



Telangana University
Department of Computer Science

Bachelor of Computer Applications (BCA)
Semester I, II, III and IV
With Effect From
2023 – 2024

Scheme of Instruction
And
Syllabus

Rules and Regulations

Attendance Requirements:

1. Candidates admitted to a particular course of study are required to pursue a 'Regular Course of Study' before they are permitted to appear for the University Examination.
2. A regular course of study means putting in attendance of not less than 75% of the lectures and practicals in all papers (this provision will be enforced strictly). In special cases and for sufficient cause shown, the Vice-Chancellor may, on the specific recommendation of the Principal/Head of the Department, condone the deficiency in attendance to the extent of 10% on medical grounds \ subject to the production of Medical Certificate and payment of 'condonation fee' as prescribed by the University.
3. Candidates not having the requisite attendance (as above) will not be allowed to appear for the examination at the end of the semester.

Promotion, Re-admission Rules & Maximum Time for Completion of Course

Promotion Criteria

Semester	Conditions to be full filled
From Semester I to Semester II	Undergone a Regular Course of Study of Semester-I and registered * for the Semester -I examination
From Semester II to Semester III	a) Undergone a Regular Course of study of Semester-I & II, and b) the number of backlogs if any, of Semester-I and II taken together, shall not exceed 50% of the total number of papers / subjects prescribed for Semesters - I and II
From Semester III to Semester IV	Undergone a Regular Course of Study of Semester-III and registered * for the Semester -III examination
From Semester IV to Semester V	a) Undergone a Regular Course of study of Semester-III & IV, and b) the number of backlogs if any, of Semester-III and IV taken together, shall not exceed 50% of the total number of papers / subjects prescribed for Semesters -III and IV

Note: * Registration means obtaining a Hall Ticket for the said examination following prescribed procedures

Backlog Rules:

For Semester Scheme

During the regular exams of I, III and V semesters, backlogs of II, IV and VI semesters will be conducted. At this time there will be no backlog exams for the I, III and V semesters. During the regular II, IV and VI semester exams, all backlogs of I, III and V semesters will be conducted.

Re-admission Rules:

- For candidates detained due to shortage of attendance: In case of the candidate who fails to put in the required attendance (75%) in a course of study, the admission into which is based on the qualifying examination he/she shall be detained in the same class and will not be permitted to appear for the University Examination. Such candidates shall have to seek re-admission into the class during the subsequent year in order to complete the shortage in attendance and appear for the examination after fulfilling the attendance requirements.
- For candidates detained due to backlogs: They have to clear the minimum number of backlog papers to be eligible
- Re-admitted candidates have to pay the Tuition fee pertaining to the academic year in which he/she takes re-admission.

The procedure to be followed for granting readmission to the students in the following cases:

- A student who did not pass in the required number of papers and thus detained.
- A student after completing a semester / year did not continue their studies in the next immediate semester / year on personal / health grounds but desired to continue his / her studies after a short break.
- A student, who has put in not less than 40% of attendance in a Semester and not registered for the examination, can take re-admission in the same semester without appearing for the entrance examination.
- Candidates who, after completing a semester / year of the course but taken T.C. to join some other course and come back to continue the earlier course.

In all the above cases, readmission is permissible provided they are ***within the period of double the duration of the course***. Further, the approvals of the university have to be obtained in respect of those students who take TC to join some other course and come back for readmission in the same college.

PROPOSED SCHEME OF INSTRUCTION
BACHELOR OF COMPUTER APPLICATIONS (BCA)
SEMESTER- I

SNo	Course Code	Course Title	Cate- gory	Hours/ Week		No of Credits	Scheme of Examination			
							Max Marks		Duration (hrs)	
THEORY				L/T	P		SEE	CIE	SEE	CIE
1	BCA101BS	Mathematical Foundations of Computer Science	BSC	4	-	4	70	30	3	1
2	BCA102PC	Digital Principles	PCC	4	-	4	70	30	3	1
3	BCA103PC	Programming in C	PCC	4	-	4	70	30	3	1
4	BCA104PC	Introduction to Web Technology	PCC	4	-	4	70	30	3	1
5	BCA105HS	Effective Communication	HSC	4	-	4	70	30	3	1
PRACTICAL										
6	BCA151LC	Programming in C Lab	LCC	-	4	2	50	25	3	2
7	BCA152LC	Web Technology Lab	LCC	-	4	2	50	25	3	2
8	BCA153LC	IT Workshop	LCC	-	4	2	50	25	3	2
Total				20	12	26	500	225	-	-

Category

BSC	Basic Science Course
PCC	Professional Core Course
ETC	Emerging Technological Course
HSC	Humanities and Social Science Course
MGC	Management Course
PEC	Professional Elective Course
LCC	Laboratory Core Course
LTC	Laboratory Technological Course
LPC	Laboratory Professional Course
LHC	Laboratory Humanities Course

Examinations

CIE – Continuous Internal Evaluation

SEE – Semester End Evaluation

L/T: Lecture/Tutorial P: Practical

BCA SEM I – THEORY			Hours /week		Credits	Scheme of Examination			
Course Code	Course Title	Category	L/T	P		MaxMarks		Duration(hrs)	
BCA101BS	Mathematical Foundations of Computer Science	BSC	4	-	4	70	30	3	1

UNIT- I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication, Use of Quantifiers, Definitions and the Proof of Theorems.

Set Theory and Properties of the Integers: Set and Subsets, Set Operations, and the Laws of Set theory, Counting and Venn Diagrams. The well – ordering principle, Recursive Definitions, Division Algorithm, Fundamental theorem of Arithmetic.

UNIT-II

Relations and Functions: Cartesian Product, Functions onto Functions, Special Functions, Pigeonhole Principle, Composition and Inverse Functions.

Properties of relations, Partial Orders, Equivalence Relations and Partitions, Principle of Inclusion and Exclusion, Generalization of principle.

UNIT-III

Generating Functions: Introductory Examples, Definition And Examples, Partitions of Integers.

Recurrence Relations: First – order linear recurrence relation, second – order linear homogenous recurrence relation with constant coefficients.

UNIT-IV

Algebraic Structures: Algebraic System – General Properties, Semi Groups, Monoids, Homomorphism,

Groups: Definition, Examples and Elementary properties, Residue Arithmetic.

UNIT -V

Graph Theory: Definitions and examples, sub graphs, complements and graph Isomorphism, Vertex degree, Planar graphs, Hamiltonian paths and Cycles.

Trees: Definitions, properties and Examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees.

Reference Book: Mott Joe L Mott, Abraham Kandel, and Theodore P Baker, Discrete Mathematics for Computer Scientists & Mathematicians, Prentice Hall NJ, 2nd Edition, 2015.

Suggested Reading:

1. Ralph P. Grimaldi, B.V Ramana., Discrete and Combinatorial Mathematics, 5th Edition, Pearson, 2004.
(An Applied Introduction)
2. Jr. P. Tremblay and R Manohar Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill, 1987.
3. R.K.Bisht and H.S.Dhami, Discrete Mathematics Oxford Higher Education, 2015
4. Bhavanari Satyanarayana, Tumurukota Venkata Pradeep Kumar and ShaikMohiddin Shaw, Mathematical Foundation of Computer Science, BSP, 2016

BCA SEM I – THEORY			Hours /week			Scheme of Examination			
Course Code	Course Title	Category	L/T	P	Cre-dits	MaxMarks		Duration(hrs)	
BCA102PC	Digital Principles	PCC	4	-	4	70	30	3	1

UNIT I

Binary Systems: Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic.

Boolean Algebra and Logic Gates: Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

UNIT II

Minimization: K-Map Method – Table Method, POS - SOP, Don't Care Conditions, NAND, NOR Implementation.

Combinational Logic: Combinational Circuits, Analysis and Design Procedure, Binary Adder, Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT III

Synchronous Sequential Logic: Sequential Circuits - Latches, Flip-Flops, An analysis of Clocked Sequential Circuits, State Reduction and Assignment Design Procedure.

UNIT IV

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counters-Johnson Counter.

UNIT V

Asynchronous Sequential Circuit : Introduction, Analysis Procedure, Circuits with Latches, Design Procedure.

