SADHANA EDUCATION SOCIETY

L. S. RAHEJA COLLEGE OF ARTS & COMMERCE

SANTACRUZ (W), MUMBAI – 400054

DEPARTMENT OF BACHELOR OF SCIENCE INFORMATION TECHNOLOGY

HANDBOOK

PREPARED BY:

Ms. PRAJAKTA JOSHI (Course Co-ordinator)

1.1. ABOUT THE PROGRAMME

Introduction and Objectives

INTRODUCTION

The University of Mumbai started the Bachelor in Science in Information Technology program in 1999-2000.Bachelor of Science (Information Technology) was one of the few programs initiated by the University of Mumbai. The program to cater to the growing needs of corporate India also leads to the all-round development of their personality.

The program takes the students beyond computer skills to telecommunication systems and Networking to e-commerce, internet security and Enterprise Resource Planning. This program will give a strategic advantage to the future Indian Manager.

With the growing use of Computers and Information Technology in our day to day life, necessitates trained man power to manufacture, maintain and use the Computers as well as write the software required for the effective and efficient use of the computers and IT.

Thus, if you have the zest and the endurance to face challenges, the passion to succeed and win and also to commit yourself to building a challenging career in Accounts & Finance with an international outlook, BMS is a program specially designed for you.

OBJECTIVES

1. **To create employable graduate in Information technology which will enable the industry to grow and the graduates to become successful in the field of Information Technology.**

2. **To create for the students of the University of Mumbai an additional avenue of self-employment and also to benefit Industry by providing them with suitably trained persons in the field of Computers and Information Technology.**

3. **To prepare students to exploit opportunities in IT related area of interest.**

4. **To create a new genre of skilled manpower capabilities to face challenges in Information Technology.**

5. **To bridge the gap and produce employable graduate in Information technology which will enable the industry to grow and graduates to become successful in the field of Information Technology.**

2.1. ELIGIBILITY CRITERION FOR ADMISSION TO THE PROGRAMME:

The Eligibility criterion for admission to the First Year of Bachelor in Science in Information Technology **Program as per O 5151 &5053 of the University of Mumbai is:**

1. A candidate for being eligible for admission to the Bachelor in Science in Information Technology Degree Program shall have passed XII Std. Examination of the Maharashtra Board of Higher Secondary Education **OR** its equivalent examination with Mathematics as one of the subjects by secured not less than 45% marks in aggregate in one attempt (General Category) and 40 % of marks in aggregate in one attempt (Reserved Category).
   OR
2. Passed three year (post) SSC Diploma in Computer Engineering/Computer Science/Computer Technology/Information Technology/Electrical, Electronics & Video Engineering and allied branches. However, the Diploma should be recognized by the Board of Technical education or recognized by any other government body. Minimum marks required is 45% marks in aggregate in one attempt (General Category) and 40 % of marks in aggregate in one attempt (Reserved Category).
   OR
3. Civil and allied branches of engineering are eligible for direct admission to the SECOND YEAR of the B.Sc.IT degree program with 45% marks in aggregate in one attempt (General Category) and 40 % of marks in aggregate in one attempt **(Reserved Category).**

4. Every candidate admitted to the degree program in the constituent /affiliated college / recognized institution, conducting the program, shall have to register himself/herself with the University.

   PLEASE NOTE THAT NO ENTRANCE EXAMINATIONS IS PRESCRIBED BY THE UNIVERSITY OF MUMBAI FOR ADMISSION TO THE PROGRAMME. THE ADMISSION TO THE PROGRAMME IS PURELY ON THE BASIS OF THE MARKS OBTAINED AT THE XII STD OR ITS EQUIVALENT EXAMINATION.

3.1 DURATION OF THE PROGRAMME:

B.Sc.IT is a THREE (03) year FULL TIME Undergraduate Degree Program offered by University of Mumbai comprising SIX (06) Semesters. Each year is divided into TWO (02) semesters.

4.1 PROGRAMME CONTENT:

Overall the program comprises of 40 courses (papers / subjects) each of 100 marks. Broadly the programs are on, Management, Law, Economics, Financial Accounting, Information Technology and Quantitative Methods. ***Detail contents are given in the next section***.

5.1 EVALUATION AND ASSESSMENT:

For every program (subject) the evaluation / assessment of the student will comprise of two components: Internal Assessment (25% of total marks 25 marks) which will be continuous evaluation and Semester End Examination which will be a theory paper of 75% of the marks for the program (subject) i.e. 75 marks. To pass in the program (subject/paper) the learner (student) is required to obtain 40% marks individually in each of the two components i.e. Internal Assessment (i.e. 10 marks out of 25 marks) and Semester End Examination (30 marks out of 75 marks) separately and overall 40% of the total marks (40 marks out of 00 marks).

Refer to the Scheme of Examination for details.

6.1 BRIEF CURRICULUM

Bachelor of Management Studies (BMS) is a 3 years full time Program offered by University of Mumbai. Each year is divided into 2 semesters. The course consists of 40 modules comprising 40 theory papers and no project. This is one of the few Self Financing Courses which does not have project as one paper.

Semester I		**Semester II**	
Course Code	Course Title	Course Code	Course Title
	Imperative Programming		Object oriented Programming
	Digital Electronics		Microprocessor Architecture
	Operating System		Web Programming
	Discrete Mathematics		Numerical and Statistical Methods
	Communication Skill		Green Computing

Semester III		Semester IV	
Course Code	**Course Title**	**Course Code**	**Course Title**
	Python Programming		Core Java
	Data Structures		Introduction to Embedded Systems
	Computer Networks		Computer Oriented Statistical Techniques
	Database Management Systems		Software Engineering

	Semester V		Semester VI
Course Code	**Course Title**	**Course Code**	**Course Title**
	Software Project Management		Software Quality Assurance
	Internet of Things		Security in Computing
	Advanced Web Programming		Business Intelligence
Elective one	Artificial Intelligence Linux System Administration	Elective one	Principles of Geographic Information Systems Enterprise Networking
Elective one	Enterprise Java Next Generation Technologies	Elective one	IT Service Management Cyber Laws
Project Dissertation		Project Implementation	

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

7.1 DETAILED SYLLABUS

Imperative Programming		
Unit I	**Introduction: Types of Programming languages, History, features and application. Simple program logic, program development cycle, pseudocode statements and flowchart symbols, sentinel value to end a program, programming and user environments, evolution of programming models, desirable program characteristics.** **Fundamentals: Structure of a program. Compilation and Execution of a Program, Character Set, identifiers and keywords, data types, constants, variables and arrays, declarations, expressions, statements, Variable definition, symbolic constants**	**12 Lectures**
Unit II	**Operators and Expressions:** **Arithmetic operators, unary operators, relational and logical operators, assignment operators, assignment operators, the conditional operator, library functions.** **Data Input and output:** **Single character input and output, entering input data, scanf function, printf function, gets and puts functions, interactive programming**	**12 Lectures**
Unit III	**Conditional Statements and Loops: Decision Making Within A Program, Conditions, Relational Operators, Logical Connectives, If Statement, If-Else Statement, Loops: While Loop, Do While, For Loop.** **Nested Loops, Infinite Loops, Switch Statement Functions:** **Overview, defining a function, accessing a function, passing arguments to a function, specifying argument data types, unction prototypes, recursion, modular programming and functions, standard library of c functions, prototype of a function: foo1lal parameter list, return type,** **function call, block structure, passing arguments to a function: call by reference, call by value**	**12 Lectures**
Unit IV	**Program structure:** **Storage classes, automatic variables, external variables, static variables, multifile programs, more library functions,** **Preprocessor: Features, #define and #include, Directives and Macros** **Arrays:** **Definition, processing, passing arrays to functions, multidimensional arrays, arrays and strings**	**12 Lectures**
Unit V	**Pointers:** **Fundamentals, declarations, Pointers Address Operators, Pointer Type Declaration, Pointer Assignment, Pointer**	**12 Lectures**

	Initialization, Pointer Arithmetic, Functions and Pointers, Arrays and Pointers, Pointer Arrays, passing functions to other functions **Structures and Unions:** **Structure Variables, Initialization, Structure Assignment, Nested Structure, Structures and Functions, Structures and Arrays: Arrays of Structures, Structures Containing Arrays, Unions, Structures and pointers**	

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Programming with C	Byron Gottfried	Tata McGRAW-Hill	2nd	1996
2.	Programming Logic and Design	Joyce Farell	Cengage Learning	8th	2014
3.	"C" Programming"	Brian W. Kernighan and Denis M. Ritchie.	PHI	2nd	
4.	Let us C	Yashwant P. Kanetkar,	BPB publication		
5.	C for beginners	Madhusudan Mothe	X-Team Series	1st	2008
6.	21st Century C	Ben Klemens	OReilly	1st	2012

List of Practical: (Can be done in any imperative language)	
1.	**Basic Programs:**
a.	Write a program to display the message HELLO WORLD.
b.	Write a program to declare some variables of type int, float and double. Assign some values to these variables and display these values.
c.	Write a program to find the addition, subtraction, multiplication and division of two numbers.
2.	**Programs on variables:**
a.	Write a program to swap two numbers without using third variable.
b.	Write a program to find the area of rectangle, square and circle.
c.	Write a program to find the volume of a cube, sphere, and cylinder.
3.	**Conditional statements and loops(basic)**
a.	Write a program to enter a number from the user and display the month name. If number >13 then display invalid input using switch case.
b.	Write a program to check whether the number is even or odd.
c.	Write a program to check whether the number is positive, negative or zero.
d.	Write a program to find the factorial of a number.
e.	Write a program to check whether the entered number is prime or not.
f.	Write a program to find the largest of three numbers.

4.	**Conditional statements and loops(advanced)**
a.	Write a program to find the sum of squares of digits of a number.
b.	Write a program to reverse the digits of an integer.
c.	Write a program to find the sum of numbers from 1 to 100.
d.	Write a programs to print the Fibonacci series.
e.	Write a program to find the reverse of a number.
f.	Write a program to find whether a given number is palindrome or not.
g.	Write a program that solve the quadratic equation $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
h.	Write a program to check whether the entered number is Armstrong or not.
i.	Write a program to count the digit in a number
5.	**Programs on patterns:**
a.	Programs on different patterns.
6.	**Functions:**
a.	Programs on Functions.
7.	**Recursive functions**
a.	Write a program to find the factorial of a number using recursive function.
b.	Write a program to find the sum of natural number using recursive function.
8.	**Arrays**
a.	Write a program to find the largest value that is stored in the array.
b.	Write a program using pointers to compute the sum of all elements stored in an array.
c.	Write a program to arrange the ‘n’ numbers stored in the array in ascending and descending order.
d.	Write a program that performs addition and subtraction of matrices.
e.	Write a program that performs multiplication of matrices.
9.	**Pointers**
a.	Write a program to demonstrate the use of pointers.
b.	Write a program to perform addition and subtraction of two pointer variables.
10.	**Structures and Unions**
a.	Programs on structures.
b.	Programs on unions.

Digital Electronics

Unit I	**Number System:** **Analog System, digital system, numbering system, binary number system, octal number system, hexadecimal number system, conversion from one number system to another, floating point numbers, weighted codes binary coded decimal, non-weighted codes Excess – 3 code, Gray code, Alphanumeric codes – ASCII Code, EBCDIC, ISCII Code,** **Hollerith Code, Morse Code, Teletypewriter (TTY), Error detection and correction, Universal Product Code, Code conversion.** **Binary Arithmetic:** **Binary addition, Binary subtraction, Negative number representation, Subtraction using 1's complement and 2's complement, Binary multiplication and division, Arithmetic in octal number system, Arithmetic in hexadecimal number system, BCD and Excess – 3 Arithmetic**	**12 Lectures**
Unit II	**Boolean Algebra and Logic Gates:** **Introduction, Logic (AND OR NOT), Boolean theorems, Boolean Laws, De Morgan's Theorem, Perfect Induction, Reduction of Logic expression using Boolean Algebra, Deriving Boolean expression from given circuit, exclusive OR and Exclusive NOR gates, Universal Logic** **Gates Implementation of other gates using universal gates, Input bubbled logic, Assertion level.** **Minterm, Maxterm and Karnaugh Maps: Introduction, minterms and sum of minterm form, maxterm and Product of maxterm form, Reduction technique using Karnaugh maps –2/3/4/5/6 variable K-maps, Grouping of variables in K-maps, K-maps for product of sum form, minimize Boolean expression using K-map and obtain K-map from Boolean expression, Quine McCluskey**	**12 Lectures**
Unit III	**Combinational Logic Circuits:** **Introduction, Multi-input, multi-output Combinational circuits, Code converters design and implementations** **Arithmetic Circuits:** **Introduction, Adder, BCD Adder, Excess – 3 Adder, Binary Subtractors, BCD Subtractor, Multiplier, Comparator.**	**12 Lectures**
Unit IV	**Multiplexer, Demultiplexer, ALU, Encoder and Decoder:** **Introduction, Multiplexer, Demultiplexer, Decoder, ALU, Encoders.** **Sequential Circuits: Flip-Flop: Introduction, Terminologies used, S-R flip-flop, D flip-fop, JK flip flop, Race-around condition, Master – slave JK flip-flop, T flip-flop conversion from one type of flip-flop to another, Application of flip flops**	**12 Lectures**
Unit V	**Counters:**	**12**

	Introduction, Asynchronous counter, Terms related to counters, IC7493 (4-bit binary counter), Synchronous counter, Bushing, Type T Design, Type JK Design, Presettable counter, IC 7490, IC 7492, **Synchronous counter ICs, Analysis of counter circuits.** **Shift Register: Introduction, parallel and shift registers, serial shifting, serial–in serial–out, serial–in parallel–out , parallel–in parallel–out, Ring counter, Johnson counter, Applications of shift registers, Pseudo-random binary sequence generator, IC7495, Seven Segment displays, analysis of shift counters.**	**Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition
1.	Digital Electronics and Logic Design	N. G. Palan	Technova	
2.	Make Electronics	Charles Platt	O'Reilly	1st
3.	Modern Digital Electronics	R. P. Jain	Tata McGraw Hill	3rd
4.	Digital Principles and Applications	Malvino and Leach	Tata McGraw Hill	
5.	Digital Electronics: Principles, Devices and Applications,	Anil K. Maini	Wiley	

List of Practical

1.	**Study of Logic gates and their ICs and universal gates:**
a.	Study of AND, OR, NOT, XOR, XNOR, NAND and NOR gates
b.	IC 7400, 7402, 7404, 7408, 7432, 7486, 74266
c.	Implement AND, OR, NOT, XOR, XNOR using NAND gates.
d.	Implement AND, OR, NOT, XOR, XNOR using NOR gates.
2.	**Implement the given Boolean expressions using minimum number of gates.**
a.	Verifying De Morgan's laws.
b.	Implement other given expressions using minimum number of gates.
c.	Implement other given expressions using minimum number of ICs.
3.	**Implement combinational circuits.**
a.	Design and implement combinational circuit based on the problem given and minimizing using K-maps.
4.	**Implement code converters.**
a.	Design and implement Binary – to – Gray code converter.
b.	Design and implement Gray – to – Binary code converter.
c.	Design and implement Binary – to – BCD code converter

d.	Design and implement Binary – to – XS-3 code converter
5.	**Implement Adder and Subtractor Arithmetic circuits.**
a.	Design and implement Half adder and Full adder.
b.	Design and implement BCD adder.
c.	Design and implement XS – 3 adder.
d.	Design and implement binary subtractor.
e.	Design and implement BCD subtractor.
f.	Design and implement XS – 3 subtractor.
6.	**Implement Arithmetic circuits.**
a.	Design and implement a 2-bit by 2-bit multiplier.
b.	Design and implement a 2-bit comparator.
7.	**Implement Encode and Decoder and Multiplexer and Demultiplexers.**
a.	Design and implement 8:3 encoder.
b.	Design and implement 3:8 decoder.
c.	Design and implement 4:1 multiplexer. Study of IC 74153, 74157
d.	Design and implement 1:4 demultiplexer. Study of IC 74139
e.	Implement the given expression using IC 74151 8:1 multiplexer.
f.	Implement the given expression using IC 74138 3:8 decoder.
8.	**Study of flip-flops and counters.**
a.	Study of IC 7473.
b.	Study of IC 7474.
c.	Study of IC 7476.
d.	Conversion of Flip-flops.
e.	Design of 3-bit synchronous counter using 7473 and required gates.
f.	Design of 3-bit ripple counter using IC 7473.
9.	**Study of counter ICs and designing Mod-N counters.**
a.	Study of IC 7490, 7492, 7493 and designing mod-n counters using these.
b.	Designing mod-n counters using IC 7473 and 7400 (NAND gates)
10.	**Design of shift registers and shift register counters.**
a.	Design serial – in serial – out, serial – in parallel – out, parallel – in serial – out, parallel – in parallel – out and bidirectional shift registers using IC 7474.
b.	Study of ID 7495.
c.	Implementation of digits using seven segment displays.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Digital Electronics and Logic Design	N. G. Palan	Technova		
2.	Digital Principles and Applications	Malvino and Leach	Tata McGraw Hill		

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

Operating System

Unit I	**Introduction:** What is an operating system? History of operating system, computer hardware, different operating systems, operating system concepts, system calls, operating system structure. **Processes and Threads:** Processes, threads, interprocess communication, scheduling, IPC problems.	**12 Lectures**
Unit II	**Memory Management:** No memory abstraction, memory abstraction: address spaces, virtual memory, and page replacement algorithms, design issues for paging systems, implementation issues, and segmentation. **File Systems:** Files, directories, file system implementation, file-system management and optimization, MS-DOS file system, UNIX V7 file system, CD ROM file system.	**12 Lectures**
Unit III	**Input-Output:** Principles of I/O hardware, Principles of I/O software, I/O software layers, disks, clocks, user interfaces: keyboard, mouse, monitor, thin clients, power management, **Deadlocks:** Resources, introduction to deadlocks, the ostrich algorithm, deadlock detection and recovery, deadlock avoidance, deadlock prevention, issues.	**12 Lectures**
Unit IV	**Virtualization and Cloud:** History, requirements for virtualization, type 1 and 2 hypervisors, techniques for efficient virtualization, hypervisor microkernels, memory virtualization, I/O virtualization, Virtual appliances, virtual machines on multicore CPUs, Clouds. **Multiple Processor Systems** Multiprocessors, multicomputers, distributed systems.	**12 Lectures**
Unit V	**Case Study on LINUX and ANDROID:** History of Unix and Linux, Linux Overview, Processes in Linux, Memory management in Linux, I/O in Linux, Linux file system, security in Linux. Android **Case Study on Windows:** History of windows through Windows 10, programming windows, system structure, processes and threads in windows, memory management, caching in windows, I/O in windows, Windows NT file System, Windows power management, Security in windows.	**12 Lectures**

Books and References:				
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**
1.	Modern Operating Systems	Andrew S. Tanenbaum, Herbert Bos	Pearson	4th
2.	Operating Systems – Internals and Design Principles	Willaim Stallings	Pearson	8th
3.	Operating System Concepts	Abraham Silberschatz, Peter B. Galvineg Gagne	Wiley	8th
4.	Operating Systems	Godbole and Kahate	McGraw Hill	3rd

List of Practical	
1.	Installation of virtual machine software.
2.	Installation of Linux operating system (RedHat / Ubuntu) on virtual machine.
3.	Installation of Windows operating system on virtual machine.
4.	**Linux commands: Working with Directories:**
a.	pwd, cd, absolute and relative paths, ls, mkdir, rmdir,
b.	file, touch, rm, cp. mv, rename, head, tail, cat, tac, more, less, strings,chmod
5.	**Linux commands: Working with files:**
a.	ps, top, kill, pkill, bg, fg,
b.	grep, locate, find, locate.
c.	date, cal, uptime, w, whoami, finger, uname, man, df, du, free, whereis, which.
d.	Compression: tar, gzip.
6.	**Windows (DOS) Commands – 1**
a.	Date, time, prompt, md, cd, rd, path.
b.	Chkdsk, copy, xcopy, format, fidsk, cls, defrag, del, move.
7.	**Windows (DOS) Commands – 2**
a.	Diskcomp, diskcopy, diskpart, doskey, echo
b.	Edit, fc, find, rename, set, type, ver
8.	**Working with Windows Desktop and utilities**
a.	Notepad
b.	Wordpad
c.	Paint
d.	Taskbar
e.	Adjusting display resolution
f.	Using the browsers

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

g.	Configuring simple networking
h.	Creating users and shares
9.	**Working with Linux Desktop and utilities**
a.	The vi editor.
b.	Graphics
c.	Terminal
d.	Adjusting display resolution
e.	Using the browsers
f.	Configuring simple networking
g.	Creating users and shares
10.	**Installing utility software on Linux and Windows**

Discreate Mathematics

Unit I	**Introduction**: Variables, The Language of Sets, The Language of Relations and Function **Set Theory**: Definitions and the Element Method of Proof, Properties of Sets, Disproofs, Algebraic Proofs, Boolean Algebras, Russell's Paradox and the Halting Problem. **The Logic of Compound Statements**: Logical Form and Logical Equivalence, Conditional Statements, Valid and Invalid Arguments	**12 Lectures**
Unit II	**Quantified Statements**: Predicates and Quantified Statements, Statements with Multiple Quantifiers, Arguments with Quantified Statements **Elementary Number Theory and Methods of Proof**: Introduction to Direct Proofs, Rational Numbers, Divisibility, Division into Cases and the Quotient-Remainder Theorem, Floor and Ceiling,Indirect Argument: Contradiction and Contraposition, Two Classical Theorems, Applications in algorithms.	**12 Lectures**
Unit III	**Sequences, Mathematical Induction, and Recursion**: Sequences, Mathematical Induction, Strong Mathematical Induction and the Well-OrderingPrincipleforttheIntegers,Correctnessofalgorithms,defining sequencesrecursively,solvingrecurrencerelationsbyiteration,Second order linear homogenous recurrence relations with constant coefficients. General recursive definitions and structural induction. **Functions**: Functions Defined on General Sets, One-to-One and Onto, Inverse Functions, Composition of Functions, Cardinality with Applications to Computability	**12 Lectures**
Unit IV	**Relations**: Relations on Sets, Reflexivity, Symmetry, and Transitivity, Equivalence Relations, Partial Order Relations **Graphs and Trees**: Definitions and Basic Properties, Trails ,Paths, and Circuits, Matrix Representations of Graphs, Isomorphism's of Graphs, Trees, Rooted Trees, Isomorphism's of Graphs, Spanning	**12 Lectures**

	trees and shortest paths.	
Unit V	**Counting and Probability:** Introduction, Possibility Trees and the Multiplication Rule, Possibility Trees and the Multiplication Rule, Counting Elements of Disjoint Sets: The Addition Rule, The Pigeonhole Principle, Counting Subsets of a Set: Combinations, r-Combinations with Repetition Allowed, Probability Axioms and Expected Value, Conditional Probability, Bayes' Formula, and Independent Events.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Discrete Mathematics with Applications	Sussana S. Epp	Cengage Learning	4th	2010
2.	Discrete Mathematics, Schaum's Outlines Series	Seymour Lipschutz, Marc Lipson	Tata MCGraw Hill		2007
3.	Discrete Mathematics and its Applications	Kenneth H. Rosen	Tata MCGraw Hill		
4.	Discrete mathematical structures	B Kolman RC Busby, S Ross	PHI		
5.	Discrete structures	Liu	Tata MCGraw Hill		

List of Practical: Write the programs for the following using SCILAB	
1.	**Set Theory**
a.	Inclusion Exclusion principle.
b.	Power Sets
c.	Mathematical Induction
2.	**Functions and Algorithms**
a.	Recursively defined functions
b.	Cardinality
c.	Polynomial evaluation
d.	Greatest Common Divisor
3.	**Counting**
a.	Sum rule principle
b.	Product rule principle
c.	Factorial
d.	Binomial coefficients
e.	Permutations
f.	Permutations with repetitions
g.	Combinations
h.	Combinations with repetitions
i.	Ordered partitions

j.	Unordered partitions
4.	**Probability Theory**
a.	Sample space and events
b.	Finite probability spaces
c.	Equiprobable spaces
d.	Addition Principle
e.	Conditional Probability
f.	Multiplication theorem for conditional probability
g.	Independent events
h.	Repeated trials with two outcomes
5.	**Graph Theory**
a.	Paths and connectivity
b.	Minimum spanning tree
c.	Isomorphism
6.	**Directed Graphs**
a.	Adjacency matrix
b.	Path matrix
7.	**Properties of integers**
a.	Division algorithm
b.	Primes
c.	Euclidean algorithm
d.	Fundamental theorem of arithmetic
e.	Congruence relation
f.	Linear congruence equation
8.	**Algebraic Systems**
a.	Properties of operations
b.	Roots of polynomials
9.	**Boolean Algebra**
a.	Basic definitions in Boolean Algebra
b.	Boolean algebra as lattices
10.	**Recurrence relations**
a.	Linear homogeneous recurrence relations with constant coefficients
b.	Solving linear homogeneous recurrence relations with constant coefficients
c.	Solving general homogeneous linear recurrence relations

Introduction to C++ programming		
Unit I	**The Seven Cs of Effective Communication:** Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness **Understanding Business Communication:** Nature and Scope of Communication, Non-verbal Communication, Cross-cultural communication, Technology-enabled Business Communication	**12 Lectures**
Unit II	**Writing Business Messages and Documents:** Business writing, Business Correspondence, Instructions Business Reports and Proposals, Career building and Resume writing. **Developing Oral Communication Skills for Business:** Effective Listening, Business Presentations and Public Speaking, Conversations, Interviews	**12 Lectures**
Unit III	**Developing Oral Communication Skills for Business:** Meetings and Conferences, Group Discussions and Team Presentations, Team Briefing, **Understanding Specific Communication Needs:** Communication across Functional Areas	**12 Lectures**
Unit IV	**Understanding Specific Communication Needs:** Corporate Communication, Persuasive Strategies in Business Communication, Ethics in Business Communication, Business Communication Aids	**12 Lectures**
Unit V	**Presentation Process:** Planning the presentations, executing the presentations, Impressing the audience by performing, Planning stage: Brainstorming, mind maps / concept maps, executing stage: chunking theory, creating outlines, Use of templates. Adding graphics.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Business Communication	Edited by Meenakshi Raman and Prakash Singh	Oxford University Press	Second	
2.	Professional Communication	Aruna Koneru	Tata McGraw Hill		
3.	Strategies for improving your business communication	Prof. M. S. Rao	Shroff publishers and distributors		2016
4.	Business Communication	Dr. Rishipal and Dr. Jyoti Sheoran	SPD		2014

5.	Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials	Ruth C. Clark, Chopeta Lyons,	Pfeiffer, Wiley		2011
6.	Basic Business Communication: Skills for Empowering the Internet Generation	Lesikar Raymond V and Marie E. Flatley.	Tata McGraw-Hill	10th	2005
7.	Nonverbal Communication: Notes on the Visual Perception of Human Relations	Ruesh, Jurgen and Weldon Kees	University of California Press		1966
8.	Business Communication Today	Bovee,Courtl and L.; Thill, John V.	Pearson Education Ltd.		2015
9.	Communication Skills	Dr. Nageshwar Rao Dr.Rajendra P. Das	Himalaya Publishing House		

List of Practical Questions:	
1.	**Communication Origami, Guessing Game, Guessing the emotion**
2.	**Body Language, Follow All Instructions, Effective Feedback Skills**
3.	**The Name Game, Square Talk (Effective Communication), Room 101 (Influential and persuasive skills)**
4.	**Back to Back Communication, Paper Shapes (Importance of two-way communication), Memory Test(Presentation Skills)**
5.	**Exercises on Communication Principles**
6.	**Exercises on communication icebreakers**
7.	**Communication exercises**
	For the following practical, Microsoft Office, Open Office or any other software suite can be used.
8.	**Use of word processing tools for communication**
9.	**Use of spreadsheet tools for communication**
10.	**Use of presentation tools for communication**

F.Y.B.Sc. IT Semester II

Object Oriented Programming		
Unit I	**Object Oriented Methodology**: Introduction, Advantages and Disadvantages of Procedure Oriented Languages, what is Object Oriented? What is Object Oriented Development? Object Oriented Themes, Benefits and Application of OOPS. **Principles of OOPS:** OOPS Paradigm, Basic Concepts of OOPS: Objects, Classes, Data Abstraction and Data Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing	**12 Lectures**
Unit II	**Classes and Objects:** Simple classes (Class specification, class members accessing), Defining member functions, passing object as an argument, Returning object from functions, friend classes, Pointer to object, Array of pointer to object. **Constructors and Destructors:** Introduction, Default Constructor, Parameterized Constructor and examples, Destructors Using <STYLE> tag, Inline style information.	**12 Lectures**
Unit III	**Polymorphism:** Concept of function overloading, overloaded operators, overloading unary and binary operators, overloading comparison operator ,overloading arithmetic assignment operator ,Data Conversion between objects and basic types, **Virtual Functions:** Introduction and need, Pure Virtual Functions, Static Functions, this Pointer, abstract classes, virtual destructors, onSubmit, onUnload	**12 Lectures**
Unit IV	**Program development using Inheritance:** Introduction, Understanding inheritance, Advantages provided by inheritance, choosing the access specifier, Derived class declaration, derived class constructors, class hierarchies, multiple inheritance, multilevel inheritance, containership, hybrid inheritance. **Exception Handling:** Introduction, Exception Handling Mechanism, Concept of throw & catch with example	**12 Lectures**
Unit V	**Templates:** Introduction, Function Template and examples, Class Template and examples. **Working with Files:** Introduction, File Operations, Various File Modes, File Pointer and their Manipulation	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Object Oriented Analysis and Design	Timothy Budd	TMH	3rd	2012
2.	Mastering C++	K R Venugopal, Rajkumar Buyya, T Ravishankar	Tata McGraw Hill	2nd Edition	2011
3.	C++ for beginners	B. M. Hirwani	SPD		2013
4.	Effective Modern C++	Scott Meyers	SPD		

