BACHELOR OF SCIENCE

(Honors/Research)

in

Computer Science

(NEP 2020)

Detailed syllabi for Students Admitted to KIIT Deemed to be University

ACADEMIC CURRICULA

2025 - 2029

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
SCHOOL OF COMPUTER APPLICATIONS

COURSE STRUCTURE & SYLLABI

Bachelor of Science (Honors/ Research) in Computer Science
(2025 - 2029)
Kalinga Institute of Industrial Technology
(Deemed to be University)

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
SCHOOL OF COMPUTER APPLICATIONS

PROGRAM EDUCATIONAL OBJECTIVES

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

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.

PROGRAM 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.

PROGRAM SPECIFIC OUTCOMES

PSO1: Ability to use knowledge of financial accounting to estimate the profitability of small projects.

PSO2: Design simple software solutions for real-life problems.

PSO3: Engage in lifelong learning.

Academic Session (2025-2029)
B. Sc. (Honors/Research) in Computer Science

COURSE STRUCTURE

FIRST SEMESTER (AUTUMN)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC10001	Computer Programming	2	1	-	3
02	DC	BSC10003	Descriptive Statistics	3	1	-	4
03	AEC	BSC10005	English	3	0	-	3
04	SEC	BSC10007	Web Application Development	2	0	-	2
05	VAC	BSC10009	Environmental Science	3	0	-	3
PRACTICAL							
06	DC	BSC19001	Computer Programming Lab	0	-	4	2
07	SEC	BSC19007	Web Application Development Lab	0	-	4	2
SESSIONAL							
08	VAC	SY18001	Sports and Yoga	-	-	2	1
TOTAL				-	-	-	**20**

SECOND SEMESTER (SPRING)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC10002	Data Structures	2	1	-	3
02	DC	BSC10004	Introduction to Probability	3	1	-	4
03	MDC	BSC10006	Enterprise Resource Planning	3	0	-	3
04	MDC	BSC10008	Basic Electronics	3	-	-	3
05	AEC	BSC10010	Business Communication	3	-	-	3
06	MC		Open Elective – MC I	3	1	-	4
PRACTICAL							
07	DC	BSC19002	Data Structures Lab	-	-	4	2
08	SEC	BSC19006	Web Content Management System Lab	-	-	2	1
TOTAL				-	-	-	**23**

THIRD SEMESTER (AUTUMN)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC20001	Database Management System	2	1	-	3
02	DC	BSC20003	Computer Organization and Architecture	3	1	-	4
03	DC	BSC20005	Discrete Mathematics	3	1	-	4
04	SEC	BSC20009	Personality Development and Interview Techniques	3	-	-	3
05	MC		Open elective – MC II	3	1	-	4
PRACTICAL							
06	DC	BSC29001	Database Management System Lab	-	-	4	2
TOTAL				-	-	-	**20**

FOURTH SEMESTER (SPRING)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC20002	Object Oriented Programming using C++	2	1	-	3
02	DC	BSC20004	Software Engineering	3	1	-	4
03	DC	BSC20006	Numerical Methods	3	1	-	4
04	MC		Open Elective – MC III	3	1	-	4
05	MC		Open Elective – MC IV	3	1	-	4
PRACTICAL							
06	DC	BSC29002	C++ Lab	-	-	4	2
TOTAL				-	-	-	**21**

FIFTH SEMESTER (AUTUMN)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC30001	Operating System	3	1	-	4
02	DC	BSC30003	Java Programming	2	1	-	3
03	DC	BSC30005	Computer Networks	3	1	-	4
04	MDC	BSC30007	Introduction to GIS	2	-	-	2
05	MC		Open elective – MC V	3	1	-	4
PRACTICAL							
06	DC	BSC39005	Java Programming Lab	-	-	4	2
07	MDC	BSC39007	GIS Lab	-	-	2	1
SESSIONAL							
08	SEC	BSC37007	K-Xplore (Practice-oriented Open Elective)	-	-	2	1
TOTAL				-			**21**

SIXTH SEMESTER (SPRING)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC30002	Python Programming	2	1	-	3
02	DC	BSC30004	Information Security	3	1	-	4
03	VAC	BSC30006	Universal Human Values	2	1	-	3
04	MC		Open Elective – MC VI	3	1	-	4
PRACTICAL							
05	DC	BSC39002	Python Programming Lab	-	-	4	2
SESSIONAL							
06	Internship	BSC38004	Internship	-	-	4	2
07	AEC	BSC37002	Seminar			4	2
TOTAL				-	-	-	**20**

SEVENTH SEMESTER (AUTUMN) – B. Sc (Hons.)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC40001	Artificial Intelligence	2	1	-	3
02	DC	BSC40003	Data Analytics	2	1	-	3
03	DC	BSC40005	Computer Graphics	3	1	-	4
04	MC		Open Elective VII	3	1	-	4
PRACTICAL							
05	DC	BSC49001	Artificial Intelligence Lab	-	-	4	2
06	DC	BSC49003	Data Analytics Lab	-	-	4	2
SESSIONAL							
07	Internship	BSC48001	Internship				2
TOTAL				-	-	-	**20**

EIGHTH SEMESTER (SPRING) – B. Sc (Hons.)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC40002	Cloud Computing	3	1	-	4
02	MC		Open elective VIII	3	1	-	4
SESSIONAL							
03	Project	BSC47002	Project				12
TOTAL				-	-	-	**20**

CREDIT SUMMARY (B.Sc. Honors.)

B.Sc. (Research)	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credits
Credits	20	23	20	21	21	20	20	20	165

SEVENTH SEMESTER (AUTUMN) – B. Sc (Research)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC	BSC40003	Data Analytics	2	1	-	3
02	DC	BSC40007	Research Methods and Ethics	3	1	-	4
03	DC		Research Elective I	3	1	-	4
04	MC		Open Elective VII	3	1	-	4
PRACTICAL							
05	DC	BSC49003	Data Analytics Lab	-	-	4	2
SESSIONAL							
06	Internship	BSC48001	Internship				2
TOTAL				-	-	-	**19**

EIGHTH SEMESTER (SPRING) – B. Sc (Research)

THEORY							
SL. NO.	**CATEGORY**	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
01	DC		Research Elective II	3	1	-	4
02	MC		Open Elective VIII	3	1	-	4
SESSIONAL							
03	Project	BSC47002	Project				12
TOTAL				-	-	-	**20**

CREDIT SUMMARY (B.Sc. Research)

B.Sc. (Research)	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credits
Credits	20	23	20	21	21	20	19	20	164

MINOR CORE OPEN ELECTIVE for MANAGEMENT

SL. NO.	Minor Core	SUBJECT CODE	SUBJECT	L	T	P	CREDIT
01	MC- I	BSC10022	Business Mathematics	3	1	-	4
02	MC- II	BSC20023	Principles of Management	3	1	-	4
03	MC- III	BSC20022	Organizational Behavior	3	1	-	4
04	MC- IV	BSC20024	Operations Research	3	1	-	4
05	MC- V	BSC30021	Information Systems	3	1	-	4
06	MC- VI	BSC30022	Entrepreneurship and Startups	3	1	-	4
Total							24

MINOR CORE OPEN ELECTIVE for ELECTRONICS

SL. NO.	Minor Core	SUBJECT CODE	SUBJECT	L	T	P	CREDIT
01	MC- I	BSC10032	Principles of Analog and Digital Electronics	3	1	-	4
02	MC- II	BSC20031	Microprocessor Architecture	3	1	-	4
03	MC- III	BSC20032	Embedded Systems	3	1	-	4
04	MC- IV	BSC20034	Mobile Communication	3	1	-	4
05	MC- V	BSC30031	Digital Image Processing	3	1	-	4
06	MC- VI	BSC30032	Digital Signal Processing	3	1	-	4
Total							24

DETAILED SYLLABI

FIRST SEMESTER

BSC10001 COMPUTER PROGRAMMING CREDITS: 3

UNIT - I

Introduction and Programming Process: Steps in developing of a program, Data Flow Diagram, Decision Table, Algorithm development, Flowchart, Pseudo Code, Testing and Debugging, Structured programming, Object Oriented Programming

C Language Processing System: Components of C Language Processing systems, Pre-processor, Compiler, Assembler, Linker, Loader.

