BACHELOR OF COMPUTER APPLICATION
(BCA)

Detailed syllabi for students admitted to KIIT Deemed to be University

SCHOOL OF COMPUTER APPLICATIONS
KIIT Deemed to be University
BHUBANESWAR - 751024

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COURSE STRUCTURE

BACHELOR OF COMPUTER APPLICATION
(BCA)
(2022– 2025)

Kalinga Institute of Industrial Technology
(Deemed to be University)

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PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Pursue a successful career in the field of computer applications and contribute to the industry or undertake entrepreneurial endeavours.

PEO2: Perceive the limitations and impact of technical /IT solutions in social, legal, commercial and multidisciplinary contexts.

PEO3: Demonstrate professional and ethical responsibilities, and engage in life-long learning.

PROGRAMME OUTCOMES

PO1: Learn the fundamentals of mathematics and computer science.

PO2: Design simple solutions using concepts of data structure and algorithms.

PO3: Solve problems and formulate simple solutions using mathematics and computer programming.

PO4: Apply the concepts of software engineering to build simple projects.

PO5: Create, select, and apply appropriate techniques using modern IT tools.

PO6: Apply soft skills appropriately in professional domain.

PO7: Understand the impact of the professional solutions in societal and environmental contexts.

PO8: Commit to professional ethics and apply ethical principles and norms of the software professional practices.

PO9: Work effectively as an individual, and as a member or team leader in diverse roles.

PO10: Communicate effectively on technical activities with the community.

PO11: Effectively write reports, prepare documentation and make effective presentations.

PO12: Demonstrate knowledge and understanding of the software and management principles and apply these to one's own work.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Ability to demonstrate a degree of mastery in the area of computer applications through the advanced knowledge of data acquisition, data analytics, big data, pattern recognition and knowledge discovery.

PO2: Ability to independently carry out research/investigation and developmental work to solve practical problems.

PO3: Develop sound knowledge and skill sets to develop and expand professional careers in fields related to human-computer interaction and management of industrial processes for the design and implementation of intelligent systems.

BCA COURSE STRUCTURE(2022-2025)

FIRST SEMESTER (AUTUMN)

THEORY						
SL. NO.	COURSE CODE	COURSE	L	T	P	CREDIT
01	BCA1001	English Language	2	-	-	2
02	BCA1003	Computer Programming	3	1	-	4
03	BCA1005	Computer Organization and Architecture	3	1	-	4
04	BCA1007	Descriptive Statistics	3	1	-	4
05	BCA1009	Fundamentals of Accounting	3	-	-	3
PRACTICAL						
06	BCA1093	Programming Lab	-	-	4	2
07	BCA1097	Statistics Lab	-	-	4	2
SESSIONAL						
08	YG-1081	Yoga and Human Consciousness	-	-	2	1
		TOTAL	-	-	-	**22**

SECOND SEMESTER (SPRING)

THEORY						
SL. NO.	SUBJ3CT CODE	COURSE	L	T	P	CREDIT
01	BCA1002	Data Structures	3	1	-	4
02	BCA1004	Python Programming	3	1	-	4
03	BCA1006	Introduction to Probability	3	1	-	4
04	BCA1012	Information Systems	3	-	-	3
05	BCA1014	Business Communication	3	-	-	3
PRACTICAL						
06	BCA1092	Data Structures Lab	-	-	4	2
07	BCA1094	Python Programming Lab	-	-	4	2
		TOTAL	-	-	-	**22**

THIRD SEMESTER (AUTUMN)

	THEORY					
SL. NO.	**COURSE CODE**	**COURSE**	**L**	**T**	**P**	**CREDIT**
01	BCA2001	Object Oriented Programming using C++	3	1	-	4
02	BCA2003	Database Management System	3	1	-	4
03	BCA2005	Computer Networks	3	1	-	4
04	BCA2007	Discrete Mathematics	3	1	-	4
05	BCA2009	Organizational Behavior	3	-	-	3
PRACTICAL						
06	BCA2093	Database Management System Lab	-	-	4	2
07	BCA2091	C++ Programming Lab	-	-	4	2
		TOTAL	**-**	**-**	**-**	**23**

FOURTH SEMESTER (SPRING)

	THEORY					
SL. NO.	**COURSE CODE**	**COURSE**	**L**	**T**	**P**	**CREDIT**
01	BCA2002	Web Designing and Programming	3	-	-	3
02	BCA2004	Software Engineering	3	1	-	4
03	BCA2006	Operating Systems	3	-	-	3
04	BCA2008	Professional Communication	2	-	-	2
05	BCA2012	Numerical Methods	3	1	-	4
PRACTICAL						
06	BCA2092	Web Designing Lab	-	-	4	2
07	BCA2096	Operating Systems Lab	-	-	4	2
08	BCA2098	Professional Communication Lab	-	-	2	1
		TOTAL	**-**	**-**	**-**	**21**

FIFTH SEMESTER (AUTUMN)

THEORY						
SL. NO.	COURSE CODE	COURSE	L	T	P	CREDIT
01	BCA3001	Open-Source Technology	3	-	-	3
02	BCA3003	Java Programming	3	1	-	4
03	BCA3005	Artificial Intelligence	3	-	-	3
04	BCA3007	Information Security	3	-	-	3
05		Open Elective	3	-	-	3
PRACTICAL						
06	BCA3093	Java Programming Lab	-	-	4	2
07	BCA3095	Artificial Intelligence Lab	-	-	4	2
TOTAL			**-**	**-**	**-**	**20**

SIXTH SEMESTER (SPRING)

THEORY						
SL. NO.	COURSE CODE	COURSE	L	T	P	CREDIT
01	BCA3004	Introduction to Data Science	3	1	-	4
02		Elective -I	3	-	-	3
03		Elective-II	3	-	-	3
04	BCA3006	Environmental Science	2	-	-	2
PRACTICAL						
05	BCA3094	Data Science Lab	-	-	4	2
SESSIONAL						
06	BCA3082	Project	-	-	-	6
07	BCA3084	Seminar	-	-	-	2
TOTAL						**22**

BCA	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	Total Credits
Credits	22	22	23	21	20	22	130

ELECTIVES

ELECTIVE - I	
COURSE CODE	**COURSE**
BCA3012	Computer Graphics
BCA3014	Multimedia & Applications
BCA3016	Operations Research
BCA3018	Wireless Sensor Networks
BCA3022	Graph Theory
ELECTIVE - II	
COURSE CODE	**COURSE**
BCA3024	Internet of Things
BCA3026	Cloud Computing
BCA3028	E-Commerce
BCA3032	Data Mining
BCA3034	Mobile Applications Development

FIRST SEMESTER (AUTUMN)

BCA1001   **ENGLISH LANGUAGE**   **CREDITS: 2**

UNIT – I

Science Fiction: Sentence Structure, Vocabulary, Idioms & Phrases and Comprehension

UNIT - II

Sounds of English: Pronunciation practice for non-native sounds, strong and weak forms, Stress & tone.

UNIT - III

Strengthening Usage: Subject-Verb Agreement, Tense basics, Articles, Prepositions, and Consistency errors.

UNIT - IV

Spoken Language: Thinking in English, Situational Conversations, Role Play & other fluency boosters.

Reference Books:

1. *Kumar, Sreehari and Savithri, Essential English, Orient Black Swan, 2011.*
2. *John Seely, Oxford Guide to Writing & Speaking, OUP, 2013.*
3. *https://classicsofsciencefiction.com/best-science-fiction-short-stories/*
4. *J D O' Connor, Better English Pronunciation, Cambridge, 1980.*
5. *John Eastwood, Oxford Practice Grammar, OUP, 2016.*
6. *Raman and Sharma, Technical Communication, OUP, 2015.*

COURSE OUTCOMES:

The students will be able to:

CO1: Understand the importance of communication skills in the professional world.

CO2: Analyse the nuances of the four pillars of communication namely, listening, speaking, reading and writing.

CO3: Classify and interpret various pronunciation tips and techniques.

CO4: Apply the usage practice of different grammar elements in speaking and writing skills.

CO5: Compare a plethora of writing styles and elucidate their purpose in the business domain.

CO6: Prioritize the essence of effective communication skills and master it.

UNIT - I

Programming Process: Steps in developing of a program, data flow diagram, decision table, algorithm development, flowchart, pseudo code, testing and debugging.

Fundamentals of C Languages: Character set, identifiers and keywords, constants, types of C constants, rules for constructing integer, real and character constants, variables, data types, rules for constructing variables.

Operators and Expressions: C instructions, arithmetic operators, relational operators, logical operators, assignment operators, type conversion in assignments, hierarchy of operations, standard and formatted statements, structure of a C program , compilation and execution.

UNIT - II

Decision Control Structure: Decision making with IF-statement, IF-Else and Nested IF Else, The else if Clause.

Loop Control Structure: While and do-while, for loop and Nested for loop.

Case Control Structure: Decision using switch, The goto statement.

Functions: Library functions and user defined functions, global and local variables, function declaration, calling and definition of function, methods of parameter passing to functions, recursion and storage classes in C.

UNIT - III

Arrays: Introduction, Array declaration, accessing values in an array, initializing values in an array, Single and Two-Dimensional Arrays, Initializing a 2-Dimensional Array, Memory Map of a 2-Dimensional Array, Passing array elements to a function: Call by value and call by reference, Arrays of characters, Insertion and deletion operations, Searching the elements in an array, Using matrices in arrays, Passing an Entire Array to a Function.

Pointers: Pointer declaration, Address operator "&", Indirection operator "*", Pointer and arrays, Pointers and 2-Dimensional Arrays, Pointer to an Array, Passing 2-D array to a Function,

Dynamic Memory Allocation: malloc(), calloc(), realloc(), free() functions.

UNIT – IV

String Manipulation: Declaring and Initializing string variables, Reading and writing strings, String Handling functions(strlen(), strcpy(), strcmp(), strcat()).

Structures and Unions: Declaration of structures, Structure Initialization, Accessing structure members, Arrays of structure.

Files Handling: Introduction, Opening and Closing files, Basic I/O operation on files.

Reference Books:

1. *Reema Thareja, Computer Fundamentals and Programming in C, 2nd Edition, Oxford University Press, 2016.*
2. *Ashok N Kamthane: Programming in C, 2nd Edition, Pearson Edition Publication, 2011.*
3. *P. Dey, M. Ghosh, Programming in C, 2nd Edition, Oxford University Press, 2013.*
4. *K. R. Venugopal, S. R. Prasad, Mastering C, McGraw-Hill Education India, 2007.*
5. *R.S. Bichkar, Programming with C, University Press, 2012.*

COURSE OUTCOMES:

The students will be able to

CO1: Design correct programs to solve problems.