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

5.	Object Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill	4th	
6.	Learning Python	Mark Lutz	O' Reilly	5th	2013
7.	Mastering Object Oriented Python	Steven F. Lott	Pact Publishing		2014

List of Practical: To be implemented using object oriented language	
1.	**Classes and methods**
a.	Designanemployeeclassforreadinganddisplayingtheemployeeinformation,the getInfo() and displayInfo() methods will be used respectively. Where getInfo() will be private method
b.	Design the class student containing getData() and displayData() as two of its methods which will be used for reading and displaying the student information respectively. Where getData() will be private method.
c.	Design the class Demo which will contain the following methods: readNo(), factorial() for calculating the factorial of a number, reverseNo() will reverse the given number, isPalindrome() will check the given number is palindrome, isArmstrong() which will calculate the given number is armStrong or not.Where readNo() will be private method.
d.	Write a program to demonstrate function definition outside class and accessing class members in function definition.
2.	**Using friend functions.**
a.	Write a friend function for adding the two complex numbers, using a single class
b.	Write a friend function for adding the two different distances and display its sum, using two classes.
c.	Write a friend function for adding the two matrix from two different classes and display its sum.
3.	**Constructors and method overloading.**
a.	Design a class Complex for adding the two complex numbers and also show the use of constructor.
b.	Design a class Geometry containing the methods area() and volume() and also overload the area() function .
c.	Design a class StaticDemo to show the implementation of static variable and static function.
4.	**Operator Overloading**
a.	Overload the operator unary (-) for demonstrating operator overloading.
b.	Overloadtheoperator+foraddingthetimingsoftwoclocks,Andalsopassobjects as an argument.
c.	Overload the + for concatenating the two strings. For e.g "Py" + "thon" = Python
5.	**Inheritance**
a.	Design a class for single level inheritance using public and private type derivation.
b.	Design a class for multiple inheritance.
c.	Implement the hierarchical inheritance.
6.	**Virtual functions and abstract classes**

a.	Implement the concept of method overriding.
b.	Show the use of virtual function
c.	Show the implementation of abstract class.
7.	**String handling**
a.	String operations for string length , string concatenation
b.	String operations for string reverse, string comparison,
c.	Console formatting functions.
8.	**Exception handling**
a.	Show the implementation of exception handling
b.	Show the implementation for exception handling for strings
c.	Show the implementation of exception handling for using the pointers.
9.	**File handling**
a.	Design a class FileDemo open a file in read mode and display the total number of words and lines in the file.
b.	Design a class to handle multiple files and file operations
c.	Design a editor for appending and editing the files
10.	**Templates**
a.	Show the implementation for the following
b.	Show the implementation of template class library for swap function.
c.	Design the template class library for sorting ascending to descending and vice-Versa

Microprocessor Architecture		
Unit I	**Microprocessor, microcomputers, and Assembly Language:** Microprocessor, Microprocessor Instruction Set and Computer Languages, From Large Computers to Single-Chip Microcontrollers, Applications. **Microprocessor Architecture and Microcomputer System:** Microprocessor Architecture and its operation's, Memory, I/O Devices, Microcomputer System, Logic Device Interfacing, Microprocessor-Based System Application. **8085 Microprocessor Architecture and Memory Interface:** Introduction, 8085 Microprocessor unit, 8085-Based microcomputer, Memory Interfacing, Interfacing the 8155 Memory Segment, Illustrative Example: Designing Memory for the MCTS Project, Testing and Troubleshooting Memory Interfacing Circuit, 8085-BasedSingle-Board microcomputer.	**12 Lectures**
Unit II	**Interfacing of I/O Devices** Basic Interfacing concepts, Interfacing Output Displays, Interfacing	**12 Lectures**

	Input Devices, Memory Mapped I/O, Testing and Troubleshooting I/O Interfacing Circuits. **Introduction to 8085 Assembly Language Programming:** The 8085 Programming Model, Instruction Classification, Instruction, Data and Storage, writing assembling and Execution of a simple program, Overview of 8085 Instruction Set, Writing and Assembling Program. **Introduction to 8085 Instructions:** Data Transfer Operations, Arithmetic Operations, Logic Operation, Branch Operation, Writing Assembly Languages Programs, Debugging a Program.	
Unit III	**Programming Techniques with Additional Instructions:** Programming Techniques: Looping, Counting and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Instruction Related to Memory, Logic Operations: Rotate, Logics Operations: Compare, Dynamic Debugging. **Counters and Time Delays:** Counters and Time Delays, Illustrative Program: Hexadecimal Counter, Illustrative Program: zero-to-nine (Modulo Ten) Counter, Generating Pulse Waveforms, Debugging Counter and Time-Delay Programs. **Stacks and Sub-Routines:** Stack, Subroutine, Restart, Conditional Call, Return Instructions, Advanced Subroutine concepts.	**12 Lectures**
Unit IV	**Code Conversion, BCD Arithmetic, and 16-Bit Data Operations:** BCD-to-Binary Conversion, Binary-to-BCD Conversion, BCD-to-Seven-Segment-LED Code Conversion, Binary-to-ASCII and ASCII-to-Binary Code Conversion, BCD Addition, BCD Subtraction, Introduction To Advanced Instructions and Applications, Multiplication, Subtraction With Carry. **Software Development System and Assemblers:** Microprocessors-Based Software Development system, Operating System and Programming Tools, Assemblers and Cross-Assemblers, Writing Program Using Cross Assemblers. **Interrupts:** The 8085 Interrupt, 8085 Vectored Interrupts, Restart as S/W Instructions, Additional I/O Concepts and processes.	**12 Lectures**
Unit V	**The Pentium and Pentium Pro microprocessors:** Introduction, Special Pentium registers, Memory management, Pentium instructions, Pentium Pro microprocessor, Special Pentium Prefectures. **Core 2 and later Microprocessors:** Introduction, Pentium II software changes, Pentium IV and Core 2, i3, i5 and i7. **SUN SPARC Microprocessor:** Architecture, Register file, data types and instruction format	**12 Lectures**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**

1.	Microprocessors Architecture, Programming and Applications with the 8085.	Ramesh Gaonkar	PENRAM	Fifth	2012
2.	Computer System Architecture	M. Morris Mano	PHI		1998
3.	Structured Computer Organization	Andrew C. Tanenbaum	PHI		

List of Practical	
1.	**Perform the following Operations related to memory locations.**
a.	Store the data byte 32H into memory location 4000H.
b.	Exchange the contents of memory locations 2000H and 4000H
2.	**Simple assembly language programs.**
a.	Subtract the contents of memory location 4001H from the memory location 2000H and place the result in memory location 4002H.
b.	Subtract two 8-bit numbers.
c.	Addthe16-bitnumberinmemorylocations4000Hand4001Htothe16-bitnumber in memory locations 4002H and 4003H. The most significant eight bits of the two numberstobeaddedareinmemorylocations4001Hand4003H.Storetheresultin memorylocations4004Hand4005Hwiththemostsignificantbyteinmemory location 4005H.
d.	Add the contents of memory locations 40001H and 4001H and place the result in the memory locations 4002Hand 4003H.
e.	Subtract the 16-bit number in memory locations 4002H and 4003H from the 16-bit number in memory locations 4000H and 4001H. The most significant eight bits of the two numbers are in memory locations 4001H and 4003H. Store the result in memory locations 4004H and 4005H with the most significant byte in memory location 4005H.
f.	Find the l's complement of the number stored at memory location 4400H and store the complemented number at memory location 4300H.
g.	Find the 2's complement of the number stored at memory location 4200H and store the complemented number at memory location 4300H.
3.	**Packing and unpacking operations.**
a.	PackthetwounpackedBCDnumbersstoredinmemorylocations4200Hand4201H and store result in memory location 4300H. Assume the least significant digit is stored at 4200H.
b.	Two-digit BCD number is stored in memory location 4200H. Unpack the BCD number and store the two digits in memory locations 4300H and 4301H such that memory location 4300H will have lower BCD digit.
4.	**Register Operations.**
a.	Write a program to shift an eight-bit data four bits right. Assume that data is in register C.
b.	Program to shift a 16-bit data 1 bit left. Assume data is in the HL register pair
c.	Write a set of instructions to alter the contents of flag register in 8085.

d.	Write a program to count number of l's in the contents of D register and store the count in the B register.
5.	**Multiple memory locations.**
a.	Calculate the sum of series of numbers. The length of the series is in memory location4200 Hand the series begins from memory location 4201H.a. Consider the sum to be 8bitnumber.So, ignorecarries.Storethesumatmemorylocation4300H. b. Consider the sum to be 16 bit number. Store the sum at memory locations 4300H and 4301H
b.	Multiply two 8-bit numbers stored in memory locations 2200H and 2201H by repetitive addition and store the result in memory locations 2300H and 2301H.
c.	Divide 16-bit number stored in memory locations 2200H and 2201H by the 8 bit number stored at memory location 2202H. Store the quotient in memory locations 2300H and 2301H and remainder in memory locations 2302H and 2303H.
d.	Find the number of negative elements (mostsignificantbit1) in a block of data. The length of the block is in memory location 2200H and the block itself begins in memorylocation2201H.Storethenumberofnegativeelementsinmemorylocation 2300H
e.	Find the largest number in a block of data. The length of the block is in memory location 2200H and the block itself starts from memory location 2201H. Store the Maximum num berinmemorylocation2300H.Assume that the number sin the block are all 8-bitunsigned binary numbers.
6.	**Calculations with respect to memory locations.**
a.	Write a program to sort given 10 numbers from memory location 2200H in the ascending order.
b.	Calculate the sum of series of ven numbers from the list of numbers. The length of the list is in memory location 2200H and the series itself begins from memory location 2201H. Assume the sum to be 8 bit number so you can ignore carries and store the sum at memory location 2Sample problem:
c.	Calculate the sum of series of odd numbers from the list of numbers. The length of the list is in memory location 2200H and the series itself begins from memory location 2201H. Assume the sum to be 16-bit. Store the sum at memory locations 2300H and 2301H.
d.	Find the square of the given numbers from memory location 6100H and store the result from memory location 7000H
e.	Search the given byte in the list of 50 numbers stored in the consecutive memory locations and store the address of memory location in the memory locations 2200H and2201H.AssumebyteisintheCregisterandstartingaddressofthelist is2000H. If byte is not found store 00 at 2200H and 2201H
f.	Two decimal numbers six digits each, are stored in BCD package form. Each number occupies a sequence of byte in the memory. The starting address of first numberis6000HWriteanassemblylanguageprogramthataddsthesetwonumbers and stores the sum in the same format starting from memory location 6200H
g.	Add2arrayshavingten8-bitnumber search and generate third array of result. It is necessary to add the first element of array 1 with the first element of array-2 and so on.Thestartingaddressesofarrayl,array2andarray3are2200H,2300Hand 2400H, respectively
7.	**Assembly programs on memory locations.**

a.	Write an assembly language program to separate even numbers from the given list of 50 numbers and store them in another list starting from 2300H. Assume starting address of 50 number list is 2200H
b.	Write assembly language program with proper comments for the following: A block of data consisting of 256 bytes is stored in memory starting at 3000H. This block is to be shifted (relocated) in memory from 3050H onwards. Do not shift the block or part of the block anywhere else in the memory.
c.	Add even parity to a string of 7-bit ASCII characters. The length of the string is in memory location 2040H and the string itself begins in memory location 2041H. Place even parity in the most significant bit of each character.
d.	A list of 50 numbers is stored in memory, starting at 6000H. Find number of negative, zero and positive numbers from this list and store these results in memory locations 7000H, 7001H, and 7002H respectively
e.	Write an assembly language program to generate fibonacci number.
f.	Program to calculate the factorial of a number between 0 to 8.
8.	**String operations in assembly programs.**
a.	Write an 8085-assembly language program to insert a string of four characters from the tenth location in the given array of 50 characters
b.	Write an 8085-assembly language program to delete a string of 4 characters from the tenth location in the given array of 50 characters.
c.	Multiplythe8-bitunsignednumberinmemorylocation2200Hbythe8-bitunsigned number in memory location 2201H. Store the 8 least significant bits of the result in memory location 2300H and the 8 most significant bits in memory location 2301H.
d.	Divide the 16-bit unsigned number in memory locations 2200H and 2201H (most significant bits in 2201H) by the B-bit unsigned number in memory location 2300H store the quotient in memory location 2400H and remainder in 2401H
e.	DAA instruction is not present. Write a sub routine which will perform the same task as DAA.
9.	**Calculations on memory locations.**
a.	TotestRAMbywriting'1'andreadingitbackandlaterwriting'0'(zero)andreading it back. RAM addresses to be checked are 40FFH to 40FFH. In case of any error, it is indicated by writing 01H at port 10
b.	Arrange an array of 8-bit unsigned no in descending order
c.	Transfer ten bytes of data from one memory to another memory block. Source memory block starts from memory location 2200H whereas destination memory block starts from memory location 2300H
d.	Write a program to find the Square Root of an 8-bit binary number. The binary number is stored in memory location 4200H and store the square root in 4201H.
e.	Write a simple program to Split a HEX data into two nibbles and store it in memory
10.	**Operations on BCD numbers.**
a.	Add two 4-digit BCD numbers in HL and DE register pairs and store result in memory locations, 2300H and 2301H. Ignore carry after 16 bits.
b.	Subtract the BCD number stored in E register from the number stored in the D Register
c.	Write an assembly language program to multiply 2 BCD numbers

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Microprocessors Architecture, Programming and Applications with the 8085.	Ramesh Gaonkar	PENRAM	Fifth	2012
2.	8080A/8085 Assembly Language Programming	Lance A. Leventhel	Osborne		1978

Web Technology		
Unit I	**Internet and the World Wide Web:** What is Internet? Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address, World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers–internet explorer, Netscape navigator, opera, Firefox, chrome, Mozilla. Search engine, webserver–apache ,IIS, proxy server, HTTP protocol **HTML5:** Introduction, Why HTML5? Formatting text by using tags, using lists and backgrounds, Creating hyperlinks and anchors. Style sheets, CSS formatting text using style sheets, formatting paragraphs using style sheets.	**12 Lectures**
Unit II	**HTML5 Page layout and navigation:** Creating navigational aids: planning site organization, creating text-based navigation bar, creating graphics based navigation bar, creating graphical navigation bar, creating image map, redirecting to another URL, creating division based layouts: HTML5 semantic tags, creating divisions, creating HTML5semanticlayout, positioning and formatting divisions. **HTML5 Tables, Forms and Media:** Creating tables: creating simple table, specifying the size of the table, specifying the width of the column ,merging table cells, using tables for page layout, formatting tables: applying table borders, applying background and foreground fills, changing cell padding, spacing and alignment, creating user forms: creating basic form, using check boxes and option buttons, creating lists, additional input types in HTML5, Incorporating sound and video: audio and video in HTML5, HTML multimedia basics, embedding video clips, incorporating audio on webpage.	**12 Lectures**
Unit III	**Java Script:** Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security, **Operators**: Assignment Operators, Comparison Operators, Arithmetic Operators, % (Modulus), ++(Increment), --(Decrement), -(Unary Negation), Logical Operators, Short-Circuit Evaluation, String Operators, Special Operators, ?: (Conditional operator), , (Comma operator), delete, new, this, void	**12 Lectures**

	Statements: Break, comment, continue, delete, do...while, export, for, for...in, function, if...else, import, labelled, return, switch, var, while, with, **Core JavaScript (Properties and Methods of Each) :** Array, Boolean, Date, Function, Math, Number, Object, String, regExp **Document and its associated objects:** document, Link, Area, Anchor, Image, Applet, Layer **Events and Event Handlers:** General Information about Events, Defining Event Handlers, event, onAbort, onBlur, onChange, onClick, onDblClick, onDragDrop, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onMove,onReset, onResize, onSelect, onSubmit, onUnload	
Unit IV	**PHP:** Why PHP and MySQL? Server-side scripting, PHP syntax and variables, comments, types, control structures, branching, looping, termination, functions, passing information with PHP, GET, POST, formatting form variables, super global arrays, strings and string functions, regular expressions, arrays, number handling, basic PHP errors/problems	**12 Lectures**
Unit V	**Advanced PHP and MySQL:** PHP/MySQL Functions, Integrating web forms and databases, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, E-Mail	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Web Design The Complete Reference	Thomas Powell	Tata McGraw Hill		-
2.	HTML5 Step by Step	Faithe Wempen	Microsoft Press		2011
3.	PHP 5.1 for Beginners	Ivan Bayross Sharanam Shah,	SPD		2013
4.	PHP Project for Beginners	SharanamShah, Vaishali Shah	SPD		2015
5.					
6.	PHP 6 and MySQL Bible	Steve Suehring, Tim Converse, Joyce Park	Wiley		2009
7.	Head First HTML 5 programming	Eric Freeman	O'Reilly		2013
8.	JavaScript 2.0: The Complete Reference	Thomas Powell and Fritz Schneider	Tata McGraw Hill	2nd	

List of Practical	
1.	**Use of Basic Tags**
a.	Design a web page using different text formatting tags.
b.	Design a web page with links to different pages and allow navigation between web pages.
c.	Design a web page demonstrating all Style sheet types
2.	**Image maps, Tables, Forms and Media**
a.	Design a web page with Image maps.
b.	Design a web page demonstrating different semantics
c.	Design a web page with different tables. Design a webpage using table so that the content appears well placed.
d.	Design a web page with a form that uses all types of controls.
e.	Design a web page embedding with multimedia features.
3.	**Java Script**
a.	Using JavaScript design, a web page that prints factorial/Fibonacci series/any given series.
b.	Design a form and validate all the controls placed on the form using Java Script.
c.	Write a JavaScript program to display all the prime numbers between 1 and 100.
a.	Write a JavaScript program to accept a number from the user and display the sum of its digits.
d.	Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function).
e.	Write a java script program to design simple calculator.
4.	**Control and looping statements and Java Script references**
a.	Design a web page demonstrating different conditional statements.
b.	Design a web page demonstrating different looping statements.
c.	Design a web page demonstrating different Core JavaScript references (Array, Boolean, Date, Function, Math, Number, Object, String, regExp).
5.	**Basic PHP I**
a.	Write a PHP Program to accept a number from the user and print it factorial.
b.	WriteaPHPprogramtoacceptanumberfromtheuserandprintwhetheritisprime or not.
6.	**Basic PHP II**
a.	Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.
b.	Write a PHP program to display the following Binary Pyramid: 1 0 1 1 0 1 0 1 0 1
7.	**String Functions and arrays**
a.	Write a PHP program to demonstrate different string functions.
b.	Write a PHP program to create one dimensional array.

8.	**PHP and Database**
a.	Write a PHP code to create: • Create a database College • Create a table Department (Dname, Dno,Number_Of_faculty)
b.	Write a PHP program to create a database named "College". Create a table named "Student" with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to75 in a tabular format.
c.	Design a PHP page for authenticating a user.
9.	**Email**
a.	Write a program to send email with attachment.
10.	**Sessions and Cookies**
a.	Write a program to demonstrate use of sessions and cookies.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	HTML5 Step by Step	Faithe Wempen	Microsoft Press		2011
2.	JavaScript 2.0: The Complete Reference	Thomas Powell and Fritz Schneider	Tata McGraw Hill	2nd	
3.	PHP 6 and MySQL Bible	Steve Suehring, Tim Converse, Joyce Park	Wiley		2009
4.	PHP 5.1 for Beginners	Ivan Bayross Sharanam Shah,	SPD		2013
5.	PHP Project for Beginners	SharanamShah, Vaishali Shah	SPD		2015
6.	Murach's PHP and MySQL	Joel Murach Ray Harris	SPD		2011

Numerical and Statistical Methods

Unit I	**Mathematical Modeling and Engineering Problem Solving:** A Simple Mathematical Model, Conservation Laws and Engineering Problems **Approximations and Round-Off Errors:** Significant Figures, Accuracy and Precision, Error Definitions, Round-Off Errors **Truncation Errors and the Taylor Series:** The Taylor Series, Error Propagation, Total Numerical Errors, Formulation Errors and Data Uncertainty	**12 Lectures**
Unit II	**Solutions of Algebraic and Transcendental Equations:** The Bisection Method, The Newton-Raphson Method, The Regula-falsi method, The Secant Method. **Interpolation:** Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation.	**12 Lectures**
Unit III	**Solution of simultaneous algebraic equations (linear) using iterative methods:** Gauss-Jordan Method, Gauss-Seidel Method. **Numerical differentiation and Integration:** Numberical differentiation, Numerical integration using Trapezoidal Rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules. **Numerical solution of 1st and 2nd order differential equations:** Taylor series, Euler's Method, Modified Euler's Method, Runge-Kutta Method for 1^{st} and 2^{nd} Order Differential Equations.	**12 Lectures**
Unit IV	**Least-Squares Regression:** Linear Regression, Polynomial Regression, Multiple Linear Regression, General Linear Least Squares, Nonlinear Regression **Linear Programming:** Linear optimization problem, Formulation and Graphical solution, Basic solution and Feasible solution.	**12 Lectures**
Unit V	**Random variables:** Discrete and Continuous random variables, Probability density function, Probability distribution of random variables, Expected value, Variance. **Distributions:** Discrete distributions: Uniform, Binomial, Poisson, Bernoulli,Continuous distributions:uniformdistributions,exponential, (derivation of mean and variance only and state other properties and discuss their applications) Normal distribution state all the properties and its applications.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Introductory Methods of Numerical Methods	S. S. Shastri	PHI	Vol – 2	
2.	Numerical Methods for Engineers	Steven C. Chapra, Raymond P. Canale	Tata Mc Graw Hill	6^{th}	2010
3.	Numerical Analysis	Richard L. Burden, J. Douglas Faires	Cengage Learning	9^{th}	2011

Compiled by Ms. Prajakta Joshi (Course Co-ordinator) and Ms. Tanvi Nerurkar (Asst. Professor)
L. S. Raheja College of Arts and Commerce.

4.	Fundamentals of Mathematical Statistics	S. C. Gupta, V. K. Kapoor			
5.	Elements of Applied Mathematics	P.N.Wartikar and J.N.Wartikar	A. V. Griha, Pune	Volume 1 and 2	

List of Practical	
1.	**Iterative Calculation**
a.	Program for iterative calculation.
b.	Program to calculate the roots of a quadratic equation using the formula.
c.	Program to evaluate e^xusing infinite series.
2.	**Solution of algebraic and transcendental equations:**
a.	Program to solve algebraic and transcendental equation by bisection method.
b.	Program to solve algebraic and transcendental equation by false position method.
c.	Program to solve algebraic and transcendental equation by Secant method.
d.	Program to solve algebraic and transcendental equation by Newton Raphson method.
3.	**Interpolation**
a.	Program for Newton's forward interpolation.
b.	Program for Newton's backward interpolation.
c.	Program for Lagrange's interpolation.
4.	**Solving linear system of equations by iterative methods**
a.	Program for solving linear system of equations using Gauss Jordan method.
b.	Program for solving linear system of equations using Gauss Seidel method.
5.	**Numerical Differentiation**
a.	Programing to obtain derivatives numerically.
6.	**Numerical Integration**
a.	Program for numerical integration using Trapezoidal rule.
b.	Program for numerical integration using Simpson's $1/3^{rd}$ rule.
c.	Program for numerical integration usingSimpson's$3/8^{th}$ rule.
7.	**Solution of differential equations**
a.	Program to solve differential equation using Euler's method
b.	Program to solve differential equation using modified Euler's method.
c.	Program to solve differential equation using Runge-kutta 2^{nd} order and 4^{th} order methods.
8.	**Regression**
a.	Program for Linear regression.
b.	Program for Polynomial Regression.
c.	Program for multiple linear regression.
d.	Program for non-linear regression.

9.	**Random variables and distributions**
a.	Program to generate random variables.
b.	Program to fit binomial distribution.
c.	Program to fit Poisson distribution.
10.	**Distributions**
a.	Program for Uniform distribution.
b.	Program for Bernoulli distribution
c.	Program for Negative binomial distribution.

Green Computing		
Unit I	**Overview and Issues:** Problems: Toxins, Power Consumption, Equipment Disposal, Company's Carbon Footprint: Measuring, Details, reasons to bother, Plan for the Future, Cost Savings: Hardware, Power. **Initiatives and Standards:** Global Initiatives: United Nations, Basel Action Network, Basel Convention, North America: The United States, Canada, Australia, Europe, WEEE Directive, RoHS, National Adoption, Asia: Japan, China, Korea.	**12 Lectures**
Unit II	**Minimizing Power Usage:** Power Problems, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Virtualization, Management, Bigger Drives, Involving the Utility Company, Low-Power Computers, PCs, Linux, Components, Servers, Computer Settings, Storage, Monitors, Power Supplies, Wireless Devices, Software. **Cooling:** Cooling Costs, Power Cost, Causes of Cost, Calculating Cooling Needs, Reducing Cooling Costs, Economizers, On-Demand Cooling, HP's Solution, Optimizing Airflow, Hot Aisle/Cold Aisle, Raised Floors, Cable Management, Vapor Seal, Prevent Recirculation of Equipment Exhaust, Supply Air Directly to Heat Sources, Fans, Humidity, Adding Cooling, Fluid Considerations, System Design, Data Centre Design, Centralized Control, Design for Your Needs, Put Everything Together.	**12 Lectures**
Unit III	**Changing the Way of Work:** Old Behaviours,starting at the Top, Process Reengineering with Green in Mind, Analyzing the Global Impact of Local Actions, Steps: Water, Recycling, Energy, Pollutants, Teleworkers and Outsourcing, Telecommuting, Outsourcing, how to Outsource. **Going Paperless:** Paper Problems, The Environment, Costs: Paper and Office, Practicality, Storage, Destruction, Going Paperless, Organizational Realities, Changing Over, Paperless Billing, Handheld Computers vs. the Clipboard, Unified Communications, Intranets, What to Include,	**12 Lectures**

	Building an Intranet, Microsoft Office SharePoint Server 2007, Electronic Data Interchange (EDI), Nuts and Bolts, Value Added Networks, Advantages, Obstacles.	
Unit IV	**Recycling:** Problems, China, Africa, Materials, Means of Disposal, Recycling, Refurbishing, Make the Decision, Life Cycle, from beginning to end, Life, Cost, Green Design, Recycling Companies, Finding the Best One, Checklist, Certifications, Hard Drive Recycling, Consequences, cleaning a Hard Drive, Pros and cons of each method, CDs and DVDs, good and bad about CD and DVDs disposal, Change the mind-set, David vs. America Online **Hardware Considerations:** Certification Programs, EPEAT, RoHS, Energy Star, Computers, Monitors, Printers,Scanners,All-in-Ones,ThinClients,Servers,Blade Servers, Consolidation, Products, Hardware Considerations, Planned Obsolescence, Packaging, Toxins, Other Factors, Remote Desktop, Using Remote Desktop, Establishing a Connection, In Practice	**12 Lectures**
Unit V	**Greening Your Information Systems:** Initial Improvement Calculations, Selecting Metrics, Tracking Progress, Change Business Processes, Customer Interaction, Paper Reduction, Green Supply Chain, Improve Technology Infrastructure, Reduce PCs and Servers, Shared Services, Hardware Costs, Cooling. **Staying Green:** Organizational Check-ups, Chief Green Officer, Evolution, Sell the CEO, SMART Goals, Equipment Check-ups, and Gather Data, Tracking the data, BaselineData, Benchmarking, Analyze Data, ConductAudits Certifications, Benefits, Realities, and Helpful Organizations.	**12 Lectures**

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Green IT	Toby Velte, Anthony Velte, Robert Elsenpeter	McGraw Hill		2008
2.	Green Data Center: Steps for the Journey	Alvin Galea, Michael Schaefer, Mike Ebbers	Shroff Publishers and Distributers		2011
3.	**Books and References:**	Jason Harris	Emereo		
4.	Green Computing Tools and Techniques for Saving Energy, Money and Resources	Bud E. Smith	CRC Press		2014

Project and Viva Voce	
1.	**A project should be done based on the objectives of Green Computing. Report minimum 50 pages should be prepared. The report should have a font size of 12, Times new roman and 1.5 line spacing. The headings should have font size 14. The report should be hard bound.**
2.	**The project can be done individually or a group of two students.**
3.	**The students will have to present the project during the examination.**
4.	**A certified copy of the project report is essential to appear for the examination.**

S.Y. BSc. IT Semester III

Python Programming		
Unit – I	**Introduction:** The Python Programming Language, History, features, Installing Python, Running Python program, Debugging: Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The Difference Between Brackets, Braces, and Parentheses, **Variables and Expressions** Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. **Conditional Statements:** if, if-else, nested if –else **Looping**: for, while, nested loops **Control statements:** Terminating loops, skipping specific conditions	**12 Lectures**
Unit – II	**Functions:** Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, Checking Types **Strings:** A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations.	**12 Lectures**
Unit – III	**Lists:** Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, `In` Operator, Built-in List functions and methods **Tuples and Dictionaries:** Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, `in` Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of	**12 Lectures**

	Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods **Files:** Text Files, The File Object Attributes, Directories **Ex** with Arguments, User-defined Exceptions **captions:** Built-in Exceptions, Handling Exceptions, Exception	
Unit – IV	**Regular Expressions –** Concept of regular expression, various types of regular expressions, using match function. **Classes and Objects:** Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Data Hiding **Multithreaded Programming:** Thread Module, creating a thread, synchronizing threads, multithreaded priority queue **Modules:** Importing module, Creating and exploring modules, Math module, Random module, Time module	**12 Lectures**
Unit - V	**Creating the GUI Form and Adding Widgets:** **Widgets:** Button, Canvas, Checkbutton, Entry, Frame, Label, Listbox, Menubutton, Menu, Message, Radio button, Scale, Scrollbar, text, Toplevel, Spinbox, PanedWindow, LabelFrame, tkMessagebox. Handling Standard attributes and Properties of Widgets. **Layout Management:** Designing GUI applications with proper Layout Management features. **Look and Feel Customization**: Enhancing Look and Feel of GUI using different appearances of widgets. **Storing Data in Our MySQL Database via Our GUI: Connecting** to a MySQL database from Python, Configuring the MySQL connection, Designing the Python GUI database, Using the INSERT command, Using the UPDATE command, Using the DELETE command, Storing and retrieving data from MySQL database.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Think Python	Allen Downey	O'Reilly	1st	2012
2.	An Introduction to Computer Science using Python 3	JasonMontojo, JenniferCampbell, Paul Gries	SPD	1st	2014
3.	Python GUI Programming Cookbook	Burkhard A. Meier	Packt		2015
4.	Introduction to Problem Solving with Python	E. Balagurusamy	TMH	1st	2016
5.	Murach's Python Programming	Joel Murach, Michael Urban	SPD	1st	2017