Suggested Reading:

1. M.Morris Mano, "Digital Design", 3rd edition, Pearson Education, Delhi, 2007.
2. Donald P Leech, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", Tata Mc Graw Hill, 2007.

BCA SEM I – THEORY			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
BCA103PC	Programming in C	PCC	4	-	4	70	30	3	1

UNIT – I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.

Number Systems: Binary, Octal, Decimal, and Hexadecimal

Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements

Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT-II

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If- Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and Goto statements

Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. **Recursion-** Recursive Functions.

Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

UNIT – III

Preprocessors: Preprocessor Commands. **Arrays -** Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

UNIT - IV

Pointers - Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L-value and R-value, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.

Strings - Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions.

UNIT - V

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self Referential Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions.

Suggested Reading:

1. B.A. Forouzan and R.F. Gilberg, “A Structured Programming Approach in C” , Cengage Learning, 2007
2. Kernighan BW and Ritchie DM, “The C Programming Language”, 2nd Edition, Prentice Hall of India, 2006.
3. Rajaraman V, “The Fundamentals of Computer”, 4th Edition, Prentice-Hall of India, 2006.

BCA SEM I – THEORY			Hours /week			Scheme of Examination			
Course Code	Course Title	Category	L/T	P	Credits	MaxMarks		Duration(hrs)	
						SEE	CIE	SEE	CIE
BCA104PC	Introduction to Web Technology	PCC	4	-	4	70	30	3	1

UNIT-I Introduction to World Wide Web, WebBrowsers, WebServers, BOM, DOM, HTTP. **HTML5:**Introduction,HTML5 Tags, Links, Input, Images, Lists, Tables, Creating Forms, Styling Forms, Placeholder, Inline and Block elements, Id vs. Class elements

UNIT-II

CSS3– Basics: Need and Benefit of CSS3, CSS3 Syntax, Comments, and Including CSS3 in HTML Documents (Inline, Embedded and External Style Sheets).CSS3- Selectors: Universal Selector, Element Type Selector, Id Selectors, Class Selectors, and Group Selectors.

CSS3-Styles: CSS Color, CSS Background, CSS Fonts, CSS Text, CSS Links, CSS Lists, CSS Tables.CSS3- Box Model: Margin, Padding, Border, Outline, Visibility, Display, Multiple Columns.

UNIT –III

Responsive Web Design(RWD)- Introduction, Viewport, Creating Responsive Websites, Responsive Images, Responsive Texts.

RWD-Media Queries: Introduction, Media Types, Device Breakpoints. RWD-Grid View: Introduction, grid-row, grid-column.

UNIT-IV

Introduction to Java script: Java Script and Forms Variables, Functions, Operators, Conditional Statements and Loops, Arrays, DOM Methods, Strings, Java Script Closures, JSON. Events Handling (Mouse Events, Keyboard Events).

UNIT-V

Introduction to Type Script-Overview of Typescript, Interface, classed, Functions, Generices, Enums, Adv Types, Modules, JSX overview.

Suggested Reading:

1. RobertW.Sebesta,ProgrammingtheWorldWideWeb,8thEdition,PearsonEducation,2006.
2. Internet & World Wide Web-HOW TO PROGRAM-5th Edition, Deitel. Published by Pearson (July 14th 2021) - Copyright © 2012.
3. Yakov Fain, Anton Moiseev, TypeScript Quickly, 1st Edition, Manning Publications,2020.

BCA SEM I – THEORY			Hours /week		Credits	Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Category	L/T	P	Credits	SEE	CIE	SEE	CIE
BCA105HS	Effective Communication	HSC	4	-	4	70	30	3	1

UNIT – I

Effective Communication: Role and importance of communication; Features of human communication; Process of communication; Barriers to communication; Oral and Written Communication; Importance of listening, speaking, reading, and writing;

Types of communication: Verbal – formal versus informal communication, one-way versus two-way communication, Non-verbal communication.

UNIT – II

Personality Development and Interpersonal Communication: Models of interpersonal development, Johari window, Knapp's model, Styles of communication, Time management, Emotional Quotient, Teamwork, Persuasion techniques.

UNIT – III

Remedial English: Tenses, Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.

(Note: The focus is on appropriate usage)

UNIT – IV

Vocabulary Building and Written Communication: Roots and affixes;

Words often confused: Homonyms, Homophones, Homographs; One-word substitutes; **Idiomatic usage:** Idioms, Phrases, Phrasal Verbs; Synonyms; Antonyms; Paragraph writing; Précis writing; Essay writing; Official letters; E-mail etiquette;

Technical report writing: Feasibility and Progress reports.

UNIT – V

Reading Comprehension: Unseen Passages, A.P.J. Abdul Kalam, Azim Premji, Sachin Tendulkar, Sathya Nadella, Sam Pitroda

(Note: No descriptive questions to be set from this unit and only Reading Comprehension/s from unseen passages should be set in the Examination Question Papers)

Suggested Readings:

1. E. Suresh Kumar, *Engineering English*, Orient Black Swan, 2014
2. *Language and Life A Skills Approach*, Orient Black Swan, 2018
3. Michael Swan, *Practical English Usage*. OUP, 1995
4. Ashraf Rizvi, M, *Effective Technical Communication*, Tata McGraw Hill, 2009.
5. Meenakshi Raman and Sangeeta Sharma. *Technical Communication: Principles and Practice*. OUP, 2011.

BCA SEM I – Laboratory			Hours /week			Scheme of Examination			
Course Code	Course Title	Cate- gory	L/T	P	Cre- dits	MaxMarks		Duration(hrs)	
						SEE	CIE	SEE	CIE
BCA151LC	Programming in C Lab	LCC	-	4	2	50	25	3	2

1. Write programs using arithmetic, logical, bitwise and ternary operators.
2. Write programs simple control statements : Roots of a Quadratic Equation, extracting digits of integers, reversing digits ,finding sum of digit ,printing multiplication tables, Armstrong numbers, checking for prime, magic number,
3. Sin x and Cos x values using series expansion
4. Conversion of Binary to Decimal, Octal, Hexa and Vice versa
5. Generating a Pascal triangle and Pyramid of numbers
6. Recursion: Factorial, Fibonacci, GCD
7. Finding the maximum, minimum, average and standard deviation of given set of numbers using arrays
8. Reversing an array ,removal of duplicates from array
9. Matrix addition , multiplication and transpose of a square matrix .using functions
10. Functions of string manipulation: inputting and outputting string , using string functions such as strlen(),strcat(),strcpy().....etc
11. Writing simple programs for strings without using string functions.
12. Finding the No. of characters, words and lines of given text file
13. File handling programs : student memo printing

BCA SEM I – Laboratory			Hours /week			Scheme of Examination			
Course Code	Course Title		L/T	P		MaxMarks		Duration(hrs)	
BCA152LC	Web Technology Lab	LCC	-	4	2	50	25	3	2

1. Visual Studio Code Installation, Type Script Extension Installation in Visual Studio Code.
2. Create a Webpage Layout using Semantic elements.
3. Add Audio and Video element to a Webpage.
4. Drawing 2D graphics using Canvas.
5. Program to Find current location using Geo location.
6. Example for local Storage and session Storage.
7. Styling text and fonts using CSS3 properties.
8. Styling Lists and Links using CSS3 properties.
9. Styling tables using CSS3 properties.
10. Styling Webpage backgrounds using CSS3 properties.
11. Demonstrate Form validation.
12. Demonstrate DOM methods.
13. Demonstrate HTML events.
14. Write Type Script code to perform arithmetic operations.
15. Demonstrate functions in Type Script.

BCA SEM I – Laboratory			Hours /week			Scheme of Examination			
						MaxMarks	Duration(hrs)		
Course Code	Course Title	Cate-gory	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
BCA153LC	IT Workshop	LCC	-	4	2	50	25	3	2

1. System Assembling , Disassembling and identification of Parts / Peripherals
2. Operating System Installation – Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. Introducing to programming Environment(Linux commands, editing tools such as vi editor, sample program entry, compilation and execution)
4. MS-Office / Open Office
 - a) Word – Formatting Page Borders, Reviewing Equations, symbols
 - b) Spread Sheet – organize data, usage of formula graphs charts
 - c) Power point – features of power point, guidelines for preparing an effective presentation
 - d) Access – creation of database, validate data
5. Network Configuration & Software Installation: Configuring TCP/IP, proxy and firewall settings. Installing application software system software & tools.
6. Internet and World Wide Web-Search Engines. Types of search engines, netiquette, Cyber hygiene.
7. Trouble Shooting – Hardware trouble shooting, Software trouble shooting.