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

Selective Control Structure: Decision making with if-statement, if-else and nested if-else, the else if Clause. switch-case statement.

Iterative Control Structure: while, do-while, for loop and nested loop.

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, 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, Array of Pointers.

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, Nested structures, Structure with pointers, Union**.**

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, MGH, 2007.
5. R.S. Bichkar, Programming with C, University Press, 2012.
6. E Balagurusamy; Programming in ANSI C; 8thedn., MGH; 2019
7. Behrouz A. Forouzan; Richard F. Gilberg: Computer Programming in C : 1/e : Cengage.
8. A.K. Sharma; Computer Fundamentals and Programming in C; 2/e; Universities press; 2018

BSC10003 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, ElementaryStatistics: 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.
7. Speigel, David P. Lindstrom; Schaums Easy Outline Of Statistics; 2/e; MGH; 2020
8. John Rice; Mathematical Statistics and Data Analysis; 3/e; Cengage; 2013
9. Robert V. Hogg; Introduction to Mathematical Statistics, 8/e; Pearson; 2021
10. Nadar, E. Narayanan: Statistics; PHI

BSC10005 ENGLISH CREDITS:3

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. J D O' Connor, Better English Pronunciation, Cambridge, 1980.
4. John Eastwood, Oxford Practice Grammar, OUP, 2016.
5. Raman and Sharma, Technical Communication, OUP, 2015.

BSC10007 WEB APPLICATION DEVELOPMENT CREDITS: 2

UNIT - I

Introduction to HTML: Introduction to HTML language, 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, Frames and Graphics, HTML Tables.

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 - II

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 - III

Introduction to PHP: PHP basic syntax, variables and constants, operators, handling HTML forms with PHP, conditional statements and looping and functions. Database connectivity with MySql. Creating simple forms with CRUD operations.

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, 3rd Edition (Paperback), Pearson, 2020
4. Thomas Powell, HTML &CSS:The Complete Reference, 5th. Edition, MGH
5. Thomas Powell, Fritz Schneider, JavaScript: The Complete Reference, 3rd. Edition, 2017.
6. DT Editorial: Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book; dreamtech (Wiley).
7. Terry Felke-Morris; Web Development and Design Foundations with HTML5, 9/e: Pearson
8. DT Editorial: HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed; dreamtech (Wiley).

BSC10009 ENVIRONMENTAL SCIENCE CREDITS: 3

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, Textbooks: of Environment studies for undergraduatecourses, Universities Press, 2nd Edition.
2. D. De and D. De, Fundamentals of Environment and Ecology, S. Chand & Co, 2013.

BSC19001 COMPUTER PROGRAMMING LAB CREDITS:2

List of Experiments:

1. Operators, expressions, I/O Functions
2. ControlStructure: goto, if-else, switch-case, break-continue, for, while, do-while
3. Arrays: Single and Multi-dimensional arrays, traversal
4. Strings: operations
5. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
6. Functions: Built-in and User defined, Invoke/call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
9. Files: reading and writing, File pointers, file operations, random access, processor directives.

BSC19007 WEB APPLICATION DEVELOPMENT LAB CREDITS- 2

List of Experiments:

1. Creating HTML page structure with tables
2. Styling HTML page using CSS classes
3. Creating HTML page structure using and css classes
4. Creating HTML forms and styling them using CSS
5. Creating Javascript functions to create interactive HTML page
6. Use Javascript functions to validate HTML forms
7. Create MySQL tables and perform CRUD operations using simple forms in PHP
8. Make a data driven working application using HTML, CSS, Javascript, PHP and MySQL

SY18001 SPORTS AND YOGA CREDITS - 1

UNIT-I

Concept and significance of consciousness: Modern and ancient approach of consciousness, Types of consciousness viz., Jagrata, Svapna, Susupti, Turya, and Turiyatita.

UNIT-II

Preparatory practices: Breathing practices, Suksma vyayma (all 46 practices), and Sthoolavyayma (all 14)

UNIT-III

Dharana practices: Principles and procedure of Antaranga&Bahrangatrataka, Jatrutrataka& Jyoti trataka; Principles and practices of Ajappajapa, Antarmouna, Chakra meditation, Cyclic meditation, and Transcendental meditation.

UNIT-IV

Concept and practice of Dhyana: Concept of Jyoti and Bindu dhyana, principle and procedure of Vipassana meditation, Preksha meditation, Transcendental meditation, Brahma kumari Raja yoga meditation, and Yoga nidra.

Reference Book:

Yogic Sukshma Vyayma by Dhirendra Brahmachari, MDNIY publisher, Ashoka Road, New Delhi 2. Mandukya Upanishad by Swami Harsanansda, R K Mission Publication, Belur math, Kolkata

SECOND SEMESTER

BSC10002 DATA STRUCTURES CREDITS: 3

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.
5. E Balagurusamy; Data Structures using C; 1/e; MGH; 2013
6. Ritika Mehra; Data Structures Using C, 1/e; Pearson; 2021
7. Shriram K. Vasudevan, Abhishek S. Nagarajan; Data Structures using Python; Oxford; 2021
8. Horowitz & Sahni: Fundamentals of Data Structures in C; Universities Press; 2018

BSC10004 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, negativebinomial, 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.
7. G Shanker Rao: Probability and Statistics for Science and Engineering; Universities Press; 2011
8. Richard A. Johnson; Miller and Freund's Probability and Statistics for Engineering; Pearson

BSC10006 ENTERPRISE RESOURCE PLANNING CREDITS: 3

UNIT-I

Introduction to ERP: Enterprise - and Overview, Integrated management information, Business modeling, integrated data model.

UNIT- II

ERP and Related Technology: Business process re-engineering (BPR), MIS, EIS, Decision support system, Supply chain management.

UNIT-III

ERP Manufacturing Prospective, ERP modules, Benefits of ERP, ERP Market.

UNIT- IV

Implementation of ERP Lifecycle, Implementation methodology, Transition strategy, people involved in implementation, Success and failure in implementation factors, Operation and maintenance of ERP system.

ReferenceBooks:

1. Enterprise Resource Planning – Alexis Leon – Fourth Edition – TMH
2. Enterprise Resource Planning-Concept and Practice - Vinod Kumar Garg and N.K. Venkitakrishnan – Second Edition- PHI
3. Enterprise Resource Planning – Ellen F. Monk, Bret J. Wagner – Fourth Edition- CENGAGE
4. Enterprise Resource Planning –Diversified by Alexis Leon – TMH
5. Enterprise Resource Planning – Ravishankar and S. Jaiswal – GALGOTIA

BSC10008 BASIC ELECTRONICS CREDITS: 3

UNIT-I

Passive Components: Study of basic circuit elements and passive components (with special reference to working principle, circuit symbols, types, specifications and applications): Resistor, Capacitor, Inductor, Transformer, Cables, Connectors, Switches, Fuses, Relays, Batteries.

UNIT-II

Semiconductor Diodes and Circuits: Study of semiconductor devices with reference to symbol, working principle, I-V characteristics, parameters, specifications: diode, Zener diode, light emitting diode, photo diode, optocoupler, varactor diode, solar cell, clipper and clamper circuits. Rectifiers (half and full wave), rectifier with capacitor-filter, Zener regulator, Block diagram of power supply.

UNIT-III

Bipolar Junction Transistor and Circuits: Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, I-V characteristics, parameters, specifications, Concept of amplification, voltage and current amplifier, Transistor amplifier configurations - CB, CC and CE, biasing circuits, voltage divider, collector feedback bias and emitter feedback bias, DC load line (CE), Q point and factors affecting the stability, transistor as a switch, concept of class A, B and class C amplifiers, emitter follower amplifier, Single stage RC coupled CE amplifier, concept of frequency response and bandwidth. Multistage amplifies; Transformer coupled amplifiers, Feedback amplifiers, Oscillators, Feedback requirement of oscillations.

UNIT-IV

UJT, FETs and Applications: Symbol, types, construction, working principle, I-V characteristics, Specifications parameters of: Uni-Junction Transistor (UJT), Junction Field Effect Transistor (JFET), Metal Oxide Semiconductor FET (MOSFET), comparison of JFET, MOSFET and BJT Applications: JFET as voltage variable resistor, MOSFET as a switch.