6.	Object-oriented Programming in Python	Michael H. Goldwasser, David Letscher	Pearson Prentice Hall	1st	2008
7.	Exploring Python	Budd	TMH	1st	2016

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Think Python	Allen Downey	O'Reilly	1st	2012
2.	An Introduction to Computer Science using Python 3	Jason Montojo, Jennifer Campbell, Paul Gries	SPD	1st	2014

List of Practical	
1.	**Write the program for the following:**
a.	Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years Old.
b.	Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user.
c.	Write a program to generate the Fibonacci series.
d.	Write a function that reverses the user defined value.
e.	Write a function to check the input value is Armstrong and also write the function for Palindrome.
f.	Write a recursive function to print the factorial for a given number.
2.	**Write the program for the following:**
a.	Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise.
b.	Define a function that computes the *length* of a given list or string.

c.	Define a *procedure* `histogram ()` that takes a list of integers and prints a histogram to the screen. For example, `histogram ([4, 9, 7])` should print the following:
	
	`****`
	`*********`
	`*******`

3.	**Write the program for the following:**
a.	A *pangram* is a sentence that contains all the letters of the English alphabet at least once, for example: *The quick brown fox jumps over the lazy dog*. Your task here is to write a function to check a sentence to see if it is a pangram or not.

b.	Take a list, say for example this one: `a=[1,1,2,3,5,8,13,21,34,55,89]` and write a program that prints out all the elements of the list that are less than 5.
4.	**Write the program for the following:**
a.	Write a program that takes two lists and returns True if they have at least one common member.
b.	Write a Python program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.
c.	Write a Python program to clone or copy a list
5.	**Write the program for the following:**
a.	Write a Python script to sort (ascending and descending) a dictionary by value.
b.	Write a Python script to concatenate following dictionaries to create a new one. Sample Dictionary: dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}
c.	Write a Python program to sum all the items in a dictionary.
6.	**Write the program for the following:**
a.	Write a Python program to read an entire text file.
b.	Write a Python program to append text to a file and display the text.
c.	Write a Python program to read last n lines of a file.
7.	**Write the program for the following:**
a.	Design a class that store the information of student and display the same
b.	Implement the concept of inheritance using python
c.	Create a class called `Numbers`, which has a single class attribute called `MULTIPLIER`, and a constructor which takes the parameters `x` and `y` (these should all be numbers). i Write a method called `add` which returns the sum of the attributes `x` and `y`. i Write a class method called multiply, which takes a single number parameter a and returns the product of a and MULTIPLIER. i Write a static method called subtract, which takes two number parameters, b and c, and returns b -c. iv Write a method called value which returns a tuple containing the values of x and y. Make this method into a property, and write a setter and a delete for manipulating the values of `x` and `y`.
8.	**Write the program for the following:**

a.	Open a new file in IDLE ("New Window" in the "File" menu) and save it as geometry.py in the directory where you keep the files you create for this course. Then copy the functions you wrote for calculating volumes and areas in the "Control Flow and Functions" exercise into this file and save it. Now open a new file and save it in the same directory. You should now be able
	to import your own module like this: `import geometry` Try and add `print dir.(geometry)` to the file and run it. Now write a function pointy ShapeVolume(x, y, squareBase) that calculates the volume of a square pyramid if squareBase is True and of a right circular cone if squareBase is False. x is the length of an edge on a square if squareBase is True and the radius of a circle when squareBase is False. y is the height of the object. First use squareBase to distinguish the cases. Use the circleArea and squareArea from the geometry module to calculate the base areas.
b.	Write a program to implement exception handling.
9.	**Write the program for the following:**
a.	Try to configure the widget with various options like: bg="red", family="times", size=18
b.	Try to change the widget type and configuration options to experiment with other widget types like Message, Button, Entry, Checkbutton, Radiobutton, Scale etc.
10.	**Design the database applications for the following:**
a.	Design a simple database application that stores the records and retrieve the same.
b.	Design a database application to search the specified record from the database.
c.	Design a database application to that allows the user to add, delete and modify the records.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Think Python	Allen Downey	O'Reilly	1st	2012
2.	An Introduction to Computer Science using Python 3	JasonMontojo, JenniferCampbell, Paul Gries	SPD	1st	2014

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

Data Structure		
Unit I	**Introduction:** Data and Information, Data Structure, Classification of Data Structures, Primitive Data Types, Abstract Data Types, Data structure vs. File Organization, Operations on Data Structure, Algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Asymptotic Analysis and Notations, Big O Notation, Big Omega Notation, Big Theta Notation, Rate of Growth and Big O Notation. **Array**: Introduction, One Dimensional Array, Memory Representation of One Dimensional Array, Traversing, Insertion, Deletion, Searching, Sorting, Merging of Arrays, Multidimensional Arrays, Memory Representation of Two Dimensional Arrays, General Multi- Dimensional Arrays, Sparse Arrays, Sparse Matrix, Memory Representation of Special kind of Matrices, Advantages and Limitations of Arrays	**12 Lectures**
Unit II	**Linked List:** Linked List, One-way Linked List, Traversal of Linked List, Searching, Memory Allocation and De-allocation, Insertion in Linked List, Deletion from Linked List, Copying a List into Other List, Merging Two Linked Lists, Splitting a List into Two Lists, Reversing One way linked List, Circular Linked List, Applications of Circular Linked List, Two way Linked List, Traversing a Two way Linked List, Searching in a Two way linked List, Insertion of an element in Two way Linked List, Deleting a node from Two way Linked List, Header Linked List, Applications of the Linked list, Representation of Polynomials, Storage of Sparse Arrays, Implementing other Data Structures.	**12 Lectures**
Unit III	**Stack**: Introduction, Operations on the Stack Memory Representation of Stack, Array Representation of Stack, Applications of Stack, Evaluation of Arithmetic Expression, Matching Parenthesis, infix and postfix operations, Recursion. **Queue:** Introduction, Queue, Operations on the Queue, Memory Representation of Queue, Array representation of queue, Linked List Representation of Queue, Circular Queue, Some special kinds of queues, Deque, Priority Queue, Application of Priority Queue, Applications of Queues.	**12 Lectures**
Unit IV	Sorting and Searching Techniques Bubble, Selection, Insertion, Merge Sort. Searching: Sequential, Binary, Indexed Sequential Searches, Binary Search. Tree: Tree, Binary Tree, Properties of Binary Tree, Memory Representation of Binary Tree, Operations Performed on Binary Tree, Reconstruction of Binary Tree from its Traversals, Huffman Algorithm, Binary Search Tree, Operations on Binary Search Tree, Heap, Memory Representation of Heap, Operation on Heap, Heap Sort. Advanced Tree Structures: Red Black Tree, Operations Performed on Red Black Tree, AVL Tree, Operations performed on AVL Tree, 2-3 Tree, B-Tree.	**12 Lectures**
Unit V	**Hashing Techniques** Hash function, Address calculation techniques, Common hashing functions Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing, Deletion and rehashing **Graph**: Introduction, Graph, Graph Terminology, Memory	**12 Lectures**

	Representation of Graph, Adjacency Matrix Representation of Graph, Adjacency List or Linked Representation of Graph, Operations Performed on Graph, Graph Traversal, Applications of the Graph, Reachability, Shortest Path Problems, Spanning Trees	

List of Practical	
1.	**Implement the following:**
a.	Write a program to store the elements in 1-D array and perform the operations like searching, sorting and reversing the elements. [Menu Driven]
b.	Read the two arrays from the user and merge them and display the elements in sorted order.[Menu Driven]
c.	Write a program to perform the Matrix addition, Multiplication and Transpose Operation. [Menu Driven]
2.	**Implement the following for Linked List:**
a.	Write a program to create a single linked list and display the node elements in reverse order.
b.	Write a program to search the elements in the linked list and display the same
c.	Write a program to create double linked list and sort the elements in the linked list.
3.	**Implement the following for Stack:**
a.	Write a program to implement the concept of Stack with Push, Pop, Display and Exit operations.
b.	Write a program to convert an infix expression to postfix and prefix conversion.
c.	Write a program to implement Tower of Hanoi problem.
4.	**Implement the following for Queue:**
a.	Write a program to implement the concept of Queue with Insert, Delete, Display and Exit operations.
b.	Write a program to implement the concept of Circular Queue
c.	Write a program to implement the concept of Deque.
5.	**Implement the following sorting techniques:**
a.	Write a program to implement bubble sort.
b.	Write a program to implement selection sort.
c.	Write a program to implement insertion sort.
6.	**Implement the following data structure techniques:**
a.	Write a program to implement merge sort.
b.	Write a program to search the element using sequential search.
	Write a program to search the element using binary search.
7.	**Implement the following data structure techniques:**
a.	Write a program to create the tree and display the elements.

b.	Write a program to construct the binary tree.
c.	Write a program for inorder, postorder and preorder traversal of tree
8.	**Implement the following data structure techniques:**
a.	Write a program to insert the element into maximum heap.
b.	Write a program to insert the element into minimum heap.
9.	**Implement the following data structure techniques:**
a.	Write a program to implement the collision technique.
b.	Write a program to implement the concept of linear probing.
10.	**Implement the following data structure techniques:**
a.	Write a program to generate the adjacency matrix.
b.	Write a program for shortest path diagram.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Data Structures and Algorithms Using Python	RanceNecaise	Wiley	First	2016
2.	Data Structures Using C and C++	Langsam,Augenstein, Tanenbaum	Pearson	First	2015

Computer Network

Unit I	**Introduction:** Data communications, networks, network types, Internet history, standards and administration. **Network Models:** Protocol layering, TCP/IP protocol suite, The OSI model. **Introduction to Physical layer:** Data and signals, periodic analog signals, digital signals, transmission impairment, data rate limits, performance. **Digital and Analog transmission:** Digital-to-digital conversion, analog-to-digital conversion, transmission modes, digital-to-analog conversion, and analog-to-analog conversion.	**12 Lectures**
Unit II	**Bandwidth Utilization: Multiplexing and Spectrum Spreading:** Multiplexing, Spread Spectrum **Transmission media:** Guided Media**,** Unguided Media **Switching:** Introduction, circuit switched networks, packet switching, and structure of a switch. **Introduction to the Data Link Layer:** Link layer addressing, Data Link Layer Design Issues, Error detection and correction, block coding, cyclic codes, checksum, forward error correction, error correcting codes, error detecting codes.	**12 Lectures**
Unit III	**Data Link Control:** DLC services, data link layer protocols, HDLC, Point-to-point protocol.	**12 Lectures**

	Media Access Control: Random access, controlled access, channelization, Wired LANs – Ethernet Protocol, standard Ethernet, fast Ethernet, gigabit Ethernet, 10 gigabit Ethernet, **Wireless LANs:** Introduction, IEEE 802.11 project, Bluetooth, WiMAX, Cellular telephony, Satellite networks. **Connecting devices and Virtual LANs.**	
Unit IV	**Introduction to the Network Layer**: Network layer services, packet switching, network layer performance, IPv4 addressing, forwarding of IP packets, Internet Protocol, ICMPv4, Mobile IP **Unicast Routing:** Introduction, routing algorithms, unicast routing protocols. **Next generation IP:** IPv6 addressing, IPv6 protocol, ICMPv6 protocol, transition from IPv4 to IPv6.	**12 Lectures**
Unit V	**Introduction to the Transport Layer**: Introduction, Transport layer protocols (Simple protocol, Stop-and-wait protocol, Go-Back-n protocol, Selective repeat protocol, Bidirectional protocols), Transport layer services, User datagram protocol, Transmission control protocol, **Standard Client0Server Protocols:** World wide-web and HTTP, FTP, Electronic mail, Telnet, Secured Shell, Domain name system.	12 Lectures

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Data Communication and Networking	Behrouz A. Forouzan	Tata McGraw Hill	Fifth Edition	2013
2.	TCP/IP Protocol Suite	Behrouz A. Forouzan	Tata McGraw Hill	Fourth Edition	2010
3.	Computer Networks	Andrew Tanenbaum	Pearson	Fifth	2013

List of Practical

1. IPv4 Addressing and Subnetting

a) Given an IP address and network mask, determine other information about the IP address such as:
- Network address
- Network broadcast address
- Total number of host bits
- Number of hosts

b) Given an IP address and network mask, determine other information about the IP addresssuchas:
- The subnet address of this subnet
- The broadcast address of this subnet
- The range of host addresses for this subnet
- The maximum number of subnets for this subnet mask
- The number of hosts for each subnet
- The number of subnet bits
- The number of this subnet

2. Use of ping and tracert / traceroute, ipconfig / ifconfig, route and arp utilities.

3.	Configure IP static routing.
4.	Configure IP routing using RIP.
5.	Configuring Simple OSPF.
6.	Configuring DHCP server and client.
7.	Create virtual PC based network using virtualization software and virtual NIC.
8.	Configuring DNS Server and client.
9.	Configuring OSPF with multiple areas.
10.	Use of Wireshark to scan and check the packet information of following protocols • HTTP • ICMP • TCP • SMTP • POP3

Database Management System

Unit I	**Introduction to Databases and Transactions** What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management **Data Models** The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction. **Database Design, ER Diagram and Unified Modeling Language** Database design and ER Model: overview, ER Model, Constraints, ER Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML	**12 Lectures**
Unit II	**Relational database model:** Logical view of data, keys, integrity rules, Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF). **Relational Algebra and Calculus** Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. **Calculus:** Tuple relational calculus, Domain relational Calculus, calculus vs algebra ,computational capabilities	**12 Lectures**
Unit III	Constraints, Views and SQL Constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.	**12 Lectures**
Unit IV	**Transaction management and Concurrency** Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks),Time stamping methods, optimistic methods, database	**12 Lectures**

	Recovery management.	
Unit V	**PL-SQL**: Beginning with PL / SQL, Identifiers and Keywords, Operators, Expressions, Sequences, Control Structures, Cursors and Transaction, Collections and composite data types, Procedures and Functions, Exceptions Handling, Packages, With Clause and Hierarchical Retrieval, Triggers.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Database System and Concepts	A Silberschatz, H Korth, S Sudarshan	McGraw-Hill	Fifth Edition	
2.	Database Systems	RobCoronel	Cengage Learning	Twelfth Edition	
3.	Programming with PL/SQL for Beginners	H.Dand, R.Patil and T. Sambare	X –Team	First	2011
4.	Introduction to Database System	C.J.Date	Pearson	First	2003

List of Practical

1.	**SQL Statements – 1**
a.	Writing Basic SQL SELECT Statements
b.	Restricting and Sorting Data
c.	Single-Row Functions
2.	**SQL Statements – 2**
a.	Displaying Data from Multiple Tables
b.	Aggregating Data Using Group Functions
c.	Subqueries
3.	**Manipulating Data**
a.	Using INSERT statement
b.	Using DELETE statement
c.	Using UPDATE statement
4.	**Creating and Managing Tables**
a.	Creating and Managing Tables
b.	Including Constraints
5.	**Creating and Managing other database objects**
a.	Creating Views
b.	Other Database Objects
c.	Controlling User Access
6.	**Using SET operators, Date/Time Functions, GROUP BY clause (advanced features) and advanced subqueries**
a.	Using SET Operators

b.	Date time Functions
c.	Enhancements to the GROUP BY Clause
d.	Advanced Subqueries
7.	**PL/SQL Basics**
a.	Declaring Variables
b.	Writing Executable Statements
c.	Interacting with the Oracle Server
d.	Writing Control Structures
8.	**Composite data types, cursors and exceptions.**
a.	Working with Composite Data Types
b.	Writing Explicit Cursors
c.	Handling Exceptions
9.	**Procedures and Functions**
a.	Creating Procedures
b.	Creating Functions
c.	Managing Subprograms
d.	Creating Packages
10.	**Creating Database Triggers**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Database System and Concepts	A Silberschatz, H Korth, S Sudarshan	McGraw-Hill	Fifth Edition	
2.	Programming with PL/SQL for Beginners	H.Dand , R.Patil and T. Sambare	X –Team	First	2011
3.	PL/SQL Programming	Ivan Bayross	BPB	First	2010

Applied Mathematics

Unit I	**Matrices:** Inverse of a matrix, Properties of matrices, Elementary Transformation, Rank of Matrix, Echelon or Normal Matrix, Inverse of matrix, Linear equations, Linear dependence and linear independence of vectors, Linear transformation, Characteristics roots and characteristics vectors, Properties of characteristic vectors, Caley- Hamilton Theorem, Similarity of matrices, Reduction of matrix to a diagonal matrix which has elements as characteristics values. **Complex Numbers:** Complex number, Equality of complex numbers, Graphical representation of complex number(Argand's Diagram), Polar form of complex numbers, Polar form of x+iy for different signs of x, y, Exponential form of complex numbers, Mathematical operation with complex numbers and their representation on Argand's Diagram, Circular functions of complex angles, Definition of hyperbolic function, Relations between circular and hyperbolic functions, Inverse hyperbolic functions, Differentiation and Integration, Graphs of the hyperbolic functions, Logarithms of complex quality, j(=i)as an operator (Electrical	**12 Lectures**

	circuits)	
Unit II	**Equation of the first order and of the first degree:** Separation of variables, Equations homogeneous in x and y, Non-homogeneous linear equations, Exact differential Equation, Integrating Factor, Linear Equation and equation reducible to this form, Method of substitution. **Differential equation of the first order of a degree higher than the first:** Introduction, Solvable for p (or the method of factors), Solve for y, Solve for x, Clairaut's form of the equation, Methods of Substitution, Method of Substitution. **Linear Differential Equations with Constant Coefficients:** Introduction, The Differential Operator, Linear Differential Equation f(D) y = 0, Different cases depending on the nature of the root of the equation f(D) = 0, Linear differential equation f(D) y = X, The complimentary Function, The inverse operator 1/f(D) and the symbolic expiration for the particular integral 1/f(D) X; the general methods, Particular integral : Short methods, Particular integral : Other methods, Differential equations reducible to the linear Differential equations with constant coefficients.	**12 Lectures**
Unit III	**The Laplace Transform:** Introduction, Definition of the Laplace Important Properties of Laplace Transformation, First Shifting Theorem, Second Shifting Theorem, The Convolution Theorem, Laplace Transform of an Integral, Laplace Transform of Derivatives, **Inverse Laplace Transform:** Shifting Theorem, Partial fraction Methods, Use of Convolution Theorem, Solution of Ordinary Linear Differential Equations with Constant Coefficients, Solution of Simultaneous Ordinary Differential Equations, Laplace Transformation of Special Function, Periodic Functions, Heaviside Unit Step Function, Dirac-delta Function(Unit Impulse Function),Transform, Table of Elementary Laplace Transforms, Theorems.	**12 Lectures**
Unit IV	**Multiple Integrals:** Double Integral, Change of the order of the integration, Double integral in polar co-ordinates, Triple integrals. **Applications of integration:** Areas, Volumes of solids.	**12 Lectures**
Unit V	**Beta and Gamma Functions –** Definitions**,** Properties and Problems. Duplication formula. **Differentiation Under the Integral Sign** **Error Functions**	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	A text book of Applied Mathematics Vol I	P. N. Wartikar and J. N. Wartikar	Pune VidyathiGraha		
2.	Applied Mathematics II	P. N. Wartikar and J. N. Wartikar	Pune VidyathiGraha		
3.	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publications		

List of Practical

	Setting up CORDOVA, Phone GAP Project and environment.
1.	• Creating and building simple "Hello World" App using Cordova □ Adding and Using Buttons □ Adding and Using EventListeners
2.	• Creating and Using Functions • Using Events • Handling and Using Back Button
3.	• Installing and Using Plugins • Installing and Using Battery Plugin • InstallingandUsingCameraPlugin
4.	• Installing and Using Contacts Plugin • InstallingandUsingDevicePlugin • InstallingandUsingAccelerometerPlugin
5.	• Install and Using Device Orientation plugin • InstallandUsingDeviceOrientationplugin • CreateandUsingPromptFunction
6.	□ Installing and Using File Plugin □ InstallingandUsingFileTransferPlugin □ Using Download and Upload functions
7.	• Installing and Using Globalization Plugin • Installing and Using Media Plugin • Installing and Using Media Capture Plugin
8.	• Installing and Using Network Information Plugin
	• Installing and Using Splash Screen Plugin • Installing and Using Vibration Plugin
9.	• Developing Single Page Apps • Developing Multipage Apps • Storing Data Locally in a Cordova App
10.	• Use of sqlite plugin with Phone Gap/apache Cordova • Using Sqlite read /write and search • Populating Cordova SQL it estorage with the JQuery API

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Apache Cordova 4 Programming	John M. Wargo	Addison-Wesley Professional	1st	2015

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

2.	Apache Cordova in Action	Raymond Camden	Manning Publications	1st	2015
3.	PhoneGap By Example	Andrey Kovalenko	PACKT Publishing	1st	2015

B.Sc. IT Semester IV

Core Java		
Unit I	**Introduction:** History, architecture and its components, Java Class File, Java Runtime Environment, The Java Virtual Machine, JVM Components, The Java API, java platform, java development kit, Lambda Expressions, Methods References, Type Annotations, Method Parameter Reflection, setting the path environment variable, Java Compiler And Interpreter, java programs, java applications, main(), public, static, void, string[] args, statements, white space, case sensitivity, identifiers, keywords, comments, braces and code blocks, variables, variable name **Data types:** primitive data types, Object Reference Types, Strings, Auto boxing, operators and properties of operators, Arithmetic operators, assignment operators, increment and decrement operator, relational operator, logical operator, bitwise operator, conditional operator.	**12 Lectures**
Unit II	**Control Flow Statements:** The If…Else If…Else Statement, The Switch…Case Statement **Iterations:** The While Loop, The Do … While Loop, The For Loop, The For each Loop, Labeled Statements, The Break And Continue Statements, The Return Statement **Classes:** Types of Classes, Scope Rules, Access Modifier, Instantiating Objects From A Class, Initializing The Class Object And Its Attributes, Class Methods, Accessing A Method, Method Returning A Value, Method's Arguments, Method Overloading, Variable Arguments [Var args], Constructors, this Instance, super Instance, Characteristics Of Members Of A Class, constants, this instance, static fields of a class, static methods of a class, garbage collection.	**12 Lectures**
Unit III	**Inheritance:** Derived Class Objects, Inheritance and Access Control, Default Base Class Constructors, this and super keywords. Abstract Classes And Interfaces, Abstract Classes, Abstract Methods, Interfaces, What Is An Interface? How Is An Interface Different From An Abstract Class, Multiple Inheritance, Default Implementation, Adding New Functionality, Method Implementation, Classes V/s Interfaces, Defining An Interface, Implementing Interfaces **Packages:** Creating Packages, Default Package, Importing Packages, Using Package	**12 Lectures**
Unit IV	**Enumerations, Arrays:** Two Dimensional Arrays, Multi-Dimensional Arrays, Vectors, Adding Elements To A Vector, Accessing Vector Elements, Searching For Elements In A Vector, Working With The Size of The Vector. **Multithreading:** the thread control methods, thread life cycle, the	**12 Lectures**

	main thread, creating a thread, extending the thread class. **Exceptions:** Catching Java Exceptions, Catching Run-Time Exceptions, Handling Multiple Exceptions, The finally Clause, The throws Clause **Byte streams:** reading console input, writing console output, reading file, writing file, writing binary data, reading binary data, getting started with character streams, writing file, reading file	
Unit V	**Event Handling:** Delegation Event Model, Events, Event classes, Event listener interfaces, Using delegation event model, adapter classes and inner classes. **Abstract Window Toolkit:** Window Fundamentals, Component, Container, Panel, Window, Frame, Canvas. Components – Labels, Buttons, Check Boxes, Radio Buttons, Choice Menus, Text Fields, Text, Scrolling List, Scrollbars, Panels, Frames **Layouts:** Flow Layout, Grid Layout, Border Layout, Card Layout.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Core Java 8 for Beginners	Vaishali Shah, Sharnam Shah	SPD	1st	2015
2.	Java: The Complete Reference	Herbert Schildt	McGraw Hill	9th	2014
3.	Murach's beginning Java with Net Beans	Joel Murach , Michael Urban	SPD	1st	2016
4.	Core Java, Volume I: Fundamentals	Hortsman	Pearson	9th	2013
5.	Core Java, Volume II: Advanced Features	Gary Cornell and Hortsman	Pearson	8th	2008
6.	Core Java: An Integrated Approach	R. Nageswara Rao	DreamTech	1st	2008

List of Practical

1.	**Java Basics**
a.	Write a Java program that takes a number as input and prints its multiplication table up to 10.
b.	Write a Java program to display the following pattern. ***** **** *** ** *
c.	Write a Java program to print the area and perimeter of a circle.
2.	**Use of Operators**
a.	Write a Java program to add two binary numbers.
b.	Write a Java program to convert a decimal number to binary number and vice versa.
c.	Write a Java program to reverse a string.

3.	**Java Data Types**
a.	Write a Java program to count the letters, spaces, numbers and other characters of an input string.
b.	Implement a Java function that calculates the sum of digits for a given char array consisting of the digits '0' to '9'. The function should return the digit sum as a long value.
c.	Find the smallest and largest element from the array
4.	**Methods and Constructors**
a.	Designed a class Sort Data that contains the method asec() and desc().
b.	Designed a class that demonstrates the use of constructor and destructor.
c.	Write a java program to demonstrate the implementation of abstract class.
5.	**Inheritance**
a.	Write a java program to implement single level inheritance.
b.	Write a java program to implement method overriding
c.	Write a java program to implement multiple inheritance.
6.	**Packages and Arrays**
a.	Create a package, Add the necessary classes and import the package in java class.
b.	Write a java program to add two matrices and print the resultant matrix.
c.	Write a java program for multiplying two matrices and print the product for the same.
7.	**Vectors and Multithreading**
a.	Write a java program to implement the vectors.
b.	Write a java program to implement thread life cycle.
c.	Write a java program to implement multithreading.
8.	**File Handling**
a.	Write a java program to open a file and display the contents in the console window.
b.	Write a java program to copy the contents from one file to other file.
c.	Write a java program to read the student data from user and store it in the file.
9.	**GUI and Exception Handling**
a.	Design an AWT program to print the factorial for an input value.
b.	Design an AWT program to perform various string operations like reverse string, string concatenation etc.
c.	Write a java program to implement exception handling.
10.	**GUI Programming.**
a.	Design an AWT application that contains the interface to add student information And display the same.
b.	Design a calculator based on AWT application.
c.	Design an AWT application to generate result marks sheet.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Core Java 8 for Beginners	Vaishali Shah, Sharnam Shah	SPD	1st	2015
2.	Java: The Complete Reference	Herbert Schildt	McGraw Hill	9th	2014
3.	Murach's beginning Java with Net Beans	Joel Murach , Michael Urban	SPD	1st	2016
4.	Core Java, Volume I: Fundamentals	Hortsman	Pearson	9th	2013
5.	Core Java, Volume II: Advanced Features	Gary Cornell and Hortsman	Pearson	8th	2008
6.	Core Java: An Integrated Approach	R. Nageswara Rao	DreamTech	1st	2008

Embedded System

Unit – I	**Introduction:** Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems **Core of embedded systems:** microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components. **Characteristics and quality attributes of embedded systems:** Characteristics, operational and non-operational quality attributes.	**12 Lectures**
Unit II	**Embedded Systems – Application and Domain Specific:** Application specific – washing machine, domain specific - automotive. **Embedded Hardware:** Memory map, i/o map, interrupt map, processor family, external peripherals, memory – RAM , ROM, types of RAM and ROM, memory testing, CRC ,Flash memory. **Peripherals:** Control and Status Registers, Device Driver, Timer Driver - Watchdog Timers.	**12 Lectures**
Unit III	**The 8051 Microcontrollers:** Microcontrollers and Embedded processors, Overview of 8051 family.8051 Microcontroller hardware, Input/output pins, Ports, and Circuits, External Memory. **8051 Programming in C:** Data Types and time delay in 8051 C, I/O Programming, Logic operations, Data conversion Programs.	**12 Lectures**
Unit IV	**Designing Embedded System with 8051 Microcontroller:** Factors to be considered in selecting a controller, why 8051 Microcontroller, Designing with 8051. **Programming embedded systems:** structure of embedded program, infinite loop, compiling, linking and debugging.	**12 Lectures**
Unit V	**Real Time Operating System (RTOS):** Operating system basics, types of operating systems, Real-Time Characteristics, Selection Process of an RTOS. **Design and Development:** Embedded system development Environment – IDE, types of file generated on cross compilation,	**12 Lectures**

	disassembler/ de-compiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry	

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Programming Embedded Systems in C and C++	Michael Barr	O'Reilly	First	1999
2.	Introduction to embedded systems	Shibu K V	Tata Mcgraw-Hill	First	2012
3.	The 8051 Microcontroller and Embedded Systems	Muhammad Ali Mazidi	Pearson	Second	2011
4.	Embedded Systems	Rajkamal	Tata Mcgraw-Hill		

List of Practical

1.	Design and develop a reprogrammable embedded computer using 8051 microcontrollers and to show the following aspects. a. Programming b. Execution c. Debugging
2.A	Configure timer control registers of 8051 and develop a program to generate given time delay.
B	To demonstrate use of general purpose port i.e. Input/ output port of two controllers for data transfer between them.
3.A	Port I / O: Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's
B	To interface 8 LEDs at Input-output port and create different patterns.
C	To demonstrate timer working in timer mode and blink LED without using any loop delay routine.
5. A	Serial I / O: Configure 8051 serial port for asynchronous serial communication with serial port of PC exchange text messages to PC and display on PC screen. Signify end of message by carriage return.
B	To demonstrate interfacing of seven-segment LED display and generate counting from 0 to 99 with fixed time delay.
C	Interface 8051 with D/A converter and generate square wave of given frequency on oscilloscope.
6. A	Interface 8051 with D/A converter and generate triangular wave of given Frequency on oscilloscope.
B	Using D/A converter generate sine wave on oscilloscope with the help of lookup table stored in data area of8051.

