Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(under Maharashtra Act No. XXIX of 2014)
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Detailed Syllabus
for
Second Year
B. Tech program in Computer Engineering/ Computer Science/ Computer Science & Engineering

With effective from
Academic year July 2018-19
Approved in the 11th meeting of Academic Council 8th June 2018

Teaching and Evaluation Scheme Second Year B. Tech. (Computer Engineering)

Sr. No.	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit
			L	T	P	MSE	CA	ESE	
Semester III									
1	BTBSC301	Engineering Mathematics -III	3	1	-	20	20	60	4
2	BTCOC302	Discrete Mathematics	2	1	-	20	20	60	3
3	BTCOC303	Data Structures	2	1	-	20	20	60	3
4	BTCOC304	Computer Architecture & Organization	2	1	-	20	20	60	3
5	BTCOC305	Digital Electronics & Microprocessors	2	1	-	20	20	60	3
6	BTHMC306	Basic Human Rights	2	-	-	-	50	-	Audit
7	BTCOL307	Python Programming	1	-	2	-	60	40	2
8	BTCOL308	HTML and Javascript	1		2		60	40	2
8	BTCOL309	Data Structures Lab	-	-	2	-	60	40	1
9	BTCOL310	Digital Electronics & Microprocessor Lab	-	-	2	-	60	40	1
10	BTCOF311	Field Training / Internship/Industrial Training Evaluations	-	-	-	-	-	100	1
		Total	**15**	**5**	**8**	**100**	**390**	**560**	**23**
Semester IV									
1	BTCOC401	Design & Analysis of Algorithms	2	1	-	20	20	60	3
2	BTCOC402	Probability & Statistics	2	1	-	20	20	60	3
3	BTCOC403	Operating System	2	1	-	20	20	60	3
4	BTCOE404	**Elective-I** A) Object Oriented Programming in C++ B) Object Oriented Programming in Java	2	1	-	20	20	60	3
5	BTCOE405	**Elective-II** A) Numerical Methods B) Physics of Engineering Materials C) Soft Skills and Personality Development	2	1	-	20	20	60	3
6	BTXXC406	Product Design Engineering	2	-	-	20	20	60	2
7	BTCOL407	Design & Analysis of Algorithms Lab	-	-	2	-	60	40	1
8	BTCOL408	Introduction to Data Science with R	1	-	2	-	60	40	2
9	BTCOL409	Object Oriented Programming Lab	-	-	2	-	60	40	1
10	BTCOL410	Operating System Lab	-	-	2		60	40	1
11	BTCOF411	Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in first semester and second Semester or in at one time.)						100	Credits to be evaluated at in V Sem.
		Total	**13**	**5**	**8**	**120**	**360**	**620**	**22**

(BTBSC301) Engineering Mathematics III

Unit 1: Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function. **[07 Hours]**

Unit 2: Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients. **[07 Hours]**

Unit 3: Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms. **[07 Hours]**

Unit 4: Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$). **[07 Hours]**

Unit 5: Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping. **[07 Hours]**

Unit 6: Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs). **[07 Hours]**

Text Books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

BTCOC302 Discrete Mathematics

Unit 1 **6 hrs**

Fundamental Structures and Basic Logic: Sets, Venn diagram, Cartesian product, Power sets, Cardinality and countability, Propositional logic, Logical connectives, Truth tables, Normal forms, Validity, Predicate logic, Limitations of predicate logic, Universal and existential quantification, First order logic.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Unit 2 **6 hrs**

Functions and Relations: Subjective, Injective, Bijective and inverse functions, Composition of function, Reflexivity, Symmetry, Transitivity and equivalence relations.

Unit 3 **6 hrs**

Combinatorics: Counting, Recurrence relations, generating functions.

Unit 4 **6 hrs**

Graph Theory: Basic terminology, Multi graphs and weighted graphs, Paths and circuits, Shortest path problems, Euler and Hamiltonian paths, Representation of graph, Isomorphic graphs, Planar graphs, Connectivity, Matching Coloring.

Unit 5 **6 hrs**

Trees: Rooted trees, Path length in rooted tree, Binary search trees, Spanning trees and cut set, Minimal spanning trees, Kruskal's and Prim's algorithms for minimal spanning tree.

Unit 6 **6 hrs**

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient79 Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Reference Books:

1. Lipschutz, *Discrete Mathematics*, McGraw-Hill Publication, 3rd Edition, 2009.
2. V. K. Balakrishnan, *Schaum's Outline of Graph Theory*, McGraw-Hill Publication, 1st Edition, 1997.
3. Eric Gossett, *Discrete Mathematics with Proof*, Wiley Publication, 2nd Edition, 2009.

