Syllabi and Scheme of Examinations
for
4-year Bachelor of Computer Applications – Single Major Program

(Based on Curriculum and Credit Framework for UG Programs under NEP)

With Effect from the session 2023-24

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

Academic Session 2023-24
Second Semester

Name of the Program	**4-Year Bachelor of Computer Applications**	**Program Code**	**-----**
Name of the Course	**Digital Logic Design**	**Course Code**	**23BCA402DS01**
Hours/Week	**4 (4+0+0)**	**Credits (L:T:P)**	**4:0:0**
Max. Marks.	**Theory: 100 (70+30)**	**Time of end term examination**	**3 Hours**

Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of 7 parts (short-answer type questions) covering the entire syllabus. Student will be required to attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory.

Course Objectives:

To acquire the basic knowledge of digital logic levels and application to understand digital electronics circuits. This course also prepares students to perform the analysis and design of various digital electronic circuits, design and analyze sequential and combinational logic circuits.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Understand the concept of logic gates.
CO2: Understand and use of number system and their conversion.
CO3: Learn the concept of combinational circuit and sequential circuits.
CO4: Understand the concept of Computer Organization and instruction sets.
CO5: Explore concepts related to Memory Organization and Input Output Organization.

Unit – I

Digital Systems and Binary Numbers: Digital Systems: Digital Signals, Digital Waveforms, Digital Computers and Digital Integrated Circuits. **Number Systems:** Binary Number Systems, Octal and Hexadecimal Number System. Number Base Conversions. Complements, Signed Binary Numbers and Binary Codes, Error Detection and Correction codes.

Boolean Algebra and Logic Gates: Boolean Algebra: Axiomatic Definition, Theorems and Properties. Boolean Functions, Canonical Standard forms: SOP and POS forms. **Digital Logic Gates:** NOT, OR, AND, NOR, NAND, XOR and XNOR. Universal Gates and their implementation

Unit – II

Gate Level Minimization: Karnaugh Map (K-map) Method: Simplification: Algebra postulates and Canonical forms. Prime Implicants: Types, Determination and Selection of Prime implicants.

Don’t Care Conditions, NAND and NOR implementation.

Unit – III

Combinational Circuits: Introduction, Characteristics and Designing principles of Combinational circuits. Binary Adder: Half-Adder & Full-Adder, Subtractor: Half-Subtractor & Full-Subtractor, Parallel binary Adder/Subtractor, Binary Multiplier, Comparators, Multiplexers, De-multiplexers, Encoders and Decoders.

Unit – IV

Sequential Circuits: Characteristics of Sequential Circuits, Latches, **Flip-Flops:** Introduction, S-R Flip flop, J-K Flip Flop, D Flip flop, T Flip flop and Master Slave Flip flop.

Registers: Shift Registers, Applications of Registers. **Counters**: Asynchronous & Synchronous Counters. Modulo-N Counters and Up-Down Counters.

Suggested Readings:

1. Mano, M.M. : Digital Logic and Computer Design, Prentice- Hall of India.
2. Gill, Nasib Singh and Dixit J.B.: Digital Design and Computer Organisation, University Science Press (Laxmi Publications), New Delhi.
3. Stallings, William: Computer Organisation & Architecture.
4. Mano, M.M. : Digital Design, Prentice-Hall of India.
5. Anand Kumar : Fundamentals of Digital Circuits, PHI.
6. Tokheim : Digital Electronics, TMH.
7. S. Rangnekar: Digital Electronics, ISTE/ EXCEL
8. Any other book covering the contents of the subject.

Note: Latest and additional good books may be suggested and added from time to time.

Name of the Program	**4-Year Bachelor of Computer Applications**	**Program Code**	**-----**
Name of the Course	**Data and File Structures**	**Course Code**	**23BCA402DS02**
Hours/Week	**5 (3+0+2)**	**Credits (L:T:P)**	**3:0:1**
Max. Marks.	**Theory: 75 (50+25)** **Practical: 25 (20+5)**	**Time of end term examination**	**3 Hours**

Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of 5 parts (short-answer type questions) covering the entire syllabus. Student will be required to attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory.