6.	Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clock wise direction.
7.	Generate traffic signal.
8.	Implement Temperature controller.
9.	Implement Elevator control.
10.	**Using Flash Magic**
A	To demonstrate the procedure for flash programming for reprogrammable embedded system board using Flash Magic
B	To demonstrate the procedure and connections for multiple controllers programming of same type of controller with same source code in one go, using Flash magic.

Computer Oriented Statistical Techniques

Unit I	**The Mean, Median, Mode, and Other Measures of Central Tendency**: Index, or Subscript, Notation, Summation Notation, Averages, or Measures of Central Tendency ,The Arithmetic Mean , The Weighted Arithmetic Mean ,Properties of the Arithmetic Mean ,The Arithmetic Mean Computed from Grouped Data ,The Median ,The Mode, The Empirical Relation Between the Mean, Median, and Mode, The Geometric Mean G, The Harmonic Mean H ,The Relation Between the Arithmetic, Geometric, and Harmonic Means, The Root Mean Square, Quartiles, Deciles, and Percentiles, Software and Measures of Central Tendency. **The Standard Deviation and Other Measures of Dispersion**: Dispersion, or Variation, The Range, The Mean Deviation, The Semi-Interquartile Range, The 10–90 Percentile Range, The Standard Deviation, The Variance, Short Methods for Computing the Standard Deviation, Properties of the Standard Deviation, Charlie's Check, Sheppard's Correction for Variance, **Introduction to R:** Basic syntax, data types, variables, operators, control statements, R-functions, R –Vectors, R – lists, R Arrays.	**12 Lectures**
Unit II	**Moments, Skewness, and Kurtosis** :Moments , Moments for Grouped Data ,Relations Between Moments , Computation of Moments for Grouped Data, Charlie's Check and Sheppard's Corrections, Moments in Dimensionless Form, Skewness, Kurtosis, Population Moments, Skewness, and Kurtosis, Software Computation of Skewness and Kurtosis. **Elementary Probability Theory**: Definitions of Probability, Conditional Probability; Independent and Dependent Events, Mutually Exclusive Events, Probability Distributions, Mathematical Expectation, Relation Between Population, Sample Mean, and	**12 Lectures**
Unit III	**Statistical Estimation Theory**: Estimation of Parameters, Unbiased	**12**

	Estimates, EPoint Estimates and Interval Estimates; Their Reliability, Confidence-Interval Estimates of Population Parameters, Probable Error. **Statistical Decision Theory:** Statistical Decisions, Statistical Hypotheses, Tests of Hypotheses and Significance, or Decision Rules, Type I and Type II Errors, Level of Significance, Tests Involving Normal Distributions, Two-Tailed and One-Tailed Tests, Special Tests, Operating-Characteristic Curves; the Power of a Test, p-Values for Hypotheses Tests, Control Charts, Tests Involving Sample solving Binomial Distributions. **Statistics in R:** mean, median, mode, Normal Distribution , Binomial Distribution, Frequency Distribution in R.	**Lectures**
Unit IV	**Small Sampling Theory**: Small Samples, Student's t Distribution, Confidence Intervals, Tests of Hypotheses and Significance, The Chi-Square Distribution, Confidence Intervals for Sigma , Degrees of Freedom, The F Distribution. **The Chi-Square Test**: Observed and Theoretical Frequencies, Definition of chi-square, Significance Tests, The Chi-Square Test for Goodness of Fit, Contingency Tables, Yates' Correction for Continuity, Simple Formulas for Computing chi-square, Coe Contingency, Correlation of Attributes, Additive Property of chi-square.	**12 Lectures**
Unit V	**Curve Fitting and the Method of Least Squares:** Relationship Between Variables, Curve Fitting, Equations of Approximating Curves, Freehand Method of Curve Fitting, The Straight Line, The Method of Least Squares, The Least-Squares Line, Nonlinear Relationships, The Least-Squares Parabola, Regression, Applications to Time Series, Problems Involving More Than Two Variables. **Correlation Theory:** Correlation and Regression, Linear Correlation, Measures of Correlation, The Least-Squares Regression Lines, Standard Error of Estimate, Explained and Unexplained Variation, Coe Series, Correlation of Attributes, Sampling Theory of Correlation	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	STATISTICS	Murray R. Spiegel, Larry J. Stephens.	McGraw – HILL ITERNATIONAL	FOURTH	
2.	A Practical Approach using R	R.B. Patil, H.J. Dand and R. Bhavsar	SPD	1st	2017
3.	FUNDAMENTAL OF MATHEMATICAL STATISTICS	S.C. GUPTA and V.K. KAPOOR	SULTAN CHAND and SONS	ELEVENTH REVISED	2011
4.	MATHEMATICAL STATISTICS	J.N. KAPUR and H.C. SAXENA	S. CHAND	TWENTIETH REVISED	2005

List of Practical	
1.	Using R execute the basic commands, array, list and frames.
2.	Create a Matrix using R and Perform the operations addition, inverse, transpose and multiplication operations.
3.	Using R Execute the statistical functions: mean, median, mode, quartiles, range, inter quartile range histogram
4.	Using R import the data from Excel / .CSV file and Perform the above functions.
5.	Using R import the data from Excel / .CSV file and Calculate the standard deviation, variance, co-variance.
6.	Using R import the data from Excel / .CSV file and draw the skewness.
7.	Import the data from Excel / .CSV and perform the hypothetical testing.
8.	Import the data from Excel / .CSV and perform the Chi-squared Test.
9.	Using R perform the binomial and normal distribution on the data.
10.	Perform the Linear Regression using R.
11.	Compute the Least squares means using R.
12.	Compute the Linear Least Square Regression

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	A Practical Approach to R Tool	R.B. Patil, H.J. Dand and R. Dahake	SPD	First	2011
2.	STATISTICS	Murray R. Spiegel, Larry J. Stephens.	McGraw –HILL INTERNATIONAL	FOURTH	2006

Software Engineering		
Unit I	**Introduction:** What is software engineering? Software Development Life Cycle, Requirements Analysis, Software Design, Coding, Testing, Maintenances. **Software Requirements:** Functional and Non-functional requirements, User Requirements, System Requirements, Interface Specification, Documentation of the software requirements. **Software Processes:** Process and Project, Component Software Processes. **Software Development Process Models.** • Waterfall Model.	**12 Lectures**

	• Prototyping. • Iterative Development. • Rational Unified Process. • The RAD Model • Time boxing Model. **Agile software development**: Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods.	
Unit II	**Socio-technical system:** Essential characteristics of socio technical systems, Emergent System Properties, Systems Engineering, Components of system such as organization, people and computers, Dealing Legacy Systems. **Critical system:** Types of critical system, A simple safety critical system, Dependability of a system, Availability and Reliability, Safety and Security of Software systems. **Requirements Engineering Processes:** Feasibility study, Requirements elicitation and analysis, Requirements Validations, Requirements Management.	**12 Lectures**
Unit III	**Architectural Design:** Architectural Design Decisions, System Organization, Modular Decomposition Styles, Control Styles, Reference Architectures. **User Interface Design:** Need of UI design, Design issues, The UI design Process, User analysis, User Interface Prototyping, Interface Evaluation. **Project Management** Software Project Management, Management activities, Project Planning, Project Scheduling, Risk Management. **Quality Management:** Process and Product Quality, Quality assurance and Standards, Quality Planning, Quality Control, Software Measurement and Metrics.	**12 Lectures**
Unit IV	**Verification and Validation:** Planning Verification and Validation, Software Inspections, Automated Static Analysis, Verification and Formal Methods. **Software Testing:** System Testing, Component Testing, Test Case Design, Test Automation. **Software Measurement**: Size-Oriented Metrics, Function-Oriented Metrics, Extended Function Point Metrics **Software Cost Estimation:** Software Productivity, Estimation Techniques, Algorithmic Cost Modelling, Project Duration and Staffing	**12 Lectures**
Unit V	**Process Improvement:** Process and product quality, Process Classification, Process Measurement, Process Analysis and Modeling, Process Change, The CMMI Process Improvement Framework. **Service Oriented Software Engineering:** Services as reusable components, Service Engineering, Software Development with Services. **Software reuse:** The reuse landscape, Application frameworks, Software product lines, COTS product reuse. **Distributed software engineering**: Distributed systems issues, Client–server computing, Architectural patterns for distributed systems, Software as a service	**12 Lectures**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Software Engineering, edition,	Ian Somerville	Pearson Education.	Ninth	
2.	Software Engineering	Pankaj Jalote	Narosa Publication		
3.	Software engineering, a practitioner's approach	Roger Pressman	Tata Mcgraw-hill	Seventh	
4.	Software Engineering principles and practice	WS Jawadekar	Tata Mcgraw-hill		
5.	Software Engineering-A Concise Study	S.A Kelkar	PHI India.		
6.	Software Engineering Concept and Applications	Subhajit Datta	Oxford Higher Education		
7.	Software Design	D.Budgen	Pearson education	2nd	
8.	Software Engineering	KL James	PHI	EEE	2009

List of Practical (To be executed using Star UML or any similar software)	
1.	Study and implementation of class diagrams.
2.	Study and implementation of Use Case Diagrams.
3.	Study and implementation of Entity Relationship Diagrams.
4.	Study and implementation of Sequence Diagrams.
5.	Study and implementation of State Transition Diagrams.
6.	Study and implementation of Data Flow Diagrams.
7.	Study and implementation of Collaboration Diagrams.
8.	Study and implementation of Activity Diagrams.
9.	Study and implementation of Component Diagrams.
10.	Study and implementation of Deployment Diagrams.

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Object - Oriented Modeling and Design	Michael Blaha, James Rumbaugh	Pearson		2011
2.	Learning UML 2. 0	Kim Hamilton, Russ Miles	O'Reilly Media		2006
3.	The unified modeling language user guide	Grady Booch, James Rumbaugh, Ivar Jacobson	Addison-Wesley		2005
4.	UML A Beginners Guide	Jason T. Roff	McGraw Hill Professional		2003

Computer Graphics and Animation

Unit I	**Introduction to Computer Graphics:** Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays. **Scan conversion** – Digital Differential Analyzer (DDA) algorithm, Bresenhams' Line drawing algorithm.Bresenhams' method of Circle drawing, Midpoint Circle Algorithm, Midpoint Ellipse Algorithm, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Clipping Lines algorithms– Cyrus-Beck, Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.	**12 Lectures**
Unit II	**Two-Dimensional Transformations:** Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations. **Three-Dimensional Transformations:** Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique	**12 Lectures**

	Projections, View volumes for projections.	
Unit III	**Viewing in 3D** Stages in 3D viewing, Canonical View Volume (CVV), Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar Geometric Projections, Combined transformation matrices for projections and viewing, Coordinate Systems and matrices, camera model and viewing pyramid. **Light:** Radiometry, Transport ,Equation, Photometry **Color:** Colorimetry ,Color Spaces, Chromatic Adaptation, Color Appearance	**12 Lectures**
Unit IV	**Visible-Surface Determination:** Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods. **Plane Curves and Surfaces:** Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, Representation of Space Curves, Cubic Splines, , Bezier Curves, B-spline Curves, B-spline Curve Fit, B-spline Curve Subdivision, Parametric Cubic Curves, Quadric Surfaces. Bezier Surfaces.	**12 Lectures**
Unit V	**Computer Animation:** Principles of Animation, Key framing, Deformations, Character Animation, Physics-Based Animation, Procedural Techniques, Groups of Objects. **Image Manipulation and Storage:** What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Computer Graphics - Principles and Practice	J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes	Pearson	2nd	
2.	Steve Marschner, Peter Shirley	Fundamentals of Computer Graphics	CRC press	4th	2016
3.	Computer Graphics	Hearn, Baker	Pearson	2nd	
4.	Principles of Interactive Computer Graphics	William M. Newman and Robert F. Sproull	TMH	2nd	
5.	Mathematical Elements for CG	D. F. Rogers, J. A. Adams	TMH	2nd	

List of Practical	
1.	**Solve the following:**
a.	Study and enlist the basic functions used for graphics in C / C++ / Python language. Give an example for each of them.
b.	Draw a co-ordinate axis at the center of the screen.
2.	**Solve the following:**
a.	Divide your screen into four region, draw circle, rectangle, ellipse and half ellipse in each region with appropriate message.
b.	Draw a simple hut on the screen.
3.	**Draw the following basic shapes in the center of the screen :**
	i. Circle ii. Rectangle iii. Square iv. Concentric Circles v. Ellipse vi. Line
4.	**Solve the following:**
a.	Develop the program for DDA Line drawing algorithm.
b.	Develop the program for Bresenham's Line drawing algorithm.
5.	**Solve the following:**
a.	Develop the program for the mid-point circle drawing algorithm.
b.	Develop the program for the mid-point ellipse drawing algorithm.
6.	**Solve the following:**
a.	Write a program to implement 2D scaling.
b.	Write a program to perform 2D translation
7.	**Solve the following:**
a.	Perform 2D Rotation on a given object.
b.	Program to create a house like figure and perform the following operations. i. Scaling about the origin followed by translation. ii. Scaling with reference to an arbitrary point. iii. Reflect about the line y = mx +c.
8.	**Solve the following:**
a.	Write a program to implement Cohen-Sutherland clipping.
b.	Write a program to implement Liang - Barsky Line Clipping Algorithm
9.	**Solve the following:**
a.	Write a program to fill a circle using Flood Fill Algorithm.
b.	Write a program to fill a circle using Boundary Fill Algorithm.
10.	**Solve the following:**
a.	Develop a simple text screen saver using graphics functions.
b.	Perform smiling face animation using graphic functions.
c.	Draw the moving car on the screen.

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Computer Graphics - Principles and Practice	J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes	Pearson Education	Second Edition	
2.	Steve Marschner, Peter Shirley	Fundamentals of Computer Graphics	CRC press	Fourth Edition	2016
3.	Computer Graphics	Hearn, Baker	Pearson Education	Second	
4.	Principles of Interactive Computer Graphics	William M. Newman and Robert F. Sproull	Tata McGraw Hill	Second	

T.Y.B.Sc. IT Semester V

Software Project Management		
Unit I	Introduction to Software Project Management: Introduction, Why is Software Project Management Important? What is a Project? Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure, What is Management? Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices. Project Evaluation and Programme Management: Introduction, Business Case, Project Portfolio Management, Evaluation of Individual Projects, Cost–benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programmes, Strategic Programme Management, Creating a Programme, Aids to Programme Management, Some Reservations about Programme Management, Benefits Management. An Overview of Project Planning: Introduction to Step Wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyze Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Effort for Each Activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review/Publicize Plan, Steps 9 and 10: Execute Plan/Lower Levels of Planning	**12Lectures**
Unit II	Selection of an Appropriate Project Approach: Introduction, Build or Buy? Choosing Methodologies and Technologies, Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, The	**12Lectures**

	Waterfall Model, The Spiral Model, Software Prototyping, Other Ways of Categorizing Prototypes, Incremental Delivery, Atern/Dynamic Systems Development Method, Rapid Application Development, Agile Methods, Extreme Programming (XP), Scrum, Lean Software Development, Managing Iterative Processes, Selecting the Most Appropriate Process Model. Software Effort Estimation: Introduction, Where are the Estimates Done? Problems with Over- and Under-Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom up Estimating, The Top-down Approach and Parametric Models, Expert Judgement, Estimating by Analogy, Albrecht Function Point 12 6 Analysis, Function Points Mark II, COSMIC Full Function Points, COCOMO II: A Parametric Productivity Model, Cost Estimation, Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.	
Unit III	Activity Planning: Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Networks. Risk Management: Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Boehm's Top 10 Risks and Counter Measures, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts. Resource Allocation: Introduction, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence	**12 Lectures**
Unit IV	Monitoring and Control: Introduction, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM). Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance. Managing People in Software Environments: Introduction, Understanding Behavior, Organizational Behavior: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress	**12 Lectures**
Unit V	Working in Teams: Introduction, becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership. Software Quality: Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process	**12 Lectures**

	Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans	

Internet on Things		
Unit I	**The Internet of Things: An Overview**: The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? **Design Principles for Connected Devices:** Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway? Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens on The Internet, Graceful Degradation, and Affordances. **Internet Principles:** Internet Communications: An Overview, IP,TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dyn amic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols, HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols	**12 Lectures**
Unit II	**Thinking About Prototyping:** Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalization, climbing into the Cloud, Open Source versus Closed Source, Why Closed? Why Open? Mixing Open and Closed Source, Closed Source for Mass Market Projects, Tapping into the Community. **Prototyping Embedded Devices:** Electronics, Sensors, Actuators, Scaling Up the Electronics, Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness.	**12 Lectures**
Unit III	**Prototyping the Physical Design:** Preparation, Sketch, Iterate, and Explore, No digital Methods, Laser Cutting, Choosing a Laser Cutter, Software, Hinges and Joints, 3D Printing, Types of 3D Printing, Software, CNC Milling, Repurposing/Recycling. **Prototyping Online Components:** Getting Started with an API, Mashing Up APIs, Scraping, Legalities, writing a New API, Clockodillo, Security, implementing theAPI,Using CurltoTest, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.	**12 Lectures**
Unit IV	**Techniques for Writing Embedded Code:** Memory Management, Types of Memory, Making the Most of Your RAM, Performance and Battery Life, Libraries, Debugging. **Business Models:** A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet,	**12 Lectures**

	Learning from History, The Business Model Canvas, Who Is the Business Model For? Models, Make Thing, Sell Thing, Subscriptions, Customization, be a Key Resource, Provide Infrastructure: Sensor Networks, take a Percentage, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital, Government Funding, Crowdfunding, Lean Startups.	
Unit V	**Moving to Manufacture:** What Are You Producing? Designing Kits, Designing Printed circuit boards, Software Choices, The Design Process, Manufacturing Printed Circuit Boards, Etching Boards, Milling Boards. Assembly, Testing, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software, Deployment, Correctness and Maintainability, Security, Performance, User Community. **Ethics:** Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, and The Internet of Things as Part of the Solution, Cautious Optimism, and The Open Internet of Things Definition.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	WILEY	First	2014
2.	Internet of Things – Architecture and Design	Raj Kamal	McGraw Hill	First	2017
3.	Getting Started with the Internet of Things	Cuno Pfister	O'Reilly	Sixth	2018
4.	Getting Started with Raspberry Pi	Matt Richardson and Shawn Wallace	SPD	Third	2016

.

Practical No	Details
0	Starting Raspbian OS, Familiarising with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.
1	Displaying different LED patterns with Raspberry Pi.
2	Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi
3	Raspberry Pi Based Oscilloscope
4	Controlling Raspberry Pi with WhatsApp.
5	Setting up Wireless Access Point using Raspberry Pi

6	Fingerprint Sensor interfacing with Raspberry Pi
7	Raspberry Pi GPS Module Interfacing
8	IoT based Web Controlled Home Automation using Raspberry Pi
9	Visitor Monitoring with Raspberry Pi and Pi Camera
10	Interfacing Raspberry Pi with RFID.
11	Building Google Assistant with Raspberry Pi.
12	Installing Windows 10 IoT Core on Raspberry Pi

Advanced Web Programming

Unit I	**Introducing .NET**: The .NET Framework, C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library. **The C# Language**: C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods. **Types, Objects, and Namespaces**: The Basics About Classes, Building a Basic Class, Value Types and Reference Types, Understanding Namespaces and Assemblies, Advanced Class Programming.	12 Lectures
Unit II	**Web Form Fundamentals**: Writing Code, Using the Code-Behind Class, Adding Event Handlers, Understanding the Anatomy of an ASP.NET Application, Introducing Server Controls, Using the Page Class, Using Application Events, Configuring an ASP.NET Application. **Form Controls**: Stepping Up to Web Controls, Web Control Classes, List Controls, Table Controls, Web Control Events and Auto Post Back, Validation, Understanding Validation, Using the Validation Controls, Rich Controls, The Calendar, The AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls, Dynamic Graphics, The Chart Control, Website Navigation: Site Maps, URL Mapping and Routing, The Sitemap Path Control, The Tree View Control, The Menu Control.	12 Lectures
Unit III	**Error Handling, Logging, and Tracing**: Avoiding Common Errors, Understanding Exception Handling, Handling Exceptions, Throwing Your Own Exceptions, Using Page Tracing **State Management**: Understanding the Problem of State, Using View State, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using Application State, Comparing State Management Options **Styles, Themes, and Master Pages**: Styles, Themes, Master Page Basics, Advanced Master Pages,	12 Lectures
Unit IV	**ADO.NET Fundamentals**: Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access. **Data Binding**: Introducing Data Binding, Using Single-Value Data	12 Lectures

	Binding, Using Repeated-Value Data Binding, Working with Data Source Controls,	
Unit V	**The Data Controls**: The Grid View, Formatting the Grid View, selecting a Grid View Row, Editing with the Grid View, Sorting and Paging the Grid View, Using Grid View Templates, The Details View and FormView	12 Lectures

List of Practical	
1.	**Working with basic C# and ASP .NET**
a.	Create an application that obtains four int values from the user and displays the product.
b.	Create an application to demonstrate string operations.
c.	Create an application that receives the (Student Id, Student Name, Course Name, Date of Birth) information from a set of students. The application should also display the Information of all the students once the data entered.
d.	Create an application to demonstrate following operations i. Generate Fibonacci series. ii. Test for prime numbers. iii. Test for vowels. iv. Use of for each loop with arrays v. Reverse a number and find sum of digits of a number.
2.	**Working with Object Oriented C# and ASP .NET**
a.	Create simple application to perform following operations i. Finding factorial Value ii. Money Conversion Iii. Quadratic Equation iv. Temperature Conversion
b.	Create simple application to demonstrate use of following concepts i. Function Overloading ii. Inheritance (all types) iii. Constructor overloading iv. Interfaces
c.	Create simple application to demonstrate use of following concepts i. Using Delegates and events ii. Exception handling
3.	**Working with Web Forms and Controls**
a.	Create a simple web page with various sever controls to demonstrate setting and use of Their properties. (Example : AutoPostBack)
b.	Demonstrate the use of Calendar control to perform following operations. a)Display messages in a calendar control b)Display vacation in a calendar control c) Selected day in a calendar control using style d) Difference between two calendar dates
c.	Demonstrate the use of Tree view control perform following operations. a) Tree view control and data list b) Tree view operations
4.	**Working with Form Controls**
a.	Create a Registration form to demonstrate use of various Validation controls.
b.	Create Web Form to demonstrate use of Ad rotator Control.
c.	Create Web Form to demonstrate use User Controls.
5.	**Working with Navigation, Beautification and Master page.**
a.	Create Web Form to demonstrate use of Website Navigation controls and Site Map.
b.	Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification.

c.	Create a web application to demonstrate various states of ASP.NET Pages.
6.	**Working with Database**
a.	Create a web application bind data in a multiline textbox by querying in another textbox.
b.	Create a web application to display records by using database.
c.	Demonstrate the use of Data list link control.
7.	**Working with Database**
a.	Create a web application to display Databinding using dropdown list control.
b.	Create a web application for to display the phone no of an author using database.
c.	Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).
8.	**Working with data controls**
a.	Create a web application to demonstrate various uses and properties of SqlDataSource.
b.	Create a web application to demonstrate data binding using Details View and Form View Control.
c.	Create a web application to display Using Disconnected Data Access and Databinding Using Grid View.
9.	**Working with Grid View control**
a.	Create a web application to demonstrate use of Grid View control template and Grid View hyperlink.
b.	Create a web application to demonstrate use of grid View button column and grid View events.
c.	Create a web application to demonstrate Grid View paging and Creating own table format using Grid View.
10.	**Working with AJAX and XML**
a.	Create a web application to demonstrate reading and writing operation with XML.
b.	CreateawebapplicationtodemonstrateFormSecurityandWindowsSecuritywithproper Authentication and Authorization properties.
c.	Create a web application to demonstrate use of various Ajax controls.
11.	**Programs to create and use DLL**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning ASP.NET 4.5 in C#	Matthew MacDonald	Apress		2012
2.	C# 2015	Anne Bohem and Joel Murach	Murach	Third	2016
3.	Murach's ASP.NET 4.6 Web Programming in C#2015	Mary Delamater and Anne Bohem	SPD	Sixth	2016
4.	ASP.NET 4.0 Programming	J. Kanjilal	Tata McGraw-Hill		2011

5.	Programming ASP.NET	D.Esposito	Microsoft Press (Dreamtech)		2011
6.	Beginning Visual C# 2010	K. Watson, C. Nagel, J.H Padderson, J.D. Reid, Skinner	Wrox (Wiley)		2010

Artificial Intelligence

Unit I	**Introduction:** What is Artificial Intelligence? Foundations of AI, history, the state of art AI today. **Intelligent Agents:** agents and environment, good behavior, nature of environment, the structure of agents	12 Lectures
Unit II	**Solving Problems by Searching:** Problem solving agents, examples problems, searching for solutions, uninformed search, informed search strategies, heuristic functions. **Beyond Classical Search:** local search algorithms, searching with on-deterministic action, searching with partial observations, online search Agents and unknown environments.	12 Lectures
Unit III	**Adversarial Search:** Games, optimal decisions in games, alpha-beta pruning, stochastic games, partially observable games, state-of-the-are game programs. **Logical Agents:** Knowledge base agents, The Wumpus world, logic, propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic.	12 Lectures
Unit IV	**First Order Logic:** Syntax and semantics, using First Order Logic, Knowledge engineering in First Order Logic. **Inference in First Order Logic:** propositional vs. First Order, unification and lifting, forward and backward chaining, resolution.	12 Lectures
Unit V	**Planning:** Definition of Classical Planning, Algorithms for planningas state space search, planning graphs, other classical planning approaches, analysis of planning approaches, Time, Schedules and resources, hierarchical planning, Planning and Acting in Nondeterministic Domains, multiagent planning, **Knowledge Representation:** Categories and Objects, events, mental events and objects, reasoning systems for categories, reasoning with default information, Internet shopping world	12 Lectures

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence: A Modern Approach	Stuart Russel and Peter Norvig	Pearson	3rd	2015
2.	A First Course in Artificial Intelligence	Deepak Khemani	TMH	First	2017
3.	Artificial Intelligence: A Rational Approach	Rahul Deva	Shroff publishers	1st	2018

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

4.	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivashankar Nair	TMH	3rd	2009
5.	Artificial Intelligence & Soft Computing for Beginners	Anandita Das Bhattacharjee	SPD	1st	2013

Practical No		Details
1	a	Write a program to implement depth first search algorithm.
	b	Write a program to implement breadth first search algorithm.
2	a	Write a program to simulate 4-Queen / N-Queen problem.
	b	Write a program to solve tower of Hanoi problem.
3	a	Write a program to implement alpha beta search.
	b	Write a program for Hill climbing problem.
4	a	Write a program to implement A* algorithm.
	b	Write a program to implement AO* algorithm.
5	a	Write a program to solve water jug problem.
	b	Design the simulation of tic – tac – toe game using min-max algorithm.
6	a	Write a program to solve Missionaries and Cannibals problem.
	b	Design an application to simulate number puzzle problem.
7	a	Write a program to shuffle Deck of cards.
	b	Solve traveling salesman problem using artificial intelligence technique.
8	a	Solve the block of World problem.
	b	Solve constraint satisfaction problem
9	a	Derive the expressions based on Associative law
	b	Derive the expressions based on Distributive law
10	a	Write a program to derive the predicate. (for e.g.: Sachin is batsman , batsman is cricketer) - > Sachin is Cricketer.
	b	Write a program which contains three predicates: male, female, parent. Make rules for following family relations: father, mother, grandfather, grandmother, brother, sister, uncle, aunt, nephew and niece, cousin. Question: i. Draw Family Tree. ii. Define: Clauses, Facts, Predicates and Rules with conjunction and disjunction

Linux System Administration

Unit I	**Introduction to Red Hat Enterprise Linux:** Linux, Open Source and Red Hat, Origins of Linux, Distributions, Duties of Linux System Administrator. **Command Line:** Working with the Bash Shell, Getting the Best of Bash, Useful Bash Key Sequences, Working with Bash History, Performing Basic File System Management Tasks, Working with Directories, Piping and Redirection, Finding Files	12 Lectures

	System Administration Tasks: Performing Job Management Tasks, System and Process Monitoring and Management, Managing Processes withps, Sending Signals to Processes with the kill Command, using top to Show Current System Activity, Managing Process Niceness, Scheduling Jobs, Mounting Devices, Working with Links, Creating Backups, Managing Printers, Setting Up System Logging, Setting Up Rsyslog, Common Log Files, Setting UpLogrotate **Managing Software:** Understanding RPM, Understanding Meta Package Handlers, Creating Your Own Repositories, Managing Repositories, Installing Software with Yum, Querying Software, Extracting Files from RPM Packages	
Unit II	**Configuring and Managing Storage:** Understanding Partitions and Logical Volumes, Creating Partitions, Creating File Systems, File Systems Overview, Creating File Systems, Changing File System Properties, Checking the File System Integrity, Mounting File Systems Automatically Through fstab, Working with Logical Volumes, Creating Logical Volumes, Resizing Logical Volumes, Working with Snapshots, Replacing Failing Storage Devices, Creating Swap Space, Working with Encrypted Volumes **Connecting to the Network:** Understanding Network Manager, Working with Services and Run levels, Configuring the Network with Network Manager, Working with system-config-network, Network Manager Configuration Files, Network Service Scripts, Networking from the Command Line, Troubleshooting Networking, SettingUpIPv6,ConfiguringSSH,EnablingtheSSHServer,Usingthe SSH Client, Using PuTTY on Windows Machines, Configuring Key- Based SSH Authentication, Using Graphical Applications with SSH, Using SSH Port Forwarding, Configuring VNC Server Access	12 Lectures
Unit III	**Working with Users, Groups, and Permissions:** Managing Users and Groups, Commands for User Management, Managing Passwords, Modifying and Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, Using External Authentication Sources, the Authentication Process, sssd, nsswitch, Pluggable Authentication Modules, Managing Permissions, the Role of Ownership, Basic Permissions: Read, Write, and Execute, Advanced Permissions, Working with Access Control Lists, Setting Default Permissions with umask, Working with Attributes	12 Lectures
Unit IV	**Securing Server with iptables:** Understanding Firewalls, Setting Up a Firewall with system-config-firewall, Allowing Services, Trusted Interfaces, Masquerading, Configuration Files, Setting Up a Firewall with iptables, Tables, Chains, and Rules, Composition of Rule, Configuration Example, Advanced iptables Configuration, Configuring Logging, The Limit Module, Configuring NAT **Setting Up Cryptographic Services:** Introducing SSL, Proof of Authenticity: The Certificate Authority, Managing Certificates with openssl, Creating a Signing Request, Working with GNU Privacy Guard, Creating GPG Keys, Key Transfer, Managing GPG Keys, Encrypting Files with GPG, GPG Signing, Signing RPM Files **Configuring Server for File Sharing:** What is NFS? Advantages and Disadvantages of NFS, Configuring NFS4, Setting Up NFSv4, Mounting an NFS Share, Making NFS Mounts Persistent, Configuring Automount, Configuring Samba,	12 Lectures