Reference Books:

1. V.K Mehta, Rohit Mehta, Principles of Electronics, 7th Edition, S Chand, 2014.
2. N.N. Bhargava, Kulshreshtha, S.C. Gupta, Basic Electronics and Linear Circuits, 2nd Edition, McGraw Hill Education, 2017.
3. Jacob Millman, Electronic Devices and Circuits (SIE), 4th Edition, McGraw Hill Education, 2015.
4. Mitchel Schultz, Grob' s Basic Electronics, 10th Edition, McGraw Hill Education, 2017.
5. Albert Malvino, Electronic Principles, 7th Edition, McGraw Hill Education, 2017.
6. M. L. Anand, Basic Electronics Engineering, S. Chand, 2015.

BSC10010 INFORMATION SYSTEM CREDITS: 3

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.

BSC19002 DATA STRUCTURES LAB CREDITS: 2

List of Experiments:

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Polish Notations.
6. Implementation of Binary Trees and operations of Binary Trees
7. Implementation of Binary Search Trees
8. Implementation of AVL Trees
9. Implementation of Heaps using Priority Queues.
10. Implementation of searching and sorting algorithms

BSC19004 WEB CONTENT MANAGEMENT SYSTEM LAB CREDITS: 1

List of Experiments:

1. Installation of any popular content management system (CMS) like Wordpress, Drupal or Joomla
2. Setting up user management system in CMS.
3. Creating content using CMS
4. Storing and managing content using CMS
5. Indexing content using CMS
6. Searching for content in CMS
7. Publishing content through CMS
8. Using various plugins to enhance the functionality of the applications
9. Archiving content in CMS
10. Hosting CMS website on a serve

THIRD SEMESTER

BSC20001 DATABASE MANAGEMENT SYSTEM CREDITS:3

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 BadDatabase Design.

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.

BSC20003 COMPUTER ORGANIZATION AND ARCHITECTURE CREDITS: 4

UNIT - I

Introduction to Digital Electronics: Number systems, complements, fixed and floating-point representation, character representation, addition, subtraction, magnitude comparison, **Logic** gates, Boolean algebra, combinational circuits, circuit simplification, sequential circuits & flip flops, decoders, shift registers & 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, timing and control, instruction cycle, memory reference, input-output and interrupt.

UNIT - III

Central Processing Unit: Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Computer Arithmetic: Introduction, Multiplication and Division Algorithms for fixed point-members.

UNIT - IV

Programming the Basic Computer: Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming. 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, 2017
6. Smruti Ranjan Sarangi; Advanced Computer Organization & Architecture; 1/e, MGH; 2021
7. Alan Clements; Computer Organization &Architecture : Themes and Variations; Cengage; 2014
8. Rajaraman, V.; Computer Organization &Architecture : PHI

BSC20005 DISCRETE MATHEMATICS CREDITS: 4

UNIT - I

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, Boolean Function, Logic Circuits.

UNIT - II

Sets, relations, and functions: Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses. Arbitrary union, intersection and product.

UNIT - III

Counting: Counting Principles**,** Permutation and Combinations, Pigeon hole Principle, Recurrence Relation.

UNIT – IV

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

Coding Theory: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", McGraw Hill International, 7th Edition, 2011.
2. B. Kolman, R. C. Busby, S. Ross, "Discrete Mathematical Structures", Prentice Hall of India, 6th. Edition, 2010.
3. Trembley & Manohar, "Discrete Mathematical Structure with Applications to Computer Science", McGraw Hill, 2001.
4. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier, 2008.

BSC20009 PERSONALITY DEVELOPMENT & INTERVIEW TECHNIQUES CREDITS: 3

UNIT – I

Introduction: Soft Skills, Hard Skills versus Soft Skills, Personality development concepts, Significance of effective personality, Employability Vs Personality, Personality types.

UNIT – II

Self-Introduction: Self- introduction tactics, Do's and don'ts of self-introduction, organizing material, grooming skills and dress code, Importance of body language, Audience engagement, social etiquette and pleasing mannerisms.

UNIT – III

Time and Stress management: Significance and elements of time management, time-waster and techniques for effective time management, mental triggers and stressors, Anger and conflict management, Negative impact of stress, techniques for managing stress effectively.

UNIT – IV

Interview: Types of interviews, Strategies and techniques, methods of preparation, Dress code and its importance, Resume building and cover letter writing, lateral thinking, Mock interview sessions, Behavioral interview questions, Emotional quotient questions.

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.

SC29001 DATABASE MANAGEMENT SYSTEM LAB CREDITS: 2

List of Experiments:

1. Concept design with E-R Model
2. Relational Model
3. Normalization
4. Practicing DDL commands
5. Practicing DML commands
6. Querying (using ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.)
7. Queries using Aggregate functions, GROUP BY, HAVING and Creation and dropping of Views.

FOURTH SEMESTER

BSC20002 OBJECT ORIENTED PROGRAMMING USING C++ CREDITS: 3

UNIT – I

Introduction: Structured Vs Object-Oriented development**,** Introducing Object-Oriented Approach.

Basic terms and ideas: Abstraction, Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing, Difference between C and C++, cin, cout, new, delete operators, scope resolution operator (::), variable declaration at the point of use, variable aliases-reference variables, strict type checking, parameter passing by reference, inline function, function overloading, default arguments.

UNIT – II

Classes and Objects: Specifying and using classes, access specifies: private, public, functions and data members, default arguments, function overloading,friend functions, static members.
Constructors: default constructor, parameterized constructor, constructor with dynamic allocation, copy constructor, destructors, abstract classes.

UNIT – III

Operator overloading:overloading through friend and member functions , Conversion functions : class to basic, basic to class, class to class.
Inheritance: Derived and base classes, Class hierarchies, public, private, and protected derivations, constructors in derived classes, destructors in derived classes, constructors invocation and data members initialization in derived classes, classes within classes, virtual base class.
Polymorphism: Pointer to objects, pointer to derived class object, this pointer, run time and compile time polymorphism, virtual functions, pure virtual functions, abstract class, virtual destructor.

UNIT – IV

Files and Streams: Introduction to file handling, hierarchy of file stream classes, opening and closing of files, file modes, file pointers and their manipulators, sequential access, random access.
Exception Handling and Templates: Introduction to exception handling, throw point outside try, Multiple catch, Catch-all, throwing objects. Introduction to templates, class templates, function templates

Reference Books:

1. Reema Thareja, Object Oriented Programming with C++, 1st Edition, OXFORD University Press, 2015.
2. R. Lafore, Object Oriented Programming using C++, 4th. Edition, Pearson, 2002.

3. Ashok N. Kamthane, Object Oriented Programming with ANSI & Turbo C++", Pearson.
4. Steven C. Lawlor, "The Art of Programming Computer Science with C++", 1st. Edition, Course Technology, 1997.
5. Schildt Herbert, "C++: The Complete Reference", 4th. Edition, MGH, 2003.
6. Tony Gaddis, Watters, Muganda, "Object-Oriented Programming in C++", 3rd. Edition, Wiley Dreamtech, 2004.
7. BA Forouzan & R. Gilberg: C++ Programming: An Object-Oriented Approach: 1/e; MGH; 2022
8. E. Balagurusamy; Object Oriented Programming with C++ : 8/e; MGH; 2020

BSC20004 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 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.

Reference Books:

1. Rajib Mall: Fundamentals of Software Engineering, 4th Edition, Prentice Hall of India, 2014
2. I. Summerville: Engineering Software Products: An Introduction to Modern Software Engineering, Pearson Education, 2017
3. Roger S. Pressman: Software Engineering A Practitioner's Approach, 8th Edition, MGH, 2019
4. Craig Larman: Applying UMI and Patterns An introduction OOAD and the Unified Process, 3rd Edition, Pearson Education, 2015
5. Ugrasen Suman : Software Engineering: Concepts and Practices, 2ndEdn. ; Cengage, 2022
6. Pankaj Jalote : Software Engineering: A Precise Approach; 1stEdn. ; Wiley; 2015

Sajan Mathew: Software Engineering :1stEdn., S.Chand; 2013

BSC20006 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, regular false and Newton-Raphson method in one unknown, Conditions of convergence and rates of convergence.