Text Books:

1. C. L. Liu, *Elements of Discrete Mathematics*, McGraw-Hill Publication, 3rd Edition, 2008.
2. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, McGraw-Hill Publication, 6th Edition, 2010.
3. Y. N. Singh, *Discrete Mathematical Structures*, Wiley Publication, 1st Edition, 2010.
4. Dr. Sukhendu Dey, *Graph Theory with Applications*, SPD Publication, 1st Edition, 2012.

BTCOC303 Data Structures

Unit 1 **6 hrs**

Introduction: Data, Data types, Data structure, Abstract Data Type (ADT), representation of Information, characteristics of algorithm, program, analyzing programs.

Unit 2 **6 hrs**

Arrays and Hash Tables: Concept of sequential organization, linear and non-linear data structure, storage representation, array processing sparse matrices, transpose of sparse matrices. Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.

Unit 3 **6 hrs**

Searching and Sorting: Sequential, binary searching, skip lists – dictionaries, linear list representation, skip list representation, operations – insertion, deletion and searching. Insertion sort, selection sort, radix sort, File handling.

Unit 4 **6 hrs**

Linked Lists: Concept of linked organization, singly and doubly linked list and dynamic storage management, circular linked list, operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory management, garbage collection.

Unit 5 **6 hrs**

Stacks and Queues: Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, priority queue.

Unit 6 **6 hrs**

Trees and Graphs: Basic terminology, binary trees and its representation, insertion and deletion of nodes in binary tree, binary search tree and its traversal, threaded binary tree, Heap, Balanced Trees. Terminology and representation of graphs using adjacency matrix, Warshall's algorithm.

Reference Books:

1. E. Horowitz, S. Sahani, *Fundamentals of Data Structures*, Galgotia Publication, 1st Edition, 1983.
2. Thomas Cormen, *Introduction to Algorithms*, PHI Publication, 2nd Edition, 2002.
3. Venkatesan & Rose, *Data Structures*, Wiley Publication, 1st Edition, 2015.
4. Goodrich & Tamassia, *Data Structure & Algorithm in C++*, Wiley Publication, 2nd Edition, 2011.
5. R. G. Dromey, *"How to Solve it by Computer"*, 2nd Impression, Pearson Education.
6. Kyle Loudon, *Mastering Algorithms with C: Useful Techniques from Sorting to Encryption*, O'Reilly Media, 1st Edition, 1999.

Text Books:

1. Mark Allen Weiss, *Data structures and algorithms analysis in C++*, Pearson Education, 4th Edition, 2013.
2. S. Lipschutz, *Data Structures*, McGraw-Hill Publication, Revised 1st Edition, 2014.
3. Y. Langsm, M. Augenstin, A. Tanenbaum, *Data Structure using C and C++*, Prentice Hall India Learning Private Limited, 2nd Edition, 1998.
4. Trembley and Sorenson, *Introduction to Data Structures*, PHI Publication, 2nd Revised Edition, 1983.
5. Vishal Goyal, Lalit Goyal, *A Simplified Approach To Data Structure*, SPD Publication, 1st Edition, 2014.

BTCOC304 Computer Architecture and Organization

Unit 1 **6 hrs**

Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.

Unit 2 **6 hrs**

Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.

Unit 3 **6 hrs**

Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.

Unit 4 **6 hrs**

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems. External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.

Unit 5 **6 hrs**

Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming.

Unit 6 **6 hrs**

Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface.
Instruction pipe-lining: Concepts. Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.

Reference Books:

- Hennessy and Patterson, *Computer Architecture: A Quantitative Approach*, Morgan and Kaufman Publication, 4th Edition, 2007.
- Morris Mano, *Computer System Architecture*, Pearson Education India, 3rd Edition, 2007.
- Mostafa Abd-El-Barr, Hesham El-Rewini, *Fundamentals of Computer Organization and Architecture*, Wiley Publication, 1st Edition, 2004.
- Miles J. Murdocca, Vincent P. Heuring, *Computer Architecture and Organization: An Integrated Approach*, Wiley Publication, 1st Edition, 2007.
- Sajjan G. Shiva, *Computer Organization, Design, and Architecture*, CRC Press, 5th Edition, 2013.

Text Books:

- William Stalling, *Computer Organization and Architecture: Designing for Performance*, Prentice Hall Publication, 8th Edition, 2009.
- Hayes, *Computer Architecture and Organization*, McGraw-Hill Publication, 3rd Edition, 2012.
- Zaky, *Computer Organization*, McGraw-Hill Publication, 5th Edition, 2011.