	Setting Up a Samba File Server, Samba Advanced Authentication Options, Accessing Samba Shares, Offering FTP Services.	
Unit V	**Configuring DNS and DHCP:** Introduction to DNS, The DNS Hierarchy, DNS Server Types, The DNS Lookup Process, DNS Zone Types, Setting Up a DNS Server, Setting Up a Cache-Only Name Server, Setting Up a Primary Name Server, Setting Up a Secondary Name Server, Understanding DHCP, Setting Up a DHCP Server **Setting Up a Mail Server:** Using the Message Transfer Agent, the Mail Delivery Agent, the Mail User Agent, Setting Up Postfix as an SMTP Server, Working with Mutt, Basic Configuration, Internet Configuration, Configuring Dovecot for POP and IMAP **Configuring Apache on Red Hat Enterprise Linux:** Configuring the Apache Web Server, creating a Basic Website, Understanding the Apache Configuration Files, Apache Log Files, Working with Virtual Hosts, Securing the Web Server with TLS Certificates, Configuring Authentication,SettingUpAuthenticationwith.htpasswd,Configuring LDAP Authentication, Setting Up MySQL	12 Lectures

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Red Hat Enterprise Linux 6 Administration	Sander van Vugt	John Wiley and Sons		2013
2.	Red hat Linux Networking and System Administration	Terry Collings and Kurt Wall	Wiley	3rd	
3.	Linux Administration: A Beginner's Guide	Wale Soyinka	TMH	Fifth Edition	

Practical No	Details
0	**Installation of RHEL 6.X**
1	**Graphical User Interface and Command Line Interface and Processes**
a	Exploring the Graphical Desktop
b	The Command Line Interface
c	Managing Processes
2	**Storage Devices and Links, Backup and Repository**
b	Working with Storage Devices and Links
a	Making a Backup
b	Creating a Repository
3	**Working with RPMsm Storage and Networking**

a	Using Query Options
b	Extracting Files From RPMs
c	Configuring and Managing Storage
d	Connecting to the Network
4	**Working with Users, Groups, and Permissions**
5	**Firewall and Cryptographic services**
a	Securing Server with iptables
b	Setting Up Cryptographic Services
6	**Configuring Server for File Sharing**
a	Configuring NFS Server and Client
b	Configuring Samba
c	Configuring FTP
7	**DNS, DHCP and Mail Server**
a	Configuring DNS
b	Configuring DHCP
c	Setting Up a Mail Server
8	**Web Server**
a	Configuring Apache on Red Hat Enterprise Linux
b	Writing a Script to Monitor Activity on the Apache Web Server
c	Using the select Command
9	**Shell Scripts and High-Availability Clustering**
a	Writing Shell Scripts
b	Configuring Booting with GRUB
c	Configuring High Availability Clustering
10	**Setting Up an Installation Server**
a	Configuring Network Server as an Installation Server
b	Setting Up a TFTP and DHCP Server for PXE Boot

Enterprise Java

Unit I	**Understanding Java EE:** What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server **Java EE Architecture, Server and Containers:** Types of System Architecture, Java EE Server, Java EE Containers. **Introduction to Java Servlets:** The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do? **Servlet API and Lifecycle:** JavaServletAPI,TheServletSkeleton,The Servlet LifeCycle, A Simple e Welcome Servlet **Working with Servlets:** Getting Started, Using Annotations Instead of Deployment Descriptor. **Working with Databases:** What Is JDBC? JDBC Architecture, Accessing	12 Lectures

	Database, The Servlet GUI and Database Example.	
Unit II	**Request Dispatcher:** Request dispatcher Interface, Methods of Request dispatcher, Request dispatcher Application. **COOKIES:** Kinds of Cookies, Where Cookies Are Used? Creating Cookies Using Servlet, Dynamically Changing the Colors of A Page **SESSION:** What Are Sessions? Lifecycle of Http Session, Session Tracking With Servlet API, A Servlet Session Example **Working with Files:** Uploading Files, Creating an Upload File Application, Downloading Files, Creating a Download File Application. **Working with Non-Blocking I/O:** Creating a Non-Blocking Read Application, Creating The Web Application, Creating Java Class, Creating Servlets, Retrieving The File, Creatingindex.jsp	12 Lectures
Unit III	**Introduction To Java Server Pages:** Why use Java Server Pages? Disadvantages Of JSP, JSPv\s Servlets, Life Cycle of a JSP Page, How does a JSP function? How does JSP execute? About Java Server Pages **Getting Started With Java Server Pages:** Comments, JSP Document, JSP Elements, JSP GUI Example. **Action Elements:** Including other Files, Forwarding JSP Page to Another Page, Passing Parameters for other Actions, Loading a JavaBean. **Implicit Objects, Scope and El Expressions:** Implicit Objects, Character Quoting Conventions, Unified Expression Language [Unified El], Expression Language.	12 Lectures
Unit IV	**Java Server Pages Standard Tag Libraries:** What is wrong in using JSP Scriptlet Tags? How JSTL Fixes JSP Scriptlet's Shortcomings? Disadvantages Of JSTL, TagLibraries.	12 Lectures
Unit V	**Introduction To Enterprise Java beans:** Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans **Working with Session Beans:** When to use Session Beans? Types of Session Beans, Remote and Local Interfaces, Accessing Interfaces, Lifecycle of Enterprise Beans, Packaging Enterprise Beans, Example of Stateful Session Bean, Example of Stateless Session Bean, Example of Singleton SessionBeans. **Working with Message Driven Beans:** Lifecycle of a Message Driven Bean, Uses of Message Driven Beans, The Message Driven Beans Example. **Interceptors:** Request and Interceptor, Defining An Interceptor, Around Invoke Method, Applying Interceptor, Adding An Interceptor To An Enterprise Bean, Build and Run the Web Application. **Java Naming and Directory Interface**: What is Naming Service? What is Directory Service? What is Java Naming and Directory interface? Basic Lookup, JNDI Namespace in Java EE, Resources and JNDI, Data source Resource Definition in Java EE.	12 Lectures

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Java EE 7 For Beginners	Sharanam Shah, Vaishali Shah	SPD	First	2017

2.	Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology for enterprise development	Elder Moraes	Packt	First	2018
3.	Advanced Java Programming	Uttam Kumar Roy	Oxford Press		2015

List of Practical	
1.	**Implement the following Simple Servlet applications.**
a.	Create a simple calculator application using servlet.
b.	Create a servlet for a login page. If the username and password are correct then it says message “Hello <username>” else a message “login failed”
c.	Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database.
2.	**Implement the following Servlet applications with Cookies and Sessions.**
a.	Using Request Dispatcher Interface create a Servlet which will validate the password entered by the user, if the user has entered "Servlet" as password, then he will be Forwarded to Welcome Servlet else the user will stay on the index.html page and an error message will be displayed.
b.	Create a servlet that uses Cookies to store the number of times user has visited Servlet.
c.	Create a servlet demonstrating the use of session creation and destruction. Also check Whether the user has visited this page first time or has visited earlier also using sessions.
3.	**Implement the Servlet IO and File applications.**
a.	Create a Servlet application to upload and download a file.
b.	Develop Simple Servlet Question Answer Application using Database.
c.	Create simple Servlet application to demonstrate Non-Blocking Read Operation.
4.	**Implement the following JSP applications.**
a.	Develop a simple JSP application to display values obtained from the use of intrinsic Objects of various types.
b.	Develop simpleJSP application top ass values from one page to another with Validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
c.	Create a registration and login JSP application to register and authenticate the user Based on username and password using JDBC.
5.	**Implement the following JSP JSTL and EL Applications.**
a.	Create an html page with fields, eno, name, age, desg, salary. Now on submit this data to a JSP page which will update the employee table of database with matching eno.
b.	Create a JSP page to demonstrate the use of Expression language.
c.	Create a JSP application to demonstrate the use of JSTL.
6.	**Implement the following EJB Applications.**
a.	Create a Currency Converter application using EJB.
b.	Develop a Simple Room Reservation System Application Using EJB.

c.	Develop simple shopping cart application using EJB [Stateful Session Bean].
7.	**Implement the following EJB applications with different types of Beans.**
a.	Develop simple EJB application to demonstrate Servlet Hit count using Singleton Session Beans.
b.	Develop simple visitor Statistics application using Message Driven Bean [Stateless Session Bean].
c.	Develop simple Marks Entry Application to demonstrate accessing Database using EJB.
8.	**Implement the following JPA applications.**
a.	Develop a simple Inventory Application Using JPA.
b.	Develop a Guestbook Application Using JPA.
c.	Create simple JPA application to store and retrieve Book details.
9.	**Implement the following JPA applications with ORM and Hibernate.**
a.	Develop a JPA Application to demonstrate use of ORM associations.
b.	Develop a Hibernate application to store Feedback of Website Visitor in MySQL Database.
c.	Develop a Hibernate application to store and retrieve employee details in MySQL Database.
10.	**Implement the following Hibernate applications.**
a.	Develop an application to demonstrate Hibernate One- To -One Mapping Using Annotation.
b.	DevelopHibernateapplicationtoenterandretrievecoursedetailswith ORMMapping.
c.	Develop a five page web application site using any two or three Java EE Technologies.

Next Generation Technologies

Unit I	**Big Data:** Getting Started, Big Data, Facts About Big Data, Big Data Sources, Three Vs of Big Data, Volume, Variety, Velocity, Usage of Big Data, Visibility, Discover and Analyze Information, Segmentation and Customizations, Aiding Decision Making, Innovation, Big Data Challenges, Policies and Procedures, Access to Data, Technology and Techniques, Legacy System and Big Data ,Structure of Big Data, Data Storage, Data Processing, Big Data Technologies **NoSQL:** SQL, NoSQL, Definition, A Brief History of NoSQL, ACID vs. BASE, CAP Theorem (Brewer's Theorem), The BASE, NoSQL Advantage sand Disadvantages, Advantages of No SQL, Disadvantages of NoSQL, SQL vs. NoSQL Databases, Categories of NoSQL Databases **Introducing MongoDB:** History, MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features, Running the Database Anywhere, SQL Comparison	12 Lectures
Unit II	**The MongoDB Data Model:** The Data Model, JSON and BSON, The Identifier (_id), Capped Collection, Polymorphic Schemas, Object- Oriented	12 Lectures

	Programming, Schema Evolution **Using MongoDB Shell:** Basic Querying, Create and Insert, Explicitly Creating Collections, Inserting Documents Using Loop, Inserting by Explicitly Specifying _id, Update, Delete, Read, Using Indexes, Stepping Beyond the Basics, Using Conditional Operators, Regular Expressions, MapReduce, aggregate(), Designing an Application's Data Model, Relational Data Modeling and Normalization, MongoDB Document Data Model Approach **MongoDB Architecture:** Core Processes, mongo, mongo, mongos, MongoDB Tools, Standalone Deployment, Replication, Master/Slave Replication, Replica Set, Implementing Advanced Clustering with Replica Sets, Sharding, Sharding Components, Data Distribution Process, Data Balancing Process, Operations, Implementing Sharding, Controlling Collection Distribution (Tag-Based Sharding), Points to Remember When Importing Data in a Sharded Environment, Monitoring for Sharding, Monitoring the Config Servers, Production Cluster Architecture, Scenario 1, Scenario 2, Scenario 3, Scenario 4	
Unit III	**MongoDB Storage Engine:** Data Storage Engine, Data File(Relevant for MMAPv1), Namespace (.ns File), Data File (Relevant for Wired Tiger), Read sand Writes, How Data Is Written Using Journaling, GridFS – The MongoDB File System, The Rationale of GridFS, GridFSunder the Hood, Using GridFS, Indexing, Types of Indexes, Behaviors and Limitations **MongoDB Use Cases:** Use Case 1 -Performance Monitoring, Schema Design,Operations,Sharding,ManagingtheData,UseCase2–Social Networking, Schema Design, Operations, Sharding **MongoDB Limitations:** MongoDB Space Is Too Large (Applicable for MMAPv1), Memory Issues (Applicable for Storage Engine MMAPv1), 32-bit vs. 64-bit, BSON Documents, Namespaces Limits, Indexes Limit, Capped Collections Limit - Maximum Number of Documents in a Capped Collection, Sharding Limitations, Shard Early to Avoid Any Issues, Shard Key Can't Be Updated, Shard Collection Limit, Select the Correct Shard Key, Security Limitations, No Authentication by Default, Traffi c to and from MongoDB Isn't Encrypted, Write and Read Limitations, Case-Sensitive Queries, Type- Sensitive Fields, No JOIN, Transactions, MongoDB Not Applicable Range **MongoDB Best Practices:** Deployment, Hardware Suggestions from the MongoDB Site, Few Points to be Noted, Coding, Application ResponseTimeOptimization, DataSafety, Administration, Replication Lag, Sharding,Monitoring	12 Lectures
Unit IV	**The End of Disk? SSD and In-Memory Databases:** The End of Disk?, Solid State Disk, The Economics of Disk, SSD-Enabled Databases, In-Memory Databases, TimesTen, Redis, SAP HANA, VoltDB, Oracle 12c "in-Memory Database, Berkeley Analytics Data Stack and Spark, Spark Architecture **jQuery:** Introduction, Traversing the DOM, DOM Manipulation with jQuery, Events, Ajax with jQuery, jQuery Plug-ins, jQuery Image Slider	12 Lectures

Unit V	**JSON:** Introduction, JSON Grammar, JSON Values, JSON Tokens, Syntax, JSON vs XML, Data Types, Objects, Arrays, Creating JSON, JSON Object, Parsing JSON, Persisting JSON, Data Interchange, JSON PHP, JSON HTML, JSONP	12 Lectures

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Practical MongoDB	Shakuntala Gupta Edward Navin Sabharwal	Apress		
2.	Beginning jQuery	Jack Franklin Russ Ferguson	Apress	Second	
3.	Next Generation Databases	Guy Harrison	Apress		
4.	Beginning JSON	Ben Smith	Apress		

Practical No	**Details**
1	**MongoDB Basics**
a	Write a MongoDB query to create and drop database.
b	Write a MongoDB query to create, display and drop collection
c	Write a MongoDB query to insert, query, update and delete a document.
2	**Simple Queries with MongoDB**
3	**Implementing Aggregation**
a	Write a MongoDB query to use sum, avg, min and max expression.
b	Write a MongoDB query to use push and add To Set expression.
c	Write a MongoDB query to use first and last expression.
4	**Replication, Backup and Restore**
a	Write a MongoDB query to create Replica of existing database.
b	Write a MongoDB query to create a backup of existing database.
c	Write a MongoDB query to restore database from the backup.
5	**Java and MongoDB**
a	Connecting Java with MongoDB and inserting, retrieving, updating and deleting.
6	**PHP and MongoDB**
a	Connecting PHP with MongoDB and inserting, retrieving, updating and deleting.
7	**Python and MongoDB**

a	Connecting Python with MongoDB and inserting, retrieving, updating and deleting.
8	**Programs on Basic jQuery**
a	jQuery Basic, jQuery Events
b	jQuery Selectors, jQuery Hide and Show effects
c	jQuery fading effects, jQuery Sliding effects
9	**jQuery Advanced**
a	jQuery Animation effects, jQuery Chaining
b	jQuery Callback, jQuery Get and Set Contents
c	jQuery Insert Content, jQuery Remove Elements and Attribute
10	**JSON**
a	Creating JSON
b	Parsing JSON
c	Persisting JSON
11	**Create a JSON file and import it to MongoDB**
a	Export MongoDB to JSON.
b	Write a MongoDB query to delete JSON object from MongoDB

T.Y.B.Sc. IT Semester VI

Software Quality Assurance		
Unit I	**Introduction to Quality:** Historical Perspective of Quality, What is Quality? (Is it a fact or perception?), Definitions of Quality, Core Components of Quality, Quality View, Financial Aspect of Quality, Customers, Suppliers and Processes, Total Quality Management (TQM), Quality Principles of Total Quality Management, Quality Management Through Statistical Process Control, Quality Management Through Cultural Changes, Continual (Continuous) improvement cycle, Quality in Different Areas, Benchmarking and Metrics, Problem Solving Techniques, Problem Solving Software Tools. **Software Quality:** Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, organization Culture, Characteristics of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, and Important Aspects of Quality Management.	**12 Lectures**
Unit II	**Fundamentals of testing:** Introduction, Necessity of testing, What is testing? Fundamental test process, The psychology of testing,	**12**

	Historical Perspective of Testing, Definitions of Testing, Approaches to Testing, Testing During Development Life Cycle, Requirement Traceability Matrix, Essentials of Software Testing, Workbench, Important Features of Testing Process, Misconceptions About Testing, Principles of Software Testing, Salient Features of Good Testing, Test Policy, Test Strategy or Test Approach, Test Planning ,Testing Process and Number of Defects Found in Testing, Test Team Efficiency, Mutation Testing, Challenges inTesting, TestTeam Approach, Process Problems Faced by Testing, Cost Aspect of Testing, Establishing Testing Policy, Methods, Structured Approach to Testing, Categories of Defect, Defect, Error, or Mistake in Software, Developing Test Strategy, Developing Testing Methodologies (Test Plan), Testing Process, Attitude Towards Testing (Common People Issues), Test Methodologies/Approaches, People Challenges in Software Testing, Raising Management Awareness f or Testing, Skills Required by Tester, Testing throughout the software life cycle, Software development models, Test levels, Test types, the targets of testing, Maintenance testing	**Lectures**
Unit III	**Unit Testing: Boundary Value Testing:** Normal Boundary Value Testing, Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Special Value Testing, Examples, Random Testing, Guidelines for Boundary Value Testing, **Equivalence Class Testing:** Equivalence Classes, Traditional Equivalence Class Testing, Improved Equivalence Class Testing, Edge Testing, Guidelines and Observations. **Decision Table–Based Testing:** Decision Tables, Decision Table Techniques, Cause-and-Effect Graphing, Guidelines and Observations, **Path Testing:** Program Graphs, DD-Paths, Test Coverage Metrics, Basis Path Testing, Guide lines and Observations ,**Data Flow Testing:** Define/Use Testing, Slice-Based Testing, Program Slicing Tools.	**12 Lectures**
Unit IV	**Software Verification and Validation:** Introduction, Verification, Verification Workbench, Methods of Verification, Types of reviews the basis of Stage Phase, Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation,Softwaredevelopmentverificationandvalidationactivities. **V-test Model:** Introduction, V-model for software, testing during Proposal stage, Testing during requirement stage, Testing during test Planning phase, Testing during design phase, Testing during coding, VV Model, Critical Roles and Responsibilities.	**12 Lectures**
Unit V	**Levels of Testing:** Introduction, Proposal Testing, Requirement Testing, Design Testing, Code Review, Unit Testing, Module Testing, integration Testing. Big-bang Testing, Sandwich Testing, Critical Path First, Sub System Testing, System Testing, Testing Stages. **Special Tests:** Introduction, GUI testing, Compatibility Testing, Security Testing, Performance Testing, Volume Testing, Stress Testing, Recovery Testing, Installation Testing, Requirement Testing, Regression Testing, Error Handling Testing, Manual Support Testing, Intersystem Testing, Control Testing, Smoke Testing, Ad	**12 Lectures**

	hoc Testing, Parallel Testing, Execution Testing, Operations Testing, Compliance Testing, Usability Testing, Decision Table Testing, Documentation Testing, Training testing, Rapid Testing, Control flow graph, Generating tests on the basis of Combinatorial Designs, State Graph, Risk Associated with New Technologies, Process maturity level of Technology, Testing Adequacy of Control in New technology usage, Object Oriented Application Testing, Testing of Internal Controls, COTS Testing, Client Server Testing, Web Application Testing, Mobile Application Testing, ebusiness ecommerce Testing, Agile Development Testing, Data Warehousing Testing.	

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Software Testing and Continuous Quality Improvement	William E. Lewis	CRC Press	Third	2016
2	Software Testing: Principles, Techniques and Tools	M. G. Limaye	TMH		2017
3.	Foundations of Software Testing	Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black	Cengage Learning	3rd	
4.	Software Testing: A Craftsman's Approach	Paul C. Jorgenson	CRC Press	4th	2017

Security in Computing

Unit I	**Information Security Overview**: The Importance of Information Protection, The Evolution of Information Security, Justifying Security Investment, Security Methodology, How to Build a Security Program, The Impossible Job, The Weakest Link, Strategy and Tactics, Business Processes vs. Technical Controls. **Risk Analysis**: Threat Definition, Types of Attacks, Risk Analysis. **Secure Design Principles**: The CIA Triad and Other Models, Defense Models, Zones of Trust, Best Practices for Network Defense.	**12 Lectures**
Unit II	**Authentication and Authorization**: Authentication, Authorization **Encryption**: A Brief History of Encryption, Symmetric-Key Cryptography, Public Key Cryptography, And Public Key Infrastructure. **Storage Security**: Storage Security Evolution, Modern Storage Security, Risk Remediation, Best Practices. **Database Security**: General Database Security Concepts, Understanding Database Security Layers, Understanding Database-Level Security, Using Application Security, Database Backup and Recovery, Keeping Your Servers Up to Date, Database Auditing and Monitoring.	**12 Lectures**
Unit III	**Secure Network Design**: Introduction to Secure Network Design,	**12**

	Performance, Availability, and Security. **Network Device Security**: Switch and Router Basics, Network Hardening. **Firewalls**: Overview, The Evolution of Firewalls, Core Firewall Functions, Additional Firewall Capabilities, Firewall Design. **Wireless Network Security**: Radio Frequency Security Basics, Data-Link Layer Wireless Security Features, Flaws, and Threats, Wireless Vulnerabilities and Mitigations, Wireless Network Hardening Practices and Recommendations, Wireless Intrusion Detection and Prevention, Wireless Network Positioning and Secure Gateways.	**Lectures**
Unit IV	**Intrusion Detection and Prevention Systems**: IDS Concepts, IDS Types and Detection Models, IDS Features, IDS Deployment Considerations, Security Information and Event Management (SIEM). **Voice over IP (VoIP) and PBX Security**: Background, VoIP Components, VoIP Vulnerabilities and Countermeasures, PBX, TEM: Telecom Expense Management. **Operating System Security Models**: Operating System Models, Classic Security Models, Reference Monitor, Trustworthy Computing, International Standards for Operating System Security.	**12 Lectures**
Unit V	**Virtual Machines and Cloud Computing**: Virtual Machines, Cloud Computing. **Secure Application Design**: Secure Development Lifecycle, Application Security Practices, Web Application Security, Client Application Security, And Remote Administration Security. **Physical Security**: Classification of Assets, Physical Vulnerability Assessment, Choosing Site Location for Security, Securing Assets: Locks and Entry Controls, Physical Intrusion Detection.	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	The Complete Reference: Information Security	Mark Rhodes-Ousley	McGraw-Hill	Second	2013
2.	Essential Cybersecurity Science	Josiah Dykstra	O'Reilly	Fifth	2017
3.	Principles of Computer Security: CompTIA Security+ and Beyond	Wm.Arthur Conklin, GregWhite	McGraw Hill	Second	2010

Practical No	Details
1	**Configure Routers**
a	OSPF MD5 authentication.
b	NTP.
c	To log messages to the syslog server.
d	To support SSH connections.
2	**Configure AAA Authentication**
a	Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA

b	Verify local AAA authentication from the Router console and the PC-A client
3	**Configuring Extended ACLs**
a	**Configure, Apply and Verify an Extended Numbered ACL**
4	**Configure IP ACLs to Mitigate Attacks and IPV6 ACLs**
a	Verify connectivity among devices before firewall configuration.
b	Use ACLs to ensure remote access to the routers is available only from Management station PC-C.
c	Configure ACLs on to mitigate attacks.
d	Configuring IPv6 ACLs
5	**Configuring a Zone-Based Policy Firewall**
6	Configure IOS Intrusion Prevention System (IPS) Using the CLI
a	Enable IOS IPS.
b	Modify an IPS signature.
7	**Layer 2 Security**
a	Assign the Central switch as the root bridge.
b	Secure spanning-tree parameters to prevent STP manipulation attacks.
c	Enable port security to prevent CAM table overflow attacks.
8	**Layer 2 VLAN Security**
9	**Configure and Verify a Site-to-Site IPsec VPN Using CLI**
10	**Configuring ASA Basic Settings and Firewall Using CLI**
a	Configure basic ASA settings and interface security levels using CLI
b	Configure routing, address translation, and inspection policy using CLI
c	Configure DHCP, AAA, and SSH
d	Configure a DMZ, Static NAT, and ACLs

Business Intelligence

Unit I	**Business intelligence:** Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence **Decision support systems:** Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system	**12 Lectures**
Unit II	**Mathematical models for decision making:** Structure of mathematical models, Development of a model, Classes of models **Data mining:** Definition of data mining, Representation of input data , Data mining process, Analysis methodologies **Data preparation**: Data validation, Data transformation, Data reduction	**12 Lectures**

Unit III	**Classification**: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines **Clustering:** Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models	**12 Lectures**
Unit IV	**Business intelligence applications:** **Marketing models**: Relational marketing, Sales force management, **Logistic and production models**: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. **Data envelopment analysis**: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices	**12 Lectures**
Unit V	**Knowledge Management:** Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management **Artificial Intelligence and Expert Systems:** ConceptsandDefinitionsofArtificialIntelligence,ArtificialIntelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Business Intelligence: Data Mining and Optimization for Decision Making	Carlo Vercellis	Wiley	First	2009
2.	Decision support and Business Intelligence Systems	Efraim Turban, Ramesh Sharda, Dursun Delen	Pearson	Ninth	2011
3.	Fundamental of Business Intelligence	Grossmann W, Rinderle-Ma	Springer	First	2015

Practical No	Details
1	Import the legacy data from different sources such as (Excel , SqlServer, Oracle etc.) and load in the target system. (You can download sample database such as Adventure works, Northwind, foodmart etc.)
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sql server.
3	a. Create the Data staging area for the selected database. b. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.
4	a. Create the ETL map and setup the schedule for execution. b. Execute the MDX queries to extract the data from the data ware house.

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

5	Import the data warehouse data in Microsoft Excel and create the Pivot table and Pivot Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart to perform data analysis.
6	Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
7	Perform the data classification using classification algorithm.
8	Perform the data clustering using clustering algorithm.
9	Perform the Linear regression on the given data warehouse data.
10	Perform the logistic regression on the given data warehouse data.