CO2: Compare various programming, and apply the concept of decision structures, loops and functions.

CO3: Solve basic programming problems using a variety of skills and strategies.

CO4: Use pseudo-code and visual modelling to prepare clear and accurate program documentation and models.

CO5: Examine working programs to identify their structures.

CO6: Apply appropriate techniques to create entry-level programs from models.

BCA1005   COMPUTER ORGANIZATION AND ARCHITECTURE   CREDITS: 4

UNIT - I

Introduction to Digital Electronics: Number systems, complements, floating point representation, addition, subtraction, Hamming code for error detection and correction, Logic gates, Boolean algebra, Simplification of Boolean algebra, Combinational circuits, Sequential circuits, shift registers & counters, Design of counters.

UNIT – II

Register Transfer and Micro-operations: Register Transfer Language, Register Transfer, Bus Structure, Bus and Memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro operations. Basic Computer Organization and Design: Computer registers, bus system, instruction set, instruction cycle, memory reference, input-output and interrupt.

UNIT - III

Central Processing Unit: Register organization, arithmetic, and logical micro-operations, stack organization, microprogrammed control.

Programming the Basic Computer: Instruction formats, addressing modes, instruction codes, machine language, assembly language, and input-output programming.

UNIT - IV

Computer Arithmetic: Introduction, Multiplication and Division Algorithms for fixed point-members.

Memory: Characteristic terms of various memory devices, RAM, ROM, PLA, PAL, Cache Memory, Virtual Memory.

Input-output Organization: Peripheral devices, I/O interface, Modes of data transfer, direct memory access.

Reference Books:

1. *M. Morris Mano, Computer System Architecture, 3rd. Edition, Pearson, 2017*
2. *Modern Digital Electronics, Fourth Edition, McGrawHill Education, 2018*

3. *William Stallings, Computer Organization and Architecture: Designing for Performance, 9th Edition, Pearson, 2013*
4. *Hamacher, Computer Organization, 5th Edition, MGH, 2011*
5. *John P Hayes, Computer Architecture and Organization, 3rd Edition, MGH, 2017William Stallings, Computer Organization and Architecture: Designing for Performance, 9th Edition, Pearson, 2013*

COURSE OUTCOMES:

The students will be able to:

CO1: Illustrate the working of Computer Systems.

CO2: Classify and interpret the Instruction Set Architecture.

CO3: Solve problems related to the advanced pipelining techniques.

CO4: Analyse the system performance.

CO5: Prioritize the current state in memory system design.

CO6: Design alternate/ advanced architecture using data flow computing.

BCA1007   DESCRIPTIVE   STATISTICS   CREDITS: 4

UNIT - I

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and Sample Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

UNIT - II

Measures of Central Tendency: Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.,

UNIT - III

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation, simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

UNIT – IV

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa, Consumer price index numbers.

Reference Books:

1. *Allan G. Bluman, Elementary Statistics: a step by step approach, 10th Ed.,McGraw Hill, 2018.*
2. *F. J. Gravetter & L.B. Wallnau, Statistics for The Behavioral Sciences, 10th Ed., Cengage, 2016.*

3. R.Peck, C. Olsen,Jay L. Devore, Introduction to Statistics and Data Analysis , Brooks/Cole; 4th edition, 2010.
4. P.N.Arora (et-al), Comprehensive Statistical Methods, 4th. Ed., S. Chand, 2014.
5. S.C. Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons, 2019.
6. D.N. Elhance, V. Elhance & B.M. Aggarwal, Fundamentals of Statistics, 60th. Ed., Kitab Mahal Publishers, 2020.

COURSE OUTCOMES:

The students will be able to

CO1: Define and use the basic terminology of statistics

CO2: Analyse and compare different sets of data

CO3: Classify the data by means of diagrams and graph

CO4: Recall the meanings of statistical terms

CO5: Explain the statistical concepts of central tendency, dispersion skewness, Kurtosis & index numbers

CO6: Calculate and interpret the various measures of central tendency, dispersion skewness, Kurtosis & index numbers.

BCA1009   FUNDAMENTALS OF ACCOUNTING   CREDITS: 3

UNIT – I

Basic of Financial Accounting: Introduction to Accounting, Accounting Principle, Accounting Process, Bank Reconciliation Statement, Fixed Assets and Depreciation, Final Accounts.

UNIT – II

Analyzing Accounting Information: Financial Statement Analysis, Ratio Analysis, Funds Flow Statement and Cash flow Statement.

UNIT - III

Cost Accounting: Cost Accounting - Nature and Scope, Basic Cost Concepts, Cost Sheet, Tenders and Quotations, Process Costing, Reconciliation of Cost and Financial Accounting.

UNIT - IV

Management Accounting: Introduction, Budgeting and Budgetary Control, Standard Costing and Variance Analysis, Marginal Costing, and Cost-Volume-profit Analysis, Tactical Decision Making, Responsibility Accounting and Transfer Pricing, Neo - Concepts in Decision Making.

Reference Books:

1. CA (Dr.) P.C. Tulsian, CA Bharat Tulsian, Tulsian's Introduction to Corporate Accounting, Revised edition 2012, S. Chand & Company Pvt. ltd.

2. *S. Anil Kumar, V. Rajesh Kumar, B. Mariyappa, Fundamental of Accounting, Himalaya Publishing House.*

3. *S.N. Maheshwari, S.K. Maheshwari, An Introduction to Accountancy, 12th. Edition, Vikas publishing, 2018.*

4. *Paresh Shah, Basic Financial Accounting for Management, Oxford University press.*

COURSE OUTCOMES:

The students will be able to:

CO1: Define book keeping and accounting and describe the main elements of financial accounting information – assets, liabilities, revenue and expenses. Identify the main financial statements and their purposes.

CO2: Understand the accounting system, prepare ledger accounts using double entry bookkeeping and record journal entries accordingly and interpreting the business implications of financial statement information.

CO3: Relate the factors affecting investment decisions and opportunities presented to an organization and Select and apply techniques in managing working capital.

CO4: Analyse the ability to use and interpret financial and non-financial information in management planning and decision making, in operational control, and performance evaluation.

CO5: Critically assess and evaluate the principal concepts and techniques used in the area of accounting and financial management.

CO6: Develop a comprehensive understanding of the key role of financial management in making sound financial decisions such as fund raising and investing.

SECOND SEMESTER (SPRING)

BCA1002   DATA STRUCTURES   CREDITS: 4

UNIT - I

Introduction: Basic Concepts: Introduction to complexity, data structure and data structure operations, applications of data structure, basic data structures.

Arrays: Introduction, Types of Array, Memory representation, Applications and operations.

Stacks: Introduction and primitive operations on stack, Stack application: Infix, postfix, prefix expressions, Evaluation of postfix expression, Conversion from infix to postfix.

UNIT - II

Linked List: Operations:-traversing, searching, inserting, deleting, operations on header linked list, circular linked list, doubly linked list, memory representation, Applications, polynomial manipulation.

Queue: Introduction, types, memory representation and applications.

UNIT - III

Trees – Definition and basic concepts, representation in contiguous storage, binary tree, binary tree traversal, searching, insertion and deletion in binary trees, binary search tree.

Graphs: Introduction, memory representation, graph traversal (DFS and BFS).

UNIT - IV

Searching: Binary and Linear Search: Sorting: Bubble sort, Insertion sort, Selection sort, Merge Sort, Quick sort. Comparison of various Searching and Sorting algorithms.

Reference Books:

1. *Reema Thareja Data Structures using C, 2nd. Edition, Oxford University Press, 2014*
2. *Gilberg and Forouzan, Data Structures A pseudocode approach with C, 2nd. Edition, Cengage Learning, 2007.*
3. *Seymour Lipschutz, Schaum's outline series, Data Structure, 1st. Edition, MGH, 2014.*
4. *R. S. Salaria, Data Structures, Theory, Problems & Algorithms, 3rd. Edition, Khanna Publishing, 2017.*

COURSE OUTCOMES:

The students will be able to:

CO1: Design correct programs to solve problems.

CO2: Compare various programming, and apply the concept of decision structures, loops and functions.

CO3: Choose efficient data structures and apply them to solve problems.

CO4: Analyse the efficiency of programs based on time complexity.

CO5: Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs

CO6: Design reusable ADTs.

BCA1004   PYTHON   PROGRAMMING   CREDITS: 4

UNIT – I

Introduction: Introduction to, interactive mode and script, process of writing and running a program, data types, literals, identifiers and operators, operator precedence, console input output functions.

UNIT – II

Selective statements: if, if-else, if-elif-else;

Notion of iterative computation and control flow: for, while, break, continue and pass. Functions Built-In Function, Composition User Define Function: defining, invoking functions, passing parameters, Scope of variables, Modules (Importing entire module or selected objects using from statement).

UNIT – III

Strings: compare, concatenation, substring. Container types: Lists,

Tuples and dictionary: finding the maximum, minimum, mean; linear search on list/tuple of numbers, and counting the frequency of elements in a list using a dictionary. Introduce the notion of accessing elements in a collection using numbers and names. Sorting (bubble and insertion sort).

UNIT – IV

Exceptions in Python: Detecting and Handling Exceptions, I/O and File Handling: Output Formatting, Reading and Writing Files(text and binary mode).

Reference Books:

1. *R. Nageswara Rao, Core Python Programming, 2nd. Edition, Dreamtech Press (Wiley), 2019*
2. *Reema Thareja, Python Programming: Using Problem Solving Approach , Oxford, 2018*
3. *Ljubomir Perkovic, Introduction to Computing Using Python: An Application Development Focus, John Wiley & Sons, 2012*
4. *Mark Lutz, Learning Python, 5th. Edition, O'Reilly Publication, 2013*
5. *Michael Dawson, Python Programming for the Absolute Beginner, 3rd. Edition, Cengage Learning, 2011.*
6. *David Beazley, Python Essential Reference, 4th. Edition, Addison-Wesley Professional, 2009.*
7. *E. Balagurusamy, Introduction to Computing and Problem Solving Using Python, 1st. Edition, MGH, 2016.*

COURSE OUTCOMES:

The students will be able to:

CO1: Explain basic principles of Python programming language.

CO2: Learn and understand python looping, control statements and string manipulations.

CO3: Define and demonstrate the use of built-in data structures "lists" and "dictionary".

CO4: Design and implement a program to solve a real-world problem.

