NISHITHA DEGREE COLLEGE

(AUTONOMOUS)

Nizamabad

Accredited with "A "Grade by NAAC
UGC Recognized Under Section 2(f) & 12B

BCA I, II, III, IV, V & VI-Semester

Under CBCS System

Scheme w.e.f A.Y 2023-24

Board of Studies
DEPT. OF COMPUTER SCIENCE
NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
BESIDE POLICE COMMISSIONERATE
KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
Board of Studies
Dept. of Comp. Science

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.

V.C. NOMINEE
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Board of Studies
DEPT. OF COMPUTER SCIENCE
NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
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KANTESHWAR ROAD, NIZAMABAD.

Re-admission Rules:

- For candidates detained due to shortage of attendance: Incase of the candidate who fail 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.

V.C. NOMINEE
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Dept. of Computer Science

Board of Studies
DEPT. OF COMPUTER SCIENCE
NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
BESIDE POLICE COMMISSIONERATE
KANTESHWAR ROAD, NIZAMABAD.

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

Board of Studies
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GANESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
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Dept. of Computer Science

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
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

Board of Studies
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NISHITHA DEGREE COLLEGE
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V.C. NOMINEE
Board of Studies
Dept. of Computer Science

BCA SEM I – THEORY			Hours /week			Scheme of Examination			
						MaxMarks		Duration(hrs)	
Course Code	Course Title	Category	L/T	P	Cre-dits	SEE	CIE	SEE	CIE
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.

Board of Studies
DEPT. OF COMPUTER SCIENCE
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(AUTONOMOUS)
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KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
Board of Studies
Dept. of. Computer Science

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 Associatively 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.

Board of Studies
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V.C. NOMINEE
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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
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.

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KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
Board of Studies
Dept. of Comp. Sci. & Sci.

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
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.

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KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
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Dept. of Comp. Sciences

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
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

Board of Studies
DEPT. OF COMPUTER SCIENCE
NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
BESIDE POLICE COMMISSIONERATE
KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
Board of Studies
Dept. of. Computer Science

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
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.

Board of Studies
DEPT. OF COMPUTER SCIENCE
NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
BESIDE POLICE COMMISSIONERATE
KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
Board of Studies
Dept. of Computer Science

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 Lam port, 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.

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V.C. NOMINEE
Board of Studies
Dept. of. Computer Science

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

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	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

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Dept. of Computer Science

Board of Studies
DEPT. OF COMPUTER SCIENCE
NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
POLICE COMMISSIONERATE
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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.,Kolakota.
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.

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V.C. NOMINEE
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Dept. of Computer Science

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
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.

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Dept. of Computer Science

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.

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Dept. of..Computer Sciences

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
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.

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CA 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
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.

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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
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.

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With effect from the academic year ***2023-2024***

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:

1. Write a C++ program for the implementation of Array.
2. Write a C++ program for the implementation of Special Matrices.
3. Write a C++ program for the implementation of Sparse Matrices
4. Write a C++ program for the implementation of String
5. Write a C++ program to implement the following using array
   a) Stack
   b) Queue
6. Write a C++ program to implement the following using a) single linked list b) Doubly linked list c)Circular linked list
7. Write a C++ program to implement stack using linked list.
8. Write a C++ program to implement queue using linked list.
9. Write a C++ program to implement binary tree.
10. Write C++ program for implementing the following sorting methods
    a) Bubble sort
    b) Selection sort
    c) Insertion sort
    d) Quick sort
    e) shell sort
    f) Merge sort
    g) Heap sort
11. Programs on Linear Search and Binary Search using recursion and iteration

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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.

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

SNo	Course Code	Course Title	Cate-gory	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

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With effect from the academic year ***2023-2024***

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

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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
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 classin 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

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Suggested Reading

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

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
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. Sunders 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,IIPE,1999.
6. Green Building Council of India, Teri Document

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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
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'sSolution, 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.

