **NOE038**: Discrete Mathematics
- **NOE039**: Applied Linear Algebra

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.*
### B.TECH INFORMATION TECHNOLOGY
#### STUDY & EVALUATION SCHEME

**2nd Year**

<table>
<thead>
<tr>
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**Science Based Open Elective:**
- NOE-041: Introduction to Soft Computing (Neural Network, Fuzzy Logic and Genetic Algorithm)
- NOE-042: Nano Sciences
- NOE-043: Laser Systems and Applications
- NoE-044: Space Sciences
- NOE-045: Polymer Science & Technology
- NOE-046: Nuclear Science
- NOE-047: Material Science
- NOE-048: Discrete Mathematics
- NOE-049: Applied Linear Algebra

*Human values & Professional Ethics / Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.*
NEC-309: DIGITAL LOGIC DESIGN

Unit-I
Digital Design and Binary Numbers:
Binary Arithmetic, Negative Numbers and their Arithmetic, Floating point representation, Binary Codes, Cyclic Codes, Error Detecting and Correcting Codes, Hamming Codes.
Minterm and Maxterm Realization of Boolean Functions, Gate-level minimization: The map method up to four variable, don’t care conditions, SOP and POS simplification, NAND and NOR implementation, Quine Mc-cluskey Method (Tabular method).

Unit-II
Combinational Logic:
Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Code Converters, Parity Generators and Checkers, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Hazards and Threshold Logic

Unit-III
Memory and Programmable Logic Devices:
Semiconductor Memories, RAM, ROM, PLA, PAL, Memory System design.

Unit-IV
Synchronous Sequential Logic:
Sequential Circuits, Storage Elements: Latches, Flip Flops, Analysis of Clocked Sequential circuits, state reduction and assignments, design procedure.
Registers and Counters: Shift Registers, Ripple Counter, Synchronous Counter, Other Counters.

Unit-V
Asynchronous Sequential Logic:
Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race free state assignment, hazards.

References:

NCS-301: DATA STRUCTURES USING – C

Unit - I
Abstract Data Types (ADT)

Unit – II

Unit – III

Unit – IV
Graphs: Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth First Search, Connected Component,
Unit – V
Searching : Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting.
Search Trees: Binary Search Trees(BST), Insertion and Deletion in BST, Complexity of Search Algorithm, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees
Hashing: Hash Function, Collision Resolution Strategies
Storage Management: Garbage Collection and Compaction.

References:

NCS-302: DISCRETE STRUCTURES AND GRAPH THEORY

Unit-I
Set Theory: Introduction, Combination of sets, Multisets, Ordered pairs, Set Identities.
Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.
Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions.
Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases.

Unit-II
Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms, Definition and elementary properties of Rings and Fields, Integers Modulo n.

Unit-III
Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram.
Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete Lattice, Morphisms of lattices.
Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra. Combinational and sequential Circuits

Unit-IV
Propositional Logic: Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference, Natural Deduction.
Predicate Logic: First order predicate, well formed formula of predicate, quantifiers, Inference theory of predicate logic.

Unit-V
Trees: Definition, Binary tree, Binary tree traversal, Binary search tree.
Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring, Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences.
Combinatorics: Introduction, Counting Techniques, Pigeonhole Principle

References:
2. Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Application to
NCS-303: Computer Based Numerical and Statistical Techniques

- **Unit – I**:  
  **Computer Arithmetic and Errors**: Floating Point Arithmetic, Machine epsilon, Round off Error, Chopping Error, Truncation Error, Associative and Distributive Law in Floating Point arithmetic, Inherent Error, Error propagation, Numerical Instability  

- **Unit – II**:  
  **Interpolation**: Algorithms and Error Analysis of Lagrange and Newton divided difference interpolations, Relationship in various difference operators, Piecewise Linear Interpolation, Cubic Spline Interpolation, Natural Spline, Chebyshev Polynomial Approximations, Lanczos Economization of Power Series  
  **Curve fitting**: Linear and Non Linear Least Squares Approximation, ill Conditioning in Least Squares Methods, Gram-Schmidt Process of Orthogonalization. Computer Algorithms of Least Square Curve Fitting