CO5: Implement database and GUI applications.

CO6: Learn and know the concepts of file handling, exception handling and database Connectivity.

BCA1006   INTRODUCTION TO PROBABILITY   CREDITS: 4

UNIT - I

Probability: Introduction, random experiments, sample space, events and algebra of events.

Definitions of Probability: classical, statistical, and axiomatic, conditional probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem.

UNIT - II

Random variables: Discrete and continuous random variables, probability mass function, probability density function, cumulative density function, illustrations and properties of random variables, univariate transformations with illustrations.

Two dimensional random variables: Discrete and continuous type, joint, marginal and conditional probability mass function, probability density function, cumulative density function, independence of variables, bivariate transformations with illustrations.

UNIT - III

Mathematical Expectation and Generating Functions: Expectation of single and bivariate random variables and its properties, moments and cumulants, moment generating function, cumulant generating

function and characteristic function, Conditional expectations, Uniqueness and inversion theorems (without proof) along with applications.

UNIT – IV

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta, and gamma along with their properties and limiting/approximation cases.

Reference Books:

1.   *J. L. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2012.*

2.   *Michael Baron, probability and statistics for Computer Scientists, 2nd Ed., CRC Press, 2014.*

3.   *S.C. Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics, 11th. Edition, Sultan Chand & Sons, 2019.*

4.   *S. Ghahramani, Fundamentals of Probability with Stochastic Processes, 3rd. Edition, Pearson, 2014.*

5.   *Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, 6th Edition, John Wiley & Sons, Inc, 2014.*

6.   *S. Ross, A First Course in Probability, 9th Ed., Pearson, 2013.*

COURSE OUTCOMES:

The students will be able to:

CO1: Understand the basic principles of probability including Bayes theorem and use these principles in problem solving situations.

CO2: Understand the most common discrete and continuous probability distributions.

CO3: Identify the characteristics of different discrete and continuous distributions.

CO4: Use the normal probability distribution including standard normal curve calculations of appropriate areas.

CO5: Compute marginal and conditional distributions from joint distributions.

CO6: Calculate the simple linear regression equation for a set of data.

<u>BCA1012   INFORMATION SYSTEMS   CREDITS: 3</u>

UNIT I:

Introduction of Information System (IS): Definitions, Types of Information System, Framework Of Information System, Component of an Information System, Information Resources, activities, users. The Role of Information in Management Problem Solving, Application of IS in Business, Case Study.

UNIT II:

An Overview of Management Information System (MIS): Definition of MIS, Integrated System, MIS vs Data Processing, Structure of MIS based on Management activity and functions, Systems concepts to MIS.

Information System for Functional Areas: Information for Marketing, Inventory Control, Production function, Finance. Human Information Processing, Characteristics of Human Information Processing Performance. Cases related to information requirement for above functional areas.

UNIT III:

Information System for Managerial Decision Support Systems (DSS): Concepts of Decision making and its phases, Models of Decision Support System, Difference between MIS and DSS, The System Development Life Cycle and its models, Business Process Redesign (BPR).

Executive Information and Support System: Needs, Characteristics, Software and Hardware, Integrated EIS and DSS, EIS implementation.

UNIT IV:

Planning and Implementation of Changes: Organizational planning, types of planning, computer aided planning tools.

Control Audit, Security, Ethical and Societal Challenges of Information Technology: Types of control, need for auditing of IS, ethical and societal dimensions of it, privacy issues, ethical responsibility.

Reference Books:

1. *James O'Brien, R. Behl & G.M. Marakas, Management Information System, 11th. Edition, MGH, 2019*
2. *James A. O'Brien, Introduction to Information Systems, 12th. Edition, MGH, 2015.*
3. *C. S. V. Murthy, Management Information System, 3rd. Edition, Himalaya Publishing, 2019.*

COURSE OUTCOMES:

The students will be able to:

CO1: Describe the importance of information systems in business and management.

CO2: Compare the roles of the major types of information. systems in a business environment and their relationship to each other.

CO3: Discover the impact of the Information technology on business-electronic commerce and electronic business.

CO4: Analyse the major management challenges to building and using information systems.

CO5: Evaluate and find appropriate solutions to those challenges.

CO6: Design and develop the various securities, ethical and societal challenges faced by the management.

BCA1014   BUSINESS COMMUNICATION   CREDITS: 3

UNIT - I

Concepts of Communication: Process of communication, Verbal & Non-verbal / Formal & Informal, Communication Skills & Barriers.

UNIT – II

Spoken Communication: Principles of effective speech, Presentation Skills, Oral fluency development.

UNIT - III

Written Communication: Forms of written communication, Paragraphs, Sentences and Spellings, Punctuations and other common errors.

UNIT - IV

Business Communication: Meetings, Workshops, Conferences & Symposia, Reports, Memos, Case-studies & Letters, Group Discussions, Interviews, CVs & Cover letters

Reference Books:

1. *John Seely, Oxford Guide to Effective Writing & Speaking,3rd. Edition, Oxford University Press, 2013.*
2. *C.M. Lehman, D.D. DuFrene & M. Sinha, BCOM: Business Communication, 2nd. Edition, Cengage, 2016.*
3. *T. M. Farhatullah ,Communication skills for Technical Students, Orient Longman, 2002.*
4. *R.V. Lesikar (et-al) , Business Communication, 13th Edition, MGH, 2015.*
5. *Swati Samantaray, Business Communication & Communicative English, Sultan Chand, 2009.*

COURSE OUTCOMES:

The students will be able to:

CO1: Understand the essence of professional communication in today's competitive era.

CO2: Analyse and interpret the various components of Group Discussion.

CO3: Illustrate the methods of resume writing.

CO4: Designs different styles of resume building.

CO5: Evaluate interview types and strategies.

CO6: Perceive and apply techniques for effective campus placement preparations.

THIRD SEMESTER (AUTUMN)

BCA2001   OBJECT ORIENTED PROGRAMMING USING C++   CREDITS: 4

UNIT – I

Introduction: Introducing Object-Oriented Approach, Relating to other paradigms
(Functional, data decomposition)

Basic terms and ideas: Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++ - cin, cout, new, delete operators.

UNIT – II

Classes and Objects: Encapsulation, information hiding, abstract data types, Object & classes, attributes, methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, instantiation of objects, Default parameter value, object types, C++ garbage collection, dynamic memory allocation, metaclass/ abstract classes.

UNIT – III

Inheritance and Polymorphism: Inheritance, Class hierarchy, derivation – public, private & protected, Aggregation, composition vs classification hierarchies, Polymorphism, Categorization of polymorphism techniques, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric polymorphism.

Generic function: Template function, function name overloading, Overriding inheritance methods, Run time polymorphism, Multiple Inheritance.

UNIT – IV

Files and Exception Handling: Persistent objects, Streams and files, Namespaces,

Reference Books:

1. *R. Lafore, Object Oriented Programming using C++, 4th. Edition, Pearson, 2002.*
2. *Ashok N. Kamthane, Object Oriented Programming with ANSI & Turbo C++", Pearson.*
3. *Steven C. Lawlor, "The Art of Programming Computer Science with C++", 1st. Edition, Course Technology, 1997.*
4. *Schildt Herbert, "C++: The Complete Reference", 4th. Edition , MGH, 2003.*
5. *Tony Gaddis, Watters, Muganda, "Object-Oriented Programming in C++", 3rd. Edition , Wiley Dreamtech, 2004.*
6. *A. R. Venugopal, Rajkumar, T. Ravishanker "Mastering C++", McGraw Hill, 1997.*
7. *S. B. Lippman & J. Lajoie, "C++ Primer", 3rd. Edition, Addison Wesley, 2000.*

COURSE OUTCOMES:

The students will be able to:

CO1: Describe the differences between object-oriented programming and procedural programming.

CO2: Understand the fundamental concepts of object-oriented programming.

CO3: Apply the advanced concept of object-oriented programming such as inheritance and polymorphism.

CO4: Analyse the additional features of C++ that are not available in function oriented programming languages such as exceptional handling, virtual functions, etc.

CO5: Evaluate the functionalities like Dynamic bindings with C++

CO6: Develop small scale projects using Streams and STLs.

UNIT - I

Introduction: Database Approach, Characteristics of a Database Approach, Database System Environment.

Roles in Database Environment: Database Administrators, Database Designers, End Users, Application Developers.

Database Management Systems: Definition, Characteristics, Advantages of Using DBMS Approach, Classification of DBMSs.

Architecture: Data Models, Categories of Data Models- Conceptual Data Models, Physical data Models, Representational Data Models, such as, Object Based Models, Record Based Models, Database Schema and Instance, Three Schema Architecture, Data Independence – Physical and Logical data Independence.

UNIT - II

Database Conceptual Modelling by E-R model: Concepts, Entities and Entity Sets, Attributes, Mapping Constraints, E-R Diagram, Weak Entity Sets, Strong Entity Sets.

Enhanced E-R Modelling: Aggregation, Generalization, Converting ER Diagrams to Tables.Relational Data Model: Concepts and Terminology, Characteristics of Relations.

Constraints: Integrity Constraints, Entity and Referential Integrity constraints, Keys- Super Keys, Candidate Keys, Primary Keys, Secondary Keys and Foreign Keys.

UNIT - III

Relational Algebra: Basic Operations, Additional Operations, Example Queries.

Database Design: Informal Design Guidelines for Relation Schemas, Problems of Bad DatabaseDesign,

Normalization: Functional Dependency, Full Functional Dependency, Partial Dependency, Transitive Dependency, Normal Forms– 1NF, 2NF, 3NF, Boyce-Codd NF

UNIT – IV

Understanding SQL-1: Data Types, Creating Tables, Creating a Table with data from Another table, Inserting Values into a Table, Updating Column(s) of a Table, Deleting Row(s) from a Table, Dropping a Column, Querying database tables, Conditional retrieval of rows, Working with Null Values, Matching a pattern from a table, ordering the result of a Query Aggregate Functions, Grouping the Result of a Query, creation and deletion of Views, Managing privileges with Grant and Revoke Command, COMMIT and ROLLBACK.

Functions: Character Functions, Date Functions, Group Functions

Reference Books:

1. *Silbersettatz, Korth, Sudarshan , Database system concepts, 6th. Edition, MGH, 2013*

2. *Bipin Desai, Database Management Systems, Galgotia Publisher, 2012*

3. *Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd. Edition, MGH, 2014.*

4. Elmasri &Navathe, Fundamentals of Database Systems, Pearson Education.

COURSE OUTCOMES:

The students will be able to:

CO1: Define basic database concepts, role of a database management system including the structure and operation of the relational data model.