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I/O Systems: Overview, Application I/O Interface, Kernel I/O Subsystem, TransformingI/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 Operation 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", SecondEdition, McGraw-Hill, 2007

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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
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. Addition Wesly 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

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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
LCC351	**Java Programming Lab**	**LCC**	**-**	**4**	**2**	**50**	**25**	**3**	**2**

1. Programs on if-else, if-else-if
2. Program on switch
3. Program on while
4. Program on for loop
5. Program on do-while
6. Program to demonstrate class concept.
7. Program to demonstrate methods
8. Program to demonstrate method overloading
9. Program to demonstrate constructors
10. Program to demonstrate constructor overloading
11. Program to demonstrate an Array
12. Program to demonstrate multidimensional array
13. Program to demonstrate Strings
14. Program to demonstrate inheritance
15. Program to demonstrate method overriding
16. Program to demonstrate abstract class
17. Program to demonstrate reading console input
18. Program to demonstrate interfaces
19. Program to demonstrate packages
20. Program to demonstrate exceptional handling
21. Program to demonstrate creating a thread by extending Thread class
22. Program to demonstrate creating a thread by implementing Runnable interface
23. Program to demonstrate AWT controls
24. Program to demonstrate Layout Manager
25. Program to demonstrate Events
26. Program to demonstrate applets

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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

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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
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 l 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

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With effect from the academic year ***2023-2024***

PROPOSED SCHEME OF INSTRUCTION

BACHELOR OF COMPUTER APPLICATIONS (BCA)

SEMESTER- IV

SNo	Course Code	Course Title	Cate-gory	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

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Board of Studies
Dept. of Computer Science

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
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

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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
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, sublimal 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 main, simultaneous exchange of secrets.Esoteric Protocols-Secret Elections, secure multiparty computation, anonymous MessageBroadcast Digital cash.

UNIT-III

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

UNIT-IV

Information theory, complexly 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, SHAPublic-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

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Board of Studies
Dept. of Computer Science

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
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.

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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

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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
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 Datascience 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 andUpdated for Python 3.2, Network Theory Ltd 2011.
3. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.

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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. SarojKaushik, "Artificial Intelligence", Cengage Learning India, 2012.
4. Nelson M. Mattos ,"An Approach to Knowledge Base Management", Springer Berli

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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
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 narray 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

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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...

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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
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 firewalls8.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.

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UGC Recognized Under Section 2(f) & 12B

BCA
V and VI Semester
Under CBCS System
Scheme w.e.f A.Y 2025-26

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SCHEME OF INSTRUCTION
BCA (BACHELOR OF COMPUTER APPLICATIONS)
BCA schema with effect from the academic year 2025-2026

SEMESTER V

S.NO	Course Code	Course title	Category	Contact Hour/week			No. of Credits	Scheme of Exam Duration(hrs)		Scheme of Examination (max Marks)	
				L	T	P		SEE	CIE	SEE	CIE
Theory											
1	BCA501	Data Science with R	ETC	4	0	0	4	3	1	70	30
2	BCA502	Unix Programming	ETC	4	0	0	4	3	1	70	30
3	BCA503	Object Oriented Systems Development	ETC	4	0	0	4	3	1	70	30
4	BCA504	software Quality Testing	ETC	4	0	0	4	3	1	70	30
5	BCA#	Elective I BCA 510 Mobile Application Development BCA511 Internet Protocols	PEC	4	0	0	4	3	1	70	30
PRACTICALS											
6	BCA550	OOSD Lab	LTC	0	0	4	2	3	1	50	25
7	BCA551	Unix Programming Lab	LPC	0	0	4	2	3	1	50	25
8	BCA552	Data Science with R Lab	LCC	0	0	4	2	3	1	50	25
			TOTAL	**20**	**0**	**12**	**26**			**500**	**225**

Abbreviation	Full Form	Abbreviation	Full Form
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PCC	Professional Core Course	LPC	Laboratory Professional Course
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BCA 501

Data Science with R

Credits:4

Instruction: (4L)hrs per week | Duration of SEE: 3 hours
CIE: 30 marks | SEE:70 marks

Unit-I

Introduction to R : What is R , Why R , Advantages and Disadvantages of R over other programming Languages, Downloading and Installing R , IDE's and Text Editors , Handling packages in R.

Getting started with R : Introduction, Working with Directory, Simple Math Calculations, Reading and getting Data into R , Datatypes in R , Few commands for Data Explorations .

Unit-II

Loading and Handling Data in R : Working with Objects, Manipulating Objects , Manipulating vectors , Manipulating Matrix and Data frames , Factors , List .

Expressions, variables and functions : Expressions , Logical values, Dates , Variables, Functions , Missing Values Treatment in Data, Using 'as' operator to change the structure of Data.