Suggested Reading:

- 1) K. L. James, Computer Hardware, Installation, Interfacing Troubleshooting and maintenance, i) Eastern Economy Edition.
- 2) Gary B.Shelly, Misty E Vermaat and Thomas J. Cashman, Microsoft Office 2007 Introduction i) Concepts and Techniques, Windows XP Edition, 2007, Paperback.
- 3) Leslie Lamport, LATEX-User's Guide and Reference manual, Pearson, LPE, 2nd Edition.
- 4) Rudraprathap, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Oxford University Press, 2002.
- 5) Scott Mueller's, Upgrading and Repairing PCs, 18th Edition, Scott. Mueller, QUE, Pearson, 2008.
- 6) Cherry l A Schmidt, The Complete Computer Upgrade and Repair Book, 3rd Edition , Dream tech.
- 7) Vikas Gupta, Comdex Information Technology Course Tool Kit , WILEY Dream tech.
- 8) ITL Education Solutions Limited, Introduction to Information Technology, Pearson Education.

PROPOSED SCHEME OF INSTRUCTION
BACHELOR OF COMPUTER APPLICATIONS (BCA)
SEMESTER- II

SNo	Course Code	Course Title	Category	Hours/ Week		No of Credits	Scheme of Examination			
							Max Marks		Duration (hrs)	
THEORY				L/T	P		SEE	CIE	SEE	CIE
1	BCA201BS	Fundamentals of Probability and Statistics	BSC	4	-	4	70	30	3	1
2	BCA202PC	Object Oriented Programming using CPP	PCC	4	-	4	70	30	3	1
3	BCA203PC	Computer Architecture	PCC	4	-	4	70	30	3	1
4	BCA204PC	Data Structures	PCC	4	-	4	70	30	3	1
5	BCA205PC	Advance Computer Networks	PCC	4	-	4	70	30	3	1
PRACTICALS										
6	BCA251LC	Object Oriented Programming using CPP Lab	LCC	-	4	2	50	25	3	2
7	BCA252LC	Data Structures Lab	LCC	-	4	2	50	25	3	2
8	BCA253LH	Communication Skills Lab	LHC	-	4	2	50	25	3	2
Total				20	12	26	500	225	-	-

Category

L/T: Lecture/Tutorial

P: Practical

BSC	Basic Science Course
PCC	Professional Core Course
ETC	Emerging Technological Course
HSC	Humanities and Social Science Course
MGC	Management Course
PEC	Professional Elective Course
LCC	Laboratory Core Course
LTC	Laboratory Technological Course
LPC	Laboratory Professional Course
LHC	Laboratory Humanities Course

BCA SEM II – THEORY			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
BCA201BS	Fundamentals of Probability and Statistics	BSC	4	-	4	70	30	3	1

UNIT-I

Introduction: Importance of Statistics, Concepts of Statistics, population and a sample; quantitative and qualitative data; Collection of Primary and Secondary data; Classification and Tabulation of data. Construction of Univariate and bivariate frequency distribution; Diagrammatic and Graphical representation of data.

UNIT-II

Descriptive Statistics: Measures of central tendency: Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean; Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation. Definition of Moments; Measures of Skewness: Karl Pearson's coefficient of skewness, Bowley's coefficient of skewness; Kurtosis.

UNIT-III

Probability: Basic terminology, Mathematical probability, Statistical probability, Axiomatic approach to probability, Theorems on probability. Conditional Probability, Multiplication theorem of probability, Independent events, Pairwise /mutually independent events, Bayes' Theorem.

UNIT-IV

Random variable: Definition of a random variable, discrete and continuous random variables, functions of random variables, probability mass function and probability density function and mathematical expectation of a random variable and properties of expectation.

Probability Distributions: Binomial, Poisson and Normal Distribution.

UNIT-V

Correlation and Regression analysis: Definition of correlation, Scatter Diagram, Karl Pearson's Coefficient of correlation; Partial and Multiple correlation coefficients (for three variables); Definition of Regression, Simple Linear Regression (for 2 variables).

Small Sample Tests: Basic Definitions of testing of hypothesis ;**t-Test:** t-test for single Mean, t-test for difference of Means, Paired t-test. **F-Test:** F-test for equality of two population variances. **CHI-SQUARE Test:** Test for single variance(population variance)and test of independence of attributes.

Reference Book:

1. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, Twelfth Edition.

Suggested reading:

1. A.M. Gun, M.K. Gupta, B.Dasgupta, "Fundamentals of Statistics", Vol-1, the world press Pvt.Ltd.,Kolkata.
2. William Mendenhall, Robert J. Beaver, Barbara M.. Beaver, "Introduction to Probability and Statistics", Thomson Brooks / Cole, Eleventh Edition, 2003.
3. Richard A. Johnson, "Probability and Statistics for Engineers", Prentice Hall of India, Seventh Edition 2005.

BCA SEM II – THEORY			Hours /week		Credits	Scheme of Examination			
Course Code	Course Title		L/T	P		MaxMarks		Duration(hrs)	
BCA202PC	Object oriented Programming using CPP	PCC	4	-	4	70	30	3	1

UNIT I

Introduction to OOP: Procedure oriented programming, object oriented programming, basic concepts of OOP, benefits and applications of OOP, simple C++ program, namespace scope, and structure of C++ Program, creating, compiling and linking a file.

Tokens : Keywords, identifiers, constants, basic data types, user defined data types, storage classes, derived data types, dynamic initialization of variables, reference variables, operators in C++, scope resolution operator, member dereferencing operators, memory management operators.

UNIT II

Control Structures: if, if..else, elseif ladder, nested if, switch, for, while, do..while, break, continue, exit, goto.

Classes and Objects: Specifying a class, defining member functions, C++ program with class, private member functions, arrays within class, memory allocation for objects, static data members, static member functions, arrays of objects, returning objects.

Functions in C++: Main function, function prototyping, call by reference, return by reference, inline functions, default arguments.

UNIT III

More about Functions: Function overloading, friend function, a function friendly to two classes, objects as function arguments.

Constructors & Destructors: Constructors, parameterized constructors, multiple constructors in a class, constructors with default arguments, copy constructors, dynamic constructors, destructors.

UNIT IV

Inheritance: Introduction to inheritance, single inheritance, multi-level inheritance, multiple inheritances, hierarchical inheritance, hybrid inheritance.

Operator Overloading: Rules for overloading operators, overloading unary operators, and overloading binary operators.

Pointers: Introduction to pointers, declaring and initializing pointers, arithmetic operations on pointers, pointers with arrays, arrays of pointers, pointers to objects, 'this' pointer.

UNIT V

Polymorphism and Virtual Functions: Compile-time polymorphism, runtime polymorphism, virtual functions.

Templates: Introduction, function templates, class templates.

Exception Handling: Introduction, exception handling mechanism, throwing mechanism, catching mechanism.

Suggested Reading:

1. E. Balagurusamy, Object Oriented Programming with C++, 6/e, McGraw Hill, 2013.
2. Behrouz A. Forouzan and Richard F. Gilberg, Computer Science : A Structured Approach Using C++, 2/e, Cengage Learning, 2003.
3. Ashok N. Kamthane, Object Oriented Programming with ANSI and Turbo C++, 1/e, Pearson Education, 2006.

BCA SEM II – THEORY			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
BCA203PC	Computer Architecture	PCC	4	-	4	70	30	3	1

UNIT I

Basic Structure of Computers : Functional units, Basic operational concepts, Bus structures, Software performance, Memory locations and addresses, Memory operations, Instruction and instruction sequencing, Addressing modes, Assembly language, Basic I/O operations.