UNIT - II

System of linear algebraic equations: Gaussian elimination method, Gauss Jordan method, Gauss Jacob method, Gauss Seidel 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.

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.

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.

BSC29002 C++ PROGRAMMING LAB CREDITS: 2

List of Experiments:

1. Programs to test basic I/O (cin and cout) with all basic C++ operators.
2. Implementation of inline functions.
3. Classes and Objects (case studies) e.g. To create a class, to create different objects and to test the functioning of member functions, constructors and Destructors.
4. Arrays of Objects e.g., to create class 'student'. To create an array of students and to perform operations like to find out the student who get the first rank.
5. Static Polymorphism: operator overloading and function overloading.
6. To perform complex number arithmetic or Matrix arithmetic.
7. To create derived/sub classes by Inheritance. E.g., to create sub-class 'department' from a base class 'College' and to verify the functions in the derived and base classes.
8. Dynamic Polymorphism: virtual function e.g., to draw various shapes viz Square, Circle, Triangle and Rectangle.
9. Formatted I/O and File stream operations. E.g., to test the functions and the manipulators using filesMark sheet Processing or Payroll processing of Inventory Management.
10. Templates and Exception Handling.

FIFTH SEMESTER

BSC30001 OPERATING SYSTEMS CREDITS: 4

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: Computer-system operation, Storage structure, I/O structure, Single-processor systems, Multi-processor systems, Clustered Systems, Operating system structure, OS operations, Dual-mode and multimode operation, Process management, Memory management, Storage management, Caching, Kernel data structures, Computing environments, Open-source OS.OS services, User and OS interface, System calls, OS design and implementation, OS structure, System boot.

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 FCFS, SJF, Priority scheduling,RR , Strategy selection, non-pre-emptive and pre-emptive strategies.

UNIT - III

Memory Management: Mapping addresses space to memory space, memory allocation strategies, fixed partition, variable partition, paging, segmentation.

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

UNIT – IV

Virtual Memory: Background, Demand paging, Page fault, Basic page replacement policy, Page replacement algorithms - FIFO, OPT, LRU, LRU- Approximation, LFU, MFU, Thrashing, Working-set model, and Disk scheduling, FCFS,SSTF,SCAN ,RAID structure.

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

Reference Books:

1. A.Silberschatz,P.B.Galvin,andG.Gagne,"Operating SystemConcepts", 9th Edition, Wiley, 2019.
2. M.Milenković,"Operating Systems:ConceptsandDesign",2nd Edition,TataMcGraw-Hill,2001.
3. A. S. Tanenbaum, "Modern Operating Systems", 3rd Edition, PHI, 2009.
4. P.B.Prasad,Operating SystemsandSystem Programming,2nd Edition,ScitechPublications,2015.
5. P. C. Bhatt, An Introduction to Operating Systems: Concepts & Practice, 4th Ed, PHI
6. William Stallings: Operating Systems: 9th, Pearson Educations, 2018

BSC30003 JAVA PROGRAMMING CREDITS: 3

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 elseif 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

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

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

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.

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.

Database Connectivity with JDBC: Java database connectivity, Types of JDBC drivers, writing first JDBC applications, Types of statement objects (Statement, Prepared Statement and Callable Statement), Types of Result set, Result Set metadata, Inserting and updating records.

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.

BSC30005 COMPUTER NETWORKS CREDITS: 4

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.
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.

BSC30007 INTRODUCTION TO GIS CREDITS: 2

UNIT -I

Introduction: Overview of GIS, data representation in GIS, exploring data using GIS, understanding layer and its properties, feature class and attribute table.

Projections and geoprocessing: Introduction to projections, analysing data with geoprocessing tools, spatial relationships.

UNIT -II

Maps: Making basic maps using common datasets, core map elements, changing the look of data, symbology, labelling and map books, introduction to Google maps, Google Earth and Google Earth engine.

UNIT -III

GIS Applications: Understanding spatial analyst toolsfor solving real world problems. Applications of GIS in environmental studies. Google map applications.

Reference Books:

1. Ian Heywood, Sarah Cornelius and Steve Carver, “An Introduction to Geographical Information Systems”, 3rd. Edition, Pearson, 2006
2. Peter A. Burrough, Rachael A. Mcdonnel and Christopher D. Lloyd, “Principles of Geographical Information Systems”, 3rd. Edition, Oxford University Press, 2016.
3. Tor Bernhardsen, “Geographic Information Systems, An Introduction”, 3rd. Edition, Wiley, 2021.
4. John R. Jensen and Ryan R. Jensen, “Introductory Geographic Information System”, Pearson, 2018.

BSC39005 JAVA PROGRAMMING LAB CREDITS: 2

List of Experiments:

1. Demonstrate the use of all Java operators with basic Input and Output methods.
2. Demonstrate the use of all control structures with examples.
3. Program to perform operations on Arrays and Strings.
4. Java program to arrange the given strings in Alphabetic Order.
5. Java program to implements Addition and multiplication of two Matrices.
6. Java program to demonstrate the use of Constructor.
7. Java program to display a use of method overloading.
8. Java program to demonstrate the use of overriding Method.
9. Java program for single Inheritance.
10. Java program for implementing Interface.
11. Java program on Multiple Inheritance.
12. Java program for to implement Thread, Thread Priority,
13. Java program to demonstrate Exception handling.
14. Java program to demonstrate basic file stream operations.
15. Java program to demonstrate Threads and multi-threading

BSC39007	GIS LAB	CREDITS: 1

List of Experiments:

1. Installing GIS software and understanding with the various windows.
2. Creation of file geodatabase
3. Creation of feature class and feature datasets
4. Managing Raster data – Raster data processing
5. Displaying symbols by text values
6. Labeling maps using labelling toolbar and map manager
7. Publishing maps
8. Delineating watersheds and calculating watershed geometry
9. Creating Google map applications

SIXTH SEMESTER

BSC30002 PYTHON PROGRAMMING CREDITS: 3

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

Control flow statements: if, if-else, if-elif-else; for, while, break, continue and pass.
Functions: Built- In Function, User Defined Function: defining, invoking functions, passing parameters, Scope of variables, recursion, 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 , binary 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

Exception handling: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.
File Handling: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files

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. Michael Dawson, “Python Programming for the Absolute Beginner”, 3rd. Edition, Cengage Learning, 2011.
5. E. Balagurusamy, “Introduction to Computing and Problem Solving Using Python”, 1st. Edition, MGH, 2016.

BSC30004 INFORMATION SECURITY CREDITS: 4

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. M. Stamp: Information Security: Principles and Practice,2nd Edition, Wiley
2. V. K. Pachghare: Cryptography and Information Security, 2ndEdition, PHI, 2015
3. Michael E. Whitman: Principles of Information Security, 5thEdition, Cengage, 2015
4. Forouzan: Cryptography & Network Security,3rdEdition, MGH
5. William Stallings: Cryptography and Network Security Principles and Practices, 7thEdition, Pearson Education, 2017
6. Mark Rhodes-Ousley: Information Security: The Complete Reference,2nd Edition, MGH; 2013
7. Atul Kahate: Cryptography and Network Security: 4thEdn.; MGH; 2019
8. Bernard L. Menezes; Ravinder Kumar: Cryptography, Network Security, and Cyber Laws; Cengage; 2018

BSC30006 UNIVERSAL HUMAN VALUES CREDITS: 3

UNIT -I

Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony andco-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT -II

Understanding Harmony in the Human Being - Harmony in Myself: Understanding human being as a co-existence of the sentient 'I' and thematerial 'Body'. Understanding the needs of Self ('I') and 'Body' - happinessand physical facility. Understanding the Body as an instrument of 'I' (I beingthe doer, seerand enjoyer). Understanding the characteristics and activities of'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyamand Health; correct appraisal of Physical needs, meaning ofProsperity indetail. Programs to ensure Sanyam and Health. Include practice sessions todiscuss the role others have played in making material goods available to me.Identifying from one's own life.Differentiate between prosperity andaccumulation. Discuss program for ensuring health vs dealing withdisease.