Course Objectives:

The course aims to empower students with a comprehensive skill set in data and file structures, fostering both theoretical understanding and practical application, preparing them for analyzing and applying algorithms, design and apply efficient algorithms using data structures, understand the significance of efficient data and file organization, develop coding proficiency in data structure applications.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Understand the fundamental concepts of data structures.
CO2: Design and implement various data structures to solve computational problems.
CO3: Apply data structures for efficient storage and retrieval of information.
CO4: Develop algorithms for searching and sorting data.
CO5: Implement file handling operations in a programming environment.

Unit – I

Introduction: Elementary data organization, Data Structure definition, Data type vs. data structure, Categories of data structures, Data structure operations, Applications of data structures.

Arrays: Introduction, Linear arrays, Representation of linear array in memory, address calculations, Traversal, Insertions, Deletion in an array, Multidimensional arrays, Parallel arrays, Sparse arrays.

Searching: Introduction, Sequential search, Binary search, Prerequisite for binary search, Comparison in terms of efficiency.

Unit – II

Sorting: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Comparison in terms of their efficiency.

Stack: Introduction, Array and linked representation of stacks, Operations on stacks, Applications of stacks: Polish notation, Recursion.

Queues: Introduction, Array and linked representation of queues, Operations on queues, Deques, Priority Queues, Applications of queues.

Unit – III

Linked List: Introduction, Representation of linked lists in memory, Traversal, Insertion, Deletion, Searching in a linked list, Header linked list, Circular linked list, Two-way linked list, Threaded lists, Garbage collection, Applications of linked lists.

Tree: Introduction, Definition, Representing Binary tree in memory, Traversing binary trees, Traversal algorithms using stacks.

Graph: Introduction, Graph Theory terminology, Sequential and Linked representation of Graphs.

Unit – IV

Introduction to file structures: Concept of a file, types of files, File operations - open, read, write, close. External storage devices, Concepts of record, file, database and database system.

File Organization: Sequential file organisation – structures and processing, Record structures and access methods. Indexed sequential file organisation – structures and processing, Indexing techniques, B-trees and hashing for indexed files. Direct file organisation. Hashed File Organization - Hash function implementation.

Suggested Readings:

1. Seymour Lipschutz, "Data Structure", Tata-McGraw-Hill
2. Horowitz, Sahni & Anderson-Freed, "Fundamentals of Data Structures in C", Orient Longman.
3. Trembley, J.P. And Sorenson P.G., "An Introduction to Data Structures With Applications", McGraw-Hill International Student Edition, New York.
4. Mark Allen Weiss Data Structures and Algorithm Analysis In C, Addison- Wesley, (An Imprint Of Pearson Education), Mexico City.Prentice- Hall Of India Pvt. Ltd., New Delhi.
5. Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, "Data Structures Using C", Prentice- Hall of India Pvt. Ltd., New Delhi.
6. Any other book covering the contents of the subject.

Note: Latest and additional good books may be suggested and added from time to time.

List of Programs

1. Write a C program to demonstrate basic data structure operations such as creating, inserting, deleting, and displaying elements in an array.
2. Write a C program to insert and delete an element at a specified position in a linear array.
3. Write a C program to implement and demonstrate a sequential search on an array.
4. Write a C program to implement and demonstrate a binary search on a sorted array.
5. Write a C program to implement and demonstrate the Bubble sort algorithm.
6. Write a C program to implement and demonstrate the Selection sort algorithm.
7. Write a C program to implement and demonstrate the Insertion sort algorithm.
8. Write a C program to implement and demonstrate the Quick sort algorithm.
9. Write a C program to implement and demonstrate the Merge sort algorithm.
10. Write a C program to implement a stack using an array and perform basic stack operations: push, pop, and display.
11. Write a C program to implement a queue using an array and perform basic queue operations: enqueue, dequeue, and display.
12. Write a C program to implement a singly linked list and perform insertion, deletion, and traversal operations.
13. Write a C program to implement a binary tree and perform in-order, pre-order, and post-order traversal using recursion.
14. Write a C program to implement a binary search tree (BST) and perform insertion, deletion, and search operations.
15. Write a C program to represent a graph using an adjacency matrix and perform a depth-first search (DFS).
16. Write a C program to represent a graph using an adjacency list and perform a breadth-first search (BFS).
17. Write a C program to demonstrate basic file operations: open, read, write, and close.