UNIT II

Arithmetic Unit: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive Numbers, Signed operand multiplication and fast multiplication, Integer division , Floating point numbers and operations.

UNIT III

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Hardwired control, Microprogrammed control, Pipelining, Basic concepts, Data hazards, Instruction hazards, Influence on Instruction sets, Data path and control consideration.

UNIT IV

Memory System: Basic concepts, Semiconductor RAMs, ROMs, Speed, size and cost, Cache memories, Performance consideration, Virtual memory, Memory Management requirements, Secondary storage.

UNIT V

I/O Organization: Accessing I/O devices, Interrupts, Direct Memory Access , Buses, Interface circuits, Standard I/O Interfaces (PCI, SCSI, USB).

Suggested Reading:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5th Edition “Computer Organization”, McGraw-Hill, 2002.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6th Edition, Pearson Education, 2003.
3. David A.Patterson and John L.Hennessy, “Computer Organization and Design: The hardware
4. / software interface”, 2nd Edition, Morgan Kaufmann, 2002.
5. John P.Hayes, “Computer Architecture and Organization”, 3rd Edition, McGraw Hill, 1998.

BCA SEM II – THEORY			Hours /week			Scheme of Examination			
Course Code	Course Title	Cate-gory	L/T	P		MaxMarks		Duration(hrs)	
BCA204PC	Data Structures	PCC	4	-	4	70	30	3	1

UNIT-I

Introduction to Data Structures: Definition, Uses, Types. **Arrays:** Abstract Data Types and the C++ Class, Array as an Abstract Data Type, Representation of Arrays, Matrices, Special Matrices Sparse Matrices, Strings.

UNIT-II

Stacks and Queues: Representation of Stacks, Representation of Queue, Operations on Stacks, Operations on Queues, Types of Queues.

UNIT-III

Linked Lists: Singly Linked Lists, Doubly Linked Lists, Circular Lists. **Hashing:** Static Hashing, Hash Tables, Hash Functions, Overflow Handling.

UNIT-IV

Trees: Introduction, Binary Trees, Representation of Binary Tree, Binary Tree Traversal, Binary Search Tree, Operations on Binary Search Tree, Heap tree, B-tree.

Graphs: Terminology, Types, Representation of Graph, Elementary Graph operations- DFS and BFS.

UNIT-V

Sorting: Bubble, Selection, Insertion sort, Quick sort, Merge sort, Heap sort, shell sort. **Searching Techniques:** Linear Search, Binary Search

Suggested Reading:

1. Ellis Horowitz, Dinesh Mehta, S. Sahani. Fundamentals of Data Structures in C++, Universities Press. 2007.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education 2006.
3. Michael T. Goodrich, Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, Wiley India Pvt. Ltd, 2004.

CA SEM II – THEORY			Hours /week		Credits	Scheme of Examination			
Course Code	Course Title	Category	L/T	P		MaxMarks		Duration(hrs)	
BCA205PC	Advanced Computer Networks	PCC	4	-	4	70	30	3	1

Unit – I

Network Architecture, Performance: Bandwidth and Latency, High Speed Networks, Network-Centric View, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks, Overlay Networks: Routing Overlays, Peer-to-Peer Networks and Content Distribution Networks, Client-Server Networks, Delay-Tolerant Networks

Unit - II

Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Message- Switched Networks, Asynchronous Transfer Mode: Evolution, Benefits, Concepts, Exploring Broadband Integrated Services Digital Network, Layer and Adaptation Layer

Unit - III

IPv4: Address Space, Notations, Classful, Classless, Network Address Translation, Datagram, Fragmentation and Checksum IPv6 Addresses: Structure, Address Space, Packet Format and Extension Headers, ICMP, IGMP, ARP, RARP, Congestion Control and Resource Allocation: Problem, Issues, Queuing, TCP

Unit - IV

Congestion Control, Congestion-Avoidance Mechanisms and Quality of Service, Internetworking: Intra-Domain and Inter-Domain Routings, Unicast Routing Protocols: RIP, OSPF and BGP, Multicast Routing Protocols: DVMRP, PIM-DM, PIM-SM, CBT, MSDP and MOSPF, Spanning Tree Algorithm

Unit - V

Optical Networking: SONET/SDH Standards, Traffic Engineering: Requirement, Traffic Sizing, Characteristics, Protocols, Time and Delay Considerations, Connectivity, Availability, Reliability and Maintainability and Throughput, Multimedia Over Internet: Transmission, IP Multicasting and VoIP, Domain Name System: Name Space, Domain Name Space, Distribution, Domains, Resolutions and Dynamic Domain Name System, SNMP, Security: IPSec, SSL/TLS, PGP and Firewalls, Datacenter Design and Interconnection Networks.

Text Books/Reference Books/Online Resources:

1. Larry L. Peterson and Bruce S. Davie, Computer Networks: A System Approach, Fifth Edition, Morgan Kaufmann, Elsevier, 2012.
2. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, Fifth Edition, 2017.
3. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber Security, CRC press, Taylor & Francis Group, 2014
4. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Pearson, 5th Edition, 2014.
5. G. Wright and W. Stevens, TCP/IP Illustrated, Volume 1 and Volume 2, Addison- Wesley, 1996.
5. Dayanand Ambawade, Deven Shah, Mahendra Mehra and Mayank Agarwal, Advanced Computer Network, Dreamtech Press, 2016.
7. R. Srikant, The Mathematics of Internet Congestion Control, Springer, 2004.
8. J. L. Boudec and P. Thiran, Network Calculus, Springer, 2011.

BCA SEM II – Laboratory			Hours /week			Scheme of Examination			
Course Code	Course Title	Cate- gory	L/T	P	Cre- dits	MaxMarks		Duration(hrs)	
						SEE	CIE	SEE	CIE
BCA251LC	Object oriented Programming using CPP Lab	LCC	-	4	2	50	25	3	2

1. Write a program that contains a function to exchange (swap) values of two arguments by using pointers and References parameters
2. Write a program to check the given string is palindrome or not using a private member function.
3. Write a program to find transpose of 2-D matrix by allocating memory dynamically to the matrix. Initialize and display contents of the matrix and deallocate memory.
4. Write a program to add corresponding elements of two 2-D matrices using friend function. Create two classes each capable of storing one 2-D matrix. Declare the matrices under private access specifier and access them outside the class.
5. Write a program for finding area of different geometric shapes (Circle, Rectangle and Cube) using function overloading.
6. Write a Program to generate Fibonacci Series by using Constructor to initialize the Data Members.
7. Write a program to add two matrices of same copy. Create two objects of the class and each of which refers to one 2-D matrix. Use constructor to allocate memory dynamically and use copy constructor to allocate memory when one array object is used to initialize another.
8. Write a program to demonstrate single inheritance distinguishing public and private derivation.
9. Write a program to illustrate the implementation of both Multilevel and Multiple (Hybrid) inheritance.
10. Write a program to find transpose of a given matrix of mxn size using unary operator overloading.
11. Write a program to add two matrices of mxn size using binary operator overloading.
12. Write a program to demonstrate the usage of virtual functions.
13. Write a program to sort a given set of elements using function template.
14. Write a program to search a key element in a given set of elements using class template.
15. Write a program to find average marks of the subjects of a student.
16. Throw multiple exceptions and define multiple catch statements to handle division by zero as well as array index out of bounds exceptions.