Unit-III :

Aggregate and group processing of variables : aggregate () function, tapply () function, Methods for reading Data csv and Spreadsheets, Reading Data from packages, Reading Data from Web/ API's Data frames, 'R' functions for understanding Data in Data Frames .

Loading Data frames : Load Data Frames , Exploring Data, Data Summary , Finding Missing Values.

UNIT-IV

Data Distributions : Bar charts, Pie charts, Scatter plots, Box plots, Histograms .

Regression : Simple Linear Regression, Model fitting , lm () function in R, Assumptions of Linear Regression, Multiple Regression.

UNIT-V :

Clustering : What is Clustering , Basic concepts of Clustering, Applying K-means clustering in 'R' , Applying KNN using R , Applications of K-means and KNN Algorithms in R

Association Rules:

Similarity and distance Measures, Agglomerative Algorithm, Divisive Clustering , Frequent Itemset , Apriori Mining Algorithms.

References :

1) Beginning 'R' the statistical programming Language by Dr. Mark Gardener
2) An Introduction to R by W. N. Vemables , D.M. Smith .
3) Data Analytics using R by Seema Acharya.
4) An Introduction to machine Learning by Haul Dam III .

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BCA 502

UNIX PROGRAMMING

Credits: 4

Instruction: (4L) hrs per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

UNIT-I

Unix: Introduction, architecture of Unix, features of Unix, introduction to Unix file system, file and directory management tools,security and file permission, process management and system monitoring, daemon process.

UNIT-II

Text processing tools: grep, sed and awk for text searching and manipulation, regular expression for pattern matching.

Packet management: apt and yum for package installation and management. dependency handling and system updates.

UNIT-III

Networking tools: ifconfig, ip, ping, netstat for network configuration and diagnostics, working with SSH and remote access.

Version control with Git: introduction to version control concepts, using git for tracking changes and collaborating on projects.

UNIT-IV

shell programming: introduction to shell programming, basic shell scripting, variables and operators, conditional statements, looping constructs, functions in shell script.

Text editors and IDE: introduction to text editors like vi, vim and nano. Using integrated development environments (IDE)on Unix.

UNIT-V

Inter process Communication: Introduction, pipes and named pipes (FIFOs), message queues, shared memory, semaphores.

Socket programming: introduction to sockets, socket API and functions, TCP socket programming.

Suggested Readings:

1. 1. **Advanced Programming in the UNIX Environment** – W. Richard Stevens
2. **The UNIX Programming Environment** – Brian W. Kernighan, Rob Pike
3. **UNIX and Linux System Administration Handbook** – Evi Nemeth, Garth Snyder
4. **Linux Command Line and Shell Scripting Bible** – Richard Blum, Christine Bresnahan
5. **TCP/IP Sockets in C: Practical Guide for Programmers** – Michael J. Donahoo, Kenneth L. Calvert
6. **UNIX Network Programming** – W. Richard Stevens

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BCA 503 **OBJECT ORIENTED SYSTEMS DEVELOPMENT**

Credits:4

Instruction: (4L) hrs per week Duration of SEE: 3 hours

CIE: 30 marks SEE:70marks

UNIT-I

UML Introduction: Why we model, Introducing the UML, Hello World. Basic Structural Modeling Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams. Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagrams, Components.

Unit-II

Basic Behavioral Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction Diagrams, Activity Diagrams. Advanced Behavioral Modeling: Events and signals, State Machines, Processes and Threads, Times and space, State Chart Diagrams.

Unit-III

Architectural Modeling: Artifacts, Deployment Collaborations, patterns and Frameworks, Artifact diagrams, Deployment diagrams, Systems and models.

Unit-IV

Unified Software Development Process: The Unified Process, The Four Ps, A Use-Case-Driven Process, An Architecture, An Architecture-Centric Process, An Iterative and incremental Process.

Unit-V

Core Workflows: Requirements Capture, Capturing Requirements as Use Cases, Analysis, Design, Implementation, Test.

Suggested Reading:

1. Grady Booch, James Rumbaugh, Ivor Jacbson, The Unified Modeling Language-User Guide, (Covering UML 2.0) 2nd Edition, Pearson Education, India, 2007.