UNIT -III

Understanding Harmony in the Family and Society- Harmony inHuman-Human Relationship: Understanding values in human-human relationship; meaning of Justice(nine universal values in relationships) and program for its fulfilment toensure mutual happiness; Trust and Respect as the foundational values ofrelationship. Understanding the meaning of Trust; Difference betweenintention and competence. Understanding the meaning of Respect, Differencebetween respect anddifferentiation; the other salient values in relationship.Understanding the harmony in the society (society being an extension offamily): Resolution, Prosperity, fearlessness (trust) and co-existence ascomprehensive Human Goals. Visualizing a universal harmonious order insociety- Undivided Society, Universal Order- from family to world family.Include practice sessions to reflect on relationships in family, hostel andinstitute as extended family, real life examples, teacher-student relationship,goal of education etc. Gratitude as a universal value in relationships. Discusswith scenarios. Elicit examplesfrom students' lives.

UNIT -IV

Understanding Harmony in the Nature and Existence - Whole existenceas Coexistence: Understanding the harmony in the Nature. Interconnectedness and mutualfulfilment among the four orders of nature recyclability and self-regulation innature. Understanding Existence as Co-existence of mutually interactingunits in all-pervasive space. Holistic perception of harmony at all levels ofexistence. Include practice sessions to discuss human being as cause ofimbalance in nature (film "Home" can be used), pollution, depletion ofresources and role of technology etc.

UNIT -V

Implications of the above Holistic Understanding of Harmony onProfessional Ethics: Naturalacceptance of human values. Definitiveness of Ethical HumanConduct. Basis for Humanistic Education, Humanistic Constitution andHumanistic Universal Order. Competence in professional ethics: a) Ability toutilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c) Ability to identify and develop appropriatetechnologies and management patterns for above production systems. Case
studies of typical holistic technologies, management models and productionsystems. Strategy for transition from the present state to Universal HumanOrder: a) At the level of individual: as socially and ecologically responsibleengineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations.

Reference Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.
2. A.N. Tripathi, Human ValuesNew Age Intl. Publishers, New Delhi, 2004.
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

BSC39002 PYTHON PROGRAMMING LAB CREDITS: 2

List of Programs:

1. Identification and solving of simple real life or scientific or technical problems (Area and volume of shapes, conversion from Celsius to Fahrenheit,simple and compound interest calculation, distance between two points, exchange the values of two variables).
2. Problem solving using Conditionals and Iterative loops. (Greater of three numbers, Number series, Number Patterns, pyramid pattern).

3. Implementing programs using Functions.
4. String manipulation-based programs (substrings, concatenation, reverse, palindrome, character count, replacing characters)
5. Programming applications using Lists, Tuples,
6. Searching and Sorting .
7. Programs based on Sets & Dictionaries.
8. Programs using Exception handling. (divide by zero error, voter's age validity, student mark range validation).
9. File handling (copy from one file to another, word count, longest word).

SEVENTH SEMESTER (HONORS)

BSC40001 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)

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

BSC40003 DATA ANALYTICS CREDITS:3

UNIT-I

Introduction to Data Analysis: Probability, Random Variables, Basic Statistical Descriptions of Data: Measures of Central tendency and Measures of Dispersion. Types of data: Quantitative and Categorical, Data Representation: - Data Objects and Attribute Types: Nominal, Binary, Ordinal, Numeric, Discrete and Continuous.

UNIT-II

Data pre-processing, Data Transformation: Smoothing, Aggregation, Generalization, Discretization, Normalization, Attribute and feature construction. Basic of Statistical Tests: - Regression Tests: Logistic Regression, Linear/Multilinear Regression, Comparison Tests: T-test, ANOVA, MANOVA, and Correlation Tests: Pearson's r test.

UNIT-III

Data Mining Techniques for Analysis: -Classification: Decision tree induction, Bayes classification, Rule-based classification, Support Vector Machines, Classification Using Frequent Patterns, k-Nearest-Neighbour, Fuzzy-set approach Classifier, Clustering: K-Means, k-Medoids, Agglomerative versus Divisive Hierarchical Clustering Distance Measures in Algorithmic Methods, Mean-shift Clustering.

UNIT-IV

Data Visualization and Interpretation: - Data Visualization Objectives, Different types of plots, Histograms, Box plots, Scatter plots, Heat map, Bubble chart, Bar chart, Distribution plot, Pair plot, Line graph, Pie chart, Doughnut chart, Area chart

Reference Books:

1. Intelligent Data Analysis, M.Berthold and D.J.Hand, 2nd Edition, Springer, 2007
2. J Moreira , Andre Carvalho , T Horvath, A General Introduction to Data Analytics, Wiley, 2019
3. Jiawei Han, Micheline Kamber, Jian Pei , Data Mining Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publishers, 2011
4. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. DT Editorial Services, Big Data, Black Book, Dreamtech Press (Wiley), 2015.

BSC40005 COMPUTER GRAPHICS CREDITS: 4

UNIT - I

Introduction, what is computer graphics? 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. D. Hearn, M.P. Baker, Computer Graphics C Version, 4th Edition, Pearson Education, 2013
2. Hearn & Baker, Computer Graphics with OpenGL, 4thEdition, Pearson Education, 2014
3. Rajesh K. Maurya, Computer Graphics with Virtual Reality Systems, Wiley; Second edition, 2014
4. J.D.Foley, V.Dam, S.K.Feiner, J.F.Huges - Computer Graphics Principles Practice, 2nd Edition, Pearson Education, 2002
5. D. Rogers, Mathematical Elements of Computer Graphics, 2nd Edition, McGraw Hill Education, 2017
6. John F Hughes; Computer Graphics: Principles and Practice; 3rdEdn., Pearson; 2019
7. Samit Bhattacharya; Computer Graphics; 1stEdn., Oxford Universities Press; 2015

BSC49001 ARTIFICIAL INTELLIGENCE LAB CREDITS: 2

List of Experiments:

1. Basic Problems using Python
2. Finding Mean Median average
3. Find variation, range, standard deviation
4. Create Tic Tac Toe for two players
5. Create a game paper stone and Scissors
6. Plotting of data set using Maptolib
7. Linear Regression simple implementation
8. Represent a graph using Adjacency Matrix
9. Find out nodes which have Highest degrees
10. Implementations of searching of node in tree

BSC49003 DATA ANALYTICS LAB CREDITS:2

List of Experiments:

1. Statistical Foundation for Data Science using Spreadsheet application:
    a. Frequency distribution table.
    b. Charts: Bar diagrams., Pie diagram., Histogram.
    c. Arithmetic Mean, Median, Mode, Mean Deviation and Standard Deviation.
2. Write Steps to Installation of R language.
3. Write R program to perform all the statistical measures (above in serial number:1) on sample data.
4. Write a program in R to draw scatter chart for data visualization.
5. Write a program in R to draw pie chart for data visualization.
6. Write program in R to import the data from outside of the sources.
7. Write program in R to perform data cleansing on different outside datasets.
8. Write and implement algorithm for:
    a. Linear and Logistic Regression,
    b. k-Nearest Neighbors (k-NN),
    c. SVM
    d. Decision Tree classification.
    e. Navie Bayes.
    f. k-means

EIGHTH SEMESTER (HONORS)

BSC40002 CLOUD COMPUTING CREDITS: 4

UNIT–I

Introduction to Cloud Computing: Introduction to Distributed System, Features of Distributed System, Motivation for Cloud Computing, The need for Cloud Computing, Definition of Cloud Computing, Essential Characteristics of Cloud Computing, Cloud Computing Service Model and Deployment Models, Risks and Challenges of Cloud Computing.

UNIT–II

CloudComputingArchitecture: Cloud Computing Reference Model, Cloud based Services and Applications, Cloud Service Examples IaaS:Amazon EC2, Google Compute Engine, Azure VMs PaaS: Google App Engine, SaaS: Salesforce, IaaS, SaaS, PaaS services for Cloud Applications.

UNIT–III

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

UNIT-IV

Virtualization: Need of Virtualization, Types of Virtualization, Full Virtualization, Para Virtualization, Storage Virtualization, Network Virtualization, Server Virtualization, Desktop Virtualization, Application Virtualization, Type-1 Hypervisor, Type-2 Hypervisor, Virtual Machine Deployment, Virtual Machine Monitor Function and Services, Advantage and Limitation of Virtual Infrastructure.