- **Unit – III**:  
  **Differentiation**: Methods based on Interpolation and Finite Differences, Richardson Extrapolation  
  **Integration**: Error Analysis of Trapezoidal and Simpson Methods, Newton Cotes Integration Methods, Guassian Integration Methods: Guass Legendre Method, Lobatto Integration Method and Radau Integration Method, Error Terms in Integration Methods

- **Unit – IV**:  
  **Solution of Simultaneous Linear Algebraic Equations**: Guass Elimination Method, ill Conditioned Systems, Condition Number, Successive Over Relaxation Method, Rate of Convergence  
  **Solution of Ordinary Differential equations**: Single Step Methods-Runge-Kutta Second Order, Third Order and Fourth Order Methods, Multi Step Method-Predictor- Corrector Method  
  **Statistical Techniques**: Statistical Hypotheses, Test of Hypotheses, Type-I and Type-II Errors, Level of Significance, Test involving Normal Distribution

**Recommended Books**:  
- **Applied Numerical Analysis**: Curtis F. Gerald and Patrick O. Wheatley  
- **Schaum’s Outline of Theory and Problems of Statistics**: Murray R. Spiegel

NEC-359: LOGIC DESIGN LAB

Objective: To understand the digital logic and create various systems by using these logics.

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.  
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.  
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.  
4. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
5. Implementation of 4x1 multiplexer using logic gates.
6. Implementation of 4-bit parallel adder using 7483 IC.
7. Design, and verify the 4-bit synchronous counter.
8. Design, and verify the 4-bit asynchronous counter.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**NCS-351: DATA STRUCTURE USING C LAB**

Program in C or C++ for following:
1. To implement addition and multiplication of two 2D arrays.
2. To transpose a 2D array.
3. To implement stack using array.
4. To implement queue using array.
5. To implement circular queue using array.
6. To implement stack using linked list.
7. To implement queue using linked list.
8. To implement circular queue using linked list.
9. To implement binary tree using linked list.
10. To implement binary search tree using linked list.
11. To implement tree traversals using linked list.
12. To implement BFS using linked list.
13. To implement DFS using linked list.
14. To implement Linear Search.
15. To implement Binary Search.
16. To implement Bubble Sorting.
17. To implement Selection Sorting.
18. To implement Insertion Sorting.
19. To implement Merge Sorting.
20. To implement Heap Sorting.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**NCS-353: NUMERICAL TECHNIQUES LAB**

Write Programs in ‘C’ Language:
1. To deduce error involved in polynomial equation.
2. To Find out the root of the Algebraic and Transcendental equations using Bisection, Regula-falsi, Newton Raphson and Iterative Methods. Also give the rate of convergence of roots in tabular form for each of these methods.
3. To implement Newton’s Forward and Backward Interpolation formula.
4. To implement Gauss Forward and Backward, Bessel’s, Sterling’s and Everett’s Interpolation formula.
5. To implement Newton’s Divided Difference and Langranges Interpolation formula.
6. To implement Numerical Differentiations.
7. To implement Numerical Integration using Trapezoidal, Simpson 1/3 and Simpson 3/8 rule.
8. To implement Least Square Method for curve fitting.
9. To draw frequency chart like histogram, frequency curve and pie-chart etc.
10. To estimate regression equation from sampled data and evaluate values of standard deviation, t-statistics, regression coefficient, value of $R^2$ for atleast two independent variables.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**NCS-355: ADVANCE PROGRAMMING LAB**

LIST OF EXPERIMENTS:
1. Programs using Functions and Pointers in C
2. Programs using Files in C
3. Programs using Classes and Objects
4. Programs using Operator Overloading
5. Programs using Inheritance, Polymorphism and its types
6. Programs using Arrays and Pointers
7. Programs using Dynamic memory allocation
8. Programs using Templates and Exceptions
9. Programs using Sequential and Random access files

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**NEC-408: INFORMATION THEORY AND CODING**

Unit I
Review of probability theory, Definition of Information Measure and Entropy: Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source, Mutual information. Asymptotic Properties of Entropy and Problem Solving in Entropy

Unit – II
Block Code and its Properties, Data compression, Kraft-Mcmillan Equality and Compact Codes, Encoding of the source output, Shannon’s encoding algorithm, Coding Strategies, Huffman Coding, Shannon-Fano-Elias Coding and Introduction to Arithmetic Coding.