BTCOC305 Digital Electronics & Microprocessor

Unit 1 **6 hrs**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples ofICgates, **Number Systems:** binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

Unit 2 **6 hrs**

Combinational Digital Circuits:
Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, parity checker / generator.

Unit 3 **6 hrs**

Sequential circuits and systems:
A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K - T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Unit 4 **6 hrs**

Fundamentals of Microprocessors:
Fundamentals of Microprocessor, Comparison of 8-bit, (8085) 16-bit (8086), and 32-bit microprocessors (80386).
The 8086 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Unit 5 **6 hrs**

Memory Interfacing. I/O Interfacing. Direct Memory Access. (DMA). Interrupts in 8086.

Unit 6 **6 hrs**

8086 Instruction Set and Programming:
Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Text Books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Douglas Hall, *Microprocessors and Interfacing*, McGraw-Hill Publication, Revised 2nd Edition, 2006.

BTHMC306-Basic Human Rights

Unit 1 **6 hrs**

The Basic Concepts:
Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.

Unit 2 **6 hrs**

Human Rights and Human Duties:
Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom.

Unit 3 **6 hrs**

Society, Religion, Culture, and their Inter-Relationship:
Impact of Social Structure on Human behaviour, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

Unit 4 **6 hrs**

Social Structure and Social Problems:
Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.

Unit 5 **6 hrs**

State, Individual Liberty, Freedom and Democracy:
The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.

Unit 6 **6 hrs**

Human Rights in Indian Constitution and Law:
The constitution of India:
(i) Preamble
(ii) Fundamental Rights
(iii) Directive principles of state policy
(iv) Fundamental Duties
(v) Some other provisions
Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

Text / Reference Books:

- Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005.
- Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

BTCOL307 Python Programming

One hour per week is for program demonstration and instruction which can be conducted as a classroom session or lab session.

Module 1: **2 Hrs.**

Informal introduction to programming, algorithms and data structures, Downloading and installing Python, run a simple program on Python interpreter.

Module 2: **2 Hrs.**

Variables, operations, control flow – assignments, conditionals, loops, functions: optional arguments, default values, Passing functions as arguments.

Module 3: **2 Hrs.**

Statements, Expressions, Strings: String processing. Exception handling, Basic input/output, Handling files.

Module 4: **2 Hrs.**

Class and Object, Data Structure: List, Tuple and Sequences, Set, Dictionaries.

Module 5: **4 Hrs.**

Using Database and Structured Query Languages (SQL): SQLite manager, Spidering Twitter using a Database, Programming with multiple tables, JOIN to retrieve data.

***Programming assignments are mandatory.**

Reference Books:

1. Mark Lutz, *Learning Python*, O'Reilly Media, 5th Edition, 2013.
2. Mark Pilgrim, *Dive into Python 3*, Apress Publication, 2nd Edition, 2009.
3. Allen B. Downey, *Think Python*, O'Reilly Media, 2nd Edition, 2012.
4. Jon Kleinberg and Eva Tardos, *Algorithm Design*, Pearson Education, 1st Edition, 2006.

Text Books:

1. Michael Urban and Joel Murach, *Murach's Python Programming*, Murach's Publication, 2016.
2. Charles Severance, *Python for Informatics: Exploring Information*, University of Michigan, Version 2.7.0, 2014.
3. Dr. R. Nageswara Rao, *Core Python Programming*, Dreamtech Press, 1st Edition, 2016.

BTCOL308 HTML and JavaScript

Unit 1 **2 hrs**

Web Site development Essentials: Overview of Web Design Concepts, Web Development Teams, Web Project Management Fundamentals, Web Site Development Process, Web Page Layout and Elements, Web Site Usability and Accessibility, Configure Browsers Setting, Navigation Concepts, Web Graphics, Multimedia and the Web.

Unit 2 **2 hrs**

Hyper Text Markup Language (HTML): HTML and the Evolution of Markup languages, Create Hyperlinks, Create Tables, Create Web Forms, Image Inserting Techniques, Create Frames, GUI HTML Editors, Site Content and Metadata.

Unit 3 **2 hrs**

Introduction to Client-Server Model: Features of Dreamweaver Interface, Setting Up a Site with Dreamweaver, FTP -Site Upload Feature of Dreamweaver, Create various types of Links, Insert multimedia including text, image, animation & video, Finding a Home for your WordPress Site, Installing WordPress on Your Site, Content Management using WordPress, Selecting the Right Tools, Image Formats, Fonts and Colors, Designing Your WordPress Site, The WordPress Default Layout, Creating a Custom Site.