BCA SEM II – Laboratory			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
BCA252LC	Data Structures Lab	LCC	-	4	2	50	25	3	2

Experiments:

- Write a C++ program for the implementation of Array.
- Write a C++ program for the implementation of Special Matrices.
- Write a C++ program for the implementation of Sparse Matrices
- Write a C++ program for the implementation of String
- Write a C++ program to implement the following using array
 - Stack
 - Queue
- Write a C++ program to implement the following using a) single linked list b) Doubly linked list c) Circular linked list
- Write a C++ program to implement stack using linked list.
- Write a C++ program to implement queue using linked list.
- Write a C++ program to implement binary tree.
- Write C++ program for implementing the following sorting methods
 - Bubble sort
 - Selection sort
 - Insertion sort
 - Quick sort
 - shell sort
 - Merge sort
 - Heap sort
- Programs on Linear Search and Binary Search using recursion and iteration

BCA SEM II – Laboratory			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
BCA253LH	Communication Skills Lab	LHC	-	4	2	50	25	3	2

1. **Introduction to English Phonetics:** Organs of Speech: respiratory, articulatory and phonatory systems; Sounds of English: Introduction to International Phonetic Alphabet; Minimal pairs; Syllable; Word Stress; Introduction of rhythm and intonation; Difficulties of Indians speakers with stress and intonation.
2. **Speaking Activities:** Self Introduction, Picture perception, JAM.
3. Group discussion, Debate, Presentation skills
4. **Listening Activities:** Listening to different types of materials for effective comprehension
5. **Role play:** Use of dialogues in a variety of situations and settings

Suggested Readings:

1. E. Suresh Kumar. *A Handbook for English Language Laboratories (with CD)*. Revised edition, Cambridge University Press India Pvt. Ltd. 2014
2. T. Balasubramanian. *A Textbook of English Phonetics for Indian Students* Macmillan, 2008.
3. J. Sethi et al., *A Practical Course in English Pronunciation (with CD)*. Prentice Hall of India, 2005.
4. Hari Mohan Prasad. *How to Prepare for Group Discussions and Interviews*. Tata McGraw Hill, 2006.

PROPOSED SCHEME OF INSTRUCTION
BACHELOR OF COMPUTER APPLICATIONS (BCA)
SEMESTER- III

SEMESTER - III									
SNo	Course Code	Course Title	Category	Hours/ Week		No of Credits	Scheme of Examination		
							Max Marks	Duration (hrs)	
THEORY				L	P		SEE	CIE	SEE
1	BSC301	Applied Mathematics	BSC	4	-	4	70	30	3
2	PCC302	Java Programming	PCC	4	-	4	70	30	3
3	MC303	Environmental Science	MC	4	-	4	70	30	3
4	PCC304	Operating System Concepts	PCC	4	-	4	70	30	3
5	PCC305	Database Design	PCC	4	-	4	70	30	3
PRACTICALS									
6	LCC351	Java Programming Lab	LCC	-	4	2	50	25	3
7	LCC352	Operating System Concepts Lab	LCC	-	4	2	50	25	3
8	LCC353	Database Design Lab	LCC	-	4	2	50	25	3
Total				20	12	26	500	225	-

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	LTC	Laboratory Technological Course
PCC	Professional Core Course	LPC	Laboratory Professional Course
ETC	Emerging Technological Course	LHC	Laboratory Humanities Course
HSC	Humanities and Social Science Course	CIE	Continuous Internal Evaluation
MGC	Management Course	SEE	Semester End Evaluation
PEC	Professional Elective Course	L	Lecture
LCC	Laboratory Core Course	P	Practical

BCA SEM III – THEORY			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate- gory	L	P	Cre- dits	SEE	CIE	SEE	CIE
BSC301	Applied Mathematics	BSC	4	-	4	70	30	3	1

Unit- I

Partial Differentiation: Introduction - Functions of two variables - Neighborhood of a point (a, b) - Continuity of a Function of two variables, Continuity at a point - Limit of a Function of two variables - Partial Derivatives - Homogeneous Functions.

Unit- II

Theorem on Total Differentials - Composite Functions - Differentiation of Composite Functions - Implicit Functions - Maxima and Minima of functions of two variables – Lagrange's Method of undetermined multipliers.

Unit- III

Linear Equations in Linear Algebra – Systems of Linear Equations – Consistent and Inconsistent Systems; Solution sets of Linear Systems – trivial and Non trivial Solutions; Linear Independence – Linear Independence of Matrix Columns and Characterization of Linearly Dependent sets.

Unit- IV

Vector spaces and Subspaces, Linearly independent sets; bases. Eigenvalues and Eigenvectors - The Characteristic Equation.

Unit- V

Diagonalization – Diagonalizing Matrices with distinct eigen values and non distinct eigen values; Applications to Differential Equations.

References:

1. David C Lay, Linear Algebra and its Applications 4e
2. S Lang, Introduction to Linear Algebra
3. Gilbert Strang , Linear Algebra and its Applications
4. Shanti Narayan, P.K. Mittal Differential Calculus, S.CHAND, NEW DELHI
5. Shanti Narayan Integral Calculus, S.CHAND, NEW DELHI

BCA SEM III – THEORY		Cate- gory	Hours /week		Cre- dits	Scheme of Examination			
Course Code	Course Title		L	P		MaxMarks		Duration(hrs)	
PCC302	Java Programming	PCC	4	-	4	70	30	3	1

Unit-I

Introduction to Java: Java History – Features of java, how java differ from C and C++, Introduction to JDK and JRE, Java Primitive Types, Basic Operators, Conditional and Logical statements, Some Typical Differences Between C and Java.

Defining Classes: Adding Instance Fields and Methods, Constructors, Access Modifiers (Visibility Modes), Object Creation Examples, Method Overloading and Constructor Overloading, use of static and final keywords, Objects as parameters, Difference between local variable and instance field, Introduction to Object class, How to read user input (from keyboard).

Unit-II

Arrays, Strings in Java: How to create and define arrays, Introduction to java.util.Array class, Difference between String & StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives

Inheritance, Interfaces and Packages in Java: Defining super / sub classes, Abstract classes, Method overriding, Interfaces, Using Library Interfaces, Comparable and Comparator, Creating and Defining packages.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

Unit-III

Exception Handling in Java: What are exceptions, writing your own exception classes, try, catch, throw, throws clauses, Difference between checked vs unchecked Exceptions, Error Vs. Exception.

Multithreading in Java: Thread and its Life cycle, how to create threads, Thread class in java, use of synchronized keyword, how to avoid deadlock.

Unit-IV

GUI Design & Event Handling: Component, Container, Color, GUI Controls, Layout Managers, Introduction to Swings, Events, Listeners, Icon interface, Writing GUI Based applications, Applets, Running Applets.

Unit-V

File Handling: Stream classes, Reader and Writer classes, File and Directory class

Generics and Frameworks: Generics, Collections Framework, Collection interfaces and classes ArrayList, LinkedList, Vector

Suggested Reading

1. Herbert Schildt: "JavaTM: The Complete Reference Java", Eighth Edition, Tata McGraw Hill Publications, 2011, ISBN: 9781259002465

BCA SEM III – THEORY			Hours /week		Cre-dits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks	Duration(hrs)		
MC303	Environmental Science	MC	4	-	4	70	30	3	1

Unit I

Environmental Studies: Definition, scope and importance, need for public awareness. **Natural resources:** Water resources; use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams: benefits and problems. Effects of modern agriculture, fertilizer- pesticide problems, water logging and salinity.

Unit II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

Unit III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

Unit IV

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution; solid and liquid waste management.

Environment Protection Act: Air, water, forest and wild life Acts, enforcement of environmental legislation.

Unit V

Social Issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle, and disaster management in India.

Suggested Readings

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.
2. E.P. Odum, Fundamentals of Ecology, W.B. Saunders Co., USA.
3. M.N. Rao and A.K. Datta, Waste Water Treatment, Oxford and IBK Publications.
4. Benny Joseph, Environmental Studies, Tata McGraw Hill, 2005.
5. V.K. Sharma, Disaster Management, National Centre for Disaster Management, IPE, 1999.
6. Green Building Council of India, Teri Document

BCA SEM III – THEORY			Hours /week		Credits	Scheme of Examination			
Course Code	Course Title	Category	L	P		MaxMarks		Duration(hrs)	
PCC304	Operating System Concepts	PCC	4	-	4	70	30	3	1

Unit I

Introduction: Definition of Operating System, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating **System Structures:** Operating-System Services, System Calls, Types of System Calls. **Process:** Process Concept, Process Scheduling, Operations on Processes, Inter process Communication, **Threads:** Overview, Multi core Programming, Multithreading Models, Threading Issues. **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms

Unit II

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit III

Main Memory: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual Memory: Background, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Mass-Storage Structure, Overview of Mass- Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Formatting, RAID Structure

Unit IV

File-System Interface: File Concept, Access Methods, Directory and Disk Structure, Protection.