Reference Books:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2016
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
3. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
4. RajkumarBuyya, James Broberg and Andrzej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publication

SEVENTH SEMESTER (RESEARCH)

BSC40003 DATA ANALYTICS CREDITS:3

UNIT-I

Introduction to Data Analysis: Probability, Random Variables, Basic Statistical Descriptions of Data: Measures of Central tendency and Measures of Dispersion. Types of data: Quantitative and Categorical, Data Representation: - Data Objects and Attribute Types: Nominal, Binary, Ordinal, Numeric, Discrete and Continuous.

UNIT-II

Data pre-processing, Data Transformation: Smoothing, Aggregation, Generalization, Discretization, Normalization, Attribute and feature construction. Basic of Statistical Tests: - Regression Tests: Logistic Regression, Linear/Multilinear Regression, Comparison Tests: T-test, ANOVA, MANOVA, and Correlation Tests: Pearson's r test.

UNIT-III

Data Mining Techniques for Analysis: Classification: Decision tree induction, Bayes classification, Rule-based classification, Support Vector Machines, Classification Using Frequent Patterns, k-Nearest-Neighbour, Fuzzy-set approach Classifier, Clustering: K-Means, k-Medoids, Agglomerative versus Divisive Hierarchical Clustering Distance Measures in Algorithmic Methods, Mean-shift Clustering.

UNIT-IV

Data Visualization and Interpretation: Data Visualization Objectives, Different types of plots, Histograms, Box plots, Scatter plots, Heat map, Bubble chart, Bar chart, Distribution plot, Pair plot, Line graph, Pie chart, Doughnut chart, Area chart

Reference Books:

1. Intelligent Data Analysis, M.Berthold and D.J.Hand, 2nd Edition, Springer, 2007
2. J Moreira , Andre Carvalho , T Horvath, A General Introduction to Data Analytics, Wiley, 2019
3. Jiawei Han, Micheline Kamber, Jian Pei , Data Mining Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publishers, 2011
4. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. DT Editorial Services, Big Data, Black Book, Dreamtech Press (Wiley), 2015.

BSC40007 RESEARCH METHOD AND ETHICS CREDITS:4

UNIT I

Introduction to research: Structure of research: Scientific method and Engineering design cycle,Defining and scoping Research problems, Formulating research objectives and research questions.

Literature Review: Searching for literature; Narrative and systematic literature review; Summarizing, paraphrasing, and quoting; and Referencing styles.

UNIT II

Design of Experiments: Basic Principles of randomization, replication, and Blocking; Factors and Responses; Analysis of variance, Experiments with blocking factors, and Factorial designs.

Data Analytics: Data pre-processing; Data visualization; Tests of hypothesis; Decision trees.

UNIT III

Theoretical Models: Typology of models; Optimization models, forecasting models, and control models; Monte Carlo simulation; Genetic Algorithm; Model verification and validation; and Measurement and uncertainty analysis.

Drawing Inferences: Drawing inferences, Generalizing, Finding potential applications, Imagining future scope, and Highlighting novelty of research.

UNIT IV

Research Ethics: Ethics and morality; Utilitarian and deontological theories of ethics; Fabrication, falsification, plagiarism, and questionable research practices; Issues related to privacy and confidentiality; and Ethical issues related to publications.

Reference Materials:

1. Dunn, P. K. (2021), Scientific Research and Methodology: Tutorials, An Introduction to Quantitative Research and Statistics in Science,Engineering, and Health: Tutorials, Available free at https://bookdown.org/pkaldunn/SRM-tutorials/.

2. Dunn, P. K. (2021), Scientific Research and Methodology: Software, An Introduction to Quantitative Research and Statistics in Science,Engineering, and Health: Using Software, Available free at https://bookdown.org/pkaldunn/SRM-software/. (Uses Jamovi and SPSS Software, Jamovi is a freely downable software)

BSC49003	DATA ANALYTICS LAB	CREDITS:2

List of Experiments:

1. Statistical Foundation for Data Science using Spreadsheet application:
    a. Frequency distribution table.
    b. Charts: Bar diagrams., Pie diagram., Histogram.
    c. Arithmetic Mean, Median, Mode, Mean Deviation and Standard Deviation.
2. Write Steps to Installation of R language.
3. Write R program to perform all the statistical measures (above in serial number:1) on sample data.
4. Write a program in R to draw scatter chart for data visualization.
5. Write a program in R to draw pie chart for data visualization.
6. Write program in R to import the data from outside of the sources.
7. Write program in R to perform data cleansing on different outside datasets.
8. Write and implement algorithm for:
    a. Linear and Logistic Regression,
    b. k-Nearest Neighbors (k-NN),
    c. SVM
    d. Decision Tree classification.
    e. Navie Bayes.
    f. k-means

MINOR CORE OPEN ELECTIVE - MANAGEMENT

BSC10022 BUSINESS MATHEMATICS CREDITS:4

UNIT - I

Percentage: Meaning, practical use and computation of percentages.

Ratio, Proportion and Variation: Inverse ratio, continued ratio. Direct proportion and inverse proportion. Application to partnership.

UNIT - II

Profit and Loss: Problems involving cost price selling price, market price trade discount and cash discount.

Commission and Brokerage: Rate of commission, types of commission agents, problems**.**

UNIT - III

Simple and Compound Interest: Concept of principal rate of interest, period and amount by simple and compound interest. Calculation of compound interest when compounded quarterly half yearly and annually.

UNIT – IV

Simple Annuity: Simple annuity (time span) status of annuity, Certain annuity, Annuity Contingent, Perpetual annuity. Amount of annuity, Present value of annuity. Annuity due and immediate annuity.

Reference Books:

1. Anand Sharma, "Business mathematics and analytics", 1st Edition, Himalaya Publishing House, 2013
2. Mukesh Kumar and Anand Chauhan, "Business mathematics", 9th Edition, Medtech, 2016
3. Shadab Khan, "Textbook of business mathematics", 2nd Edition, Viva books, 2019
4. Pippa Riley, "Business Maths", Student Edition, Viva books, 2012

BSC20023 PRINCIPLES OF MANAGEMENT CREDITS:4

UNIT - I

Introduction to Management: Definition, nature, scope, and significance of management, exploring its evolution through various schools of thought including Classical, Neo-Classical, Behavioral, Quantitative, and Contemporary approaches. Managerial roles and skills, the universality of management, and the challenges faced by modern managers in a dynamic global environment.

UNIT - II

Planning and Decision-Making: Primary function of planning, encompassing its nature, importance, types of plans, and the planning process including objectives, strategies, policies, and procedures. Forecasting techniques and the crucial aspect of rational decision-making, including techniques like Management by Objectives (MBO), introduction to strategic management.

UNIT -III

Organizing and Staffing: Organizing function, including concepts like authority, responsibility, delegation, decentralization, centralization, departmentation, and span of management. Organizational structures (line, line and staff, functional, matrix) and the fundamentals of staffing, including human resource planning, recruitment, selection, training, and performance appraisal.

UNIT -IV

Directing and Controlling: Directing function, involving leadership theories (e.g., trait, behavioral, situational), motivation (e.g., Maslow's hierarchy, Herzberg's two-factor theory, McGregor's X and Y), and effective communication strategies, including overcoming barriers to communication, controlling function, its nature, process, techniques (e.g., budgeting, management information systems, PERT/CPM), characteristics of an effective control system, importance of coordination across all managerial functions.

Reference Books:

1. Robbins, Stephen P., Coulter, Mary K., Randel, Amy, & Visvanathan, Rajeesh. Management. 15th Edition, Pearson Education, 2022.
2. Harold Koontz, Heinz Weihrich&Mark V. Cannice. Essentials of Management, 11th Edition, McGraw Hill, 2020.
3. Tripathi, P.C., Reddy, P.N., & Bajpai, Ashish. Principles of Management. 7th Edition, McGraw Hill, 2021.
4. Prasad, L.M. Principles and Practice of Management, Sultan Chand & Sons, 2019
5. Rao, V.S.P. Principles of Management. 1st Edition, Himalaya Publishing House, 2024.
6. Sharma, R.K., Gupta, Shashi K., & Sharma, Rahul. Principles and Practices of Management, 1st Edition, Kalyani Publishers, 2023.