Unit 4 **2 hrs**

Cascading Style Sheets: Cascading Style Sheets for Web page design, Creating CSS rules in Dreamweaver, Format Text with CSS, Use of CSS Selectors, Embed Style Sheets, and Attach External Style Sheets.
Using CSS with Tables: Insert and Styling Tables, Import Table Data, Style Tables with CSS, Sort Data in Table.

Unit 5 **4 hrs**

JavaScript first steps; JavaScript first steps overview; What is JavaScript?; A first splash into JavaScript; What went wrong? Troubleshooting JavaScript; Storing the information you need — Variables; Basic in JavaScript — Numbers and operators; Handling text — Strings in JavaScript; Useful string methods; Arrays; Making decisions in your code — Conditionals; Looping code; Functions — Reusable blocks of code; Build your own function; Function return values; Introduction to events

***Programming assignments are mandatory.**

Reference Books:

J. N. Robbins, *Learning Web Design*, O'Reilly Media, 4th Edition, 2012.
Steven M. Schafer, *HTML, XHTML, and CSS Bible*, Wiley India, 5th Edition, 2010.
John Duckett, *Beginning HTML, XHTML, CSS, and JavaScript*, Wiley India, 3rd Edition, 2009.
Hal Stern, David Damstra, Brad Williams, Professional WordPress: Design and Development, Wrox Publication, 3rd Edition, 2015.
E. Robson, E. Freeman, *Head First HTML & CSS*, O'Reilly Media, 2nd Edition, 2012.

BTCOL309 Data Structure Laboratory

List of Experiments:

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement circular queue using arrays.
5. Write a program to implement double ended queue (dequeue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and dequeue operation runs in linear time.
9. Write programs to implement the following data structures: (a) Single linked list (b) Double linked list.
10. Write a program to implement a stack using a linked list such that the push and pop operations of stack still take O(1) time.
11. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b) Maximum key (c) Search for a given key (d) Find predecessor of a node (e) Find successor of a node (f) delete a node with given key.
12. Write a program to construct an AVL tree for the given set of keys. Also write function for deleting a key from the given AVL tree.
13. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.
14. Implement the following sorting algorithms: (a) Insertion sort (b) Merge sort (c) Quick sort (d) Heap sort.
15. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS

BTCOL310 Digital Electronics and Microprocessor Laboratory

List of Experiments:

1. Simplification, realization of Boolean expressions using logic gates/universal gates.
2. Realization of half/full adder & half/full subtractors using logic gates.
3. Realization of parallel adder/subtractors using 7483 chip, BCD to Excess-3code conversion & vice versa.
4. Realization of binary to gray code conversion & vice versa.
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits & code converter.
6. Realization of one/two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display & b) Priority encoder.
8. Truth table verification of flip-flops: i) JK Master Slave ii) T type iii) D type.
9. Realization of 3-bit counters as a sequential circuit & MOD-N counter design (7476, 7490, 74192, 74193).
10. Writing & testing of sequence generator.
11. Design of FSM: Moore machine, Mealy machine.

BTCOC401 Design and Analysis of Algorithms

Unit 1 **6 hrs**

Introduction to Algorithms: Definition of Algorithms, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem, Changing Variable, Heap Sort.

Unit 2 **6 hrs**

Divide and Conquer: Introduction to Divide and Conquer Technique, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.

Unit 3 **6 hrs**

Greedy Algorithms: Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Spanning Tree, Single-Source Shortest Path Algorithm.

Unit 4 **6 hrs**

Dynamic Programming: Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Comparison of Divide-and-Conquer and Dynamic Programming Techniques, Longest Common Sub-sequence, matrix multiplication, shortest paths: Bellman Ford, Floyd Warshall, Application of Dynamic Programming.

Unit 5 **6 hrs**

Backtracking: Backtracking Concept, N–Queens Problem, Four–Queens Problem, Eight–Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem.

Branch and Bound: Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.

Unit 6 **6 hrs**

Tree: Introduction, B-tree, Red-Black Tree (RBT): Insertion, Deletion.
NP Completeness: Introduction, The Complexity Class P, The Complexity Class NP, Polynomial-Time Reduction, The Complexity Class NP-Complete.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, *Algorithm Design – Foundation, Analysis & Internet Examples*, Wiley Publication, 2nd Edition, 2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, *Algorithms in a Nutshell, A Practical Guide*, O'Reilly Media, 2nd Edition, 2016.