2. Ivor Jacbson, Grady Booch, James Rumbaugh, The Unified Software Development Process, Pearson Education, India, 2008.

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BCA504 **SOFTWARE QUALITY TESTING**

Credits: 4

Instruction: (4L) hrs per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

UNIT I

INTRODUCTION TO SOFTWARE QUALITY: Core Ethical Principles in Software Quality, Total Quality Management Principles, Software Processes and Methodologies, Improving Quality with Methodologies

UNIT II

SOFTWARE QUALITY METRICS AND RELIABILITY: Software Requirements and Design Specifications, Analyzing Software Documents using Inspections and Walkthroughs

SOFTWARE METRICS-Product metrics, Process metrics, Project metrics and Quality Assurance (QA) Metrics.

COMMON SOFTWARE METRICS IN ACTION: Lines of code, Cyclomatic complexity Function Points, Feature Points- Software Cost Estimation.

UNIT III

TEST CASE DESIGN: Testing as an Engineering Activity- Why Testing is an Engineering Activity, Types of Testing in Engineering.

STRATEGIES AND METHODS: for Black Box Test Case Design, White-Box Test Case Design Test Adequacy Criteria-Evaluating Test Adequacy Criteria.

UNIT IV

TEST MANAGEMENT: Testing and Debugging Goals and Policies, Test Planning and it's Components, Test Plan Attachments.

REPORTING TEST RESULTS: The Role of Three Groups in Test Planning and Policy Development, Process.

UNIT V

CONTROLLING AND MONITORING: Measurement and Milestones for Controlling and Monitoring, Status Meetings, Reports and Control Issues, Criteria for Test Completion.

SOFTWARE CONFIGURATION MANAGEMENT (SCM): Types of Reviews, Developing a Review Program, Components of Review Plans, Reporting Review Results.

Suggested Readings:

1. Ilene Burnstein, Practical Software Testing, Springer International Edition, 2003.
2. Stephen Kan, Metrics and Models in Software Quality, Addison-Wesley, Second Edition, 2004.
3. Milind Limaye, Software Quality Assurance, McGraw Hill, 2011.
4. MG Limaye, Software Testing-Principles, Techniques and Tools, McGraw Hill, 2011

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BCA 510 **MOBILE APPLICATION DEVELOPMENT**

Credits: 4

Instruction: (4L) hrs per week Duration of SEE: 3 hours

CIE: 30 marks SEE: 70 marks

UNIT-I

Applications, history of mobile communications, reference model Wireless transmission - Frequencies, Signals, Antennas, Signal propagation, Multiplexing Modulation, Spread spectrum, cellular systems Medium access layer - Motivation, SOMA, FDMA, COMA Wireless LAN - Infrared vs radio transmission, infrastructure, IEEE802.11. HIPERLAN, Bluetooth

UNIT-II

Key services for mobile internet. Mobile IP - Goals, assumptions, requirements, entities, IP packet delivery. Agent advertisement and discovery, Registration. Tunneling. Optimization, reverse tunneling, DHCP, Adhoc networks, Mobile transport Layer - Traditional TCP, Indirect TCP Snooping TCP, Mobile TCP, Fast transmit Fast recovery, Transmission timeout freezing, transaction oriented TCP

UNIT-III

Wireless Application Protocol - Overview of WAR WAP architecture, components. Network infrastructure Design principles UML - Document model, Basics, basic content, events, tasks and binding, variables, other content, controls, application security, other data

UNIT-IV

Wireless binary extensible markup language WML Script - language basics, standard libraries, script libraries, script development User interface design - structured usability methods, design guidelines - user interface, selected WML elements

UNIT-V

Tailoring content to client Push messaging Wireless telephony applications Building and deploying End-to-End WAP services

Suggested Reading

1. Sundeep Singh etc. Wireless Application Protocal - Addison Wesley 2001
2. Jochen Schiller - Mobile communications, Addison-Wesley 2001

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BCA 511 **INTERNET PROTOCOLS**

Credits 4

Instruction: (4L) hrs per week Duration of SEE: 3 hours

CIE: 30 marks SEE: 70 marks

UNIT-I

Data Communications: Components - Direction of Data flow - networks - Components and Categories - types of connections - Topologies -Protocols and Standards - ISO/OSI model, TCP/IP. Transmission Media - Coaxial Cable - Fiber Optics - Line Coding

UNIT-II

Datalink Layer: Error detection and correction, CRC, Hamming code, Flow Control and Error control , Stop and Wait protocol, Sliding Window protocol -go back-N ARQ - selective repeat ARQ .