CO2: Compare simple and moderately advanced database queries using SQL and Relational Calculus.

CO3: Apply logical database design principles, including E-R diagrams and database normalization.

CO4: Analyse the concept of a database transaction and related database facilities, including concurrency control, journaling, backup and recovery, and data object locking and protocols.

CO5: Evaluate the performance of query processing in distributed database systems.

CO6: Design basic database storage structures & access techniques.

<u>**BCA2005   COMPUTER NETWORKS   CREDITS: 4**</u>

UNIT - I

Basic concepts: Components of data communication, standards and organizations, Network Classification, Network Topologies; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.

Signals: Analog and digital signals, Time and frequency domains, Frequency Spectrum and Bandwidth, Decomposition of a digital signal, Encoding and modulating, Digital to digital conversion, Unipolar, Polar, Bipolar, Analog to digital conversion, PAM, PCM, Digital to Analog conversion: ASK, FSK, PSK, QAM and Analog to Analog conversion: AM, FM, PM

UNIT - II

Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway, Multiplexing: Frequency division, wave division and time division multiplexing.

Data Link Layer: Framing techniques; Error Control; Flow Control Protocols,

UNIT - III

Network Layer: Virtual Circuits and Datagram approach, IP addressing methods, Subnetting; Routing Algorithms (adaptive and non-adaptive).

Transport Layer: Transport services, Transport Layer protocol of TCP and UDP.

UNIT - IV

Application Layer: Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP.

Network Security: Common Terms, Firewalls, Virtual Private Networks.

Reference Books:
1. *B.A. Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw Hill, 2017.*

21

2. *W. Stalling, Data and Computer Communication, 10th edition, Pearson, 2017.*

3. *D.E. Comer, Internetworking with TCP/IP, Vol. I, 6th Edition, Pearson, 2015.*

4. *D. Bertsekas, R. Gallager, Data Networks, 2nd edition, Prentice Hall of India, 1992.*

COURSE OUTCOMES:

The students will be able to:

CO1: Define fundamental concepts of computer networking.

CO2: Classify the basic taxonomy and terminology of computer networking.

CO3: Apply advanced networking concepts.

CO4: Analyse specific areas of networking such as the design and maintenance of individual networks.

CO5: Evaluate routes to create interconnect of nodes.

CO6: Design and implement the protocols used in computer networks.

BCA2007　　　　　　DISCRETE MATHEMATICS　　　CREDITS: 4

UNIT - I

Sets, relations, and functions: Definition, examples and basic properties of ordered sets, operations on sets. Different types of relations, power of relation and inverses. Types of functions, Function compositions and inverses.

Mathematical Logic: Logical Inferences, Methods of proof of an implication. First order logic and Predicate Calculus, Rules of inference for quantified propositions, Mathematical Induction. Finite Boolean algebra, Axioms of Boolean Algebra, Boolean Function, Logic Circuits.

UNIT - II

Counting: Fundamentals of counting techniques, Permutation and Combinations, Pigeon hole Principle, Recurrence Relation and Generating Functions.

UNIT - III

Introduction to Graph Theory: Definition, examples and basic properties of graphs, pseudographs, complete graphs, bipartite graphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, Travelling Salesman Problem, Shortest path Method using Dijkstra's algorithm.

UNIT – IV

Group Theory: Groups and properties, Subgroups (finite groups), Cyclic groups, Permutation groups, Normal Subgroup, Isomorphism and Homomorphism.

Coding of Binary Information and Error Detection, Hamming codes, Decoding and Error Correction using Parity-Check matrix decoding.

Reference Books:

1. *K. E. Rosen, Discrete mathematics and its applications, 7th. Edition, MGH, 2011.*

2. *B. Kolman, R. C. Busby, S. Ross, Discrete Mathematical Structures, 10th. Edition, Pearson, 2015*

3. *Trembley & Manohar, Discrete Mathematical Structure with Applications to Computer Science, 1st. Edition, MGH, 2001.*

4. *Thomas Koshy, Discrete Mathematics with Applications, 1st. Edition, Elsevier, 2008.*

COURSE OUTCOMES:

The students will be able to:

CO1: Describe fundamental mathematical concepts and terminology.

CO2: Understand circuit design using Boolean algebra concepts.

CO3: Apply counting principles of different types of discrete structures.

CO4: Analysis of recursive definitions.

CO5: Evaluates the techniques for constructing mathematical proofs using examples.

CO6: Design solutions based on Graph Theory, Coding Theory and Group Theory.

BCA2009   ORGANIZATIONAL BEHAVIOR   CREDITS: 3

UNIT - I

Introduction to OB: Nature and Scope of OB, Evolution and importance, Theoretical Framework and Model of OB

UNIT - II

Foundations of individual behavior: Values, attitudes and job satisfaction; Personality and emotions; Perception and individual decision making

UNIT - III

Group Dynamics: Evolution and importance of OB Theories in understanding Group behavior at work; Understanding work teams; Motivation; Understanding group formation and group behavior; Group and Organizational decision making; Organizational communications; Leadership.
Organizational Power and Politics: Nature of organizational politics, Introduction to Power Authority and Influence, Negotiation Process

UNIT - IV

Organizational Culture and Change: Resistance to Change, Managing and Implementing Change
Organizational Conflict: Types and Stages of Conflict, Management of Conflict
Organization Structure & Design: Emerging Organizational Dynamics

Reference Books:

1. *Stephen P. Robbins, Essentials of Organizational Behavior, 14th. Edition Pearson, 2019.*

2. *Uma Sekharan, Organizational Behavior, 2nd. Edition, MGH, 2004.*

3. *Pareek. U. Understanding Organizational Behavior (2nd ed.). Oxford University Press, 2010*

4. *Schermerhorn, J. R., Osborn, R.N., Hunt, M.U.J . Organizational Behavior, 12th ed. Wiley. 2016*

COURSE OUTCOMES:

The students will be able to:

CO1: Nature and Scope of OB, Evolution and importance, Theoretical Framework and Model of OB.

CO2: Values, attitudes and job satisfaction; Personality and emotions; Perception and individual decision making.

CO3: Evolution and importance of OB Theories in understanding Group behavior at work; Understanding work teams; Motivation; Understanding group formation and group behavior; Group and Organizational decision making; Organizational communications; Leadership.

CO4: Nature of organizational politics, Introduction to Power Authority and Influence, Negotiation Process.

CO5: Resistance to Change, Managing and Implementing Change.

CO6: Emerging Organizational Dynamics.

FOURTH SEMESTER (SPRING)

BCA2002   WEB DESIGNING AND PROGRAMMEMING   CREDITS: 3

UNIT - I

Introduction to HTML: HTML tag and elements, essentials of web page, using tags, making ordered and unordered list using bullets or numbers.

Page Formatting and Hyperlinks in HTML: Page formatting, Background with image and text colour, Linking pages using text or image hyperlink, Changing colours of links, Changing pointer of hyperlink and creating internal links in same document.

Frames and Graphics: Dividing a window with frames, Nesting framesets and Inline frame, Adding graphics in the page, Inline Image, Floating Image, Border of image, Managing Horizontal and Vertical Space of the image and image as Hyperlink.

HTML Tables: Creating tables and arranging items into table by using tags with attributes for Cellpadding, Cell spacing, Border, Align, Valign, Bgcolor, Spanning Cell using (Colspan, Rowspan), Font, Width, Size attributes, Nesting Table, Background Image in the Cell or in Table.

UNIT - II

Cascading Style Sheet and Forms: Style and Style Sheet: Use inline style with html tags, Embedded Style, External style sheet using Use text properties, Box properties, Color and Background Properties, List Properties in Style, Making style Classes and designing forms.

UNIT - III

JavaScript Fundamentals: Client-Side Programming: JavaScript Language, History and versions of JavaScript , Introduction to JavaScript , JavaScript in Perspective , Basic Syntax ,Variables and Data Types , Statements , Operators , Literals , Functions - Objects - Arrays , Built-in Objects, Host Objects:

Browsers and the DOM , Introduction to the Document Object Model, Intrinsic Event Handling, DOM History and Levels.

UNIT – IV

Apache HTTP Server: Concept of Web Server, Obtaining and Installing Apache Http Server on Windows and Linux Editing httpd.conf configuration file, Configuration directives in httpd.conf - ServerRoot, PidFile, ServerName, Add site to /etc/hosts file, DocumentRoot, ErrorLog, Listen, Directory, Files, Location, Redirect, Virtual Hosts, Modules.

Reference Books:

1. *Ivan Bayross, HTML, DHTML, JavaScript, Perl & CGI, 3rd. Edition, BPB Pub. 2005*
2. *Jon Duckett, Beginning HTML, XHTML, CSS, and Javascript, 1st. Edition (Paperback), Wiley India Pvt Ltd, 2010.*
3. *Julie C. Meloni, Sams Teach Yourself HTML, CSS, and JavaScript All in One, 1st. Edition (Paperback), Pearson, 2012.*
4. *Thomas Powell, HTML & CSS:The Complete Reference, 5th. Edition, MGH*
5. *Thomas Powell, Fritz Schneider, JavaScript: The Complete Reference, 3rd. Edition, 2017.*

COURSE OUTCOMES:

The students will be able to:

CO1: Identify the concepts of the Web & Markup Languages.

CO2: Practice and develop web Applications using HTML, CSS & Frameworks.

CO3: Distinguish and practice on client-side and server-side Internet Programming.

CO4: Identify the concepts of JavaScript.

CO5: Working with AJAX, Servlet and JSP.

CO6: Design and implement fully operational websites.

BCA2004   SOFTWARE ENGINEERING   CREDITS: 4

UNIT - I

Software Process: Introduction, S/W Engineering Paradigm, life cycle models (water fall, incremental, spiral, evolutionary, prototyping, object oriented), System engineering, computer based system, verification, validation, life cycle process, development process, system engineering hierarchy.

Software requirements: Functional and non-functional, user, system, requirement engineering process, feasibility studies, requirements, elicitation, validation and management, software prototyping, prototyping in the software process, rapid prototyping techniques, user interface prototyping, S/W document. Analysis and modelling, data, functional and behavioural models, structured analysis and data dictionary.

UNIT - II

Design Concepts and Principles: Design process and concepts, modular design, design heuristic, design model and document, Architectural design, software architecture, data design, architectural design, transform and transaction mapping, user interface design, user interface design principles. Real time

systems, Real time software design, system design, real time executives, data acquisition system, monitoring and control system.