Text Books:

1. Cormen, *Introduction to Algorithms*, PHI Publication, 2nd Edition, 2002.
2. Ellise Horowitz, Sartaj Sahni, S. Rajasekaran, *Fundamentals of Computer Algorithms*, University Press (India) Private Ltd, 2nd Edition, 2008.
3. Sara Base, *Computer algorithms: Introduction to Design and Analysis*, Addison-Wesley Publication, 2nd Edition, 1988.

BTCOC402 Probability and Statistics

Unit 1 **6 hrs**

Probability Theory: Definition of probability: classical, empirical and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes' theorem of inverse probability, Properties of probabilities with proofs, Examples.

Unit 2 **6 hrs**

Random Variable and Mathematical Expectation: Random variables, Probability distributions, Probability mass function, Probability density function, Mathematical expectation, Join and marginal probability distributions, Properties of expectation and variance with proofs.

Unit 3 **6 hrs**

Theoretical Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution, Examples.

Unit 4 **6 hrs**

Correlation: Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation, Coefficient, Properties of Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient, Probable errors.

Unit 5 **6 hrs**

Linear Regression Analysis: Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.

Unit 6 **6 hrs**

Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Reference Books:

1. Kishor S. Trivedi, *Probability, Statistics with Reliability, Queuing and Computer Science Applications*, Wiley India Pvt. Ltd, 2nd Edition, 2001.
2. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, *An Introduction To Probability And Statistics*, Wiley Publication, 2nd Edition, 2001.

Text Books:

1. S. C. Gupta, *Fundamentals of Statistics*, Himalaya Publishing House, 7th Revied and Enlarged Edition, 2016.
2. G. V. Kumbhojkar, *Probability and Random Processes*, C. Jamnadas and Co., 14th Edition, 2010.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
5. G. Haribaskaran, *Probability, Queuing Theory and Reliability Engineering*, Laxmi Publications, 2nd Edition, 2009.
6. Murray Spiegel, John Schiller, R. ALU Srinivasan, *Probability And Statistics*, Schaum's Outlines, 4th Edition, 2013.

BTCOC403 Operating System

Unit 1 **6 hrs**

Introduction and Operating system structures: Definition, Types of Operating system, Real-Time operating system, System Components- System Services, Systems Calls, System Programs, System structure. Virtual Machines, System Design and Implementation, System Generations.

Unit 2 **6 hrs**

Processes and CPU Scheduling: Process Concept, Process Scheduling, Operation on process, Cooperating processes. Threads, Inter-process Communication, Scheduling criteria, scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Scheduling Algorithms and performance evaluation.

Unit 3 **6 hrs**

Process Synchronization The critical-section problem, Critical regions, Synchronization Hardware, Semaphores, Classical Problems of synchronization, and Monitors Synchronizations in Solaris.

Unit 4 **6 hrs**

Deadlocks: Systems Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined approach to deadlock Handling.

Unit 5 **6 hrs.**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Continuous Memory Allocation, Fixed and variable partition, Internal and external fragmentation and compaction, Paging: Principle of operation, Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit 6 **6 hrs.**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, sDevice independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms.

File Management: Concept of File, Access methods, File types, File operation, 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 and performance.

Reference Books:

1. D. M. Dhamdhere, *Systems Programming and Operating Systems*, McGraw-Hill, 2nd Edition, 1996.
2. Garry Nutt, *Operating Systems Concepts*, Pearson Publication, 3rd Edition, 2003.
3. Harvey M. Deitel, *An Introduction to Operating Systems*, Addison-Wesley Publication, 2nd Edition, 1990.
4. Thomas W. Doeppner, *Operating System in Depth: Design and Programming*, Wiley Publication, 2011.

Text Books:

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, *Operating System Concepts*, Wiley Publication, 8th Edition, 2008.
2. Andrew S. Tanenbaum, *Modern Operating System*, PHI Publication, 4th Edition, 2015.

BTCOE404(A) Object-Oriented Programming using C++ (Elective I)

Unit 1 **6 hrs**

Introduction to Object Oriented Programming and Objects and Classes: Need of object oriented programming, The object oriented approach, Characteristics of object oriented languages. A class, Objects as data types, Constructors, Objects as function arguments, Returning objects.

Unit 2 **6 hrs**

Operator Overloading and Inheritance: Overloading unary and binary operators, Data conversion. Derived and base class, Public and private inheritance, Levels of inheritance, Multiple inheritance Examples.

Unit 3 **6 hrs**

Polymorphism: Virtual functions, Dynamic binding, Abstract classes and pure virtual functions, Friend functions, this pointer.

Unit 4 **6 hrs**

Streams and Files: Streams, Stream output and input, Stream manipulators, Files and streams, Creating, Reading, Updating sequential and random files.