BSC20022 ORGANIZATIONAL BEHAVIOR CREDITS:4

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, 2022
2. Uma Sekharan, Organizational Behavior, 2nd Edition, MGH, 2004
3. Pareek. U.,"Understanding Organizational Behavior", 2nd Edition, Oxford University Press, 2010
4. Schermerhorn, J. R., Osborn, R.N., Hunt, M.U.J., "Organizational Behavior", 12th ed., Wiley, 2016
5. Steven McShane, Mary Ann Von Glinow, Himanshu Rai,"Organizational Behavior", 9th Edition, MGH, 2022
6. Preetam Khandelwal; James Campbell Quick,"Organization Behavior", Cengage, 2013

BSC20024 OPERATIONS RESEARCH CREDITS:4

UNIT - I

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

Linear Pprogramming: Cconcept 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, "Operations Research", S.Chand, 2010
2. Hamdy A Taha, "Operations Research an Introduction", 8thEdition, Prentice Hall, 2006
3. S D Sharma, "Operations Research Theory and Applications", S.Chand, 2009
4. Frederick S. Hillier (et-al),"Introduction to Operations Research", 11th Edition, MGH, 2021
5. S.R. Yadav & A.K. Malik,"Operations Research", 1st Edition, Oxford, 2014
6. T. Veerarajan, "Operations Research", Universities Press; 2017

BSC30021 INFORMATION SYSTEMS CREDITS:4

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
4. Waman S Jawadekar, Sanjiva Shankar Dubey; "Management Information System"; 6th Edition, MGH, 2020
5. Patricia Wallace,"Introduction to Information Systems", 3/e: People, Technology and Processes; Pearson, 2019
6. Effy Oz, "Management Information Systems", 6th Edition, Cengage, 2013
7. Girdhar Joshi,"Management Information Systems", 1st Edition, Oxford, 2013
8. D.P. Goyal,"Management Information Systems: Managerial Perspectives", 4th Edition; Vikas, 2014

BSC30022 ENTREPRENEURSHIP AND STARTUPS CREDITS:4

UNIT – I

Entrepreneurship & Entrepreneurial Environment: Entrepreneurship-meaning, Concept, Characteristics. Entrepreneurship & Business Ethics. History of Entrepreneurship Development, Theories of Entrepreneurship Who are entrepreneur, what makes someone an entrepreneur, Factors influencing Entrepreneurship-Psychological, Political, Demographic, Socio-cultural, Technological, Legal, Economic environment. Functions and Classification of entrepreneur, Merits and Barriers to entrepreneurship, Entrepreneurship & Economic development, Qualities of successful entrepreneur, Entrepreneurship development training and role of institutions. Entrepreneurship & Social Responsibilities.

UNIT – II

Growth of Business Idea & Business Model:New Business Idea, Sources of Business Idea, Pre-selection process, Research & Business idea execution, Business Idea v/s Business Model, Components of Business Model, Business Model Canvas, Corporate instance on Business Model- Case Study. Why Business Model are often failed. Operations & Management Aspect of Business Model- Project Management, Finance, Marketing, Human Resource, E-Business, Networking, New Product Development, IT & e-Cell.

UNIT – III

Business Incubation & Start-Up: Doing Business in India- Major Issues, Types of Organization & Legal Components. Incubation & Incubator Ecosystem. Classification of Incubator, Development & Assessment of Incubator. Incubation Process, Institutional Mechanism & Capacity Building. Challenges to Business Incubation. DST Guidelines for Seed Support System (SSS). Start-Up Ecosystem. Policy Initiatives- Start-up India, Make In India & Business Clusters. Sector Covered by Start up. Factor Affecting Start-Up Ecosystem & Start up Action Plan. Managing & Financing Start ups. Stand up India Schemes. Start up Business Challenges. MSME & Start up Ecosystem, Start up Success Stories- Case Study.

UNIT – IV

Managerial Aspects & Government Initiatives: Market Strategies, Cash Management, Cost Management & Customer Relationship Management, CSR & its dimension, emphasizing best practices- AI & FINTECH. Government Initiatives – Budgetary Provisions on start-ups Make in India, MSME Provisions & Digital India initiative. Skill Development Programme. Commercial Banks and other Financial Institutional Support like SIDBI,SIDC,SFC,EXIM Bank, NSIC,SIDOSSIB,SSICS, Tax Benefits to Small Scale Industries, MODVAT and Small-Scale Industries, Information facilities center in DGS & D, Khadi and Village Industries Commission (KVIC).

Reference Books:

1. Rajeev Roy, “Entrepreneurship Management”, Oxford University Press, 2008
2. S. S. Khanka, “Entrepreneurial Development”, 4th edition, Revised Edition, S. Chand, 2020
3. Abha Mathur, “Entrepreneurship& New Venture Planning”,2024 Edition,Taxmann, 2024
4. Savita Joshi, “Entrepreneurship, Innovations & Start-Ups in India”, New century publications**,** 2017
5. M.L. Sharma, “Entrepreneurship Development and Management”, Khanna Publishers,2021

MINOR CORE OPEN ELECTIVE - ELECTRONICS

BSC10032 PRINCIPLES OF ANALOG AND DIGITAL ELECTRONICS CREDITS:4

UNIT - I

Semiconductor Physics: Study of circuit elements (Passive and Active elements), Energy bands in solids, Concept of Hole current, classification of semiconductors: Intrinsic and Extrinsic, Concept of majority and minority charge carriers.

Semiconductor Diodes and Circuits: Study of semiconductor devices with reference to symbol, working principle, I-V characteristics. diode equation, diode resistance. Zener diode, light emitting diode, photo diode, Varactor diode. Diode circuits: Clipper and clamper circuits, Rectifier circuits (half and full wave rectifiers).

UNIT - II

Bipolar Junction Transistor and Circuits: Decision Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, I-V characteristics, parameters, specifications, Concept of amplification, Transistor configurations - CB, CE and CC. DC biasing circuits: fixed bias, emitter feedback bias, voltage divider bias, collector feedback bias. DC load line (for CE configuration), Q point analysis and factors affecting the stability, transistor as a switch.

Field Effect Transistors: Symbol, types, construction, working principle, I-V characteristics of: Junction Field Effect Transistor (JFET), Metal Oxide Semiconductor FET (MOSFET).

UNIT - III

Number Systems and Codes: Binary, Octal and Hexadecimal number systems, Number base conversion, Binary arithmetic, Complements, Signed binary numbers. Binary codes: BCD, Excess-3, Gray codes.

Binary Logic and Boolean Algebra: Binary logic: Logic gates. Theorems and properties of Boolean algebra, Logic functions, Canonical and standard forms of Boolean functions, Simplification of logic functions using K-map, Don’t care conditions, Logic diagram: NAND and NOR implementation.

UNIT – IV

Combinational Logic Design: Combinational circuits: Binary adder (Half and Full adder), Binary subtractor (Half and Full subtractor), Multiplexer, Demultiplexer, Encoder and Decoder.

Sequential Logic Circuits: Flip-Flops: clocked SR, JK, D, T - Flip-Flops, Excitation table, Edge-trigered flip-flop. Registers, Counters.

Reference Books:

1. V. K Mehta, Rohit Mehta, "Principles of Electronics", 7th Edition, S Chand, 2014.
2. N. N. Bhargava, Kulshreshtha, S. C. Gupta, "Basic Electronics and Linear Circuits", 2nd Edition, McGraw Hill Education, 2017.
3. Jacob Millman, "Electronic Devices and Circuits (SIE)", 4th Edition, McGraw Hill Education, 2015.
4. R. P. Jain, "Modern Digital Electronics", 4th Edition, McGraw Hill Education, 2020.
5. M. Morris Mano, M. D. Ciletti, "Digital Design", 4th Edition, Pearson Prentice Hall, 2008.

BSC20031 MICROPROCESSOR ARCHITECTURE CREDITS:4

UNIT-I

Introduction to Microcomputer and Microprocessor: Microcomputer organization, different parts of microcomputer and operation, Microprocessor, Evaluation of Microprocessor, Generalized Microprocessors Architecture and operation, ALU, Register Array, Instruction execution, Bus operation, Memory array design and memory interfacing.