IP Addressing - Decimal Notation, Classes, Special Addresses, Unicast-Multicast and Broadcast Addresses.

Sub Netting and Super Netting - Sub Netting, Masking, Super Netting.

UNIT-III

Next Generation Ipv6: Ipv6, Addresses, Packet Format, Comparison between Ipv4 and Ipv6 Headers

Routing Protocols:

Distance Vector Routing, Link State Routing,

ICMP, IGMP, OSPF and BGP.

UNIT-IV

Transport Layer: Services of transport layer, Multiplexing. **Transmission Control Protocol (TCP)**-Process To Process Communication, Services, Segment, Options, Checksum, Flow Control, Error Control, Timers, Connection, User Datagram Protocol

UNIT-V

HTTP, File Transfer Protocol (FTP)-Connections, Communication, Command Processing, File Transfer. **Simple Mail Transfer Protocol (SMTP)** - User Agent, Addresses, Delayed Delivery, Aliases, MTA, Commands and Responses, Mail Transfer Phases, Mime, Pop.

Domain Name System (DNS) - Name Space, Domain Name Space, Distribution, DNS in Internet

Suggested Readings:

1. Behrouz A. Forouzan TCP/IP Protocol suite, McGraw 2000.
2. Douglas E.Comer, TCP/IP Protocol suite, 2004, Prentice Hall India Publications.
3. Libor Dostalele, TCP/IP Protocol suite, 2006, Pearson New International Edition.

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BCA 550 OBJECT ORIENTED SYSTEMS DEVELOPMENT LAB
Credits: 2

Instruction: (4 P) hrs per week
CIE : 25 marks

Duration of SEE: 3 hours
SEE: 50 marks

Students have to perform the following OOSD steps for the given List of Programs:

Select one Information System/Approach and device the following using UML tool:
1. Structured Diagrams (Data Flow Diagrams, Entity-Relationship Diagram etc..)
2. Preparation of Software Requirement Specification Document for a given Case Study.

UML Diagrams
1. Use Case Diagrams.
2. Class Diagrams.
3. Object Diagrams.
4. Sequence Diagrams.
5. Collaboration Diagrams.
6. Activity Diagrams.
7. State Chart Diagrams.
8. Component Diagrams.
9. Deployment Diagrams.

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BCA 551 **UNIX PROGRAMMING LAB**

Credits: 2

Instructions: (4 P) hrs per week Duration of SEE: 3hours

CIE: 25marks SEE: 50 marks

1. **1**. Execute basic UNIX commands like ls, cd, mkdir, and rm.
2. Create a directory, navigate inside it, and create an empty file.
3. Change file permissions using chmod and chown.
4. Display the current working directory and list all hidden files.
6. Create multiple directories in one command and remove them.
7. View system processes using ps and top commands.
8. Redirect command output to a file and display its contents using cat.
9. Use man to view the manual page for any UNIX command of your choice.
10. Use `grep` to search for a specific word in a text file.
11. Write a `sed` command to replace all occurrences of "error" with "warning" in a file.
12. Install a package using `apt` or `yum` and verify its installation.
13. Use `ifconfig` or `ip a` to display network configuration.
14. Create a Git repository, add a file, commit changes, and push to GitHub.
15. Write a simple shell script to print your name, rollno, class, collegename.
16. Write the following scripts using conditional operators
    i. odd or even ii. positive or negative iii.greatest of two numbers

17. Write a script using a loop to print numbers from 1 to 10.
18. Write a script to check if a file exists and display an appropriate message.
19. Write a function inside a shell script and call it.
20. Write a C program to demonstrate the use of pipes for communication between processes.

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BCA 552 **DATA SCIENCE WITH R LAB**

Credits:2

Instructions:(4P) hrs per week **Duration of SEE:3 hours**

CIE:25 marks **SEE:50 marks**

1. Develop the R program for Basic Mathematical computation -Square, Square root, exponential etc.
2. Read a data file using read.table()
3. Create a vector in r and perform operation subsetting
4. Create matrix and list in R and perform subsetting both
5. Extract the first and last elements of already created vector from, storing them as a new object
6. Store this vector of 10 values: foo <- c(7,5,6,1,2,10,8,3,8,2). Then, do the following:
   i. Extract the elements greater than or equal to 5, storing the result as bar.
   ii. Display the vector containing those elements from foo that remain after omitting all elements that are greater than or equal to 5.
7. Read a .xls file and plot a bar chart
8. Read a.xls using data frame and plot a scatter plot
9. Read a .csv file using data frames and plot histograms
10. Read a .csv file using data frame and plot Bar plot .
11. Read a .csv file and perform Kmeans algorithm using k=4 and iterations = 50