Unit 5 **6 hrs**

Templates and Exception Handling: Function templates, Overloading function templates, Class templates, Exception handling overview, Need of exceptions, An exception example, Multiple exceptions, Exception specifications.

Unit 6 **6 hrs**

Standard Template Library (STL): Introduction to STL-Containers, Iterators, Algorithms, Sequence containers, Associative containers, Container adapters.

Reference Books:

1. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley Publication, 4th Edition, 2013.
2. P. J. Deitel, H. M. Deitel, *C++ How to Program*, PHI Publication, 9th Edition, 2012.
3. John Hubbard, *Programming with C++*, Schaum's Outlines, McGraw-Hill Publication, 2nd Edition, 2000.
4. Nicolai M. Josuttis, *Object-Oriented Programming in C++*, Wiley Publication, 1st Edition, 2002.

Text Books:

1. E. Balagurusamy, *Object Oriented Programming with C++*, McGraw-Hill Publication, 6th Edition, 2013.
2. Robert Lafore, *Object Oriented Programming in C++*, Sams Publishing, 4th Edition, 2001.
3. Dr. B. B. Meshram, *Object Oriented Paradigms with C++ Beginners Guide for C and C++*, SPD Publication, 1st Edition, 2016.
4. Rajesh R. Shukla, *Object-Oriented Programming in C++*, Wiley India Publication, 1st Edition, 2008.

BTCOE404(B) Object-Oriented Programming using Java (Elective I)

Unit 1 **6 hrs**

Introduction to Computers and Java: Computers: Hardware and Software, Data Hierarchy, Computer Organization, Machine Languages, Assembly Languages and High-Level Languages, Introduction to Object Technology, Operating Systems, Programming Languages, Java and a Typical Java Development Environment, Your First Program in Java: Printing a Line of Text, Modifying Your First Java Program, Displaying Text with printf, Another Application: Adding Integers, Memory Concepts, Arithmetic, Decision Making: Equality and Relational Operators.

Unit 2 **6 hrs**

Introduction to Classes, Objects, Methods and Strings: Introduction, Declaring a Class with a Method and Instantiating an Object of a Class, Declaring a Method with a Parameter, Instance Variables, set Methods and get Methods, Primitive Types vs. Reference Types, Initializing Objects with Constructors Floating-Point Numbers and Type double.

Unit 3 **6 hrs**

Control Statements: Algorithms, Pseudocode, Control Structures, if Single-Selection Statement, if...else Double-Selection Statement, while Repetition Statement, Formulating Algorithms: Counter-Controlled Repetition, Formulating Algorithms: Sentinel-Controlled Repetition, Formulating Algorithms: Nested Control Statements, Compound Assignment Operators, Increment and Decrement Operators, Primitive Types, Essentials of Counter-Controlled Repetition, for Repetition Statement, Examples Using for Statement, do...while Repetition Statement, switch Multiple-Selection Statement, break and continue Statements, Logical Operators.

Unit 4 **6 hrs**

Array: Introduction, Declaring and Creating Arrays, Examples Using Arrays, Case Study: Card Shuffling and Dealing Simulation, Enhanced for Statement, Passing Arrays to Methods, Case Study: Class GradeBook Using an Array to Store Grades, Multidimensional Arrays, ase Study: Class GradeBook Using a Two-Dimensional Array, Variable-Length Argument Lists, Using Command-Line Arguments, Class Arrays.

Unit 5 **6 hrs**

Classes and Objects: Introduction, Controlling Access to Members, Referring to the Current Object's Members with the this Reference, Time Class Case Study: Overloaded Constructors, Time, Default and No-Argument Constructors, Notes on Set and Get Methods, Composition, Enumerations, Garbage Collection and Method finalize, static Class Members, static Import, final Instance Variables, Time Class Case Study: Creating Packages, Package Access.

Unit 6 **6 hrs**

Inheritance: Introduction, Superclasses and Subclasses, protected Members, Relationship between Superclasses and Subclasses, Hierarchy Using private Instance Variables, Constructors in Subclasses Software Engineering with Inheritance, Class Object.

Polymorphism: Introduction, Polymorphism Examples, Demonstrating Polymorphic Behavior, Abstract Classes and Methods, Case Study: Payroll System Using Polymorphism, final Methods and Classes, Case Study: Creating and Using Interfaces.