UNIT - III

Testing: Taxonomy of software testing, levels, test activities, types of s/w test, black box testing, boundary conditions, structural testing, test coverage criteria based on data flow, mechanisms, regression testing, testing in the large. S/W testing strategies, strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging.

UNIT - IV

Software Project Management: Measures and measurements, S/W complexity and science measure, size measure, data and logic structure measure, information flow measure. Estimations for Software Projects, Empirical Estimation Models, Project Scheduling.

Trends in Software Engineering: Reverse Engineering and Re-engineering – wrappers – CASE tools.

Reference Books:
1. *Roger S. Pressman, Software engineering- A practitioner's Approach, 7th Edition, MGH, 2017.*
2. *Ian Sommerville, Software engineering, 8th Edition, Pearson, 2011.*
3. *Pankaj Jalote, Software Engineering: A precise approach, Wiley, 2010.*
4. *James F Peters and Witold Pedryez, Software Engineering – An Engineering Approach,Wiley, 2010.*

COURSE OUTCOMES:

The students will be able to:

CO1: Identify requirements of the software projects.

CO2: Understand the software requirements and translate them to Design and development process.

CO3: Apply and map various testing methods to the phases of SDLC.

CO4: Analyse the basic project management practices and tools in real life projects.

CO5: Evaluate various quality factors for software.

CO6: Develop small real-world project with the help of software engineering concepts.

BCA2006	OPERATING SYSTEMS	CREDITS: 3

UNIT - I

Introduction: System Software, Resource Abstraction, OS strategies.

Types of operating systems: Multiprogramming, Batch, Time Sharing, Single user and Multiuser, Process Control & Real Time Systems.

Operating System Organization: Factors in operating system design, basic OS functions,

Implementation consideration; process modes, methods of requesting system services, systemcalls and system programs.

UNIT - II

Process Management: System view of the process and resources, initiating the OS, process address space, process abstraction, resource abstraction, process hierarchy, Thread model.

Scheduling: Scheduling Mechanisms, Strategy selection, non-pre-emptive and pre-emptive strategies.

UNIT - III

Memory Management: Mapping address space to memory space, memory allocation strategies, fixed partition, variable partition, paging, virtual memory.

Deadlock: Deadlock criteria, prevention, avoidance, detection and recovery algorithm.

UNIT - IV

File Systems: File system implementation, directories, security and protection mechanism.

Shell introduction and Shell Scripting: Shell and its types, editors in Linux, modes of operation in vi editor, shell scripting, writing and executing shell scripts, shell variables, system calls, pipes and filters, decision making in shell scripts, functions, utility programs and pattern matching utility.

Reference Books:

1. *A. K. Sharma Operating System Universities Press, 2016.*
2. *A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 9th. Edition, Wiley, 2015.*
3. *A.S. Tanenbaum, Herbert Bos, Modern Operating Systems, 4th. Edition, Pearson 2016.*
4. *W. Stallings, Operating Systems, Internals & Design Principles, 9th. Edition, Pearson, 2017.*
5. *M. Milenkovic, Operating Systems- Concepts and design, 2nd Edition, MGH, 2001.*
6. *G. Nutt, "Operating Systems: A Modern Perspective", 2nd Edition, Pearson, 1997.*

COURSE OUTCOMES:

The students will be able to:

CO1: Define fundamentals of Operating System.

CO2: Compare processes scheduling algorithms.

CO3: Apply the concepts of memory management, paging and virtual memory.

CO4: Analyse and discuss the policies of synchronization.

CO5: Evaluate the uses of system call.

CO6: Develop interaction techniques among the various components of computing system.

<u>**BCA2008   PROFESSIONAL COMMUNICATION   CREDITS: 2**</u>

UNIT – I

Introduction: Introduction to Soft Skills, Significance of hard skills and soft skills, Employability and Career Skills , Grooming Skills, Tips and tricks to enhance marketability skills.

UNIT – II

Self Introduction: Organizing material, introducing oneself to the audience, introducing a topic to the audience, The Art of presentation, Presentation strategies.

UNIT – III

Group Discussion: Introduction to Group Discussions, Types of Group Discussions, Participating in Group Discussions, Understanding group dynamics, Strategies for Group Discussion.

UNIT – IV

Resume: Resume Basics, Making a resume, Making a cover letter, Types of Resumes, Tips and tricks to design an effective resume.

Interview – Basics of an Interview, Interview Etiquette, Types of Interviews, Interview Strategies, Dress Code, and FAQ's related to job interviews.

Reference Books:

1. *Butterfield, Jeff, Soft Skills for Everyone 1st. Edition, Cengage Learning, 2011.*
2. *C.L. Bovee, J.V. Thill & R.L. Raina, Business Communication Today , 14th. Edition Pearson,*
3. *E. Suresh Kumar (et-al), Communication for Professional Success. Orient Black swan, 2013.*
4. *Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press.*
5. *S. Hariharanetal. Soft Skills. MJP Publishers.*

COURSE OUTCOMES:

The students will be able to:

CO1: To understand the relevance and importance of proper communication.

CO2: To sharpen the communication proficiency as students gain practical knowledge about how to deal and interact with others.

CO3: Create effective technical presentations.

CO4: Establish the importance of listening skills and apply listening techniques for specific needs.

CO5: Create professional and technical documents that are clear and adhering to all the necessary conventions.

CO6: To understand the professional world and enhance one's skills for effective employability.

| **BCA2012** | **NUMERICAL METHODS** | **CREDITS: 4** |

UNIT - I

Approximation and Error: Fixed point arithmetic, absolute and relative errors, rounding error, truncation error, loss of significance and error propagation, condition and stability, computational methods for error estimation, convergence of sequences, some mathematical preliminaries.

Numerical solution of equations: method of bisection and regular false. Method of fixed point iteration and Newton-Raphson method in one unknown, Conditions of convergence, rates of convergence and geometrical interpretation of each method.

UNIT - II

System of linear algebraic equations: Gaussian elimination method, Gauss Jordan method, Gauss Jacobi method, Gauss Seidel method, LU decomposition method, and their convergence analysis.

Eigen value problem: Computing Eigen value and eigenvectors, Determination of Eigen values and Eigen vectors of a matrix by iteration.

UNIT - III

Interpolation: Polynomial approximation, Difference Table, forward difference, backward difference and central Difference, linear and higher order, finite difference operators.
Newton's Forward, Backward and divided difference interpolation formulae and Lagrange's general interpolation formula, piecewise polynomial methods Error terms, Inverse interpolation.

UNIT – IV

Ordinary Differential Equations: Euler's method, Runge-Kutta methods of orders two and four.
Numerical differentiation and integration: Differentiation formulae, integration by trapezoidal rule.
Curve Fitting: Least square approximation of functions by linear regressing, polynomial regression.

Reference Books:

1. *Kendall Atkinson, An Introduction to Numerical Analysis, 2nd Edition, Wiley, 2008.*
2. *Richard L. Burden, Numerical Analysis, 9th Edition, Cengage Learning India.2012.*
3. *John H. Mathews and Kurtis D. Fink, Numerical Methods using MATLAB, 4th Edition, PHI Learning Private Limited, 2012.*
4. *Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.*
5. *M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Edition, New age International Publisher, India, 2007.*
6. *C. F. Gerald, P. O. Wheatley, Applied Numerical Analysis, 7th Edition, Pearson Education, 2007.*

COURSE OUTCOMES:

After Completion of the course the student will be able to

CO1: Familiar with calculation and interpretation of errors in numerical method.

CO2: Use various interpolation methods and finite difference concepts.

CO3: Apply numerical methods to find numerical solution of system of algebraic equations.

CO4: Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.

CO5: Solve ordinary differential equations using different methods through the theory of finite differences.

CO6: Fit the simple linear regression equation for a set of data using least square method.

FIFTH SEMESTER (AUTUMN)

BCA3001   **OPEN SOURCE TECHNOLOGY**   **CREDITS: 3**

UNIT - I

Open Source and Linux: Open Source Definition, The distribution terms of open source software, open source technology importance, Free and Open Source Software (FOSS), LAMP (Linux, Apache, MySQL, PHP, Python, and Perl.).

Benefits, Perspectives of Open Source software: License, Important FOSS Licenses (Apache, BSD, GPL, and LGPL), copyrights and copylefts.

Linux and Open Source, Linux Usage Basics: Logging into the system, changing users and editing text files, Running Commands and Getting Help, Browsing the File system, Users, Groups and Permissions.

UNIT – II

Linux Administration: Installation of   Linux interactively, Perform user and group administration, Administer the Linux printing subsystem, Install, update, query and remove software packages with RPM

Linux Application: Accessing and Running Applications: cc compiler, gcc Compiler, Mozilla Firefox. Multimedia in Linux: Listening to Audio, Playing video, Using Digital Camera, Recording music / video CDs. Publishing: Open office, working with Graphics, Printing Documents, Displaying documents with Ghostscript   and Acrobat

Apache and PHP: Introduction to Web server, Installing Apache on Linux: httpd service. **PHP:** Testing installation. Basics of PHP scripts, Variables, Data types, Operators and Expressions, Constants, Flow control functions, if statement, Loops, Arrays, Strings, Dates and Times, Forms.

UNIT - III

MySQL Server and Application: Configuring MySQL Server, working with MySQL Databases, MySQL Tables, SQL Commands – INSERT, SELECT, UPDATE, REPLACE, DELETE, Date and Time functions in MySQL.

UNIT – IV

PHP – MySQL Application Development: Connecting to MySQL with PHP, Inserting data with PHP, Retrieving data with PHP. Developing PHP scripts for dynamic web page like Feedback form, online admission form, online test.

Reference Books:
1. *Christopher Negus, Red Hat Linux Bible, Wiley Publishing, 2009.*
2. *Julie C. Meloni, PHP, MySQL and Apache, Pearson, 2008.*
3. *Peterson, The Complete Reference Linux, McGRAW HILL, 1998.*
4. *Jack Dent, Tony Gaddis, UNIX using Linux, Course Technology, Thomson Learning, 2005.*

COURSE OUTCOMES:

The students will be able to:

CO1: Understand common open source licenses and the impact of choosing a license.

CO2: Explain open source project structure and how to successfully setup a project

CO3: Identify, install and run Linux operating system and manage applications.

CO4: Identify, install open source web technologies Apache, MySql, PHP.

CO5: Develop web applications using LAMP.