Principles of Geographic Information System

Unit I	**A Gentle Introduction to GIS** **The nature of GIS:** Some fundamental observations, Defining GIS, GISystems, GIScience and GIApplications, Spatial data and Geoinformation. **The real world and representations of it:** Models and modelling, Maps, Databases, Spatial databases and spatial analysis **Geographic Information and Spatial Database Models and Representations of the real world** **Geographic Phenomena:** Defining geographic phenomena, types of geographic phenomena, Geographic fields, Geographic objects, Boundaries **Computer Representations of Geographic Information:** Regular tessellations, irregular tessellations, Vector representations, Topology and Spatial relationships, Scale and Resolution, Representation of Geographic fields, Representation of Geographic objects **Organizing and Managing Spatial Data The Temporal Dimension**	**12 Lectures**
Unit II	**Data Management and Processing** **Systems Hardware and Software Trends** **Geographic Information Systems:** GIS Software, GIS Architecture and functionality, Spatial Data Infrastructure (SDI) **Stages of Spatial Data handling:** Spatial data handling and preparation, Spatial Data Storage and maintenance, Spatial Query and Analysis, Spatial Data Presentation. **Database management Systems:** Reasons for using a DBMS, Alternatives for data management, The relational data model, Querying the relational database. **GIS and Spatial Databases:** Linking GIS andDBMS, Spatial database functionality.	**12 Lectures**
Unit III	**Spatial Referencing and Positioning** **Spatial Referencing:** Reference surfaces for mapping, Coordinate Systems, Map Projections, Coordinate Transformations	**12 Lectures**
Unit IV	**Satellite-based Positioning:** Absolute positioning, Errors in absolute	**12**

	positioning, Relative positioning, Network positioning, code versus phase measurements, Positioning technology **Data Entry and Preparation** **Spatial Data Input:** Direct spatial data capture, Indirect spatial data capture, Obtaining spatial data elsewhere **Data Quality:** Accuracy and Positioning, Positional accuracy, Attribute accuracy, temporal accuracy, Lineage, Completeness, Logical consistency **Data Preparation:** Data checks and repairs, Combining data from multiple sources **Point Data Transformation:** Interpolating discrete data, Interpolating continuous data	**Lectures**
Unit V	**Spatial Data Analysis** **Classification of analytical GIS Capabilities** **Retrieval, classification and measurement:** Measurement, Spatial selection queries, Classification **Overlay functions:** Vector overlay operators, Raster overlay operators **Neighborhood functions:** Proximity computations, Computation of diffusion, Flow computation, Raster based surface analysis **Analysis:** Network analysis, interpolation, terrain modeling **GIS and Application models:** GPS, Open GIS Standards, GIS Applications and Advances **Error Propagation in spatial data processing:** How Errors propagate, Quantifying error propagation	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Principles of Geographic Information Systems-An Introductory Text Book	Editors: Otto Huisman and Rolf A.	The International Institute of Geoinformation Science and Earth Observation	Fourth	2009
2.	Principles of Geographic Information Systems	P.A Burrough and R.A.McDonnell	Oxford University Press	Third	1999
3.	Fundamentals of Spatial Information Systems,	R.Laurini and D. Thompson,	Academic Press		1994

4.	Fundamentals of Geographic Information Systems	Michael N.Demers	Wiley Publications	Fourth	2009
5.	Introduction to Geographic Information Systems	Chang Kang-tsung (Karl),	McGrawHill	Any above 3rd Edition	2013 7th Edition
6.	GIS Fundamentals: A First Text on Geographic Information Systems	Paul Bolsatd	XanEdu Publishing Inc	5th Edition	

Practical No	**Details**
	Familiarizing Quantum GIS: Installation of QGIS, datasets for both Vector and Raster data, Maps.
1	Creating and Managing Vector Data: Adding vector layers, setting properties, formatting, calculating line lengths and statistics
2	Exploring and Managing Raster data: Adding raster layers, raster styling and analysis, raster mosaicking and clipping
3	Map, Working, Importing Spreadsheets or CSV files Using Plugins ,Searching and Downloading Open Street Map Data
4	Working with attributes, terrain Data
5	Working with Projections and WMS Data
6	Geo referencing Topo Sheets and Scanned Maps Geo referencing Aerial Imagery Digitizing Map Data
7	Managing Data Tables and Spatial data Sets: Table joins, spatial joins, points in polygon analysis, performing spatial queries
8	Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data
9	Advance GIS Operations 2: Batch Processing using Processing Framework Automating Complex Workflows using Processing Modeler Automating Map Creation with Print Composer Atlas
10	Validating Map data

Enterprise Networking

Unit I	**General Network Design:** Network Design Methodology, Architectures for the Enterprise, Borderless Networks Architecture, Collaboration and Video Architecture, Data Center and Virtualization Architecture, Design Lifecycle: Plan, Build, Manage Plan Phase Build Phase Manage Phase Prepare, Plan, Design, Implement, Operate, and Optimize Phases Prepare Phase Plan Phase Design Phase Implement Phase Operate Phase Optimize Phase Summary of PPDIOO Phases Project Deliverables Design Methodology Identifying Customer Design Requirements Characterizing the Existing Network Steps in Gathering Information Network Audit Tools Network Checklist Designing the Network Topology and Solutions Top-Down Approach Pilot and Prototype Tests Design Document **Network Design Models:** Hierarchical Network Models Benefits of the Hierarchical Model, Hierarchical Network Design, Core Layer, Distribution Layer, Access Layer, Hierarchical Model Examples, Hub- and-Spoke, Design Collapsed Core, Design Enterprise Architecture Model, Enterprise Campus Module, Enterprise Edge Area, E- Commerce Module, Internet Connectivity Module, VPN/Remote Access, Enterprise WAN, Service Provider Edge Module, Remote Modules, Enterprise Branch Module, Enterprise Data Center Module, Enterprise Teleworker Module, High Availability Network Services, Workstation-to-Router Redundancy and LAN, High Availability Protocols, ARP Explicit Configuration, RDP, RIP, HSRP,VRRP, GLBP, Server Redundancy, Route Redundancy, Load Balancing, Increasing Availability, Link Media Redundancy	**12 Lectures**
Unit II	**Enterprise LAN Design:** LAN Media, Ethernet Design Rules, 100Mbps Fast Ethernet Design Rules, Gigabit Ethernet Design Rules, 1000BASE-LX Long-Wavelength Gigabit Ethernet, 1000BASE-SX Short-Wavelength Gigabit Ethernet, 1000BASE-CX Gigabit Ethernet over Coaxial Cable, 1000BASE-T Gigabit Ethernet over UTP 86, 10 Gigabit Ethernet Design Rules, 10GE Media Types, Ether Channel, Comparison of Campus Media LAN Hardware, Repeaters, Hubs, Bridges, Switches, Routers, Layer 3 Switches, Campus LAN Design and Best Practices Best Practices for Hierarchical Layers, Access Layer Best Practices, Distribution Layer Best Practices, Core Layer Best Practices, STP Design Considerations, STP Toolkit, Port Fast, Uplink Fast, Backbone Fast, Loop Guard, Root Guard, BPDU Guard, BPDU Filter, VLAN and Trunk Considerations, Unidirectional Link Detection (UDLD) Protocol, Large-Building LANs, Enterprise Campus LANs, Edge Distribution, Medium-Size LANs, Small and Remote Site LANs ,Server Farm Module, Server Connectivity Options, Enterprise Data Center Infrastructure, Campus LAN QoS Considerations, Multicast Traffic Considerations, CGMP, IGMP Snooping. **Data Center Design:** Enterprise DC Architecture, Data Center Foundation Components, Data Center Topology Components, Data Center Network Programmability, SDN, Controllers, APIs, ACI, Challenges in the DC, Datacenter Facility Aspects, Datacenter Space, Data Center Power, Data Center Cooling, Data Center Heat, Data Center Cabling, Enterprise DC Infrastructure, Data Center Storage, Data Center Reference Architecture, Defining the DC Access Layer, Defining the DC Aggregation Layer,	**12 Lectures**

	Defining the DC Core Layer, Security in the DC, Fabric Extenders, Virtualization Overview, Challenges, Defining Virtualization and Benefits, Virtualization Risks, Types of Virtualization, Virtualization Technologies, VSS, VRF, vPC, Device Contexts, Server Virtualization, Server Scaling, Virtual Switching, Network Virtualization Design Considerations, Access Control, Path Isolation, Services Edge, Data Center Interconnect, DCI Use Cases, DCI Transport Options, DCI L2 Considerations, Load Balancing in the DC, Application Load Balancing, Network Load Balancing.	
Unit III	**Wireless LAN Design:** Wireless LAN Technologies, WLAN Standards, ISM and UNII Frequencies, Summary of WLAN Standards, Service Set Identifier, WLAN Layer 2 Access Method, WLAN Security, Unauthorized Access, WLAN Security Design Approach, IEEE 802.1X-2001 Port-Based Authentication, Dynamic WEP Keys and LEAP, Controlling WLAN Access to Servers, WLAN Authentication, Authentication Options, WLAN Controller Components, WLC Interface Types, AP Controller Equipment Scaling, Roaming and Mobility Groups, Intracontroller Roaming, Layer 2 Intercontroller Roaming, Layer 3 Intercontroller Roaming, Mobility Groups, WLAN Design, Controller Redundancy Design: Deterministic vs. Dynamic, N+1 WLC Redundancy, N+N WLC Redundancy, N+N+1 WLC Redundancy, Radio Management and Radio Groups, RF Groups, RF Site Survey, Using EoIP Tunnels for Guest Services, Wireless Mesh for Outdoor Wireless, Mesh Design Recommendations, Campus Design Considerations, Power over Ethernet (PoE), Wireless and Quality of Service (QoS), Branch Design Considerations, Local MAC, REAP, Hybrid REAP, Branch Office ControllerOptions. **WAN Technologies and the Enterprise Edge:** WAN and Enterprise Edge Overview, Definition of WAN, WAN Edge Module, Enterprise Edge Modules, WAN Transport Technologies, ISDN, ISDN BRI Service, ISDN PRI Service, Digital Subscriber Line, Cable, Wireless, Frame Relay, Time-Division Multiplexing, Metro Ethernet, SONET/SDH, Multiprotocol Label Switching (MPLS), Dark Fiber, Dense Wavelength-Division Multiplexing, Ordering WANT echnology and Contracts, WAN and Edge Design Methodologies, Response Time, Throughput, Reliability, Bandwidth Considerations, WAN Link Categories, Optimizing Bandwidth Using QoS, Queuing, Traffic Shaping and Policing, Classification, Congestion Management, Priority Queuing, Custom Queuing, Weighted Fair Queuing, Class-Based Weighted Fair Queuing, Low-Latency Queuing, Traffic Shaping and Policing, Link Efficiency, Window Size, DMZ Connectivity, Segmenting DMZs, DMZ Services, Internet Connectivity, Centralized Internet(Branch)vs. Direct Internet(Branch),High Availability for the Internet Edge, VPN Network Design. **WAN Design** Traditional WAN Technologies Hub-and-Spoke Topology Full-Mesh Topology Partial-Mesh Topology Point-to-Point Topology Remote Site Connectivity Enterprise VPN vs. Service Provider VPN Enterprise Managed VPN: IPsec IPsec Direct Encapsulation Generic Routing Encapsulation IPsec DMVPN IPsec Virtual Tunnel Interface Design GETVPN Service Provider–Managed	**12 Lectures**

	Offerings ,Metro Ethernet Service Provider VPNs: L2 vs. L3 ,Virtual Private Wire Services VPWS L2 VPN Considerations ,Virtual Private LAN Services VPLS L2 VPN Considerations ,MPLS, MPLS Layer 3 Design Overview MPLS L3 VPN Considerations ,VPN Benefits WAN Backup Design WAN Backup over the Internet Enterprise WAN Architecture Cisco Enterprise MAN/WAN Enterprise WAN/MAN Architecture Comparison ,Enterprise WAN Components Comparing Hardware and Software Enterprise Branch Architecture Branch Design Branch Connectivity Redundancy for Branches Single WAN Carrier vs. Dual WAN Carriers Single MPLS Carrier Site , Dual WAN:L3VPN with IPsecVPN,InternetforBranchesFlatLayer2vs. Collapsed Core ,Enterprise Branch Profiles Small Branch Design Medium Branch Design Large Branch Design Enterprise Teleworker Design ,ISRs for Teleworkers	
Unit IV	Hierarchical IP Address Network , Private and Public IP Address and NAT Guidelines , Steps for Creating an IPv4 Address Plan Case Study: IP Address Subnet Allocation , Address Assignment and Name Resolution , Recommended Practices of IP Address Assignment , BOOTP DHCP DNS , Internet Protocol Version 6 Design, IPv6 Header IPv6 Address Representation IPv4-Compatible IPv6Addresses IPv6 Prefix Representation IPv6 Address Scope Types and Address Allocations IPv6 Address Allocations IPv6 Unicast Address Global Unicast Addresses Link-Local Addresses , Unique Local IPv6Address Global Aggregable IPv6 Address , IPv4-Compatible IPv6 Address IPv6 Any cast Addresses , IPv6 Multicast Addresses IPv6 Mechanisms ICMPv6 , IPv6 Neighbor Discovery Protocol IPv6 Name Resolution , Path MTU Discovery IPv6 Address-Assignment Strategies , Manual Configuration SLAAC of Link-Local Address , SLAAC of Globally Unique IPv6 Address DHCPv6 , DHCPv6 Lite IPv6 Security IPv6 Routing Protocols RIPng OSPFv3 , BGP4 Multiprotocol Extensions (MP-BGP) forIPv6 , IPv6 Addressing Design , Planning for Addressing with IPv6 , Route Summarization with IPv6 IPv6 Private Addressing IPv6 for the Enterprise IPv6 Address Allocation , Partly Linked IPv4 Address into IPv6, Whole IPv4 Address Linked into IPv6 IPv6 Addresses Allocated Per Location and/or Type , IPv4-to-IPv6 Transition Mechanisms and Deployment Models , Dual-Stack MechanismIPv6overIPv4Tunnels,ProtocolTranslationMechanisms IPv6 Deployment Models , Dual-Stack Model Hybrid Model Service Block Model ,IPv6 Deployment Model Comparison IPv6 Comparison withIPv4,OSPF,BGP,RouteManipulation,andIPMulticast,OSPFv2 OSPFv2 Metric OSPFv2 Adjacencies and Hello Timers , OSPFv2 Areas OSPF Area Design Considerations OSPF Router Types OSPF DRs LSA Types Autonomous System External Path Types OSPF Stub Area Types Stub Areas Totally Stubby Areas , NSSAs Virtual Links OSPFv2 Router Authentication , OSPFv2 Summary OSPFv3 OSPFv3 Changes from OSPFv2, OSPFv3 Areas and Router Types OSPFv3 LSAs OSPFv3Summary BGP BGP Neighbors eBGP iBGP Route Reflectors Confederations BGP Administrative Distance, BGP Attributes, Weight, and the BGP Decision BGP Path Attributes Next-Hop Attribute Local Preference Attribute Origin Attribute Autonomous System Path Attribute MED Attribute Community Attribute Atomic Aggregate and Aggregator Attributes Weight BGP Decision Process, BGP Summary, Route	**12 Lectures**

	Manipulation PBR Route Summarization Route Redistribution Default Metric OSPF Redistribution Route Filtering TransitTraffic Routing Protocols on the Hierarchical Network Infrastructure IP Multicast Review, Multicast to Layer2MappingIGMP,IGMPv1IGMPv2IGMPv3CGMPIGMP Snooping, Sparse Versus Dense Multicast Multicast Source and Shared	
Unit V	Managing Security Network Security Overview Security Legislation Security Threats Reconnaissance and Port Scanning Vulnerability Scanners Unauthorized Access Security Risks Targets Loss of Availability Integrity Violations and Confidentiality Breaches , Security Policy and Process Security Policy Defined , Basic Approach of a Security Policy Purpose of Security Policies, Security Policy Components Risk Assessment , Risk Index Continuous Security Integrating Security Mechanisms into Network Design Trust and Identity Management , Trust Domains of Trust Identity Passwords Tokens Certificates , Network Access Control Secure Services Encryption Fundamentals Encryption Keys VPN Protocols , Transmission Confidentiality Data Integrity Threat Defense , Physical Security Infrastructure Protection Security Management Solutions Security Solution Network Security Platforms , Trust and Identity Technologies Firewall Fundamentals , Types of Firewalls Next-Gen Firewalls NAT Placement , Firewall Guidelines Firewall ACLs , Identity and Access Control Deployments Detecting and Mitigating Threats IPS/IDS Fundamentals IPS/IDS Guidelines , Threat Detection and Mitigation Technologies , Threat-Detection and Threat-Mitigation Solutions , Firepower IPS Security Management Applications , Security Platform Solutions Security Management Network Integrating Security into Network Devices IOS Security, ISR G2 Security Hardware Options Securing the Enterprise, Implementing Security in the Campus Implementing Security in the Data Center Implementing Security in the Enterprise Edge Network Management Protocols, Simple Network Management Protocol SNMP Components , MIBSNMP MessageVersionsSNMPv1 SNMPv2 SNMPv3, Other Network Management Technologies RMON, RMON2 Net Flow Compared to RMON and SNMP, CDP LLDPSyslog.	**12 Lectures**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	CCDA200-310Official Cert Guide	ANTHONY BRUNO, CCIE No. 2738 STEVE JORDAN, CCIE No. 11293	**Cisco Press**		
2.	Network Warrior	Gary A Donabue	**O Reilly**	2nd	2011

Practical No	**Details**
1	**Configuring OSPF – I**
a	Single-Area OSPF Link Costs and Interface Priorities
b	Multi-Area OSPF with Stub Areas and Authentication

2	**Configuring OSPF – II**
a	OSPF Virtual Links and Area Summarization
b	OSPF over Frame Relay
3	**Redistribution and Administrative Distances**
a	Redistribution Between RIP and OSPF
b	Manipulating Administrative Distances
4	**BGP**
a	Configuring BGP with Default Routing
b	Using the AS_PATH Attribute
c	BGP Route Reflectors and Route Filters
5	**IPv6**
a	Configuring OSPF for IPv6
b	Configuring 6to4 Tunnels
6	**VLANs and Ether Channel**
a	Static VLANS, VLAN Trucking, and VTP Domains and Modes
b	Configuring Ether Channel
7	**Spanning Tree Protocol**
a	Spanning Tree Protocol (STP) Default Behavior
b	Modifying Default Spanning Tree Behavior
8	**VLAN and Spanning Tree**
a	Per-VLAN Spanning Tree Behavior
b	Multiple Spanning Tree
9	**Internal VLAN Routing**
a	Inter-VLAN Routing with an External Router
b	Inter-VLAN Routing with an Internal Route Processor
10	**Configure NAT Services**

IT Services Management		
Unit I	**IT Service Management:** Introduction, What is service management? What are services? Business Process, Principles of Service management: Specialization and Coordination, The agency principle, Encapsulation, Principles of systems, The service Life Cycle, Functions and processes across the lifecycle. **Service Strategy Principles:** Value creation, Service Assets, Service Provider Service Structures, and Service Strategy Principles. **Service Strategy:** Define the market, Develop the offerings, Develop	**12 Lectures**

	Strategic Assets, Prepare for execution. **Challenges, Critical Success factors and risks:** Complexity, Coordination and Control, Preserving value, Effectiveness in measurement, Risks.	
Unit II	**Service Design:** Fundamentals, **Service Design Principles:** Goals, Balanced Design, Identifying Service requirements, identifying and documenting business requirements and drivers, Design activities, Design aspects, Subsequent design activities, Design constraints, Service oriented architecture, Business Service Management, Service Design Models **Service Design Processes:** Service Catalogue Management, Service Level Management, Capacity Management, Availability Management, IT Service Continuity Management, Information Security Management, Supplier Management **Challenges, Critical Success factors and risks:** Challenges, Risks	**12 Lectures**
Unit III	**Service Transition:** Fundamentals, **Service Transition Principles:** Principles Supporting Service Transition, Policies for Service Transition **Service Transition Processes:** Transition planning and support, Change Management, Service Asses Configuration Management, Service and Deployment Management, Service Validation and Testing, Evaluation, Knowledge Management. **Challenges, Critical Success factors and risks:** Challenges, Critical Success factors, Risks, Service Transition under difficult Conditions.	**12 Lectures**
Unit IV	**Service Operation:** Fundamentals, **Service Operation Principles:** Functions, groups, teams, departments and divisions, achieving balance in service operations, Providing service, Operation staff involvement in service design and service transition, Operational Health, Communication, Documentation **Service Operation Processes:** Event Management, Incident Management, Request fulfilment, Problem Management, Access Management, Operational activities of processes covered in other lifecycle phases. **Challenges, Critical Success factors and risks:** Challenges, Critical Success factors, Risks	**12 Lectures**
Unit V	**Continual Service Improvement(CSI) Principles:** CSI Approach, CSI and organizational change, Ownership, CSI register, External and Internal drivers, Service level management, Knowledge management, The Deming cycle, Service Measurement, IT governance, Frameworks, models, standards and quality Systems, CSI inputs and outputs. **CSI Process:** The seven-step improvement process. **CSI Methods and Techniques:** Methods and techniques, Assessments, benchmarking, Service Measurement, Metrics, Return on Investment, Service reporting, CSI and other service management processes **Organizing for CSI:** Organizational development, Functions, roles, Customer Engagement, Responsibility model - RACI, Competence and training. **Technology considerations:** Tools support CSI activities. **Implementing CSI:** Critical Considerations for implementing CSI, Thestart, Governance, CSI and organizational change,	**12 Lectures**

	Communication Strategy and Plan	

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	ITIL v3 Foundation Complete Certification Kit				2009
2.	ITIL v3 Service Strategy		OGC/TSO		
3.	ITIL v3 Service Transition		OGC/TSO		
4.	ITIL v3 Service Operation		OGC/TSO		
5.	ITIL Continual Service Improvement		TSO	2011	2011

Cyber Laws		
Unit I	**Power of Arrest Without Warrant Under the IT Act, 2000:** A Critique, Crimes of this Millennium, Section 80 of the ITAct, 2000– A Weaponora Farce? Forgetting the Line Between Cognizable and Non- Cognizable Offences, Necessity of Arrest without Warrant from Any Place, Public or Otherwise, Check and Balances Against Arbitrary Arrests, Arrest for "About to Commit" an Offence Under the ITAct: A Tribute to Draco, Arrest, But NO Punishment! **Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000:** Concept of "Cyber Crime " and the IT Act , 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cyber Cheating, Virus on the Internet, Defamation, Harassment and-mail Abuse, Cyber Pornography, Other IT Act Offences, Monetary Penalties, Adjudication and Appeals Under IT Act , 2000, Network Service Providers, Jurisdiction and Cyber Crime, Nature of Cyber Criminality, Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications on Cyber Crime.	**12 Lectures**
Unit II	**Contracts in the Infotech World:** Contracts in the Infotech World, Click-Wrap and Shrink-Wrap Contract: Status under the Indian Contract Act, 1872, Contract Formation Under the Indian Contract Act, 1872, Contract Formation on the Internet, Terms and Conditions of Contracts. **Jurisdiction in the Cyber World:** Questioning the Jurisdiction and Validity of the Present Law of Jurisdiction, Civil Law of Jurisdiction in India, Cause of Action, Jurisdiction and the Information Technology Act,2000, Foreign Judgements in India, Place of Cause of Action in Contractual and IPR Disputes, Exclusion Clauses in Contracts, Abuse of Exclusion Clauses, Objection of Lack of Jurisdiction, Misuse of the Law of Jurisdiction, Legal Principles on Jurisdiction in the United State of America, Jurisdiction Disputes w.r.t. the Internet in the United State	**12 Lectures**

	of America.	
Unit III	**Battling Cyber Squatters and Copyright Protection in the Cyber World:** Concept of Domain Name and Reply to Cyber Squatters, Meta- Tagging, Legislative and Other Innovative Moves Against Cyber Squatting, The Battle Between Freedom and Control on the Internet, Works in Which Copyright Subsists and meaning of Copyright, Copyright Ownership and Assignment, License of Copyright, Copyright Terms and Respect for Foreign Works, infringement, Remedies and Offences, Copyright Protection of Content on the Internet; Copyright Notice, Disclaimer and Acknowledgement, Downloading for Viewing Content on the Internet, Hyper-Linking and Framing, Liability of ISPs for Copyright Violation in the Cyber World: Legal Developments in the US, Napster and its Cousins: A Revolution on the Internet but a Crisis for Copyright Owners, Computer Software Piracy.	**12 Lectures**
Unit IV	**E-Commerce Taxation: Real Problems in the Virtual World:** A Tug of War on the Concept of 'Permanent Establishment', Finding the PE in Cross Border E-Commerce, The United Nations Model Tax Treaty, The Law of Double Taxation Avoidance Agreements and Taxable JurisdictionOverNon-Residents,UndertheIncomeTaxAct,1961,Tax Agents of Non-Residents under the Income Tax Act,1961 and the Relevance to E-Commerce, Source versus Residence and Classification between Business Income and Royalty, The Impact of the Internet on Customer Duties, Taxation Policies in India: At a Glance. **Digital Signature, Certifying Authorities and E-Governance:** Digital Signatures, Digital Signature Certificate, Certifying Authorities and Liability in the Event of Digital Signature Compromise, E-Governance in India: A Warning to Babudom!	**12 Lectures**
Unit V	**The Indian Evidence Act of 1872 v. Information Technology Act, 2000:** Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages, Other Amendments in the Indian Evidence Act by the IT Act, Amendments to the Bankers Books Evidence Act, 1891 and Reserve Bank of India Act, 1934. **Protection of Cyber Consumers in India:** Are Cyber Consumers Covered Under the Consumer Protection Act? Goods and Services, Consumer Complaint, Defect in Goods and Deficiency in Services, Restrictive and Unfair Trade Practices, Instances of Unfair Trade Practices, Reliefs Under CPA, Beware Consumers, Consumer Foras, Jurisdiction and Implications on cyber Consumers in India, Applicability of CPA to Manufacturers, Distributors, Retailers and Service Providers Based in Foreign Lands Whose Goods are Sold or Services Provided to a Consumer in India. Amendments in Indian IT Act 2000	**12 Lectures**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Cyber Law Simplified	Vivek Sood	TMH Education		2001
2.	Cybersecurity Law	Jeff Kosseff	Wiley		2017

Advanced Mobile Programming Practical

Practical No	Details
1	**Introduction to Android, Introduction to Android Studio IDE, Application Fundamentals:** Creating a Project, Android Components, Activities, Services, Content Providers, Broadcast Receivers, Interface overview, Creating Android Virtual device, USB debugging mode, Android Application Overview. Simple "Hello World" program.
2	**Programming Resources** Android Resources: (Color, Theme, String, Drawable, Dimension, Image),
3	**Programming Activities and fragments** Activity Life Cycle, Activity methods, Multiple Activities, Life Cycle of fragments and multiple fragments.
4	**Programs related to different Layouts** Coordinate, Linear, Relative, Table, Absolute, Frame, List View, Grid View.
5	**Programming UI elements** AppBar, Fragments, UI Components
6	**Programming menus, dialog, dialog fragments**
7	**Programs on Intents, Events, Listeners and Adapters** The Android Intent Class, Using Events and Event Listeners
8	**Programs on Services, notification and broadcast receivers**
9	**Database Programming with SQLite**
10	**Programming threads, handles and asynchronized programs**
11	**Programming Media API and Telephone API**
12	**Programming Security and permissions**
13	**Programming Network Communications and Services (JSON)**

8.1 FEE STRUCTURE of F.Y.B.SC.IT*

B.SC. (INFORMATION TECHNOLOGY)						
FEE HEADS	FYBSc.(IT)	SYBSc. (IT)	TY.B.Sc. (IT)	FEE HEADS	FYBSc.(IT)	SYBSc. (IT)
TUTION FEES	10000	10000	10000	TUTION FEES	10000	10000
LIBRARY FEES	1200	1200	1200	LIBRARY FEES	1200	1200
GYMKHANA FEES	400	400	400	GYMKHANA FEES	400	400
OTHER FEES	250	250	250	OTHER FEES	250	250
EXAM FEES	1965	1965	0	EXAM FEES	1965	1965
ENROLLMENT FEES	220	0	0	ENROLLMENT FEES	220	0
DISASTER RELIEF FUND	10	10	10	DISASTER RELIEF FUND	10	10
ADMISSION PROCESSING FEES	200	200	200	ADMISSION PROCESSING FEES	200	200
UTILITY FEES	250	250	250	UTILITY FEES	250	250
MAGAZINE FEES	100	100	100	MAGAZINE FEES	100	100
ID & LIBRARY CARD FEES	50	50	50	ID & LIBRARY CARD FEES	50	50
GROUP INSURANCE FEES	40	40	40	GROUP INSURANCE FEES	40	40
STUDENT WELFARE	50	50	50	STUDENT WELFARE	50	50
DEVELOPMENT FEES	500	500	500	DEVELOPMENT FEES	500	500
VICE CHANCELLOR FUND	20	20	20	VICE CHANCELLOR FUND	20	20

UNI-SPORTS & CULTURAL FEES	30	30	30	UNI-SPORTS & CULTURAL FEES	30	30
E-SUVIDHA FEES	50	50	50	E-SUVIDHA FEES	50	50
E-CHARGES	20	20	20	E-CHARGES	20	20
COMPUTER PRACTICAL FEES	1000	1500	2500	COMPUTER PRACTICAL FEES	1000	1500
COMPUTER LAB FEES	6000	6000	6000	COMPUTER LAB FEES	6000	6000
CAUTION MONEY*	150	0	0	CAUTION MONEY*	150	0
LIBRARY DEPOSIT*	250	0	0	LIBRARY DEPOSIT*	250	0
LABORATORY DEPOSIT*	400	400	400	LABORATORY DEPOSIT*	400	400
PROJECT FEES***	0	0	1000	PROJECT FEES***	0	0
ALIMINI ASSOCIATION FEES	25	25	25	ALIMINI ASSOCIATION FEES	25	25
UNIVERSITY EXAM FEES	0	0	1965	UNIVERSITY EXAM FEES	0	0
CONVOCATION FEES	0	0	250	CONVOCATION FEES	0	0
NSS FEES	10	10	10	NSS FEES	10	10
ADMIN FORM	0	100	100	ADMIN FORM	0	100
TOTAL	23190	23170	254	TOTAL	23190	23170

***Revised Fee Structure for the Academic Year 2008 - 2009 onwards as per the University Circular No CONCOL/FEE/292 of 2008 dtd. 07.07.2008 and KridaSamiti/18 of August 6, 2014.**

***** ₹ 36/- on ₹ 1, 00,000/- Policy towards YUVA RAKSHA GROUP INSURANCE SCHEME BY ORIENTAL INSURANCE COMPANY.**

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

The Policy will cover the following:

- **Road / Railway Accident**
- **Injury during sports**
- **Natural Calamity such as riots / earthquakes etc.**
- **Any other accident**

The student will be eligible the following as compensation as per the rules and on satisfactory submission of the documents:

- **In case of permanent disability: up to ₹ 1,00,000/-**
- **Hospitalization - as per bills subject to maximum of ₹ 1,00,000/-**
- **In case of the unfortunate death of the student, parents will get compensation up to ₹ 1,00,000/-**
- **In other cases, as per rules.**

Parents and students are requested to note that the application to the Insurance Company for claiming the compensation will have to be forwarded through the Principal of the college with complete documents and within the time frame prescribed.

Document Verification Fees: Additional fees of ₹ 400/- to be paid by the students those who have not passed the HSC examinations from Maharashtra State Board of Secondary and Higher Secondary Education.