Reference Book:

1. Paul Deitel and Harvey Detail, *Java: How to Program*, Pearson's Publication, 9th Edition,
2. Joel Murach and Michael Urban, *Murach's Beginning Java with Eclipse*, Murach's Publication, 1st Edition, 2016.
3. Doug Lowe, *Java All-in-One For Dummies*, Wiley Publication, 4th Edition, 2014.
4. Herbert Schildt, *Java The Complete Reference*, McGraw-Hill Publication, 9th Edition,
5. Patrick Niemeyer, Daniel Leuck, *Learning Java,* O'Reilly Media, 4th Edition, 2013.

BTCOE405(A) Numerical Methods (Elective-II)

This course preferably offered as a SWAYAM course

Unit 1 [5 Hrs.]
Solution of Algebraic and Transcendental Equation: Bisection method, Method of false position, Newton's method and Newton-Raphson method.

Unit 2 [5 Hrs.]
Solution of Linear Simultaneous Equation: Gauss elimination method, Gauss-Jordan method, Iterative method of solution- Jacobi iteration method, Gauss-Seidal iteration method, Relaxation method.

Unit 3 [5 Hrs.]
Finite Differences: Forward difference operator, Backward difference operator, Central difference operator, Newton's interpolation formulae, Newton's forward–backward-central interpolation formulae.

Unit 4 [5 Hrs.]
Differentiation and Integration: Newton-Cortes formula, Trapezoidal rule, Simpson one–third rule, Simpson three- eighth rule.

Unit 5 Numerical Solution of ODE: Picard's methods, Taylor series method, Euler's method, Modified Euler's method, Runge - Kutta method. [5 Hrs.]

Text Books:

1. B.S Grewal, Higher Engineering Mathematics, 40 th edition, Khanna publication.
2. S. S. Shastri, Introduction to Numerical Methods, PHI publication.
3. V. Rajaraman, Computer Oriented Methods, 3 rd edition, PHI publication.

Reference Books:

1. Conte and De boor, Elementary Numerical Analysis, BPB publication.
2. E. Kreyszig, Advanced Engineering Mathematics, BPB publication.
3. Steven C Chapra, Numerical Methods for Engineers, 5 th edition, McGraw Hill publication.

Equivalent SWAYAM/NPTEL Course

BTCOE405(B) Physics of Engineering Material (Elective-II)

Unit I Magnetic Materials: **5hrs**

Magnetic Materials: Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Ant ferromagnetic and Ferromagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.

Unit II Conducting and Superconducting Materials: Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation) **5hrs**

Unit III Semiconducting Materials: Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell **5hrs**

Unit IV Dielectric Materials: Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials **5hrs**

Unit V Nano Materials: Nanomaterials : Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials. **5hrs**

Text Books:

1. C. Kittle ,"***Introduction to Solid state Physics***".
2. C. M. Srivastava , C. Srinivasan , "***Science of Engineering Materials and Carbon Nanotubes***".
3. A. J. Dekker, "***Solid State Physics***".

Reference Books:

1. V. Raghavan, "***Material Science and Engineering***".
2. A. J. Dekker, "***Electrical Engineering Materials***".

BTCOE405(C) Soft Skills and Persnolity Development (Elective-II)

This course preferably offered as a SWAYAM course

UNIT I

Self Management:

Self Management, Self Evaluation, Self discipline, Self criticism, Recognition of one's own limits and deficiencies, dependency, etc.

Self Awareness, Self Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride,- Leadership & Team Dynamics

UNIT II

Time Management Techniques

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time.

UNIT III

Motivation/ Inspiration

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation,

Motivation techniques : Motivation techniques based on needs and field situations

Unit IV

Interpersonal Skills Development

Positive Relationship, Positive Attitudes, Empathies: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

Unit V

Effective Computing Skills

Designing an effective Presentation: Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation

Reference books:

1. Mitra, Barun, "***Personality Development and Soft Skills***", Oxford University Press, 2016.
2. Ramesh, Gopalswamy, "***The Ace of Soft Skills: Attitude, Communication and Etiquette for Success***", Pearson Education, 2013.
3. Covey, Stephen R., "***Seven Habits of Highly Effective People: Powerful Lessons in Personal Change***"
4. Rosenberg Marshall B., "***Nonviolent Communication: A Language of Life***".

BTXXC406 Product Design Engineering

Unit 1 **6 hrs**

Creating Simple Products and Modules.

Unit 2 **6 hrs**

Document Creation and Knowledge Sharing.

Unit 3 **6 hrs**

Self and Work Management.

Unit 4 **6 hrs**

Team Work and Communication.

Unit 5 **6 hrs**

Managing Health and Safety.

Unit 6 **6 hrs**

Data and Information Management.