CO6: Write session control PHP code for a website

| BCA3003 | JAVA PROGRAMMEMING | CREDITS: 4 |

UNIT - I

Fundamentals Of Object Oriented Programming–: Introduction, Object Oriented paradigm, Basic Concepts of OOP, Benefits of OOP, Applications of OOP,

Java Features: Overview of Java Language: Introduction, Simple Java program structure, Java tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Command line arguments. Constants, Variables & Data Types: Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Value to Variables, Scope of variables, Symbolic Constants, Type casting, Getting Value of Variables, Standard Default values; operator & expressions.

UNIT - II

Decision Making & Branching: Introduction, Decision making with if statement, Simple if statement, if. Else statement, Nesting of if. else statements, the else if ladder, the switch statement, the conditional operator. Looping: Introduction, The While statement, the do-while statement, the for statement, Jumps in loops.

Classes, Objects & Methods: Introduction, Defining a class, Adding variables, Adding methods, Creating objects, Accessing class members, Constructors, Method overloading, Static members, Nesting of methods.

UNIT - III

Inheritance: Extending a class, Overriding methods, Final variables and methods, Final classes, Abstract methods and classes;

Arrays and Strings: One-dimensional arrays, Creating an array, Two – dimensional arrays, Strings, Vectors, Wrapper classes;

Interfaces: Multiple Inheritance: Introduction, Defining interfaces, Extending interfaces, Implementing interfaces, Assessing interface variables;

Managing Errors and Exceptions: Types of errors, Compile-time errors, Runtime errors, Exceptions, Exception handling, Multiple Catch Statements, Using finally statement

Packages: Introduction, Java API Packages, Using System Packages, Naming conventions, Creating Packages, Accessing a Package, using a Package.

UNIT – IV

Managing Input/Output Files in Java: Introduction, Concept of Streams, Stream classes, Byte Stream Classes, Input Stream Classes, Output Stream Classes, Character Stream classes: Reader stream classes, Writer Stream classes, Using Streams, Reading and writing files.

Multithreaded Programming: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Lifecycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface.

Reference Books:

1. *Dr R Nageswara Rao, Core Java: An Integrated Approach, New: Includes All Versions upto Java 8, 3rd Edition (Updated), DreamTech Press, 2016*
2. *John R. Hubbard, Programming with Java, 2nd. Edition, Schaum's outline Series, MGH, 2004*
3. *Patric Naughton, Herbert Schildt, Java 2 Complete Reference, MGH*
4. *Paul Deital& Harvey Deital, ava: How to Program, Pearson Education.*

COURSE OUTCOMES:

The students will be able to:

CO1: Describe the differences between object-oriented programming and procedural programming.

CO2: Understand the fundamental concepts of object-oriented programming.

CO3: Apply the advanced concept of object-oriented programming such as inheritance and polymorphism.

CO4: Analyse the additional features of JAVA that are not available in function-oriented programming languages such as exceptional handling, Interface, collection classes, etc.

CO5: Evaluate the functionalities like Multithreading and Networking with JAVA

CO6: Develop small scale projects using AWT, swings and JDBC.

BCA3005   ARTIFICIAL INTELLIGENCE   CREDITS: 3

UNIT - I

Introduction: Overview of A.I: Introduction to AI, Importance of AI, AI and its related field, AI techniques, Criteria for success.

Intelligent Agents: Agents and environment; Rationality; The nature of environment; The structure of agents.

UNIT - II

Solving Problems by Searching: Problem-solving agents; Well defined problems & solutions; Formulating problems; Searching for solution;

Uninformed search strategies: (BFS, DFS, DLS, IDDFS, Bidirectional Search) **Informed Search and Exploration**: Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

UNIT - III

Constraint Satisfaction Problems: Constraint satisfaction problems; Backtracking search for CSPs; Local search for CSPs.

UNIT – IV

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic: Propositional logic Reasoning patterns in propositional logic.

First-order Logic: Syntax and semantics of first-order logic; Use of first-order logic.

Reference Books:

1. *Lavika Goel, Artificial Intelligence Concepts and Applications, Wiley, 2021*
2. *Stuart Russel, Peter Norvig Artificial Intelligence: A Modern Approach, 3rd Edition (Updated), Pearson, 2009*
3. *Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence 3rd Edition, Tata McGraw Hill, 2008*
4. *Introduction to Artificial Intelligence and Expert Systems- Dan W. Patterson 2nd Edition, PHI, 2009.*
5. *Nils J. Nilsson, Artificial Intelligence: A new Synthesis –1st Edition, Elsevier, 1997*

COURSE OUTCOMES:

The students will be able to:

CO1: Describe the key components of the artificial intelligence (AI) field

CO2: Explain search strategies and solve problems by applying a suitable search method

CO3: Apply artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning

CO4: Analyse and apply probability theorem, Bayesian networks, knowledge representation.

CO5: Describe and list the key aspects of planning in artificial intelligence

CO6: Design and implement appropriate solutions for search problems and for planning problems.

BCA3007 INFORMATION SECURITY CREDITS: 3

UNIT - I

Introduction: Security Goals (CIA), Steps for Better Security, Category of Computer Security, Security Services, Network Security, Hacking, Security Threats and Attacks.

Classical Encryption Techniques: Cryptography, Substitution Ciphers, Transposition Ciphers, Cryptanalysis, Steganography.

UNIT - II

Modern Encryption Techniques: Block Ciphers, Feistel Ciphers, Data Encryption Standard (Simplified-DES), Triple DES, Stream Ciphers.

Public Key Cryptosystems: Public Key Cryptography, RSA Algorithm, Key Distribution.

UNIT - III

Authentication Methods: Message Digest, Digital Signatures, X.509 Digital Certificate Standard**,** Access Control- Owner, Custodian and User.

Security at Network Layer: Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)

UNIT - IV

Monitoring Networks: Intrusion Detection, Worms, Viruses, Trojans, Bots, Attacks, Virus Countermeasures, Firewalls, Computer Forensics.

Cyber Security: India IT act 2000, Penalties & Offences under the Information Technology Act, 2000, Cyber forensics.

Reference Books:

1. *V. K. Pachghare, Cryptography and Information Security, 2ndEdition, PHI, 2015*
2. *Michael E. Whitman, Principles of Information Security, Cengage, 5thEdition, 2015*
3. *M. Stamp, Information Security: Principles and Practice,2nd Edition, Wiley*
4. *William Stallings, Cryptography and Network Security Principles and Practices, 7thEdition, Pearson Education, 2017.*
5. *Mark Rhodes-Ousley, Information Security: The Complete Reference, McGraw Hill Education, 2ndEdition, 2013.*

COURSE OUTCOMES:

The students will be able to:

CO1: Identify security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.

CO2: Compare symmetric and asymmetric encryption systems and their vulnerability to various attacks.

CO3: Apply block and stream ciphering techniques, sign and verify messages using well known signature generation and verification algorithms.

CO4: Analyse the existing authentication and key agreement protocols; identify the strength and weaknesses of these protocols.

CO5: Evaluate the performance of firewalls and security.

CO6: Develop applications for protocols like SSL, IPSec, PGP and access control mechanisms.

SIXTH SEMESTER (SPRING)

BCA3004   **INTRODUCTION TO DATA SCIENCE**   **CREDITS: 4**

UNIT - I

Introduction: Introduction to data science. Big data and data science. Datafication. Roles of data scientist in Academia and Industry.

Statistical Inference: Population and samples, Statistical modelling, probability distributions, fitting a model.

Exploratory Data Analysis: Basic tools of EDA, Philosophy of EDA, Data Science Process.

UNIT - II

Algorithms: Machine Learning Algorithms, Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes, Data Wrangling

Feature Generation and Feature Selection: Extracting meaning from data, Feature selection algorithms: Filters, Wrappers, Decision Trees, Random Forests

UNIT - III

Recommendation Engines: Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis

Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs

UNIT - IV

Data Visualization: Data visualization history, basic principles, ideas and tools for data visualization. Examples of data visualization projects.

Data Science and Ethical Issues: Data science and risk. Detecting suspicious activity using Machine Learning. Privacy, security and ethics.

Reference Books:

1. *Rachel Schutt and Cathy O'Neil, Doing Data Science - Straight from the Frontline, O'Reilly 2013.*
2. *SinanOzdemir, Principles of Data Science, Packt Publication 2016*
3. *Joel Grus, Data Science from Scratch, O'Reilly 2015*
4. *Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press 2016*

COURSE OUTCOMES:

The students will be able to:

CO1: Have a clear idea about the big data flow and its ecosystem.

CO2: Apply the tools and techniques on big data while applying data mining techniques.

CO3: Use statistical tool and statistical methods that can be applied on big data.

CO4: Have a clear idea about how to represent the unstructured data in the data bases.

CO5: Understand the common Hadoop ecosystem components, Hadoop Architecture, HDFS,

CO6: Anatomy of File Write and Read, Rack Awareness & Understand Hadoop Map Reduce framework and the working of MapReduce on data stored in HDFS.

BCA3006   ENVIRONMENTAL SCIENCE   CREDITS: 2

UNIT - I

Multidisciplinary nature of environmental studies: Definition, scope and importance

Natural Resources: Renewable and non-renewable resources, natural resources and associated problems. a) Forest resources b) Water resources c) Mineral resources d) Food resources e) Energy resources f) Land resources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem.

Biodiversity: Introduction. Definition: genetic, species and ecosystem diversity. Bio geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India.

Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution: Definition, cause, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT - III

Social Issues and the Environment: From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns.

Environmental Ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, issues involved in enforcement of environmental legislation, public awareness.

UNIT - IV

Human Population and the Environment: Population growth, variation among nations, population explosion – Family Welfare Program,. Environment and human health. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of information technology in environment and human health.

Reference Books:

1. *Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses (UGC), 2nd Edition University Press.*

COURSE OUTCOMES:

The students will be able to:

CO1: Know the importance of environmental studies and methods of conservation of natural resources.

CO2: Describe the structure and function of an ecosystem.

CO3: Identity the values and conservation of bio-diversity.

CO4: Explain the causes, effects and control measures of various types of pollutions.

CO5: Select the appropriate methods for waste management.

CO6: Get knowledge about various disaster management methods and recall social issues and legal provision.

ELECTIVE -1

| BCA3012 | COMPUTER GRAPHICS | CREDITS: 3 |

UNIT – I

Introduction: Elements of graphics workstation, Video Display Devices- Raster Scan Systems, Random Scan Systems, Input Devices Algorithms: Line drawing algorithms- DDA Algorithm, Bresenham's Line Algorithm, Frame Buffers. Circle and ellipse generating algorithms- Midpoint Circle Algorithm, Midpoint Ellipse Algorithm, Polynomials and spline curves, Filled -Area Primitives, Scan-Line Polygon Fill Algorithm, Inside-Outside Tests, Scan-Line Fill of Curved Boundary Areas, Boundary-Fill Algorithm, Flood-Fill Algorithm.