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SCHEME OF INSTRUCTION
BCA(BACHELOR OF COMPUTER APPLICATIONS)
Proposed scheme with effect from the academic year 2025-2026

Semester-VI

S.NO	Course Code	Course title	Category	Contact Hour/week			Credits	Scheme of Exam Duration(hrs)		Scheme of Examination(max Marks)	
Theory				L	T	P		SEE	CIE	SEE	CIE
1	BCA601	Information Security	ETC	4	0	0	4	3	1	70	30
2	BCA602	Data Mining Using Python	ETC	4	0	0	4	3	1	70	30
3	BCA	Elective-II BCA 603 Big Data Analytics BCA 604 IOT AND ITS Applications BCA 605 Machine Learning	PEC	4	0	0	4	3	1	70	30
PRACTICALS											
4	BCA651	Data Mining Using Python lab	LTC	0	0	4	2	3	1	50	25
5	BCA652	project work	PC	0	0	14	7	-	-	100	50
			TOTAL	**16**	**0**	**16**	**21**			**360**	**165**

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BCA 601 **INFORMATION SECURITY**

Credits:4

Instruction:(4L) hrs per week Duration of SEE:3 hours

CIE:30 marks SEE:70 marks

UNIT-I

Introduction: Critical characteristics of information, Components of an information system, Securing the components, Balancing security and access, The SDLC, The security SDLC. Need for Security, Threats, Attacks- secure software development.

UNIT-II

Legal, Ethical and professional Issues: Law and ethics in information security, Relevant laws and legal bodies.

Risk Management: Overview, Risk identification, Risk assessment, Risk control strategies, Quantities versus qualitative risk control practices.

UNIT-III

Planning for Security: Security policy, Standards and practices, Security blue print, Continuity strategies.

Firewalls and VPNs: Physical design, Firewalls, Protecting remote connections.

UNIT-IV

Security Technology: security tools-Intrusion detection, Prevention systems, Scanning and Analysis tools.

Cryptography: Introduction, Cryptographic Algorithms (DES & RSA), Attacks on cryptosystems (Active and Passive).

UNIT- V

Implementing Information Security: Security certification and accreditation.

Security and Personnel: Positioning and staffing security function, Internal control strategies, Digital forensics.

Suggested Reading:

1. Michel E With man and Herbert J Mattord, Principles and Practices of Information Security, Cengage Learning, 2009.
2. Thomas R Peltier, Justin Peltier, John Blackley, Information Security Fundamentals, Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, Information Security, Policy, Processes and Practices, PHI , 2008.

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BCA602

Data Mining Using Python

Credits: 4

Instructions: (4L) hours per week
CIE: 30 marks

Duration of SEE: 3 hours
SEE: 70 marks

Unit-I

Introduction to Data Mining: Overview of data mining and its applications, Data mining process: data collection, preprocessing, modeling, evaluation, and deployment, Ethical considerations in data mining

Python Basics for Data Mining: Review of Python programming fundamentals (variables, data types, control structures, functions), Introduction to data manipulation libraries. NumPy and Pandas

Unit-II

Data Pre processing: Data cleaning and handling missing values. Data transformation and normalization, Handling categorical data

Exploratory Data Analysis (EDA): Visualizing data using Matplotlib and Seaborn. Descriptive statistics and summary metrics, Identifying pattems and outliers in data

Unit-III

Data Mining Techniques: Association rule mining. Clustering techniques (K-means, hierarchical clustering), Dimensionality reduction (Principal Component Analysis)

Unit-IV

Classification Algorithms: Introduction to supervised learning. Decision trees and random forests, Naive Bayes classifier, Model evaluation metrics (accuracy, precision, recall, F1-score)

Unit-V

Regression and Time Series Analysis: Linear regression, Time series data analysis, Forecasting techniques.