Text / Reference Books:

1. Model Curriculum for “Product Design Engineer – Mechanical”, NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw - Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.). (1999).Human factors in product design: current practice and future trends. CRC Press.
4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design McGRAW- HILL book company.
5. Roozenburg, N. F., &Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.
6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.

BTCOL407 Design and Analysis of Algorithm Laboratory

List of Experiments:

1. Divide and conquer method (quick sort, merge sort, Strassen's matrix multiplication).
2. Greedy method (knapsack problem, job sequencing, optimal merge patterns, minimal spanning trees).
3. Dynamic programming (multistage graphs, OBST, 0/1 knapsack, traveling sales person problem).
4. Obtain the Topological ordering of vertices in a given digraph.
5. Back tracking (n-queens problem, graph coloring problem, Hamiltonian cycles).
6. Selection: Minimum/ Maximum, K^{th} smallest element.
7. Find optimal ordering of matrix multiplication. (Use Dynamic programming method).
8. Use dynamic programming algorithm to solve optimal binary search tree problem.
9. Compute the transitive closure of a given directed graph using Warshall's algorithm.
10. Write programs to find out a minimum spanning tree of a simple connected undirected graph by applying: (a) Prim’s algorithm (b) Kruskal’s algorithm.
11. Write a program to implement Dijkstra’s algorithm for solving single source shortest path problem using priority queue.
12. Write a program to implement Floyd-Warshall algorithm for solving all pairs shortest path problem.

BTCOL408 Introduction to data science with R

Unit 1: Introduction to Basics **2 hrs**

The basic data types in R. Variables.

Module 2 Vectors and Matrices **4hrs**

Vectors. Create, name and select elements from vectors. Learn how to work with matrices in R. Do basic computations with them and demonstrate your knowledge by analyzing the Star Wars box office figures.

Module 3: Factors & Data Frames **2 hrs**

Storeing Categorical data in factors. Learn how to create, subset and compare categorical data. When working R, you'll probably deal with Data Frames all the time. Therefore, you need to know how to create one, select the most interesting parts of it, and order them.

Module 4: Lists **2 hrs**

Create, name and select elements from Lists

Module 5: Basic Graphics **2 hrs**

Discover R's packages to do graphics and create your own data visualizations.

***Programming assignments are mandatory.**

Reference Books:

1. Joel Grus, *Data Science from Scratch: First Principles with Python*, O'Reilly Media, 1st Edition, 2015.
2. Hadley Wickham, Garrett Grolemund, *R for Data Science Import, Tidy, Transform, Visualize, and Model Data*, O'Reilly Media, 1st Edition, 2017.
3. Nina Zumel, John Mount,"Practical Data Science with R", Manning, 2014.

Text Books:

1. Rajendra Patil, Hiren dand, Rupali Dahake, *A practical approach to R Tool*, SPD Publication, 1st Edition, 2017.

BTCOL409 Object Oriented Programming Laboratory

List of Experiments:

1. Programs on Operators, Arithmetic Promotion, Method Calling.
2. Programs on dealing with Arrays.
3. Programs on Classes: String and Math.
4. Programs on Inheritance and Polymorphism.
5. Programs on Garbage collection, packaging, access Modifiers, as well as static and abstract modifiers.
6. Programs on Interfaces, block initializers, final Modifier, as well as static and dynamic binding.
7. Programs on file handling and stream manipulation.
8. Programs on Dynamic Polymorphism.
9. Programs on Dynamic Memory Management.
10. Programs on Exception Handling.
11. Programs on generic programming using templates.
12. Programs on STL-containers and iterators.

BTCOL410 Operating Systems Laboratory

1. Hands on Unix Commands
2. Shell programming for file handling.
3. Shell Script programming using the commands grep, awk, and sed.
4. Implementation of various CPU scheduling algorithms (FCFS, SJF, Priority).
5. Implementation of various page replacement algorithms (FIFO, Optimal, LRU).
6. Concurrent programming; use of threads and processes, system calls (fork and v-fork).
7. Study pthreads and implement the following: Write a program which shows the performance
8. Improvement in using threads as compared with process.(Examples like Matrix Multiplication,
9. Hyper Quick Sort, Merge sort, Traveling Sales Person problem).
10. Implementation of Synchronization primitives – Semaphore, Locks and Conditional Variables.
11. Implementation of Producer-Consumer problem, Bankers algorithm.
12. Implementation of various memory allocation algorithms, (First fit, Best fit and Worst fit), Disk
13. Scheduling algorithms (FCFS, SCAN, SSTF, C-SCAN).
14. Kernel reconfiguration, device drivers and systems administration of different operating systems.
15. Writing utilities and OS performance tuning.