File-System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.

I/O Systems: Overview, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.

Unit V

Protection: Goals of Protection, Principles of Protection, Domain of Protection Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems.

Security: The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication.

Suggested Readings

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley and Sons publication, 2013.
2. A. Tanenbaum, "Modern Operating Systems", Third Edition, Pearson Education, 2008.
3. William Stallings, "Operating Systems", Fifth Edition, Pearson Education, 2005.
4. Ida M. Flynn, "Understanding Operating Systems", Sixth Edition, Cengage, 2011.
5. D.M. Dhamdhere, "Operating systems a concept based approach", Second Edition, McGraw-Hill, 2007

BCA SEM III – THEORY			Hours /week		Cred-its	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks	Duration(hrs)		
PCC305	Database Design	PCC	4	-	4	70	30	3	1

Unit I

Database Environment - concepts and definitions, traditional file processing systems, database approach, range of database applications, advantages, costs and risks, components. Database Development process - IS development, three schema Architecture, Database Analysis - E-R Model - Entities, attributes, Relationships, degree and cardinality - case studies

Unit II

Enhanced E-R model - super type, sub type, specialization and generalization, constraints, disjointness, subtype discriminator, super type /subtype hierarchies, business rules, scope classification, structural constraints operational constraints, case study. Relational model - Definitions, integrity constraints, transforming EER diagrams into relations, normalization - normal forms, merging relations, case study.

Unit III

Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational Calculus, Expressive Power of Algebra and Calculus.

SQL: Queries, Constraints, Triggers: The Form of Basic SQL Query, Set Operators, Nested Queries, Aggregate Operators, Procedures and functions, Triggers

Unit IV

Overview of Storage and Indexing: File Organizations and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Indexed Sequential Access Method (ISAM), B+ Trees, Search, Insert Delete, B+ Trees in Practice.

Hash-Based Indexing: Static Hashing, Extendible Hashing, Linear Hashing, Extendible versus Linear Hashing.

Unit V

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

Concurrency Control: 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlock

Suggested Readings

1. Fred R Me Fadden, Jeffrey A Hoffer, Mary B Prescott - Modern Database Management, Fifth edition. Addison Wesley 1999 (Unit-1,2)
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.(Unit-3,4,5)
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011

BCA SEM III – Laboratory			Hours /week		Cre-dits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		SEE	CIE	SEE	CIE
LCC351	Java Programming Lab	LCC	-	4	2	50	25	3	2
<div>1. Programs on if-else, if-else-if</div> <div>2. Program on switch</div> <div>3. Program on while</div> <div>4. Program on for loop</div> <div>5. Program on do-while</div> <div>6. Program to demonstrate class concept.</div> <div>7. Program to demonstrate methods</div> <div>8. Program to demonstrate method overloading</div> <div>9. Program to demonstrate constructors</div> <div>10. Program to demonstrate constructor overloading</div> <div>11. Program to demonstrate an Array</div> <div>12. Program to demonstrate multidimensional array</div> <div>13. Program to demonstrate Strings</div> <div>14. Program to demonstrate inheritance</div> <div>15. Program to demonstrate method overriding</div> <div>16. Program to demonstrate abstract class</div> <div>17. Program to demonstrate reading console input</div> <div>18. Program to demonstrate interfaces</div> <div>19. Program to demonstrate packages</div> <div>20. Program to demonstrate exceptional handling</div> <div>21. Program to demonstrate creating a thread by extending Thread class</div> <div>22. Program to demonstrate creating a thread by implementing Runnable interface</div> <div>23. Program to demonstrate AWT controls</div> <div>24. Program to demonstrate Layout Manager</div> <div>25. Program to demonstrate Events</div> <div>26. Program to demonstrate applets</div>									

BCA SEM III – Laboratory			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L	P	Cre-dits	SEE	CIE	SEE	CIE
LCC352	Operating System Concepts Lab	LCC	-	4	2	50	25	3	2

OS Lab practical programs

1. Process System Calls
2. IO System Calls
3. IPC using Pipe Processing
4. First Come First Serve Scheduling
5. Shortest job first Scheduling
6. Priority Scheduling
7. Round Robin Scheduling
8. Simulate Page Replacement Algorithms FIFO
9. Simulate Page Replacement Algorithms LRU
10. Simulate Page Replacement Algorithms OPTIMAL

BCA SEM III – Laboratory			Hours /week		Cre-dits	Scheme of Examination			
Course Code	Course Title		L	P		MaxMarks		Duration(hrs)	
		Cate-gory				SEE	CIE	SEE	CIE
LCC353	Database Design Lab	LCC	-	4	2	50	25	3	2

1. Create command for creating a table using primary key
2. Alter command for altering the column name and datatype of a column in the table
3. Alter command to add new column to the existing table
4. Alter command to modify the existing name of the column in the table
5. Drop command of the table
6. Truncate command for the table
7. Insert command for storing the records in the database table
8. Update command for updating a particular record by using where clause
9. Delete command for removing a particular record from the table
10. Select command for selecting data from the table
11. Select command for selecting the specific data from the data by using where clause and select distinct statement
12. Select command for selecting the records by using ORDER BY clause ASC
13. Select command for selecting the records by using ORDER BY clause DESC
14. SQL Built in functions (MIN, MAX, COUNT, AVG, SUM)
15. SQL Query to perform AND Operator and OR Operator
16. SQL Query to perform GROUPBY Clause
17. SQL Query to perform HAVING Clause
18. SQL Queries to perform integrity constraints
19. SQL Query to perform SQL BETWEEN Operator
20. Joins – Equi Join, Non-Equi Join, Outer Join and Self Join
21. Stored Procedures
22. Triggers

PROPOSED SCHEME OF INSTRUCTION
BACHELOR OF COMPUTER APPLICATIONS (BCA)
SEMESTER- IV

SNo	Course Code	Course Title	Category	Hours/ Week		No of Credits	Scheme of Examination		
							Max Marks	Duration (hrs)	
THEORY				L	P		SEE	CIE	SEE
1	ETC401	Distributed and Cloud Computing	ETC	4	-	4	70	30	3
2	PCC402	Network Security	PCC	4	-	4	70	30	3
3	PCC403	Software Engineering	PCC	4	-	4	70	30	3
4	ETC404	Data Science using Python	ETC	4	-	4	70	30	3
5	ETC405	Artificial Intelligence	ETC	4	-	4	70	30	3
PRACTICALS									
6	LTC451	Data Science using Python Lab	LTC	-	4	2	50	25	3
7	LCC452	Software Engineering Lab	LCC	-	4	2	50	25	3
8	LCC453	Computer Networks Lab	LCC	-	4	2	50	25	3
Total				20	10	26	500	225	-

Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	LTC	Laboratory Technological Course
PCC	Professional Core Course	LPC	Laboratory Professional Course
ETC	Emerging Technological Course	LHC	Laboratory Humanities Course
HSC	Humanities and Social Science Course	CIE	Continuous Internal Evaluation
MGC	Management Course	SEE	Semester End Evaluation
PEC	Professional Elective Course	L	Lecture
LCC	Laboratory Core Course	P	Practical

BCA SEM IV – THEORY			Hours /week		Credits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks		Duration(hrs)	
ETC401	Distributed and Cloud Computing	ETC	4	-	4	70	30	3	1

Unit I

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication.

Unit II

Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation.

Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans -from objects to components.

Unit III

Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

Unit IV

Virtual Machines and Virtualization of Clusters and Data Centers: Levels of Virtualization, Virtualization Structures Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation. Case studies: Xen Virtual machine monitors- Xen API. VMware - VMware products-VMware Features.

Unit V

Cloud computing architectures over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

Suggested Readings

1. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
3. John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security ". James F. Ransome, CRC Press 2009.
4. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.
5. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski,” Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing ©2011

BCA SEM IV – THEORY			Hours /week		Cre-dits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks		Duration(hrs)	
PCC402	Network Security	PCC	4	-	4	70	30	3	1

UNIT-I

Cryptography Terminology, Stenography, Subscription ciphers, onetime patios, Cryptographic Protocols-Introduction using Symmetric Cryptography, one-way Hash Functions, communication using public-key cryptography and hybrid cryptosystems, Digital Signatures, Digital Signatures with encryption, Random and pseudo random sequence generation, Basic protocols- key Exchange, authentication and key exchange, formal analysis, secret splitting, secret sharing, cryptographic protection of databases.