References:

1. Online tutorials, resources, and research papers on specific data mining topics
2. Online platforms like Kaggle for real-world datasets and challenges
3. McKinney, W. (2017). Python for Data Analysis, O'Reilly Media.
4. Tan, PN, Steinbach, M., & Kumar, V. (2005). Introduction to Data Mining. Pearson

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BCA 603 **BIG DATA ANALYTICS**

Credits: 4

Instruction: (4L) hours per week Duration of SEE: 3 hours

CIE: 30 marks SEE: 70 marks

UNIT – I

Getting an overview of Big Data: Introduction to Big Data, Structuring Big Data, Types of Data, Elements of Big Data, Big Data Analytics, Advantages of Big Data Analytics.

Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Cloud Computing and Big Data, Features of Cloud Computing, Cloud Deployment Models, Cloud Services for Big Data, Cloud Providers in Big Data Market.

UNIT – II

Understanding Hadoop Ecosystem: Introducing Hadoop, HDFS and MapReduce, Hadoop functions, Hadoop Ecosystem. **Hadoop Distributed File System-** HDFS Architecture, Concept of Blocks in HDFS Architecture, Namenodes and Datanodes, Features of HDFS. MapReduce.

Introducing HBase- HBase Architecture, Regions, Storing Big Data with HBase, Combining HBase and HDFS, Features of HBase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT- III

Understanding MapReduce Fundamentals and HBase: The MapReduceFramework ,Exploring the features of MapReduce, Working of MapReduce, Techniques to optimize MapReduce Jobs, Hardware/Network Topology, Synchronization, File system, Uses of MapReduce, Role of HBase in Big Data Processing- Characteristics of HBase.

Understanding Big Data Technology Foundations: Exploring the Big Data Stack, Data Sources Layer, Ingestion Layer, Storage Layer, Physical Infrastructure Layer, Platform Management Layer, Security Layer, Monitoring Layer, Visualization Layer.

UNIT – IV

Storing Data in Databases and Data Warehouses: RDBMS and Big Data, Issues with Relational Model, Non – Relational Database, Issues with Non Relational Database, Polyglot Persistence, Integrating Big Data with Traditional Data Warehouse, Big Data Analysis and Data Warehouse.

UNIT-V

NoSQL Data Management: Introduction to NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL Data Models- Key Value Data Model, Column Oriented Data Model, Document Data Model, Graph Databases, Schema-Less Databases, Materialized Views, CAP Theorem.

Reference

1. BIG DATA, Black Book TM, DreamTech Press, 2016 Edition.

Suggested Reading:

2. Seema Acharya, SubhasniChellappan , "BIG DATA and ANALYTICS", Wiley publications, 2016

3. Nathan Marz and James Warren, "BIG DATA- Principles and Best Practices of Scalable Real-Time Systems", 2010

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BCA 604 **IOT AND ITS APPLICATIONS**

Credits: 4

Instruction: (4L) hours per week Duration of SEE: 3 hours

CIE: 30 marks SEE: 70 marks

UNIT – 1

IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT – 2

M2M to IoT- A Basic Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT -3

IoT Architecture -State of the Art - Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT – 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT – 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT- Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

TEXT BOOK:

1 .Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, F Edition.

REFERENCE BOOKS:

1. Michael Miller , "The Internet of Things: How Smart TVs , Smart Cars, Smart Homes, and Smart Cities are changing the world", Pearson Education 2015.

2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",Apress Publications 2013,1st Edition.

3. Waltenegus Dargie,Christian Poellabauer,"Fundamental of Wireless Sensor Networks:Theory and practice",Wiley 2014.

4. CunoPfister,"Getting started with the Internet of Things",O Reilly Media 2011.

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BCA 605 **MACHINE LEARNING**

Credits: 4

Instruction: (4L) hrs per week Duration of SEE: 3 hours

CIE: 30 marks SEE: 70 marks

Unit-I

Introduction: What does it mean to learn, Some canonical Learning Problems, The Decision Tree Model of Learning, Formalizing the Learning Problem, ID3 Algorithm Limits of Learning: Data Generating Distributions, Inductive Bias, Not everything is learnable.

Under fitting and Overfitting: Separation of training and test Data, Models, parameters and Hyper parameters, Real World Applications of Machine Learning Geometry and Nearest Neighbors: From Data to Feature Vectors, k-Nearest Neighbors, Decision Boundaries, k-means Clustering, High Dimensions.