9.1*0.2859: Refund of Tuition, Development and all other fees after cancellation of admissions:*

The candidates who have taken admission in under graduate courses in Govt. colleges, in Govt. aided and unaided courses conducted by affiliated colleges, and recognized Institutions may request for refund of fees after applying in writing for cancellation of their admission to the course. The refund of fees as applicable shall be made on or before the 30th day after the date of cancellation and thereafter. The percentage of fees for the course shall be refunded to the candidate after deducting charges as follows:

Table – 1: Fees Deduction on cancellation of admission

Period and Percentage of Deduction charges

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	Prior to Commencement of academic term and instruction of the course	Up to 20 days after commencement of the academic term of the course	From 21st day up to 50 days After Commencement of the academic term of the Course	From 51st day up to 80 days after the commencement of academic term of the course or August 31st	From September 1st to September 30th	After September 30th

				whichever is earlier		
Deduction	**₹ 500/- Lump Sum**	**20% of the total Amount of fees.**	**30% of the total Amount of fees.**	**50% of the total Amount of fees.**	**60% of the total Amount of fees.**	**100% of the total Amount of fees.**

Note: The total amount considered for the refund of fees from the commencement of academic term of the courses including the following:

ii) The fee charged towards group insurance and all fee components to be paid as University share (including Vice-Chancellor fund, University fee for sports and cultural activities, E-charge, disaster management fund, exam. Fee and Enrollment fee) are non-refundable if payment is made by the college prior to the date of cancellation.

iii) Fee collected for identity card and Library card, admission form and prospectus, enrollment and any other course specific fee are not refundable after the commencement of the academic term.

iv) All refundable deposits (Laboratory, Caution Money and Library etc.) shall be fully returned at the time of cancellation.

Provided that wherever admissions are made through centralized admission process for professional and / or for any other courses by other competent Authorities, the Refund Rules are applicable if specified by such authorities (as per the rules of relevant agencies) for the 1st year admission. In case of admission to subsequent years of the course, 0.2859 is applicable for cancellation of admission.

Provided further that this refund rule is concurrent with the rules and guidelines of other professional statutory bodies appointed for admission for relevant courses.

Further that 0.2859-A & 0.2859-B have been repealed and the amended 0.2859 relating to the refund of Tuition Fees, Development and all other fees after cancellation of admission for the Under Graduate Courses has been brought into force with effect from the academic year 2008-2009.

10.1 R:8433: The definitions of the key terms used in the Choice Based Credit System Introduced from the academic year 2011-12 are as under:

Program:

A **Program** is a set of program that are linked together in an academically meaningful way and generally ends with the award of a Certificate or Diploma or Degree depending on the level of knowledge attained and the total duration of study. (for ex **B.A., B.Sc. and B.Com. are Programs.)**

Program

A '**program**' corresponds to the word 'course' used in many universities. A program is essentially a constituent of a 'program' and may be conceived of as a composite of several learning topics taken from a certain knowledge domain, at a certain level. All the learning topics included in a program must necessarily have academic coherence, that is, there must be a common thread linking the various components of a program. A number of linked programs considered together are in practice, a 'program'.

Credit Point:

Credit Point refers to the 'Workload' of a learner and is an index of the number of learning hours deemed for a certain segment of learning. These learning hours may include a variety of learning activities like reading, reflecting, discussing, attending lectures / counseling sessions, watching especially prepared videos, writing assignments, preparing for examinations, etc. Credits assigned for a single program always pay attention to how many hours it would take for a learner to complete a single program successfully. A single program should have, by and large a program may be assigned anywhere between 2 to 8 credit points wherein 1 credit is construed as corresponding to approximately 30 to 40 learning hours.

Credit completion and Credit accumulation:

Credit completion or Credit acquisition shall be considered to take place after the learner has successfully cleared all the evaluation criteria with respect to a single program. Thus, a learner who successfully completes a 4 CP (Credit Point) program may be considered to have collected or acquired 4 credits. His level of performance above the minimum prescribed level (viz. grades / marks obtained) has no bearing on the number of credits collected or acquired. A learner keeps on adding more and more credits as he completes successfully more and more programs. Thus the learner 'accumulates' program wise credits.

Credit Bank:

The process of accumulating Credits over a period of time, leads to the idea of a 'Credit Bank'. Conceptually, a Credit Bank in simple terms refers to stored and dynamically updated information regarding the number of Credits obtained by any given learner along with details regarding the program/s for which Credit has been given, the program-level, nature, etc. In addition, all the information regarding the number of Credits transferred to different programs or credit exemptions given may also be stored with the individual's history. In short, this would involve maintaining all the Credit–related transactions of an individual. Credit Banking, when practiced would go a long way in facilitating credit transfers and learner mobility.

O. 5974

Duration of the B.A., B.Com. and B.Sc. program will be of 3 years in the Semester pattern i.e. from Sem. I to Sem. VI. Bachelor of Commerce (Accounting & Finance) will be a THREE (03) year Program comprising SIX (06) Semesters i.e. each year will be divided into 2 semesters.

The degree will be awarded to a learner who successfully completes 120 credits of the program in period of 3 to 6 years from the year of enrollment to Semester I.

If a learner does not earn 120 credits in 12 semesters from the year of enrolment to semester I, he/she may at his/her option transfer his/her performance in the existing/new program after establishing equivalence between old and new syllabus. Such a performance transfer will be decided by the Board of Studies / Ad-hoc Board / Ad hoc Committee of the concerned course. The admission to the program will be governed by the existing rules.

11.1SCHEME OF EXAMINATION

The University of Mumbai has introduced the **Choice Based Semester and Grading System**from the academic year 2011-2012 for all the programs offered by the Faculty of Commerce, Faculty of Arts and Faculty of Science for all their Undergraduate Programs including the unaided or self-financing programs. The **Scheme of Examination** is as explained in brief and further details can be obtained from the Chairperson Examination Department or the Vice Principals. You may also refer to the University Circular no. UG/144 of 2011 dated June 14, 2011 and subsequent circulars for getting more information about the scheme of examination as applicable.

SCHEME OF EXAMINATION: As Applicable Today to All the Undergraduate Courses Under Faculty of Commerce.

Students / Learners of the BAF program are required to offer 40 courses each of 3 credits over the six semesters. Each course will be evaluated for 100 marks. The performance of the learner shall be evaluated in two components: Internal Assessment of 25 marks by way of continuous evaluation and Semester End Examination of 75 marks by conducting the theory examination.

INTERNAL ASSESSMENT: - Internal Assessment is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the credit based system by way of participation of learners in various academic and its correlated activities in the given semester of the program.

A) **Internal Assessment – 25 marks**

Sr. No.	Particulars	Marks
1	**ONE** periodical class test to be conducted in the given semester	20 Marks
2	Active participation in routine class instructional deliveries and overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities.	05 Marks

Courses with practical's (for Theory Component) - 50 Marks

Sr. No	Evaluation type	Marks
1	Semester End Practical Examination	
	Journal	05
	Viva –voce	05

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

	Laboratory Work	40

SEMESTER END EXAMINATION: - It is defined as the examination of the learners on the basis of performance in the semester end theory / written examinations.

B) Semester End Examinations – 75 Marks

I. **Duration** – Theses examinations shall be of **2½ Hours** duration.

II. Question Program Pattern: -

1) There shall be five questions each of 15 marks.
2) All questions shall be compulsory with internal choice within the questions.
3) Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.

The Pattern of the Question Paper may change as per the instructions from the approved bodies of the University.

12.1 ASSESSMENT OF SEMESTER I TO SEMESTER IV:

The assessment of **Part 'A' i.e. Internal Assessment and Part 'B' i.e. Semester End Examination** for Semesters I to IV shall be processed by the Colleges / Institutions of their learner on behalf of the University of Mumbai. The Mumbai University will set the question papers and colleges/institutions conduct the examinations, assess the answer books and declare the result of the learner. The College / Institution will issue the grade cards to the learner after the conversion of marks into grade as per the procedure mentioned in the manual. The format of the grade card will be as prescribed by the University so as to maintain the uniformity across the all colleges for the examinations conducted by the colleges on behalf of the University.

13.1 ASSESSMENT OF SEMESTER V and SEMESTER VI:

The assessment of **Part 'A' i.e. Internal Assessment** for **Semesters V & VI shall be processed/conducted by the Colleges / Institutions** of their learners admitted to the programme while the University of Mumbai shall conduct the assessment of **Part 'B' i.e. Semester End Examination** for Semesters V & VI. The Internal Assessment marks of learners appearing for Semesters V & VI shall be submitted to the University by the respective colleges/ Institutions before the commencement of respective Semester End Examinations. The Semester End Examinations for Semesters V & VI shall be conducted by the University and the results shall be declared after processing the internal assessment and the marks awarded to the learners. The grade card shall be issued by the University after converting the marks into grades. The overall performance of the learner will be taken into account before declaring the result of the learner by the University i.e. overall result / performance of the learner will be based on the performance of the learner at Semester I, Semester II, Semester III, Semester IV, Semester V and Semester VI Examinations.

THE MARKS OF THE INTERNAL ASSESSMENT SHOULD NOT BE DISCLOSED TO THE STUDENTS TILL THE RESULTS OF THE CORRESPONDING SEMESTER IS DECLARED.

14.1R.8436 PASSING STANDARD AND PERFORMANCE GRADING:

PASSING STANDARD

The learners to pass a programme shall have to obtain a minimum of 40% marks in aggregate for each programme where the programme consists of Internal Assessment & Semester End Examination. The learners shall obtain minimum of 40% marks (i.e. 10 out of 25) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 30 Out of 75) separately, to pass the programme and minimum of Grade E in the project component, wherever applicable to pass a particular semester. A learner will be said to have passed the programme if the learner passes the Internal Assessment & Semester End Examination together.

15.1PERFROMANCE GRADING:

The PERFORMANCE GRADING of the learners shall be on the SEVEN-point ranking system as under:

Grade	Marks	Grade Points
O	70 & above	7
A	60 to 69.99	6
B	55 to 59.99	5
C	50 to 54.99	4
D	45 to 49.99	3
E	40 to 44.99	2
F (Fail)	39.99 & below	1

The performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

R: 8437 CARRY FORWARDS OF MARKS IN CASE OF A LEARNER WHO FAILS IN THE INTERNAL ASSESSMENT AND/OR SEMESTER END ASSESSMENT IN ONE OR MORE COURSES:

1) A learner who PASSES in the Internal Examination but FAILS in the Semester End Examination of the programme shall reappear for the Semester End Examination of that programme. However his/her marks of the Internal Examinations shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

2) A learner who PASSES in the Semester End Examination but FAILS in the Internal Assessment of the programme shall reappear for the Internal Examination of that programme. However his/her marks of the Semester End Examination shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

16.1 EXAMINATION PATTERN OF THE SEMESTER END ATKT EXAMINATION

A learner who fails in some or all the courses can appear for A.T.K.T. Examination which will be conducted only in the month of October & April of every year for all semester i.e. Semester I, II, III & IV.

16.2 EXAMINATION PATTERN OF THE SEMESTER END FOR INTERNAL ADDITIONAL EXAMINATION

With reference to University of Mumbai Circular No. UG/61 of 2005 dated 20th August, 2015, it is informed to the students that ADDITIONAL EXAMINATION of Internal Examination for Semester I to VI will be conducted only for those students who have remain absent on the ground Medical/ Participation in Sports /Cultural /NCC/Camps, Coaching Campus for Sports & Cultural activities etc..

17.1 R.8438 ALLOWED TO KEEP TERMS (ATKT): (as per circular no. UG/02 of 2012-2013 dated April 3, 2012, UG/52 of 2013-2014 dated August 26, 2013)

ALLOWED TO KEEP TERMS (ATKT):

i) A learner shall be allowed to keep term for Semester II irrespective of grades obtained in each course of Semester I.

ii) A learner shall be allowed to keep term for Semester III if he/she passes (grade 'E' or above in each course) each of Semester I and Semester II

OR

He/she fails in not more than two courses, in each of Semester I and Semester II. (For all subjects, carrying 900 or more marks).

He/she fails in not more than two courses with not more than total 200 marks, in each of Semester I and Semester II. (For all subjects carrying less than 900 marks.)

iii) A learner shall be allowed to keep term for Semester IV irrespective of grades obtained in each course of Semester III.

iv) A learner shall be allowed to keep term for Semester V if he / she passes Semester I, Semester II, Semester III and Semester IV

OR

He/she has passed Semester I and Semester II and fails in not more than two courses in each of Semester III and Semester IV. (For all subjects, carrying 900 or more marks).

He/she has passed Semester I and Semester II and fails in not more than two courses with not more than total 200 marks, in each of Semester III and Semester IV. (For all subjects carrying less than 900 marks.)

18.1 ADDITIONAL OF INTERNAL EXAMINATION FOR SEMESTER I to VI. (vide circular no UG/61 0f 2015 dated 20/8/2015)

The additional examination for semester I, II, III & IV be conducted only for those who have remained absent on the ground in consistence with R 8917. A learner can who fails in some or all the courses can appear for A.T.K.T. Examination which will be conducted only in the month of October & April of every year for all semester i.e. Semester I to VI.

19.1 R. 8917 ELIGIBILITY NORMS TO APPEAR FOR INTERNAL ADDITIONAL SEMESTER END EXAMINATIONS

A learner who does not appear in some or all the courses on medical grounds or for representing the College/University in Sports, Cultural Activities. Activities of NSS/NCC or Sports Training Camps conducted by recognized bodies/competent authorities or for any other reason which is considered valid under exceptional circumstances and to the satisfaction of the Principal or the Head of the institution is eligible to appear for Additional Examination.

It is not the right of the leaner, who has failed or has remained absent, to appear for the additional examination without fulfilling the norms prescribed by the Head of the Institution / Department / Principal of the College and same has been brought into force with effect from the academic year 2015-16.

20.1 EXAMINATION PATTERN OF THE SEMESTER END ADDITIONAL EXAMINATION & ATKT EXAMINATION

The Additional Semester End Examination shall be of two and half hours duration and of 75 marks per course. The learner shall appear for the semester END examination of the course for which he/she was absent for the reason as stated above. Learner who is punished under O.5059 shall not be eligible to appear for this Additional Examination.

21.1 R.8441: Program wise, Semester wise Credit allocation:

Faculty	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Arts for BA Program only.	15	15	22	22	22	24	**120**
Science (for all programs)	20	20	20	20	20	20	**120**
Bachelor of Commerce (B.Com.)	20	20	17	17	23	23	**120**
Bachelor of Management Studies (BMS)	21	21	18	18	21	21	**120**
Bachelor of Commerce (Accounting &Finance) (BAF)	21	21	21	21	18	18	**120**
Bachelor of Commerce (Banking &Insurance) (BBI)	18	18	21	21	21	21	**120**
Bachelor of Commerce (Financial Markets) (BFM)	18	18	21	21	21	21	**120**

22.1R. 8447 Revaluation: Norms, Rules, Regulations and procedure for Verification and Revaluation shall be as per the existing ordinances and regulation & VCD of the University. **(vide Circular No. Exam. /Photo & Rev./Univ./VCD/ 4637 of 2010)**

PHOTOCOPY REVALUATION OF THE ASSESSED ANSWER BOOK/S:

The University of Mumbai by the directives by Hon. Vice Chancellor vide the VCD no. **Exam/Photo & Rev./College/VCD/4636 of 2010 dated April 5 2010** has provided the facility of Verification, Revaluation and for obtaining the Xerox copy of the assessed answer books. Please note that Applying for Photocopy of the answer book/s and Applying for Revaluation will be two independent processes and separate application will have to be made by the candidate for obtaining the Photocopy of the answer book/s and for revaluation of the answer book/s. However, applying for photocopy of the answer book /s or having photocopy of the answer book/s shall not be a pre-requisite for applying for revaluation of the answer book on the said course. The student can apply independently for revaluation or photocopy or both simultaneously.

Procedure for obtaining the Photocopy of the Assessed Answer book/s.

1. This facility, thus provided, shall be for **THEORY PAPERS ONLY** of all the examinations conducted by the college / institution on behalf of the University in the current session.
2. Under these rules applying for the Photocopy/ies of answer-books shall not be permitted in respect of the scripts of practical examination / term-work / sessional work / project work / dissertation / internal assessment / term work (including theory part) and in Viva voce /oral / practical examinations.
3. The Photocopy/ies shall be sought by submitting an application in the prescribed form **(available with college)** along with the non-refundable fee of ₹100/- per answer book by the examinee ***within seven (7) working days*** from the date of the ***declaration of result of the examination or issue of the statement of marks by the college / institution, whichever is later***. The examinee/s belonging to reserved categories shall be granted 50% concession in fee.
4. Incomplete application form shall be rejected without assigning any reason whatsoever and the fees paid along with the application form shall neither be refunded nor will any representation be entertained.
5. No application after the due date will be entertained on any ground whatsoever.
6. The College/Institution/Department shall endeavor to supply Photocopy/ies of answer books as far as possible within fifteen (15) working days from the date of receipt of application for photocopy/ies of the answer book/s.
7. The Photocopy/ies shall be handed over to the applicant examinee in person only and under no circumstances to any other person.
8. On receipt of Photocopy/ies the applicant examinee shall be the sole custodian of it and under any circumstances the examinee shall not part with the custody/possession of the same and also shall not use the same for any other purpose/s.
9. If the examinee is found guilty of indulging in any unfair act/attempt he/she shall be liable

to be tried before the Unfair Means Inquiry Committee of the college and the decision taken by the authorities based on the recommendation of the said committee shall be final.

23.1PROCEDURE FOR REVALUATION OF THE ASSESSED ASNWER BOOK/S

In case of discrepancy in the Assessed Answer book

On receipt of the photocopy if the discrepancy of following nature (listed below) is noticed by the examinee, he/ she should apply to the Principal in the prescribed form along with the said **photocopy and copy of the question paper within three (03) working days from the date of publication of the notice by the Principal** of the respective college as per the provisions hereinabove.

i) Mistake in totaling

ii) ii) Non assessment of a question / sub-question

If required after due verification, the Principal of respective college shall make necessary rectification in the marks allotted to the said course and consequently in the result of the candidate without charging any further fee for necessary rectification.

On rectification of the result as per the provisions above, the candidate can apply for revaluation within seven (7) working days from the date of receipt of the rectified result, if he/she was not eligible to apply for revaluation of the said answer book under Rule 29 herein below mentioned and only by such rectification becomes eligible for revaluation in the said course, course to other limitations contained herein.

The examinee is free to apply for Photocopy/ies of answer books of as many courses as he / she so desires.

REVALUATION OF THE ANSWER BOOK/S: RULES AND PROCEDURE:

- This revaluation facility shall be for theory papers only of all the examinations conducted by the college on behalf of the University for the respective current session.

- A candidate can apply for the revaluation of the answer book of the course only if he/she has secured at least 20% of the total marks in that course or 40% of the marks required for passing in the said course, whichever is less or the grade equivalent to the above criteria where grades are assigned to the theory papers.

- The non-refundable prescribed a fee of ₹ 260/- per course per answer book for the purpose of revaluation shall be paid by the examinee within seven (07) working days from the date of the declaration of the result of the respective examination or from the date on which the college issued the statement of marks, whichever is later. The examinees from the reserved categories shall be given fifty per cent (50%) concession, provided a certified copy of the caste certificate is enclosed.

- The revised marks obtained by a candidate after revaluation, as accepted by the Principal of

the respective college shall be taken into account for the purpose of amendment of his results only and the said result shall be communicated to the student/s by the Principal of the respective college.

- The whole process of revaluation shall be completed as far as possible within a period of thirty (30) days from the date of receipt of the application for revaluation by the college / institution.

THE PHOTO COPY/COPIES OF THE REVALUATED ANSWER-BOOK/S SHALL NOT BE PROVIDED TO THE EXAMINEES

CAN THE STUDENT BE ADMITTED TO THE NEXT HIGHER CLASS PENDING THE RESULT OF VERIFICATION / REVALUATION?

1. Pending the process of revaluation, and course to the availability of the seats in the college, the student may be admitted to the next higher class to which he could have been admitted if he/she had passed in the said examination or had been granted A.T.K.T. for admission to the next class in the original examination as per the rules applicable for the stream and faculty of his education, as per the following norms:
2. The student may be admitted to the next higher class to which he could have been admitted if he/she had passed in the said examination or had been granted A.T.K.T. for admission to the next class in the original examination as per the rules applicable for the stream and faculty if he/she had originally obtained required passing marks in the papers in which he/she had applied for revaluation,
3. The college shall be entitled to charge a fee of ₹ 260/- at the time of granting admission to such students to the next class before declaration of the result of the revaluation,
4. Such admission shall be provisional; and automatically stands cancelled on receipt of the result of revaluation process, if the student is not declared passed in the requisite number of the courses on revaluation which would entitle him/her to take admission in the next higher class, and in such case the fees originally collected by the college or any part of the same shall not be refunded,
5. In case if the student is declared to have passed in the requisite number of the courses on revaluation which would entitle him/her to take admission in the next higher class as per the Ordinances / regulations, the provisional admission will be regularized.
6. In case of the reserved category students or other students who are entitled to get fee concession, on appropriating the amount equal to the amount of fees which the college can collect from the student and the balance amount shall be refunded to the student at the time of confirmation and continuation of his/her admission.
7. In case of other students, the said amount shall be deducted from the total fees which the college or the institution is entitled to collect from the student as per the rules applicable.
8. Pending the declaration of the result of the revaluation, the students who have taken

admission to next higher class, as mentioned above, shall be allowed to appear at the examination to the next class and their results of the next examinations shall be declared only on their passing in the requisite number of the courses on revaluation which would entitle them to take admission in the next class; and in case the students does not succeed **in passing in such requisite number of courses, their admission to the examinations of the next class, their performance and results of the same shall be treated as null and void.**

The details of the procedure can be obtained from the examination department of the college.

24.1 REVISED EXAMINATION FEES (FOR UG AND PG COURSES TO BE PAID BY STUDENTS/EXAMINEES)

Clauses 3.15 (Sr. No. 5 and 6) of VCD No. Exam VCD/DBOEE/ICD/2017-18/325 dated 24th July 2017

No. of subjects/ Papers	Old fee For UG	Reduction In (%)for UG	New fee for UG	Old fee For PG	Reduction In (%) for PG	New fee for PG
One	**Rs. 1000/-**	**80%**	**Rs. 200/-**	**Rs. 1500/-**	**73%**	**Rs. 400/-**
Two	**Rs. 1000/-**	**60%**	**Rs. 400/-**	**Rs. 1500/-**	**53%**	**Rs 700/-**
Three or More and Fresh students	**Rs.1000/-**	**10%**	**Rs. 900/-**	**Rs. 1500/-**	**10%**	**Rs. 1350/-**

25.1 *ISSUANCE OF DUPLICATE MARKSHEET*

In the event if any student loses or misplaces his / her mark-sheet can apply for a duplicate mark-sheet in the prescribed form along with the prescribed fees (as applicable) to the college office.

26.1 IMPROVEMENT OF GRADE AND CGPA

(University circular KA/UG/2015-16 dated 19th December, 2015.)

In order to improve Grade in CBSGS, a learner may reappear in ANY OF THE TWO SEMESTERS of Undergraduate and Post graduate programme concern.

27.1 Resorting to Use of Unfair Means by the students during the Examination

UNFAIR MEANS INQUIRY COMMITTEE

Students resorting to the use of unfair means during the examinations conducted by the College or conducted by the college on behalf of the University or by the University itself are requested to note that the course of action and the procedure to be followed by the college / university i.e. the examination conducting authority will be governed by circular no. UG / 139 OF 2001 DATED 23RD APRIL 2001 of University of Mumbai. The minimum punishment recommended by the University (vide circular no. UG / 139 OF 2001 DATED 23RD APRIL 2001) is "Annulment of the performance of the Student at the University / College / Institution Examination in full."

The above recommended punishment is for the learner / student / candidate found in possession of the copying material. If it is established that he/she has actually copied from the material, the recommendation is "Exclusion of the student from the University or College or Institution Examination for one additional examination".
Given below is the extract from the University circular no. UG / 139 OF 2001 DATED 23RD APRIL 2001) specifying the broad Categories of Unfair Resorted to by Students at the University/ College/ Institution Examinations and the Quantum of Punishment for each Category thereof.

Sr.No.		Quantum of Punishment
(1)	Possession of copying material	Annulment of the performance of the student at the University/ College/ Institution examination in full. (Note: - This quantum of punishment shall apply also to the following categories of malpractices at Sr. No. (2) to Sr. No. (12) In addition to the punishment prescribed thereat.
(2)	Actual copying from the copying material	Exclusion of the student from University or College or Institution examination for one additional examination.
(3)	Possession of another student's answer book	Exclusion of the student from University or College or Institution examination for one additional examination. (BOTH THE STUDENTS)
(4)	Possession of another student's answer book + Actual evidence of copying there from.	Exclusion of the student from University or College or Institution examination for two additional examinations. (BOTH THE STUDENTS)
(5)	Mutual / Mass copying	Exclusion of the student from University or College or Institution examination for two additional examinations.

(6) i. Smuggling-out or smuggling-in of answer book as copying material. ii. Smuggling-in of written answer-book based on the question paper set at the examination. iii. Smuggling-in of written answer book and forging signature of the Jr. Supervisor thereon.	i. Exclusion of the student from University or College or Institution examination for two additional examinations. ii. Exclusion of the student from University or College or Institution examination for two additional examinations. iii. Exclusion of the student from University or College or Institution examination for two additional examinations.
(7) Attempt to forge the signature of the Jr. Supervisor on the answer book or supplement.	Exclusion of the student from University or College or Institution examination for two additional examinations.
(8) Interfering with or counterfeiting of University / College / Institution seal, or answer books or office stationary used in the examinations.	Exclusion of the student from University or College or Institution examination for two additional examinations.
(9) Answer book, main or supplement written outside the examination hall or any other insertion in answer book.	Exclusion of the student from University or College or Institution examination for two additional examinations.
(10) Insertion of currency notes/to bribe or attempting to bribe any of the person/s connected with the conduct of examinations.	Exclusion of the student from University or College or Institution examination for two additional examinations.
(11) Using obscene language / violence threat at the examination center by a student at the University / College / Institution examination to Jr. /Sr. Supervisors / Chief Conductor or Examiners.	Exclusion of the student from University or College or Institution examination for two additional examinations.

(12)	(a)Impersonation at the University/ College/ Institution examination. (b) Impersonation at the University/ College/ Institute student at S.S.C. /H.S.C. any other examinations.	Exclusion of the student from University or College or Institution examination for two additional examinations. Exclusion of the impersonator from University or College or Institution examination for five additional examinations.
(13)	Revealing Identity in any form in the answer book by the student at the University or College or Institution examination.	Annulment of the performance of the Student at the University or College or Institution examination in full.
(14)	Found having written on palms or on the body, or on the clothes while in the examination.	Annulment of the performance of the student at the University or College or Institution examination in full.
(15)	All other malpractices not covered in the aforesaid categories.	Annulment of the performance of the student at the University or College or Institution examination in full, and severe punishment depending upon the gravity of the offence.
(16)	If on previous occasion a disciplinary action was taken against a student for malpractice used at examination and he/she is caught again for malpractices used at the examinations, in this event he/she shall be dealt with severely. Enhanced punishment can be imposed on such students. This enhanced punishment may extend to double the punishment provided for the offence, when committed at the second or subsequent examination.	
(17)	Practical /Dissertation/Project report Examination. Student involved in malpractices at Practical / Dissertation/ Project report examinations shall be dealt with as per the punishment provided for the theory examination.	
(18)	The Competent Authority, in addition to the above mentioned punishments may impose a fine on the student declared guilty. (Note: The term "Annulment of Performance in full" includes performance of the student at the theory as well as Annual Practical examination, but does not include performance at term work, project work with its term work, oral or practical and dissertation examinations unless malpractice used threat).	

Note: Exact details of the above can be obtained from the University website.

28.1 RULES & REGULATIONSRELATED TO ATTENDANCE AS PER ORDINANCE 6086 OF UNIVERSITY OF MUMBAI:

Given below in brief are the rules, regulations about the requirement of attendance and the procedure to be followed by the college and/or the student who is detained. Detail circular available on University website.

Ordinance 6086 relating to the attendance for learners

1) There shall be the Attendance Committee, for smooth conduct of this ordinance, in every college/institute/Department of the University comprising of at least three members (to be nominated from other departments in case of the University Department having less than 3 teachers), the Vice-Principal/ Senior Teacher (Convener) and at least two more teachers ensuring representation of the concerned faculties, nominated by the Principal/Director/Head.

2) Every bonafide learner shall ordinarily be allowed to keep terms for the given semester in a program of his/her enrolment, only if he/she fulfils at least seventy five present (75%) of the attendance taken as an average of the total number of lectures practical's, tutorials together etc. wherein short and/or long excursions/field visits/study tours organized by the college and supervised by the teachers as envisaged in the syllabus shall be credited to his attendance for the total no of periods which are otherwise delivered on the material day/s Further it mandatory for every learner to have min 50% attendance for each course & overall attendance has to be 75%.

3) The same ratio shall be applied for computing the attendance of the learners by crediting the number of periods which are missed while participating in an extracurricular/co-curricular activity/competition/camp/workshop/convention/symposium/seminar etc. where the said learner is officially representing the college/ University/ District/ State/ Country with the permission of the Principal/ Director/ Head of the College/ Institute/ University Department or by the direction of the University Officer as the case may be wherein for the purpose of computing the average attendance the periods missed for what is envisaged here-in above, at Sr. No 2, shall be deemed to have been attended by the said learner.

4) Without prejudice to what is stated here-in-above, the Principal/Director/Head of the concerned College/Institute/Department of the University shall be the competent authority to condone the absence of any learner further up to additional 25%, if deemed fit and on recommendation of the attendance committee of the said college/ Institute/Department of the University, wherein it is mandatory on the said committee to do natural justice by giving personal hearing to every learner falling short of minimum attendance for keeping terms and recommending case by case to the competent authority having verified the genuineness and gravity of the problem that justifies the learner to remain absent, which generally shall be limited to his own sickness, sickness of his parent, death of his parent etc. supported by valid evidence, documentary or otherwise.

5) The attendance committee will ensure that the attendance records are maintained in order and that the warning letters are issued to the defaulting learners at least twice in every semester & that in the first week of every month for the previous month defaulters list it displayed on college notice board. If the students are falling short of attendance while also displaying the list of defaulters declaring their respective attendance for the month. The defaulting learners should also be called (along with parent/guardian wherever necessary) to meet the Convener, attendance committee in the middle of the semester with a view to make the consequences adequately clear while understanding the difficulties if any and encouraging the learner to comply with the requirement of the attendance. Needless to say that the learners should be made aware of the provision of the ordinances for attendance at the time of admission and an undertaking may be obtained from them (countersigned by the parent/guardian wherever necessary) assuring regular attendance while understanding the consequences of defaulting.