Unit – III
Introduction to Information Channels, Communication Channels, Discrete communication channels, Continuous channels. Discrete memory less Channels, Mutual information, Channel Capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

Unit – IV
Introduction to Error Control Coding: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding

Unit – V
Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes. RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes. Convolution Codes, Time domain approach. Transform domain approach.

**Reference:**

**NCS-401: OPERATING SYSTEM**

Unit – I

Unit – II

Unit – III

Unit – IV
Memory Management: Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation,
Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.

Unit – V
I/O Management and Disk Scheduling: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.

References:
3. Harvey M Dietel, “An Introduction to Operating System”, Pearson Education

NCS-402: THEORY OF AUTOMATA AND FORMAL LANGUAGES

Unit – I
Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem

Unit – II
Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen’s Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

Unit – III
Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

Unit – IV
Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

Unit – V

References:
6. K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.
NIT-401: MULTIMEDIA AND ANIMATION

Unit I – Introduction:
Introduction to Multimedia and animation, Multimedia Systems, Design Fundamentals, Elements of multimedia and animation and their use, Background of Art, Color theory overview, Sketching & illustration, Storyboarding, different tools for animation.

Unit- 2 – Multimedia Projects:

Unit-3 – Tools of Multimedia:
Paint and Draw Applications, Graphic effects and techniques, Image File Format, Anti-aliasing, Morphing, Multimedia Authoring tools, professional development tools.

Unit-4 - Animation:

References:

NCS-451: OPERATING SYSTEM LAB

1. To implement CPU Scheduling Algorithms
   - FCFS
   - SJF
   - SRTF
   - PRIORITY
   - ROUND ROBIN
2. Simulate all Page Replacement Algorithms
   - FIFO
   - LRU
3. Simulate Paging Technique of Memory Management

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NIT-451: MULTIMEDIA AND ANIMATION LAB

1. Procedure to create an animation to represent the growing moon.
2. Procedure to create an animation to indicate a ball bouncing on steps.
3. Procedure to simulate movement of a cloud.
4. Procedure to draw the fan blades and to give proper animation.
5. Procedure to display the background given (filename: tulip.jpg) through your name.
6. Procedure to display the background given (filename: garden.jpg) through your name using mask.
7. Procedure to create an animation with the following features.
   WELCOME (Letters should appear one by one. The fill color of the text should change to a different
   colour after the display of the full word.)

8. Procedure to simulate a ball hitting another ball.

9. Procedure to design a visiting card containing at least one graphic and text information.

10. Procedure to take a photographic image. Give a title for the image. Put the border. Write your
    names. Write the name of institution and place.

11. Procedure to prepare a cover page for the book in your subject area. Plan your own design.

12. Procedure to extract the flower only from given photographic image and organize it on a
    background. Selecting your own background for organization.

13. Procedure to change a circle into a square using flash.

14. Procedure to display the background given (FILENAME: GARDEN.JPG) through your name using
    mask.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

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**NCS-455: FUNCTIONAL AND LOGIC PROGRAMMING LAB**

Program in SML, NJ or CAML or F# for following:

1. To implement Linear Search.
2. To implement Binary Search.
3. To implement Bubble Sorting.
4. To implement Selection Sorting.
5. To implement Insertion Sorting.

Implement using LISP

6. Write a function that compute the factorial of a number. (Factorial of 0 is 1, and
   factorial of n is n*(n-1)*...*1. Factorial is defined only for integers greater than or
   equal to 0.)
7. Write a function that evaluate a fully parenthesized infix arithmetic expression.
   For examples, (infix (1+(2*3))) should return 7.
8. Write a function that perform a depth first traversal of binary tree. The function
   should return a list containing the tree nodes in the order they were visited.
9. Write a LISP program for water jug problem.
10. Write a LISP program that determines whether an integer is prime.
11. Write a PROLOG program that answers questions about family members and
    relationships includes predicates and rules which define
    sister, brother, father, mother, grandchild, grandfather and uncle. The program
    should be able to answer queries such as the following:

    - father(x, Amit)
    - grandson(x, y)
    - uncle(sumit, puneet)
    - mother(anita, x)

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.