Any other programs assigned by the teachers.

Name of the Program	4-Year Bachelor of Computer Applications	Program Code	-----
Name of the Course	Python Programming	Course Code	23BCA402SE01
Hours/Week	5 (1+4)	Credits (L:T:P)	1:0:2
Max. Marks.	Theory: 25 (20+5) Practical: 50 (35+15)	Time of end term examination	3 Hours

Note: The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of 4 short-answer type questions covering the entire syllabus. Student will be required to attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory.

Course Objectives:

The course is designed to impart knowledge of one of the latest and most powerful programming languages – Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

Course Outcomes:

By the end of the course the students will be able to:
CO1: Develop problem-solving skills and critical thinking in Python using basic programming constructs including variables, operators and data types.
CO2: Will be able to learn the automating repetitive tasks using loop and conditional controlled statements.
CO3:Understand the complex data types including lists, tuples, dictionaries and Function packages.
CO4: Identify and use libraries for algorithmic thinking to implement various data structures.
CO5: Will be able to implement important concept of Database programming.

Unit – I

Introduction to Python: History and Features of Python Programming, Basics of Python:Keywords, Variables, Operators, I/O Statements, Indentation, and Comments. Python Basic Data Types, Data Types Declaration, and Implementation.

Unit – II

Flow Control Statement: if statement, if-else statement, nested-if statement,if-elif-else ladder, While loop, range() Function, For Loop, Nested Loops, Infinite Loop, Break Statement, Continue Statement, Pass Statement

Unit – III

Python Complex data types: String Data Type, String Manipulation Methods and implementation using Python Programming
List and Dictionary Data Type, Declaration, and Implementation using Various built-in Functions and Libraries

Unit – IV

Python File Operations: Reading Files, Writing Files in Python, Understanding Read Functions:read(), readline(), readlines(), Understanding Write Functions: write() and writelines() Manipulating file pointer using seek Programming, using file **operations**.

Database Programming: Connecting to a Database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, and Exception Handling in Databases.

Suggested Readings:

1. Al Sweigart: Automate the Boring Stuff with Python.
2. Allen B. Downey: Think Python: How to Think Like a Computer Scientist, 2nd Edition, Green Tea Press
3. Charles Dierbach: Introduction to Computer Science Using Python, 1st Edition, Wiley India Pvt Ltd.
4. Wesley J Chun: Core Python Applications Programming, 3rd Edition, Pearson Education India
5. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich: Data Structures and Algorithms in Python, 1st Edition, Wiley India Pvt Ltd
6. Reema Thareja: Python Programming using problem solving approach, Oxford University press.
7. Charles R. Severance: Python for Everybody: Exploring Data Using Python 3, 1 st Edition, Shroff Publishers.
8. Any other book covering the contents of the subject.

Note: Latest and additional good books may be suggested and added from time to time.

Course Code	23HNDX01AE01	**Course Credits**	2(L:T:P:) (2:0:0)
Max. Marks	50(External (term-end exam)-35 (Internal -15)	**Time of end term examination**	3 Hours

The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units.The candidate has to attempt one question each from each unit along the compulsory question (5 X7- 35 marks)

Course Objectives:

1. विद्यार्थियों को हिन्दी भाषा के महत्त्व एवं गुणवत्ता से सुविज्ञ करवाकर हिन्दी की ओर उन्मुख करना।

2. विद्यार्थियों को हिन्दी–भाषा की वैज्ञानिकता के विषय में बतलाकर इसके गौरव से सुपरिचित करवाना।

3. हिन्दी भाषा के माध्यम से नवयुवक–नवयुवतियों को राष्ट्रीयता के पुनीत भावों की ओर उन्मुख करना।

Course Outcomes

1. शुद्ध हिन्दी के प्रयोग में अभिवृद्धि होगी।

2. व्यवसाय एवं रोजगार की उपलब्धता वाले सभी क्षेत्रों में हिन्दी भाषा में निष्णात युवाओं की प्रतिभागिता में अभिवृद्धि होगी।

3. अन्तरराष्ट्रीय स्तर पर हिन्दी–भाषा के वर्चस्व की स्थापना होगी और हिन्दी–भाषी को देश और विदेश में समुचित सम्मान मिलेगा।