UNIT-II

Intermediate protocols-Time stamping, subliminal channel, Signatures, Bit commitment, fair coin flops, mental poker, key Escrow. Advanced Protocols-Zero Knowledge proofs, Blind signatures, identity based Public-key cryptography obvious transfer, simultaneous contract signing, Digital certified mail, simultaneous exchange of secrets. Esoteric Protocols-Secret Elections, secure multiparty computation, anonymous Message Broadcast Digital cash.

UNIT-III

Key Length-symmetric key length, public key length Key Management Generation transfer, verification use, Store Backup, life time, destruction, public key management. Algorithm types and modes-Electronic codebook, Block replay, Cipher Block clouding, Stream Ciphers, self synchronizing, cipher-feedback, synchronous stream, output feedback, counter mode, choosing cipher mode, comparison Using Algorithms-choosing an algorithm, public key versus symmetric encrypting and communication channels. Encrypting data for storage hardware encryption versus software Encryption

UNIT-IV

Information theory, complexity theory, number theory, factoring, prime number generation DBS –Background, Description, security of DES, Differential and linear crypto analysis, DB vacancy, pseudo random sequence generators, linear congruential, Linear feed back shift register stream ciphers, Design and analysis, Stream Cipher using LFSRs

UNIT-V

One way hash functions, Background, MDS, SHA Public-key Algorithms-Backgrounders' Digital Signature Algorithm Diffie helman algorithm for key exchange Implementation Examples-IBM, ISDN, Kerberos, ISO authentication framework, PBM PKCDEPS

Suggested Reading:

1. Bruce Schneier-Applied Cryptography, Wiley 2001.
2. William Stallings –Cryptography and Network Security, PH

BCA SEM IV – THEORY			Hours /week		Cre-dits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks		Duration(hrs)	
PCC403	Software Engineering	PCC	4	-	4	70	30	3	1

Unit I

Software Engineering – Introduction, Program Versus Software, Software Engineering, Software Development Process and its Stages, Generic Software Development Process Models, Code of Ethics and Professional Practice, Software Development and Maintenance Cost Breakup.

Requirement Engineering Processes – Requirement Engineering Process, Feasibility Study, Cost and Benefit Analysis.

Unit II

Requirement Specification, Characteristics of a Good Requirement and Validation Techniques, Requirements Management Planning, Process of Requirement Change Management.

Software Requirement Specifications – Introduction, Stakeholder Analysis, Software Requirements Document, IEEE Standard of Software Requirement Specifications, Organizing Functional Requirements, Traceability and Validation of Specifications.

Unit III

Architectural Styles – Introduction, Architecture Styles, Object Oriented Architecture, Inter-organizational Communication, Cloud Computing Architecture Style, Core, Configurable and Customizable Architecture, Design Models, Architectural Design Principles.

Object Oriented System Analysis – Introduction, Object Oriented Design, Object Oriented Design Models, Object Oriented Analysis, Data Modeling, Comparison Between Top Down Structured and Object Oriented Analysis, Description of Logical and Static Modeling, Identification of Class Relationships.

Unit IV

Object Oriented Design Using UML – Introduction, Sequence Diagram, State Machine Diagram, Timing Diagram, Describing Detailed Object Oriented Design, Decision Tree and Decision Table, Composite Structure Diagram, Generating Test Cases, Moving Towards Physical Design, Structured Methods.

Software Development – Introduction, Good Coding Practices, Code Reuse, Design Pattern, Generator Based Reuse, Application/Software Developed on Product Lines Approach, Component Based Software Engineering, Agile Methods.

Unit V

Verification, Validation and Software Testing – Introduction, Software Verification and Validation Process, Software Testing, System Testing, Object Oriented Testing Strategy, Test Cases, Equivalence Partitioning (Black Box Testing), Art of Debugging.

Measurement and Metrics for Assessing Software Quality – Introduction, ISO 9126 Quality Standards, Quality Management Models, Ways to Build Quality in Software, Software Quality Control and Metrics, Defect Density Metrics, Chidamber and Kemerer Metric Suites for Object Oriented System, Class Coupling Metric-Coupling Between Objects, Monitoring Dynamic Quality Attributes (Visible Externally) of a Software

Suggested Readings

1. Rajesh Narang, Software Engineering: Principles and Practices
2. Ian Sommerville, Software Engineering
3. R. Mall, Fundamentals of Software Engineering
4. Pankaj Jalote, An Integrated Approach to Software Engineering
5. Frank Tsui, Orlando Karam, Barbara Bernal, Essentials of Software Engineering
6. Roger S Pressman, B R Maxim, Software Engineering – A Practitioner's Approach
7. Grady Booch, The Unified Modeling Language User Guide

BCA SEM IV – THEORY			Hours /week		Credits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks		Duration(hrs)	
ETC404	Data Science using Python	ETC	4	-	4	70	30	3	1

Unit I

Introduction to data science – Introduction to data science, Data Science Components, Data Science Process, Data Science Jobs Roles, Tools for Data Science, Difference between Data Science with BI (Business Intelligence), Applications of Data science, Challenges of Data science Technology. Data analysis – Introduction to data analysis, Data Analysis Tools, Types of Data Analysis: Techniques and Methods, Data Analysis Process Introduction to Python, Python features, Python Interpreter, modes of Python Interpreter, Values and Data types, Variables, Key words, Identifiers, Statements.

Unit II

Expressions, Input & Output, Comments, Lines & Indentation, Quotations, Tuple assignment, Operators, Precedence of operators. Functions: Definition and use, Types of functions, Flow of execution, Parameters and Arguments, Modules. Conditionals: Conditional (if), Alternative(if-else), Chained Conditionals(if-elif-else), Nested conditionals; Iteration/Control statements: while, for, break, continue, pass; fruitful function vs void function, Parameters/Arguments, Return values, Variables scope(local, global), Function composition.

Unit III

Strings: Strings, String slices, Immutability, String functions & Methods, String module; List as array: Array, Methods of array. Lists: List operations, List slices, List methods, List loops, Mutability, aliasing, Cloning list, List parameters; Tuple: Benefit of Tuple, Operations on Tuple, Tuple methods, Tuple assignment, Tuple as return value, Tuple as argument; Dictionaries: Operations on Dictionary, methods in Dictionary, Difference between List, Tuple and Dictionary; Advanced List processing: List comprehension, Nested List.