8086 Hardware Specifications: Pin functions, Bus buffering and latching, Bus timing. Detail Architecture of 8086, Addressing Modes, Assembler directives. Instruction Sets: Data movement instructions, Arithmetic instructions. Instruction Sets: Logic Instructions and Program Control Instructions, Assembly Language Programming, system design and interrupt.

UNIT-II

An Introduction to Processor Design: Processor architecture and organization, Abstraction in hardware design, MU0 - a simple processor, Instruction set design, Processor design trade-offs, The Reduced Instruction Set Computer, Design for low power consumption. The ARM Architecture: The Acorn RISC Machine,Architectural inheritance, The ARM programmer's model, ARM development tools.

Assembly Language Programming: Data processing instructions, Data transfer instructions, Control flow instructions, Writing simple assembly language programs. ARM Organization and Implementation:

Pipeline, Types, 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.

UNIT-III

ARM Assembly Language Programming: Data processing instructions, Data transfer instructions, Control flow instructions, Writing simple assembly language programs. ARM Organization and Implementation: Pipeline, Types, 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.

UNIT-IV

The ARM Instruction Set: Introduction, Exceptions, Conditional execution , Branch and Branch with Link (B, BL),Branch, Branch with Link and exchange (BX, BLX) , Software Interrupt (SWI) ,Data processing instructions, Multiply instructions, Single word and unsigned byte data transfer instructions , Half-word and signed byte data transfer instructions, Multiple register transfer instructions , Status register to general register transfer instructions ,General register to status register transfer instructions , Coprocessor instructions. Coprocessor data operations, Coprocessor data transfers, Coprocessor register transfers, Breakpoint instruction (BRK - architecture v5T only), Unused instruction space, Memory faults, ARM architecture variants.

Reference Books:

1. Steve Furber, "ARM System-On-Chip Architecture", Pearson Education India, 2014
2. Brey, "The Intel Microprocessors-Architecture, Programming, and Interfacing", 8th Edition, Pearson Education India, 2008

BSC20032 EMBEDDED SYSTEMS CREDITS:4

UNIT - I

Introduction to Embedded Computing and ARM Processors: Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT - II

Embedded Computing Platform Design: The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program sizeProgram validation and testing.Interfacing ADC and DAC, Interfacing LED and PWM, Interfacing real time clock and serial port, Interfacing keyboard and LCD, Interfacing EPROM and interrupt.

UNIT - III

Processes and Operating Systems: IntroductionIntroduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

UNIT – IV

System Design Techniques and Networks: Declaring Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems. Introduction to Networks, Distributed Embedded Architectures, Networks for Embedded Systems, Network-Based Design, Internet-Enabled Systems, Vehicles as Networks, Sensor Networks, Design Example: Elevator Controller.

Reference Books:

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design” Third Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2. Wayne Wolf, “Computers as Components- Principles of Embedded Computing System Design”, Morgan Kaufmann Publishers, Second edition, 2008.
3. Jonathan W. Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.
4. Peter Barry Patrick Crowley, “Modern Embedded Computing Designing Connected, Pervasive, Media- Rich Systems”, Elsevier, 2012.

BSC20034 MOBILE COMMUNICATIONS CREDITS:4

UNIT - I

Introduction to Mobile Communications and Computing: Applications of Mobile Computing, Generations of Mobile Communication Technologies.

(Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and Exposed terminals, Near and Far terminals), SDMA, FDMA, TDMA, CDMA. Spreading Techniques.

UNIT - II

Cellular Systems: GSM, Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security and new data services, General Packet Radio Service (GPRS), EDGE, Universal Mobile Telecommunication System (UMTS). Next Generation Networks – Orthogonal Frequency Division Multiplexing (OFDM), LTE – Architecture & Interface – LTE radio planning, 5G Architecture, MIMO Satellite Communications Systems.

UNIT - III

Wireless LAN: IEEE 802.11 - Architecture – Services – MAC – Physical layer – IEEE 802.11a - 802.11b/g/n - 802.11AC/AD/AX standards – HIPERLAN – Bluetooth, ZigBee, RFID.

Mobile Network Layer: Mobile IP -Goals, assumptions, Entities and terminology, IP packet delivery, Agent Advertisement and Discovery, Registration, Tunnelling and Encapsulation.

Mobile Ad hoc Networks (MANETs): Properties of a MANET, Routing and various routing algorithms, Dynamic Source Routing (DSR), Vehicular Ad Hoc networks (VANET) – MANET Vs VANET.

UNIT – IV

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast re-transmit/fast recovery, Transmission/time-out freezing, Selective Re-transmission, Transaction oriented TCP.

Protocols and Tools: Wireless Application Protocol-WAP Architecture, Mobile Device Operating Systems: iOS, Android, Security.

Reference Books:

1. Jochen Schiller, "Mobile Communications", Pearson Education, Second edition, 2014.
2. Theodore S. Rappaport, "Wireless Communications: Principles and Practice",Second edition, Pearson / PHI Publication, 2023.
3. Upena Dalal, "Wireless communication & networks", Oxford University Press, 2014.
4. Kumkum Garg, "Mobile Computing", Pearson Education India, 2010.
5. GottapuSasibhushana Rao, "Cellular Mobile Communication", Pearson Education India, 2012.
6. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, 2004.
7. Uwe Hansmann, LotharMerk, Martin S, Nicklous, Thomas Stober, "Principles of Mobile Computing", 2nd Edition, Springer, 2006.

BSC30031 DIGITAL IMAGE PROCESSING CREDITS:4

UNIT - I

Digital Image Fundamentals: Introduction, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.

UNIT – II

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-domain Filters, Sharpening Frequency-domain

Filters.

UNIT - III

Image Restoration: A Model of the Image Degradation/Restoration Process, Linear, Position-Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

Image Transformation:Wavelets and Multi resolution Processing: Multi resolution Expansions, Wavelet Transforms in one Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions.

UNIT – IV

Image Compression: Compression Fundamentals, Image Compression models, Error Free Compression, Lossy compression, Image Compression standards.

Image Segmentation: Fundamentals, Point, Line and Edge detection, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging.

Reference Books:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
5. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

BSC30032 DIGITAL SIGNAL PROCESSING CREDITS:4

UNIT - I

Introduction: Signal, System, Classification of signals, Concept of frequency in continuous-time and discrete-time signals, A-to-D and D-to-A conversion: sampling, quantization and encoding.

Discrete-Time Signals and Systems: Discrete-Time Signals, Discrete-Time Systems, Analysis of Discrete-Time Linear Time-Invariant Systems: Linear convolution sum, Stability, and Causality. Recursive and Non-recursive Discrete-Time Systems, LTI Systems Characterized by Constant-Coefficient Difference Equations, Implementation of Discrete-Time Systems.

UNIT - II

Z-Transform and its Application to the Analysis of LTI Systems:Direct Z-transform, Properties of the Z-Transform, Poles and Zeros, Inversion of the Z-Transform, One-sided Z-Transform, Solution of Difference Equations Using Z-Transform.

UNIT - III

Discrete Fourier Transforms: Discrete Fourier Transform (DFT), Properties of DFT. Linear convolution of sequences using DFT. Computation of DFT: Over-lap Add method, Over-lap Save method.

Fast Fourier Transforms: Fast Fourier Transform (FFT) algorithms, Radix-2 FFT algorithms: Decimation-in-Time and Decimation-in-Frequency FFT algorithms, Inverse FFT.

UNIT – IV

IIR Digital Filters: Analog Filter Approximations - Butterworth and Chebyshev, Design of IIR digital filters from analog filters, Bilinear Transformation method.

FIR Digital Filters: Characteristics of FIR digital filters. Design of FIR filters using Window techniques, Comparison of IIR & FIR filters.

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", Pearson Education / PHI, 2007.
2. A. V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing",PHI, 2009.
3. S.Salivahanan, A.Vallavaraj and C.Gnanapriya, "Digital Signal Processing", TMH, 2009.
4. Robert J. Schilling, Sandra L. Harris, B Thomson,"Fundamentals of Digital Signal Processing using MATLAB", CL Engineering, 2004.
5. Nagoor Khani, "Digital Signal Processing", TMG, 2012.

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