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

6) At the end of the semester on recommendation of the attendance committee the Principal/Director/Head of the college/Institute/ University Department shall display list of the learners who are not allowed to keep terms, allowing them to appeal to the Principal/Director/Head of the College/Institute/Department of the University within 3 days from the date of display of the notice. After disposing the appeals, the Principal/Director/Head shall intimate the same to the In-charge of Examinations/the Controller of examinations to withdraw the examination forms of such defaulting learner under intimation to those learners ensuring that this communication reaches the concerned at least 10 working days before the commencement of the respective examinations.

7) The learners whose terms are not granted by the college/institute/department of the University can appeal to the controller of examinations, if desired, in a prescribed form and by paying fee prescribed by the Management Council within 3 days from the receipt of the intimation and that the controller of examinations shall arrange a hearing of the learners along with their concerned Principals/Director/Heads of the Department, represented in person or through a teacher nominated by them before the committee (one each for every faculty) nominated by the Management Council comprising of 3 members including the convener. The respective committees shall convey their decisions to the controller of examinations which shall be final and binding on the learners once accepted and communicated by the controller of examinations.

(The existing Ordinances 0.119, 0.120 & 0.125 are repealed)

****

L. S. Raheja College of Arts and Commerce

SFC Department's

Information Technology Glossary

Alphabet	Term	Meaning
A	access point:	A device that allows wireless-equipped computers and other devices to communicate with a wired network.

Compiled by Ms. Prajakta Joshi (Course Co-ordinator)
L. S. Raheja College of Arts and Commerce.

A	accessibility:	As specified in Section 508 of the 1998 Rehabilitation Act, the process of designing and developing Web sites and other technology that can be navigated and understood by all people, including those with visual, hearing, motor, or cognitive impairments. This type of design also can benefit people with older/slower software and hardware.
A	ActiveX:	A technology from Microsoft that links desktop applications to the World Wide Web. Using ActiveX tools, interactive web content can be created. Example: In addition to viewing Word and Excel documents from within a browser, additional functionality such as animation, credit card transactions, or spreadsheet calculations.
A	address:	Identifies the location of an Internet resource. Examples: an e-mail address (sales@dataprise.com); a web address (http://www.dataprise.com); or an internet address (192.168.100.1).
A	alias:	A short, easy to remember name created for use in place of a longer, more complicated name; commonly used in e-mail applications. Also referred to as a "nickname".
A	anonymous FTP:	Archive sites where Internet users can log in and download files and programs without a special username or password. Typically, you enter anonymous as a username and your e-mail address as a password.
A	Anti-Spam	To prevent e-mail spam, both end users and administrators of e-mail systems use various anti-spam techniques. Some of these techniques have been embedded in products, services and software to ease the burden on users and administrators. No one technique is a complete solution to the spam problem, and each has trade-offs between incorrectly rejecting legitimate e-mail vs. not rejecting all spam, and the associated costs in time and effort. Dataprise Cloud-Based Anti-SPAM e-mail service eliminates the problem almost entirely. Our state-of-the-art solution lets users see only the e-mail they want — and filters out all of the viruses and e-solicitations they don't want before they reach user's computers and mobile devices. To learn more click here.
A	applet:	A program capable of running on any computer regardless of the operating system. Many applets can be downloaded from various sites on the Internet.
A	application:	A program designed for a specific purpose, such as word processing or graphic design.

A	ASCII file:	A file that can be opened and read by standard text editor programs (for example, Notepad or Simple Text) on almost any type of computer. Also referred to as "plain text files". Examples: documents saved in ASCII format within word processors like Microsoft Word or WordPerfect; e-mail messages created by a program like Outlook; or HTML files.
A	AT command set:	An industry standard set of commands beginning with the letters "AT" that are used to control a modem. Example: ATDT tells the modem to dial (D) using touch-tone dialing (T). ATDP specifies pulse dialing (P). Also referred to as the "Hayes Command Set".
A	attachment:	In this context, a file that is sent along with an e-mail message. ASCII (plain text) files may be appended to the message text, but other types of files are encoded and sent separately (common formats that can be selected include MIME, BinHex, and Uuencode).
A	authentication:	The process of identifying yourself and the verification that you're who you say you are. Computers where restricted information is stored may require you to enter your username and password to gain access.
B	backbone:	A term that is often used to describe the main network connections that comprise the Internet or other major network.
B	bandwidth:	A measurement of the amount of data that can be transmitted over a network at any given time. The higher the network's bandwidth, the greater the volume of data that can be transmitted.
B	BCP:	Business Continuity Plan, or "BCP," is a set of documents, instructions, and procedures which enable a business to respond to accidents, disasters, emergencies, and/or threats without any stoppage or hindrance in its key operations. It is also called a business resumption plan, disaster recovery plan, or recovery plan.
B	BI:	Business Intelligence - A recognized industry term for organizational analytics, including historical, current, and predictive views of business operations. To learn more please click here.
B	binary file:	A file that cannot be read by standard text editor programs like Notepad or Simple Text. Examples: documents created by applications such as Microsoft Word or WordPerfect or DOS files with the extension ".com" or ".exe".

B	BinHex:	A common file format for Macintosh computers; it enables a binary file to be transferred over the Internet as an ASCII file. Using a program like Stuffit, a file can be encoded and renamed with an ".hqx" extension. The recipient uses a similar program to decode the file.
B	bit:	A binary digit (either 0 or 1); it is the most basic unit of data that can be recognized and processed by a computer.
B	blended learning:	Instruction that combines aspects of both face-to-face (F2F) and online learning experiences. An increasing number of courses at OSU now offer this type of mix.
B	blog:	Refers to a weblog, a web page that contains journal-like entries and links that are updated daily for public viewing.
B	bluetooth:	A wireless networking technology that allows users to send voice and data from one electronic device to another via radio waves.
B	BMP:	Bitmap file; a common image format on Windows computers. Files of this type usually have the suffix ".bmp" as part of their name.
B	browser:	A program used to access World Wide Web pages. Examples: Firefox, Safari or Internet Explorer.
B	buffer:	On a multitasking system, a certain amount of RAM that is allocated as a temporary holding area so that the CPU can manipulate data before transferring it to a particular device.
B	byte:	A group of adjacent binary digits that a computer processes as a unit to form a character such as the letter "C". A byte consists of eight bits.
C	cable modem:	A special type of modem that connects to a local cable TV line to provide a continuous connection to the Internet. Like an analog modem, a cable modem is used to send and receive data, but the difference is that transfer speeds are much faster. A 56 Kbps modem can receive data at about 53 Kbps, while a cable modem can achieve about 1.5 Mbps (about 30 times faster). Cable modems attach to a 10Base-T Ethernet card inside your computer.
C	cache:	Refers to: 1) a region of computer memory where frequently accessed data can be stored for rapid access; or 2) an optional file on your hard drive where such data also can be stored. Examples: Internet Explorer and Firefox have options for defining both memory and disk cache. The act of storing data for fast retrieval is called "caching".
C	client-server technology:	Refers to a connection between networked computers in which the services of one computer (the server) are requested by the other (the client). Information obtained is then processed locally on the client computer.

C	cloud computing:	A general term used to describe Internet services such as social networking services (e.g., Facebook and Twitter), online backup services, and applications that run within a Web browser. Could computing also includes computer networks that are connected over the Internet for server redundancy or cluster computing purposes.
C	CMS:	'Content Management System' is the collection of procedures used to manage work flow in a collaborative environment. In a CMS, data can be defined as nearly anything: documents, movies, pictures, phone numbers, scientific data, and so forth. CMSs are frequently used for storing, controlling, revising, semantically enriching, and publishing documentation. Serving as a central repository, the CMS increases the version level of new updates to an already existing file. Version control is one of the primary advantages of a CMS.
C	cookie:	A small piece of information you may be asked to accept when connecting to certain servers via a web browser. It is used throughout your session as a means of identifying you. A cookie is specific to, and sent only to the server that generated it.
C	CSS:	Cascading Style Sheet; A set of rules that define how web pages are displayed using CSS, designers can create rules that define how page
D	data center:	A data center (data Centre / datacenter / datacenter) is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression) and security devices. To learn more please click here.
D	database:	A collection of information organized so that a computer application can quickly access selected information; it can be thought of as an electronic filing system. Traditional databases are organized by fields, records (a complete set of fields), and files (a collection of records). Alternatively, in a Hypertext database, any object (e.g., text, a picture, or a film) can be linked to any other object.
D	decompress:	Opposite of compressing a file; the process of restoring the file to its original size and format. The most common programs for decompressing files are WinRAR for PC and compatible computers (.zip files) and Stuffit Expander (.sit files) for Macintosh computers.

D	defragmentation:	The process of rewriting parts of a file to contiguous sectors on a hard drive to increase the speed of access and retrieval.
D	dial up connection:	A connection from your computer that goes through a regular telephone line. You use special communications software to instruct your modem to dial a number to access another computer system or a network. May also be referred to as "dial up networking".
D	DNS:	Domain Name System; a service for accessing a networked computer by name rather than by numerical, (IP) address.
D	domain:	Part of an Internet address. The network hierarchy consists of domains and subdomains. At the top are a number of major categories (e.g., com, edu, gov); next are domains within these categories (e.g., ohio-state); and then there are subdomains. The computer name is at the lowest level of the hierarchy.
D	download:	The process of transferring one or more files from a remote computer to your local computer. The opposite action is upload.
E	eLearning:	Electronic learning; applies to a wide scope of processes including Web-based learning, computer-based instruction, virtual classrooms, and digital collaboration. Content may be delivered in a variety of ways including via the Internet, satellite broadcast, interactive TV, and DVD- or CD-ROMs.
E	e-mail:	Electronic mail; the exchange of messages between users who have access to either the same system or who are connected via a network (often the Internet). If a user is not logged on when a new message arrives, it is stored for later retrieval.
E	encryption:	The manipulation of data to prevent accurate interpretation by all but those for whom the data is intended.
E	Ethernet:	A popular network technology that enables data to travel at 10 megabits per second. Campus microcomputers connected to a network have Ethernet cards installed that are attached to Ethernet cabling. An Ethernet connection is often referred to as a "direct connection" and is capable of providing data transmission speeds over 500 Kbps.
E	extension:	A suffix preceded by a period at the end of a filename; used to describe the file type. Example: On a Windows computer, the extension ".exe" represents an executable file.
F	field:	A single piece of information within a database (e.g., an entry for name or address). Also refers to a specific area within a dialog box or a window where information can be entered.

F	file:	A collection of data that has a name (called the filename). Almost all information on a computer is stored in some type of file. Examples: data file (contains data such as a group of records); executable file (contains a program or commands that are executable); text file (contains data that can be read using a standard text editor).
F	firewall:	A method of preventing unauthorized access to or from a particular network; firewalls can be implemented in both hardware and software, or both.
F	folder:	An area on a hard disk that contains a related set of files or alternatively, the icon that represents a directory or subdirectory.
F	font:	A complete assortment of letters, numbers, and symbols of a specific size and design. There are hundreds of different fonts ranging from businesslike type styles to fonts composed only of special characters such as math symbols or miniature graphics.
F	fragmentation:	The scattering of parts of the same disk file over different areas of a disk; fragmentation occurs as files are deleted and new ones are added.
F	FTP:	File Transfer Protocol; a method of exchanging files between computers via the Internet. A program like WS_FTP for IBM PC or compatibles or Fetch for Macintosh is required. Files can contain documents or programs and can be ASCII text or binary data.
G	GIF:	Graphics Interchange Format; a format for a file that contains a graphic or a picture. Files of this type usually have the suffix ".gif" as part of their name. Many images seen on web pages are GIF files.
G	gigabyte (Gig or GB):	1024 x 1024 x 1024 (2 to the 30th power) bytes; it's usually sufficient to think of a gigabyte as approximately one billion bytes or 1000 megabytes.
G	GPS:	Global Positioning System; a collection of Earth-orbiting satellites. In a more common context, GPS actually refers to a GPS receiver which uses a mathematical principle called "trilateration" that can tell you exactly where you are on Earth at any moment.
G	GUI:	Graphical user interface; a mouse-based system that contains icons, drop-down menus, and windows where you point and click to indicate what you want to do. All new Windows and Macintosh computers currently being sold utilize this technology.

H	handshaking:	The initial negotiation period immediately after a connection is established between two modems. This is when the modems agree about how the data will be transmitted (e.g., error correction, packet size, etc.). The set of rules they agree on is called the protocol.
H	hard disk:	A storage device that holds large amounts of data, usually in the range of hundreds to thousands of megabytes. Although usually internal to the computer, some types of hard disk devices are attached separately for use as supplemental disk space. "Hard disk" and "hard drive" often are used interchangeably but technically, hard drive refers to the mechanism that reads data from the disk.
H	hardware:	The physical components of a computer including the keyboard, monitor, disk drive, and internal chips and wiring. Hardware is the counterpart of software.
H	header:	The portion of an e-mail message or a network newsgroup posting that precedes the body of the message; it contains information like who the message is from, its subject, and the date. A header also is the portion of a packet that proceeds the actual data and contains additional information the receiver will need.
H	host:	A computer accessed by a user working at a remote location. Also refers to a specific computer connected to a TCP/IP network like the Internet.
H	HTML:	HyperText Markup Language; a language used for creating web pages. Various instructions and sets of tags are used to define how the document will look.
H	HTTP:	HyperText Transfer Protocol; a set of instructions that defines how a web server and a browser should interact. Example: When you open a location (e.g., enter a URL) in your browser, what actually happens is an HTTP command is sent to the web server directing it to fetch and return the requested web page.
H	hyperlink:	Connects one piece of information (anchor) to a related piece of information (anchor) in an electronic document. Clicking on a hyperlink takes you to directly to the linked destination which can be within the same document or in an entirely different document. Hyperlinks are commonly found on web pages, word documents and PDF files.
I	IaaS:	Infrastructure as a Service; In the most basic cloud-service model, providers of IaaS offer computers - physical or (more often) virtual machines - and other resources. To learn more please click here.

I	image map:	A graphic overlay that contains more than one area (or hot spot) which is clickable and links to another web page or anchor. Image maps provide an alternative to text links for directing the user to additional information.
I	IMAP:	Internet Message Access Protocol. A method of accessing e-mail messages on a server without downloading them to your local hard drive; it is the main difference between IMAP and POP3 which requires messages to be downloaded to a user's hard drive before the message can be read.
I	Internet Explorer:	A client program from Microsoft that comespre installed on most new PC or compatible computers; enables you to browse the World Wide Web.
I	Internet:	A worldwide network based on the TCP/IP protocol that can connect almost any make or model of popular computers from micros to supercomputers. Special programs called "clients" enable users with a network connection to do things like process e-mail or browse web sites using the familiar interface of a desktop computer.
I	IP address:	Internet Protocol address; every computer connected to the Internet has a unique identifying number. Example: 192.168.100.2.
J	Java:	A general purpose programming language commonly used in conjunction with web pages that feature animation. Small Java applications are called Java applets; many can be downloaded and run on your computer by a Java-compatible browser like Firefox or Internet Explorer.
J	JavaScript:	A publicly available scripting language that shares many of the features of Java; it is used to add dynamic content (various types of interactivity) to web pages.
J	JPEG:	Joint Photographic Experts Group; a graphics format which compresses an image to save space. Most images imbedded in web pages are GIFs, but sometimes the JPEG format is used (especially for detailed graphics or photographs). In some cases, you can click on the image to display a larger version with better resolution.
K	K (kilobyte, KB, or Kb):	An abbreviation for kilobyte; it contains 1,024 bytes; in turn 1,024 kilobytes is equal to one megabyte.
K	Kbps:	Kilobits per second; a measure of data transfer speed; one Kbps is 1,000 bits per second. Example: a 28.8 Kbps modem.
K	keyword:	Most often refers to a feature of text editing and database management systems; a keyword is an index entry that correlates with a specific record or document.
K	knowledge base:	A database where information common to a particular topic is stored online for easy reference; for example, a frequently-

		asked questions (FAQ) list may provide links to a knowledge base.
L	LAN:	Local area network; a network that extends over a small area (usually within a square mile or less). Connects a group of computers for the purpose of sharing resources such as programs, documents, or printers. Shared files often are stored on a central file server.
L	link:	Another name for a hyperlink.
L	LINUX:	An open-source operating system that runs on a number of hardware platforms including PCs and Macintoshes. Linux is freely available over the Internet.
L	ListProcessor:	A program that manages electronic mailing lists; OIT is responsible for the List Processor software and also handles requests from the OSU community or new mailing lists.
L	log in, log on:	The process of entering your username and password to gain access to a particular computer; e.g., a mainframe, a network or secure server, or another system capable of resource sharing.
M	mail server:	A networked computer dedicated to supporting electronic mail. You use a client program like Microsoft Outlook for retrieving new mail from the server and for composing and sending messages.
M	mailing list:	A collection of e-mail addresses identified by a single name; mailing lists provide a simple way of corresponding with a group of people with a common interest or bond. There are two main types of lists: 1) one you create within an e-mail program like Outlook that contains addresses for two or more individuals you frequently send the same message; and 2) a List serve type that requires participants to be subscribed (e.g., a group of collaborators, a class of students, or often just individuals interested in discussing a particular topic).
M	main memory:	The amount of memory physically installed in your computer. Also referred to as "RAM".
M	mainframe:	A very large computer capable of supporting hundreds of users running a variety of different programs simultaneously. Often the distinction between small mainframes and minicomputers is vague and may depend on how the machine is marketed.
M	malware:	Software programs designed to damage or do other unwanted actions on a computer; common examples of malware include viruses, worms, Trojan horses, and spyware.

M	Microsoft Windows:	A group of operating systems for PC or compatible computers; Windows provides a graphical user interface so you can point and click to indicate what you want to do.
M	MIME:	Multipurpose Internet Mail Extensions; a protocol that enables you to include various types of files (text, audio, video, images, etc.) as an attachment to an e-mail message.
M	modem:	A device that enables a computer to send and receive information over a normal telephone line. Modems can either be external (a separate device) or internal (a board located inside the computer's case) and are available with a variety of features such as error correction and data compression.
M	MPEG:	Motion Picture Experts Group; a high quality video format commonly used for files found on the Internet. Usually a special helper application is required to view MPEG files.
M	multimedia:	The delivery of information, usually to a personal computer, in a combination of different formats including text, graphics, animation, audio, and video.
M	multitasking:	The ability of a CPU to perform more than one operation at the same time; Windows and Macintosh computers are multitasking in that each program that is running uses the CPU only for as long as needed and then control switches to the next task.
N	network adapter:	A device that connects your computer to a network; also called an adapter card or network interface card.
N	network hub:	A common connection point for devices on a network.
N	network security:	Network security consists of the provisions and policies adopted by a network administrator to prevent and monitor unauthorized access, misuse, modification, or denial of the computer network and network-accessible resources. Network Security is the authorization of access to data in a network, which is controlled by a network administrator. Dataprise uses state-of-the-art network security techniques while providing authorized personnel access to important files and applications. Every organization’s needs are different and hackers are always adapting their techniques, so we are extremely serious about staying up to date with the latest network security tools, threats and industry developments.
N	network:	A group of interconnected computers capable of exchanging information. A network can be as few as several personal computers on a LAN or as large as the Internet, a worldwide network of computers.

O	online:	A term that has commonly come to mean "connected to the Internet". It also is used to refer to materials stored on a computer (e.g., an online newsletter) or to a device like a printer that is ready to accept commands from a computer.
P	PaaS:	Platform as a Service, in the PaaS model, cloud providers deliver a computing platform that typically including an operating system, programming language execution environment, database, and web server.
P	packet:	A unit of transmission in data communications. The TCP/IP protocol breaks large data files into smaller chunks for sending over a network so that less data will have to be re-transmitted if errors occur.
P	page:	Refers to an HTML document on the World Wide Web or to a particular web site; usually pages contain links to related documents (or pages).
P	palette:	The range of colors a computer or an application is able to display. Most newer computers can display as many as 16 million colors, but a given program may use only 256 of them. Also refers to a display box containing a set of related tools within a desktop publishing or graphics design program.
P	password:	A secret combination of characters used to access a secured resource such as a computer, a program, a directory, or a file; often used in conjunction with a username.
P	PDF:	Portable Document Format; a type of formatting that enables files to be viewed on a variety computers regardless of the program originally used to create them. PDF files retain the "look and feel" of the original document with special formatting, graphics, and color intact. You use a special program or print driver (Adobe Distiller or PDF Writer) to convert a file into PDF format.
P	peer-to-peer:	A type of connection between two computers; both perform computations, store data, and make requests from each other (unlike a client-server connection where one computer makes a request and the other computer responds with information).
P	Perl:	Practical Extraction and Report Language; a programming language that is commonly used for writing CGI scripts used by most servers to process data received from a client browser.
P	pixel:	Stands for one picture element (one dot on a computer monitor); commonly used as a unit of measurement.
P	program:	A set of instructions that tells a computer how to perform a specific task.

P	protocol:	A set of rules that regulate how computers exchange information. Example: error checking for file transfers or POP for handling electronic mail.
P	proxy:	Refers to a special kind of server that functions as an intermediate link between a client application (like a web browser) and a real server. The proxy server intercepts requests for information from the real server and whenever possible, fills the request. When it is unable to do so, the request is forwarded to the real server.
Q	QuickTime:	A video format developed by Apple Computer commonly used for files found on the Internet; an alternative to MPEG. A special viewer program available for both IBM PC and compatibles and Macintosh computers is required for playback.
R	RAM:	Random Access Memory; the amount of memory available for use by programs on a computer. Also referred to as "main memory". Example: A computer with 8 MB RAM has approximately 8 million bytes of memory available. Contrast to ROM (read-only memory) that is used to store programs that start your computer and do diagnostics.
R	record:	A set of fields that contain related information; in database type systems, groups of similar records are stored in files. Example: a personnel file that contains employment information.
R	registry:	A database used by Windows for storing configuration information. Most 32-bit Windows applications write data to the registry. Although you can edit the registry, this is not recommended unless absolutely necessary because errors could disable your computer.
R	remote desktop:	A Windows feature that allows you to have access to a Windows session from another computer in a different location (XP and later).
R	RGB:	Red, green, and blue; the primary colors that are mixed to display the color of pixels on a computer monitor. Every color of emitted light can be created by combining these three colors in varying levels.
R	RJ-45 connector:	An eight-wire connector used for connecting a computer to a local-area network. May also be referred to as an Ethernet connector.
R	ROM:	Read Only Memory; a special type of memory used to store programs that start a computer and do diagnostics. Data stored in ROM can only be read and cannot be removed even when your computer is turned off. Most personal computers have only a few thousand bytes of ROM. Contrast to RAM

		(random access or main memory) which is the amount of memory available for use by programs on your computer.
R	router:	A device used for connecting two Local Area Networks (LANs); routers can filter packets and forward them according to a specified set of criteria.
S	SaaS:	Software as a Service; a software delivery model in which software and associated data are centrally hosted on the cloud. SaaS is typically accessed by users using a thin client via a web browser.
S	SATA:	Serial Advanced Technology Attachment or Serial ATA. An interface used to connect ATA hard drives to a computer's motherboard that provides a better, more efficient interface; Serial ATA is likely to replace the previous standard, Parallel ATA (PATA), which has become dated.
S	satellite transmission:	A method of data transmission; the sender beams data up to an orbiting satellite and the satellite beams the data back down to the receiver.
S	search engine:	A tool that searches documents by keyword and returns a list of possible matches; most often used in reference to programs such as Google that are used by your web browser to search the Internet for a particular topic.
S	secure server:	A special type of file server that requires authentication (e.g., entry a valid username and password) before access is granted.
S	server:	A computer that is responsible for responding to requests made by a client program (e.g., a web browser or an e-mail program) or computer. Also referred to as a "file server".
S	SMTP:	Simple Mail Transfer Protocol; a method of handling outgoing electronic mail.
S	software:	Any program that performs a specific function. Examples: word processing, spreadsheet calculations, or electronic mail.
T	table:	With reference to web design, a method for formatting information on a page. Use of tables and the cells within also provide a way to create columns of text. Use of tables vs frames is recommended for helping to make your web site ADA-compliant.
T	TCP/IP:	Transmission Control Protocol/Internet Protocol; an agreed upon set of rules that tells computers how to exchange information over the Internet. Other Internet protocols like FTP, Gopher, and HTTP sit on top of TCP/IP.

T	telnet:	A generic term that refers to the process of opening a remote interactive login session regardless of the type of computer you're connecting to.
T	Trojan horse:	A harmless-looking program designed to trick you into thinking it is something you want, but which performs harmful acts when it runs.
T	twisted pair cable:	A type of cable that is typically found in telephone jacks; two wires are independently insulated and are twisted around each other. The cable is thinner and more flexible than the coaxial cable used in conjunction with 10Base-2 or 10Base-5 standards. Most Ohio State UNITS telephone jacks have three pairs of wires; one is used for the telephone and the other two can be used for 10Base-T Ethernet connections.
U	UNIX:	A popular multitasking computer system often used as a server for electronic mail or for a web site. UNIX also is the leading operating system for workstations, although increasingly there is competition from Windows NT which offers many of the same features while running on a PC or compatible computer.
U	upload:	The process of transferring one or more files from your local computer to a remote computer. The opposite action is download.
U	URL:	Uniform Resource Locator; a means of identifying resources on the Internet. A full URL consists of three parts: the protocol (e.g., FTP, gopher, http, nntp, telnet); the server name and address; and the item's path. The protocol describes the type of item and is always followed by a colon (:). The server name and address identifies the computer where the information is stored and is preceded by two slashes (//). The path shows where an item is stored on the server and what the file is called; each segment of the location s preceded by a single slash (/). Examples: The URL for the Dataprise home page is http://www.dataprise.com.
U	USB:	Universal Serial Bus; a connector on the back of almost any new computer that allows you to quickly and easily attach external devices such as mice, joysticks or flight yokes, printers, scanners, modems, speakers, digital cameras or webcams, or external storage devices. Current operating systems for Windows and Macintosh computers support USB, so it's simple to install the device drivers. When a new device is connected, the operating system automatically activates it and begins communicating. USB devices can be connected or disconnected at any time.

U	username:	A name used in conjunction with a password to gain access to a computer system or a network service.
V	virtual reality:	An artificial environment created with computer hardware and software to simulate the look and feel of a real environment. A user wears earphones, a special pair of gloves, and goggles that create a 3D display. Examples: manipulating imaginary 3D objects by "grabbing" them, taking a tour of a "virtual" building, or playing an interactive game.
V	virtualization:	Virtualization is the creation of a virtual (rather than actual) version of something, such as a hardware platform, operating system, a storage device or network resources. In hardware virtualization, the term host machine refers to the actual machine on which the virtualization takes place; the term guest machine, however, refers to the virtual machine. Likewise, the adjectives host and guest are used to help distinguish the software that runs on the actual machine from the software that runs on the virtual machine. The software or firmware that creates a virtual machine on the host hardware is called a hypervisor or Virtual Machine Monitor.
V	virus:	A program intended to alter data on a computer in an invisible fashion, usually for mischievous or destructive purposes. Viruses are often transferred across the Internet as well as by infected diskettes and can affect almost every type of computer. Special antivirus programs are used to detect and eliminate them.
V	VoIP:	Voice over Internet Protocol; a means of using the Internet as the transmission medium for phone calls. An advantage is you do not incur any additional surcharges beyond the cost of your Internet access.
V	VPN:	Virtual Private Networking; a means of securely accessing resources on a network by connecting to a remote access server through the Internet or other network.
W	WAN:	Wide Area Network; a group of networked computers covering a large geographical area (e.g., the Internet).
W	WAP:	Wireless Application Protocol; a set of communication protocols for enabling wireless access to the Internet.
W	wi-fi:	Wireless Fidelity; A generic term from the Wi-Fi Alliance that refers to of any type of 802.11 network (e.g., 802.11b, 802.11a, dual-band, etc.). Products approved as "Wi-Fi Certified" (a registered trademark) are certified as interoperable with each other for wireless communications.
W	Windows:	A casual way of referring to the Microsoft Windows operating systems.

W	wireless (networking)	The ability to access the Internet without a physical network connection. Devices such as cell phones and PDAs that allow you to send and receive e-mail use a wireless Internet connection based on a protocol called WAP (Wireless Application Protocol). At this point, web sites that contain wireless Internet content are limited, but will multiply as the use of devices relying on WAP increases.
W	WLAN:	Wireless Local Area Network; the computers and devices that make up a wireless network.
W	World Wide Web:	A hypertext-based system of servers on the Internet. Hypertext is data that contains one or more links to other data; a link can point to many different types of resources including text, graphics, sound, animated files, a network newsgroup, a telnet session, an FTP session, or another web server. You use a special program called a "browser" (e.g., Firefox or Internet Explorer) for viewing World Wide Web pages. Also referred to as "WWW" or "the web".
W	worm:	A program that makes copies of itself and can spread outside your operating system worms can damage computer data and security in much the same way as viruses.
W	WPA:	Wi-Fi Protected Access; a standard designed to improve on the security features of WEP.
W	WWW:	An abbreviation for World Wide Web.
X	XHTML:	Extensible Hypertext Markup Language. A spinoff of the hypertext markup language (HTML) used for creating Web pages. It is based on the HTML 4.0 syntax, but has been modified to follow the guidelines of XML and is sometimes referred to as HTML 5.0.
X	XML:	Extensible Markup Language; A markup language for coding web documents that allows designers to create their own customized tags for structuring a page.
Z	zip:	A common file compression format for PC or compatibles; the utility WinZip or Winrar is used for compressing and decompressing files. Zipped files usually end with a ".zip" file extension. A special kind of zipped file is self-extracting and ends with an ".exe" extension. Macintosh OSX also supports the .zip format and has tools that can compress and decompress zip files.
Z	zoom:	The act of enlarging a portion of an onscreen image for fine detail work; most graphics programs have this capability.