Unit IV

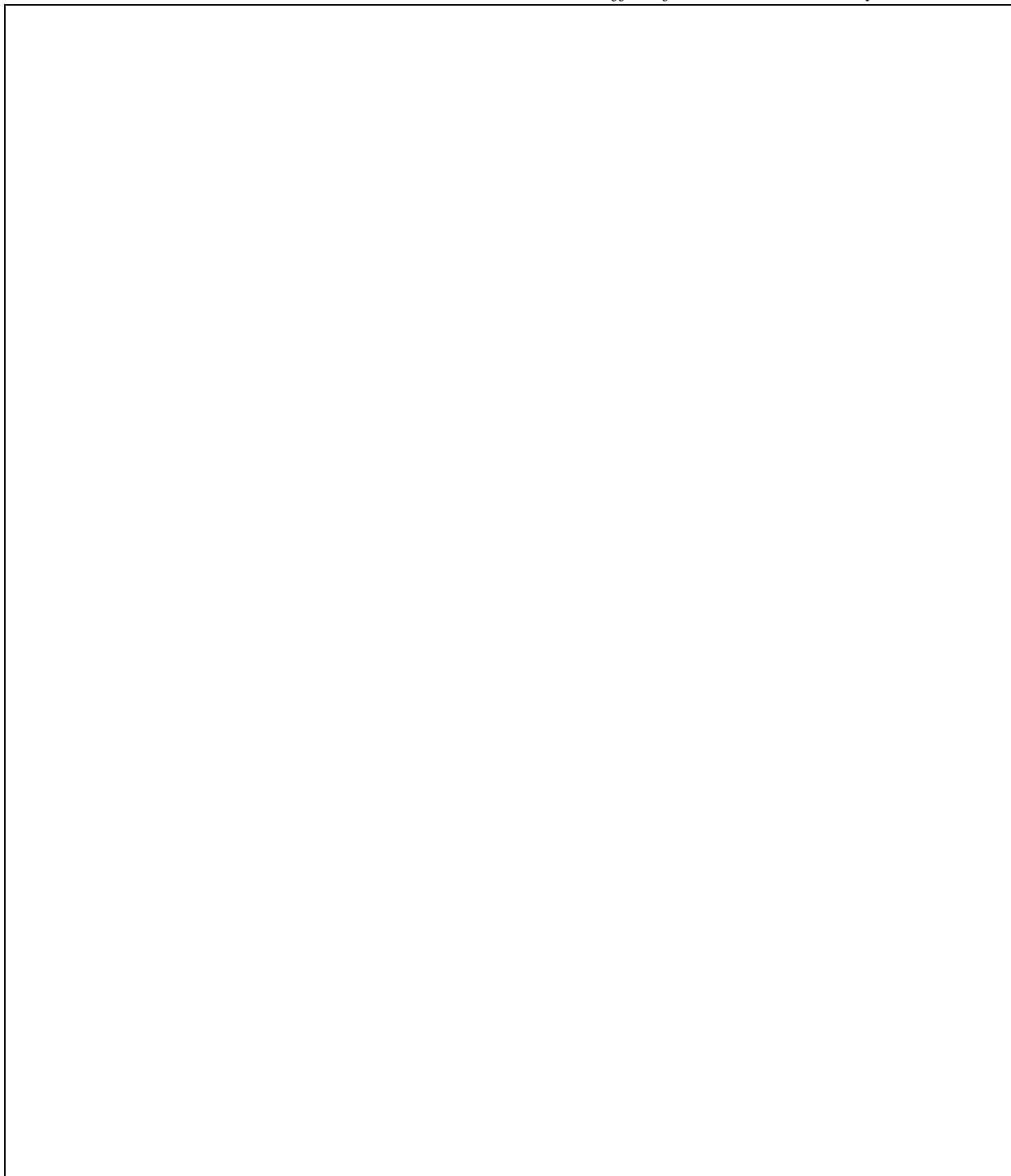
Introduction to Numpy – The basics of numpy array, computation on numpy arrays, aggregations, computations on arrays, comparisons, masks and Boolean logic, fancy indexing, sorting arrays, structured data.

Unit V

Data Manipulation with Pandas – Introducing pandas objects, data indexing and selection, operating on data in pandas, handling missing data, hierarchical indexing, combining datasets, aggregation and grouping.

Suggested Readings

1. Allen B Downey, "Think Python: How to think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, - An Introduction to Python - Revised and Updated for Python 3.2, Network Theory Ltd 2011.
3. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.



BCA SEM IV – THEORY			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate- gory	L	P	Cre- dits	SEE	CIE	SEE	CIE
ETC405	Artificial Intelligence	ETC	4	-	4	70	30	3	1

Unit I

Introduction & Problem Solving: AI problems, AI Technique, Defining problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Heuristic Search Techniques: Generate – and – test, Hill Climbing, Best – First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.

Unit II

Game Playing: Overview, Min-Max search Procedure, Adding Alpha-beta Cutoffs, Additional Refinements, Iterative Deepening. Knowledge Representation Issues: Approaches, Issues, Frame Problem, Using Predicate Logic: Representing simple facts in logic, Representing Instance and ISA Relationships, Computable Functions and predicates, Resolution, Natural Deduction.

Unit III

Uncertainty and Reasoning Techniques: Non monotonic reasoning, Logics for Non monotonic reasoning, Implementation issues, Augmenting a problem solver, implementation of Depth First Search and Breadth first search. Statistical reasoning: Probability and Bayes theorem, Certainty factors and Rule-based systems, Bayesian Networks, Dempster-Shafer Theory.

Unit IV

Learning: What is Learning, Rote learning, Learning by taking advice, Learning in problem solving, learning from examples: Induction, Learning by Decision trees. Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition.

Unit V

Perception and Action: Real Time Search, Vision, Speech Recognition, And ACTION: Navigation, Manipulation, Robot architectures. Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Statistical NLP, Spell Checking.

Suggested Readings

1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”, 3rd Edition., 2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3 rd edition, 2009.
3. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
4. Nelson M. Mattos, “An Approach to Knowledge Base Management”, Springer Berli

BCA SEM IV – Laboratory			Hours /week		Cre-dits	Scheme of Examination			
Course Code	Course Title	Cate-gory	L	P		MaxMarks		Duration(hrs)	
LTC451	Data Science using Python Lab	LTC	-	4	2	50	25	3	2

Python

1. Write a program to demonstrate different numbers data types in python.
2. Write a python program to design simple calculator using functions.
3. Write a python program to check whether a given number is Armstrong number or not.
4. Write a python program to generate prime numbers between different intervals.
5. Write a python program to find factorial of a number using recursion.
6. Write a python program to check whether a string is palindrome or not.
7. Write a python program to count the number of characters present in a word.
8. Write a python program to create, append and remove lists.
9. Write a program to demonstrate working with tuples in python.
10. Write a program to demonstrate dictionaries in python.

Numpy

11. Python program to demonstrate basic array characteristics
12. Python program to demonstrate array creation techniques
13. Python program to demonstrate indexing in numpy
14. Python program to demonstrate basic operations on single array
15. Python program to demonstrate unary operators in numpy

Pandas

16. Python code demonstrate to make a Pandas DataFrame with two-dimensional list
17. Python code demonstrate creating DataFrame from dictionary of ndarray and lists
18. Python code demonstrate creating a Pandas dataframe using list of tuples
19. Python code demonstrate how to iterate over rows in Pandas Dataframe
20. Python code demonstrate how to get column names in Pandas dataframe

BCA SEM IV – Laboratory			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Cate-gory	L	P	Cre-dits	SEE	CIE	SEE	CIE
LCC452	Software Engineering Lab	LCC	-	4	2	50	25	3	2

Case Studies

1. Banking System
2. Hotel management system
3. Inventory Control System
4. Library management system
5. Railway Reservation System

Choose any two of above case studies and do the following exercises for that case studies

1. Write the complete problem statement
2. Write the software requirements specification document
3. Draw the entity relationship diagram
4. Draw the data flow diagrams
5. Draw use case diagrams
6. Draw activity diagrams for all use cases
7. Draw sequence diagrams for all use cases
8. Draw collaboration diagram
9. Assign objects in sequence diagrams to classes and make class diagram.

Note

To draw dataflow diagrams using Microsoft Visio Software, SmartDraw, etc...

1. To draw UML diagrams using Rational Rose Software, StarUML, etc...

BCA SEM IV – Laboratory		Cate- gory	Hours /week		Cre- dits	Scheme of Examination			
Course Code	Course Title		L	P		MaxMarks		Duration(hrs)	
LCC453	Computer Networks Lab	LCC	-	4	2	50	25	3	2

Networking concepts demonstration

1. Demonstrations of IP address and ports in computer system.
2. Explanation of settings in network connections
3. Testing of networking connectivity using ping, tracepath
4. Checking network statistics with netstat
5. Demonstration of static and dynamic IP address settings
6. Understanding ethernet cabling and switched networks
7. Comprehension of routers and
firewalls
8. Significance of DNS

Network programming

1. Implement IPC using a) Pipes b) FIFO
2. Implement file transfer using Message Queue form of IPC
3. Design TCP iterative Client and server application to reverse the given input sentence
4. Design TCP concurrent Client and server application to reverse the given input sentence
5. Design TCP client and server application to transfer file
6. Design UDP Client and server application to reverse the given input sentence
7. Design UDP Client and server application to reverse the given input sentence
8. Design UDP Client server to transfer a file

Suggested Reading

1. Advance UNIX Programming Richard Stevens, Second Edition Pearson Education
2. Advance UNIX Programming, N.B. Venkateswarlu, BS Publication.