Unit-II

The Perceptron: Bio-inspired Learning, The Perceptron Algorithm, Geometric Interpretation, Interpreting Perceptron Weights, Perceptron Convergence and Linear Separability, Improved Generalization, Limitations of the Perceptron.

Unit-III

Practical Issues: Importance of Good Features, Irrelevant and Redundant Features, Feature Pruning and Normalization, Cross Validation, Hypothesis Testing and Statistical Significance, Debugging Learning Algorithms, Linear Models: The Optimization Framework for Linear Models, Convex Surrogate Loss Functions, Optimization and Gradient Descent, Support Vector Machines

Unit-IV

Probabilistic Modeling: Classification by Density Estimation, Statistical Estimation, Naïve Bayes Models, Prediction Neural Networks: Bio-inspired Multi-Layer Networks, The Back-propagation Algorithm, Initialization and Convergence of Neural Networks, Beyond two layers, Breadth vs Depth, Basis Functions

Unit V

Unsupervised Learning: Clustering Introduction, Similarity and Distance Measures, Agglomerative Algorithms, Divisive Clustering, Minimum Spanning Tree Association Rules: Introduction, large Item sets, A priori Algorithm.

References:

1. A Course in Machine Learning (CIML). Hal Daume III, 2017 (freely available online) http://ciml.info/
2. Data Mining: Introductory and Advanced Topics. Margaret H Dunham, Pearson Education, 2003

Suggested Reading:

1. Hands on Machine Learning with SciKit-Learn, Keras and Tensor Flow. AurélienGéron. O'Reily, 2019
2. Machine Learning with Python Cookbook. Chris Albo, O'Reily, 2018
3. Introduction to Machine Learning with Python: A guide. Andreas C Miller, Sarah Guido O'Reily, 2017

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BCA 651 **Data Mining Using Python LAB**

Credits:2

Instruction: (4 P) hrs per week Duration of SEE: 3 hours
CIE: 25 marks SEE:50marks

1. Setting up Python environment (Anaconda, Jupyter Notebook)
2. Programs Using NumPy and Pandas for data manipulation
3.Cleaning and handling missing data using Pandas, Normalization and scaling techniques, One-hot encoding for categorical data
4. Visualizing data using Matplotlib and Seaborn, Calculating summary statistics and distribution analysis, Identifying and handling outliers
5. Implementing Apriori algorithm to find frequent itemsets, Generating association rules from frequent itemsets
6. Interpretation and evaluation of association rules
7. Implementing K-means clustering algorithm, Hierarchical clustering using SciPy. Visualizing clusters and evaluating clustering results
8. Applying Principal Component Analysis (PCA) for feature reduction, Visualizing reduced-dimensional data, Understanding the trade-offs of dimensionality reduction
9. Implementing decision tree and random forest classifiers, Training and evaluating a Naive Bayes classifier, Comparing classification performance metrics
10. Using cross-validation for model evaluation, Hyperparameter tuning for improving model performance, Selecting the best model based on evaluation results
11. Implementing linear regression for predicting numerical values, Analyzing and visualizing time series data
12. Forecasting using basic time series techniques

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NISHITHA DEGREE COLLEGE
(AUTONOMOUS)
BESIDE POLICE COMMISSIONERATE
KANTESHWAR ROAD, NIZAMABAD.

V.C. NOMINEE
Board of Studies
Dept. of.. Computer Science

BCA 652 **PROJECT WORK**

Credits 7

Instruction: (14P) hrs per week Duration of SEE: 3Hours

CIE: 50 Marks SEE: 100 Marks

Sixth Semester of the MCA course is exclusively meant for project work. Project has to be carried out by each student individually in a period of 15 weeks of duration. Students should submit a synopsis at the end of 2nd week in consultation with the Project Guide. The synopsis should consist of definition of the problem, scope of the problem and plan of action. After completion of eight weeks students are required to present a Project Seminar on the topic covering the aspects of analysis, design and implementation of the project work.

At the end of the semester the students are required to present themselves for a University Vive-voce examination.

A committee consisting of two faculty members of the respective college along with a guide will evaluate the project and award CIE marks.

Each student will be required to:

1. Submit one page of synopsis on the project work for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the project.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of CIE marks which will be on the basis of performance in all the 3 items stated above. The project seminar presentation should include the following components of the project:

- Problem definition and specification.
- Literature survey, familiarity with research journals.
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation both oral and written.

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