UNIT – II

Attributes of Output Primitives: Line Attributes- Line Type, Line Width, Pen and Brush Options, Line Color, Color and Grayscale levels- Color Tables, Grayscale, Area-Fill Attributes- Fill Styles, Pattern Fill, Soft Fill, Character Attributes, Text Attributes. Geometric Transformations: Matrices, 2D transformations, Homogeneous representations – other transformation, Two-Dimensional Viewing, The viewing pipeline, Viewing Coordinate Reference Frame, Window-to-viewport Coordinate Transformation, Two-Dimensional Viewing Functions, Clipping Operations- Point Clipping, Line Clipping, Cohen-Sutherland Line Clipping, Polygon Clipping, Sutherland-Hodgeman Polygon Clipping.

UNIT – III

Three -Dimensional Concepts: Three -Dimensional Display Methods- Parallel Projection, Perspective Projection, Visible Line and surface Identification, Surface Rendering, Three Dimensional Object Representations, 3D transformations, Bezier Curves and surfaces.

UNIT – IV

Visibility, Image and Object Precision: Z-buffer algorithm, Floating horizons, Computer Animations, Design of Animation Sequences, General Computer Animation Functions, Raster Animations, Key-Frame Systems, Morphing, Motion Specifications.

Reference Books:
1. *Donald Hearn & M. Pauline Baker, Computer Graphics,,VIIEdition, PHI*
2. *Steven Harington, Computer Graphics HilJr Computer Graphics, MGH*
3. *Zhigang Xiang, Roy A. Plastock, Computer Graphics, MGH*
4. *Er. Rajiv Chopra, Computer Graphics, S. Chand.*
5. *W. M. Newmen, R.F. Sproull, Principles of Interactive Computer Graphics, McGraw Hill.*

COURSE OUTCOMES:

The students will be able to:

CO1: Explain the core concepts of computer graphics.

CO2: Understand a typical graphics pipeline.

CO3: Apply various algorithms to scan convert the basic geometrical primitives, transformations, area filling, clipping.

CO4: Analyse the importance of viewing and projections in both 2D and 3D.

CO5: Evaluate the various factors of color and shading.

CO6: Design animations using related technologies.

BCA3014   MULTIMEDIA AND APPLICATIONS   CREDITS: 3

UNIT-I

Introduction: Multimedia Basics, The Multimedia Highway, use of Multimedia, Introduction to making multimedia, Multimedia skills and Training: The team. Introduction: Multimedia Literature, Media & Data Streams, types of medium: Perception Medium, Representation Medium, Presentation Medium, Storage Medium, Informal Exchange, Values, Representation spaces, and Representation Dimension, Main properties of Multimedia System, Data Streams: Characteristics for continuous & discrete media, Basic Concepts of Sound /Audio, Music, Speech, Image Graphics & Computer Image Processing,

Images and Animation: Images: Before you start to create, Making still images, colour Image file formats. Animation: Principles of Animation, Making Animations that Work. Video: Using video, how video works, Broadcast video standards, video tips, Recording formats, Digital video, basic concepts of Video & Animation.

UNIT II

Encoding & Data Compression: Storage Space, Coding Requirements, Source, Entropy & Hybrid Coding, Compression (Lossy & Lossless): Runlength Coding, Huffman Coding, Shannon–Fano coding, Arithmetic Coding, LZW Coding.

UNIT III

Computer Technology: Communication Architecture, Multimedia Workstation, Multimedia Operating System, Networking system, Multimedia Communication System (Application Subsystem, Transport Subsystem, Quality of Service and Resource Management), Database Systems (Data Analysis, Data Structure).

Multimedia Software: Basic Tools: Text editing and word processing tools, OCR Software, painting and drawing tools, 3D modelling and animation tools, Image editing tools, Sound editing tools, Animation video and Digital Movie Tools. Making instant Multimedia: Linking multimedia objects, Office suites.

UNIT IV:

Documents: Hypertext and MHEG (Documents, Hypertext and Hypermedia, Document Architecture SGML, Document Architecture ODA, MHEG), User and Interface, Synchronization (Notion of Synchronization, Presentation Requirements).

Multimedia Applications: Media Preparation, Media Composition, Media Integration, and Media Communication.

Reference Books:

1. *Steinmetz R. and Nahrstedt K. Multimedia: Computing, Communications & Applications, Pearson Education, 1995.*
2. *Vaughan Tay, Multimedia: Making it Work, McGraw Hill., 5th. Edition, 2006.*
3. *Halsall F., Multimedia Communications, Pearson Education, 2001.*

COURSE OUTCOMES:

The students will be able to:

CO1: Understand multimedia in respect to many applications including business, schools, home, education, and virtual reality.

CO2: Demonstrate in-depth knowledge in an industry-standard multimedia development tool and its associated scripting language

CO3: Create time-based and interactive multimedia components

CO4: Describe various forms of keyframe interpolation, puppetry, masking and painting

CO5: Identify and define problem with computing requirements appropriate to its solution.

CO6: Analyse the cost involved in multimedia planning, designing, and producing.

BCA3016   OPERATIONS RESEARCH   CREDITS: 3

UNIT-I

Introduction to Operations Research: Origin and Development of OR, characteristics of OR, limitations of OR, methodologies and applications of OR.

Linear Programming: Concept of linear programming model, mathematical formulation of the problem, Graphical solution methods, Simplex method, Big-M Methods.

UNIT II

Transportation Problem: Mathematical models for transportation problem, types and solution methods.

Assignment Problem: Mathematical model for assignment problem. Types of assignment problem. Hungarian method.

UNIT III

Network Scheduling: CPM / PERT - Introduction, basic concept, constraints in network, critical path method (CPM), PERT network , PERT calculations. Time –cost –Trade _off Aspects in Network technique, advantages of network (PERT/CPM).

UNIT IV

Duality Concepts: Formulation of a Dual Problem, Dual Simplex Method.

Game Theory: Introduction, Maximin-Minimax Principle, 2-player problem, Games with Saddle point.

Reference Books:

1. *D.S Hira and Prem Kumar Gupta, Problems in Operations Research, S.Chand, 2010.*
2. *Hamdy A Taha, Operations Research an Introduction, 8th Edition, Prentice Hall, 2006.*
3. *S D Sharma, Operations Research Theory and Applications, S.Chand, 2009.*

COURSE OUTCOMES:

The students will be able to:

CO1: To define what is meant by operations research, and account for which phases are normally part of a study applying operations research.

CO2: To describe the assumptions on which linear programming (LP) is built to formulate LP models on the basis of verbal problem descriptions.

CO3: To solve LP problems graphically (for two variables), by using spreadsheets, and by hand using the simplex method, both algebraic and in tabular form.

CO4: To formulate and solve a number of network models.

CO5: To set up decision models and use some solution methods for Transportation and Assignment optimization problems.

CO6: Analyse the cost involved in project planning, designing, and managing.

BCA3018   WIRELESS SENSOR NETWORKS   CREDITS: 3

UNIT I

Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum, radio propagation mechanisms, characteristics of the wireless channel, mobile ad hoc networks (MANETS) and wireless sensor networks (WSNs): concepts and architectures. Applications of ad hoc and sensor networks, Design challenges in ad hoc and sensor networks.

UNIT II

Mac Protocols For Ad Hoc Wireless Networks: Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11.

UNIT III

Wireless Sensor Networks (WSNs) and Mac Protocols: Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

UNIT IV

WSN Routing, Localization &Qos: Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

Reference Books:

1. *C. Siva Ram Murthy, B.S. Manoj, Ad Hoc Wireless Networks: Architecture and Protocols, PHI*
2. *Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007.*
3. *Ian F. Akyildiz and Mehmet Can Vu, Wireless Sensor Networks -John Wiley and Sons Ltd, Publication,2010.*
4. *Jun Zhny and Abbos Jama Lipcar, Wireless Sensor Network - a networking perspective ,Wiley 2009.*
5. *C. Raghavendram, K Sivalingam and T. Znati, Wireless Sensor Network, Springer, 2005.*

COURSE OUTCOMES:

The students will be able to:

CO1: Describe the unique issues in ad-hoc/sensor networks.

CO2: Understand current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.

CO3: Explain the challenges in designing MAC, routing and transport protocols for wireless adhoc sensor networks.

CO4: Gain knowledge on implementation of protocols on a sensor test bed network.

CO5: Explain the principles of mobile ad hoc networks (MANETs)

CO6: Explain the principles and characteristics of wireless sensor networks (WSNs).

BCA 3022   GRAPH THEORY   CREDITS: 3

UNIT I

Graphs: Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness – Components – Euler Graphs – Hamiltonian Paths and Circuits.

Trees: Properties of trees – Distance and Centers in Tree – Rooted and Binary Trees.

UNIT II

Spanning Trees: Fundamental Circuits –Spanning Trees in a Weighted Graph – Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network flows –-Isomorphism – Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.

UNIT III

Incidence Matrix: Submatrices – Circuit Matrix – Path Matrix – Adjacency Matrix – Chromatic Number – Chromatic partitioning – Chromatic polynomial - Matching - Covering – Four Color Problem

Directed Graphs: Types of Directed Graphs – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs – Adjacency Matrix of a Digraph.

UNIT IV

Algorithms: Connectedness and Components: Spanning tree – Finding all Spanning Trees of a Graph – Set of Fundamental Circuits – Cut Vertices and Separability – Directed Circuits.

Algorithms: Shortest Path Algorithm – DFS – Planarity Testing – Isomorphism.

Reference Books:

1. *Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", PHI, 2003.*
2. *R.J. Wilson, "Introduction to Graph Theory", Fourth Edition, Pearson Education, 2003.*
3. *Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.*
4. *Grimaldi R.P, "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 1994.*

COURSE OUTCOMES:

The students will be able to:

CO1: Explain vertices and their properties, types of paths, classification of graphs, and trees & their properties.

CO2: Demonstrate the fundamental theorems on Eulerian and Hamiltonian graphs.

CO3: Illustrate the working of Prim's and Kruskal's algorithms for finding the minimum cost spanning tree and Dijkstra's and Floyd-Warshall's algorithms for finding the shortest paths.

CO4: Explain planar graphs, their properties, and an application for planar graphs.

CO5: Illustrate how one can represent a graph on a computer.

CO6: Explain the Vertex Color problem in graphs and illustrate an example application for vertex coloring.

ELECTIVE – 2

BCA3024   INTERNET OF THINGS   CREDITS: 3

UNIT - I

Introduction to Internet of Things: Definition & Characteristics of IoT, Physical Design of IoT, Things, Protocols, Logical Design of IoT, Functional Blocks, Communication Models, Communication APIs.

IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analytics, Embedded Systems, IoT Levels (1 to 6) & Deployment Templates.

UNIT - II

Prototyping: Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community. Prototyping Embedded Devices: Electronics, Embedded Computing Basics, Developing on the Arduino, Raspberry Pi, Beaglebone Black, Electric Imp, Mobile Phone and Tablets, Plug Computing: Always-on Internet of Things. Prototyping the Physical Design: Preparation, Sketch, Iterate, and Explore, Non-digital Methods,

Laser Cutting, 3D Printing, CNC Milling, Repurposing/Recycling. Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions and other Protocols.

UNIT – III

Domain Specific IoTs: Home Automation, Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Smart Cities: Parking, Lighting, Smart Roads. Structural Health Monitoring, Surveillance, Emergency Response. Environment: Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection. Energy: Smart Grids, Renewable Energy Systems. Retail: Inventory Management, Smart Payments, Smart Vending Machines. Logistics: Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics. Agriculture: Smart Irrigation, Green House Control. Industry: Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle Health & Fitness Monitoring, Wearable Electronics.

UNIT - IV

IoT and M2M: Introduction, Difference between IoT and M2M. SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization.

Developing Internet of Things: IoT Platforms Design Methodology, Purpose & Requirements Specification, Process Specification, Domain Model, Information Model, Service Specifications, Functional View, Operational View, Specification, Device & Component Integration, Application Development.

Reference Books:

1. *Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015*
2. *Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.*
3. *Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.*
4. *Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.*

COURSE OUTCOMES:

The students will be able to:

CO1: Assess the vision and introduction of IoT.

CO2: Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

CO3: Understand IoT Market perspective.

CO4: Implement Data and Knowledge Management and use of Devices in IoT Technology.

CO5: Understand State of the Art - IoT Architecture.

CO6: Classify Real World IoT Design Constraints, Industrial Automation in IoT.

BCA3026   CLOUD COMPUTING   CREDITS: 3

UNIT - I

Introduction: Cloud Computing Overview, Origins of Cloud computing, Cloud components , Essential characteristics, On-demand self-service, Broad network access , Location independent resource pooling, Rapid elasticity , Measured service.

Cloud scenarios – Benefits: scalability,simplicity, vendors, security. Limitations, Sensitive information, Application development, Security concerns, privacy concern with a third party, security level of third party, security benefits Regularity issues, Government policies.

UNIT - II

Cloud architecture: Cloud delivery model – SPI framework, SPI evolution, SPI vs. traditional IT Model

Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and google platform, Benefits, Operational benefits, Economic benefits, Evaluating SaaS

Platform as a Service (PaaS): PaaS service providers, Right Scale, Salesforce.com, Rackspace, Force.com, Services and Benefits**.**

UNIT - III

Infrastructure as a Service (IaaS): IaaS service providers, Amazon EC2, GoGrid Microsoft soft implementation and support, Amazon EC service level agreement, Recent developments, Benefits

Cloud deployment model: Public clouds, Private clouds, Community clouds, Hybrid clouds, Advantages of Cloud computing.

UNIT - IV

Virtualization: Virtualization and cloud computing Need of virtualization, cost, administration, fast deployment, reduce infrastructure cost, limitations

Types of hardware virtualization: Full virtualization, partial virtualization, para virtualization desktop virtualization: Software virtualization, Memory virtualization, Storage virtualization, Data virtualization, Network virtualization

Microsoft Implementation: Microsoft Hyper V – Vmware features and infrastructure, virtual Box, Thin client.

Reference Books:

1. *RajkumarBuyya, James Broberg and Andrzej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publication.*
2. *Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Cloud Computing for Dummies Wiley Publication.*
3. *Thomas Erl, Cloud Computing: Concepts, Technology & Architecture, PHI*
4. *Michael Miller, Cloud computing, Pearson.*

COURSE OUTCOMES:

The students will be able to:

CO1: Identify the limitations of fixed networks.

CO2: Understand the network infrastructure requirements to support mobile devices and users.

CO3: Relate the different wireless technologies such as CDMA, GSM, GPRS, LTE, etc.

CO4: Compare the protocols and architectures employed in wireless local area networks and cellular networks.

CO5: Evaluate the techniques to design and develop a simple mobile application for smaller devices.

CO6: Design solutions using mobile computing techniques.

BCA3028   **E-COMMERCE**   **CREDITS: 3**

UNIT - I

Introduction: Types of E-commerce, Advantages and Disadvantages of E-commerce, Key concepts in E-commerce, Difference between E-commerce and E-Business, E-commerce opportunities for Industries, Threats of E-commerce, Growth of E-commerce, E-Commerce Business Models and Concepts.

UNIT - II

Technology Infrastructure for E-commerce: Key Technology Concepts, Internet Protocols, Hypertext, Building an E-commerce Presence, Choosing Software and Hardware, Web Server Software, Software Packages, The Hardware Platform.

UNIT - III

The E-commerce Security Environment: E-commerce Payment Systems, Types of Payment Systems, Online Credit Card Transactions: Mobile Payment Systems, Bitcoin, Digital signature, E-commerce Marketing And Advertising Concepts, Digital Commerce Marketing and Advertising Strategies and Tools, The Web Site as a Marketing Platform.

UNIT - IV

Understanding Ethical, Social, and Political Issues in E-commerce: A Model for Organizing the Issues, Basic Ethical Concepts, E-customer Relationship management and E-Supply Chain Management.

Reference Books:

1. *Kenneth C. Laudon, Carol Guercio Traver, E-commerce Business. Technology. Society, 10th Edition, Pearson, 2014*
2. *P.T.Joseph, S.J. E-Commerce-An Indian Perespective, 3rd Edition, PHI, 2009*
3. *Dave Chaffey, E-Business and E-Commerce Management Strategy, Implementation and Practice, 4th. Edition, PHI, 2009.*
4. *Gary P.Schneider, Electronic Commerce, 11th. Edition, Cengage, 2015*

COURSE OUTCOMES:

The students will be able to:

CO1: Explain the concept of ecommerce, infrastructure and its revolution.

CO2: Develop solutions for implementing an ecommerce website.

CO3: Discuss security of ecommerce and the ramifications of neglecting it.

CO4: Create a marketing plan and promotional plan for an ecommerce site.

CO5: Evaluate a payment system for a site.

CO6: Implement, in simulation or authentically, an ecommerce site.

BCA3032   DATA MINING   CREDITS: 3

UNIT - I

Introduction to Data Mining: Fundamentals of data mining, data mining functionalities, data and attribute types, statistical description of data.

Data Pre-processing: Data cleaning, data integration, data reduction, data transformation and data discretization.

UNIT - II

Data Warehouse Fundamentals: Introduction to Data Warehouse, OLTP Systems, OLAP, Differences between OLTP and OLAP, Characteristics of Data Warehouse, Functionality of Data Warehouse, Advantages and Applications of Data Warehouse, Advantages, Applications, Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development, Data Warehouse Types, Data cubes.

UNIT - III

Association Rules: Basic Algorithms for Association Rule, Incremental Association Rules, Measuring the Quality of Rules.

Classification: Introduction, Issues, Decision Tree Induction, Naïve Bayesian Classification, Classification based on Concepts from Association Rule Mining, Classifier Accuracy.

UNIT – IV

Cluster Analysis: Basic concepts, clustering structures, major clustering approaches, partitioning methods, hierarchical methods, density based methods, outlier detection.

Reference Books:

1. *J. Han and M. Kamber. Data Mining: Concepts and Techniques, 3rd Edition Morgan Kaufman. 2012.*
2. *M. H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson, 2001.*
3. *P.Tan, M.Steinbach and V.Kumar,Introduction to Data Mining–Pearson Education, 2005.*

COURSE OUTCOMES:

The students will be able to:

CO1: Fundamentals of data mining Functionalities, major issues in Data Mining.

CO2: Data Warehousing fundamentals and the OLTP, OLAP systems.

CO3: Need for Pre-processing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization .

CO4: Mining Frequent Patterns, Associations.

CO5: Different Classification Methods and evaluating the accuracy of a Classifier or a Predictor.

CO6: Major Clustering Methods and Outlier Analysis.

UNIT I

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User.

UNIT II

Intents on UIs VUIs and Mobile Apps: Text-to-Speech Techniques Designing the Right UI Multichannel and Multimodal UIs and Services, Android Intents and Services, Characteristics of Mobile Applications, Successful Mobile Development, Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

UNIT III

Communications Via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony, Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony, Notifications and Alarms, Performance, Performance and Memory Management, Android Notifications and Alarms.

UNIT IV

Graphics: Performance and Multithreading, Graphics and UI Performance, Android Graphics and Multimedia, Mobile Agents and Peer-to-Peer Architecture, Android Multimedia, Location, Mobility and Location Based Services in Android. Packaging and Deploying, Performance Best Practices, Android Field Service App, Security and Hacking, Active Transactions, More on Security, Hacking Android, Platforms and Additional Issues, Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing.

Reference Books:

1. *John Horton, Android Programming for Beginners, 2nd. Edition, Packt Publishing, 2018.*
2. *Jeff Mcherter and Scott Gowell, Professional Mobile Application Development, Wrox (Wiley), 2012.*
3. *Lorn Potter, Hands-On Mobile and Embedded Development with Qt 5 Build apps for Android, iOS, and Raspberry Pi with C++ and Qt. , Packt Publishing, 2019.*
4. *Prajyot Mainkar, Salvatore Giordano, Google Flutter Mobile Development Quick Start Guide [Get up and running with iOS and Android mobile app development],Packt Publishing, 2018.*

COURSE OUTCOMES:

The students will be able to:

CO1: Understand the concept of mobile computing and Android Development Environment.

CO2: Apply the concept of Intents on UIs VUIs and Mobile Apps.

CO3: Analyse and evaluate the utility of communications Via Network and the Web.

CO4: Telephony, Notifications and Alarms, Performance, Performance and Memory Management, Android Notifications and Alarms.

CO5: Analyse graphics, Performance and Multithreading, Graphics and UI Performance.

CO6: Understanding of development process, architecture, design, technology selection, and mobile App development hurdles and testing.