इकाई–1

लिपि का मानकीकरण, मानक वर्णमाला, देवनागरी अंक माला, अनुस्वार और विसर्ग, अनुनासिक, वर्तनी की शुद्धता के लिए ध्यान देने योग्य बातें, वर्तनी संबंधी अशुद्धियों के कारण, वर्तनी संबंधी अशुद्धियों को दूर करने के उपाय

इकाई–II

सृजनात्मक साहित्य का अर्थ, परिभाषा और स्वरूपः आलोचनात्मक साहित्य का अर्थ, परिभाषा और स्वरूपः सृजनात्मक साहित्य का भाषा–विकास में महत्त्व, निबंध लेखन, कहानी लेखन, काव्य लेखन

इकाई– III

अनुवाद : अर्थ, परिभाषा और स्वरूपय अनुवाद का महत्त्व, अनुवादक के गुण, अनुवाद के प्रकार : अनुवाद में कंप्यूटर का योगदान, सीरियलों का हिंदी अनुवाद, बैंकिंग साहित्य का अनुवाद, डबिंग क्षेत्र में अनुवाद, लिप्यंतरण, हिंदी साहित्य का अन्य भाषाओं में अनुवाद, अनुवाद–क्षेत्र में रोजगार

इकाई–IV

पत्र प्रस्तुतीकरण का अर्थ, पत्र प्रस्तुतीकरण और नवीन शोधात्मक वैचारिकता, पत्र प्रस्तुतीकरण और शिक्षक की भूमिका, प्रस्तोता का मनोबल, वक्तृत्व कला का विकास, शोधात्मक अभिरुचि का विकास

प्रेरणास्पद पुस्तकें :

1. डॉ० हरिश्चन्द्र वर्मा, शुद्ध लेखन और हिन्दी का मानक रूप, विद्या भारती, संस्कृति शिक्षा संस्थान, कुरुक्षेत्र (हरियाणा)

2. सम्पा० कालिका प्रसाद, राजवल्लभ सहाय, मुकुन्दीलाल श्रीवास्तव, बृहत् हिन्दी कोशः ज्ञानमण्डल लिमिटेड, वाराणसी

3. मुख्य सम्पादक, डॉ० लक्ष्मीनारायण शर्मा, परिशोध, मानव–मूल्य विशेषांक, 1993

4. डॉ० धर्मपाल मैनी, भारतीय जीवनमूल्य, भारतीय संस्कृति संस्थान, गुड़गाँव

5. बृहत् प्रशासन शब्दावली, हिन्दी–अंग्रेजी, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली–110006

6. बृहत् प्रशासन शब्दावली, अंग्रेजी–हिन्दी, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली–110006

7. बृहत् पारिभाषिक शब्द–संग्रह, मानविकी, खंड–।।, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, केन्द्रीय हिन्दी निदेशालय शिक्षा तथा समाज कल्याण मंत्रालय, भारत सरकार

8 डॉ० अनन्त चौधरी, नागरी लिपि और हिन्दी–वर्तनी बिहार हिन्दी ग्रन्थ अकादमी, पटना–3

9. डॉ० सुरेश सिंहल, अनुवाद सिद्धान्त एवं व्यवहार, अभिनव प्रकाशन, दिल्ली–6

10. डॉ० सुरेश सिंहल, प्रयोजनमूलक अनुवाद, मोनिका प्रकाशन, दिल्ली–110053

Allen, LA, ―Management and Organisation-Tokyo.
Kumar, Pardeep. Management: Principles and Applications. JSR Publication House LP, Delhi.
Stoner and Freeman, ―Management—Prentice Hall, New Delhi. R
Griffin- Management Principles and Application. Cengage
Parag Deewan, ―Management, Principles and practices-Excel Books.
Mahajan, J.P. and Mahajan Anupama. Management Principles and Applications. Vikas Publications

Semester II
Session: 2024-25

Name of Program	**B.COM**	**Program Code**	
Name of the Course	**Fundamentals of Accounting**	**Course Code**	**24COM402MI01**
Hours per Week	**4**	**Credits**	**4**
Maximum Marks	**100** **Internal 30** **External 70**	**Time of Examinations**	**3**

Note:
The examiner shall set nine questions in all covering the whole syllabus. Question No.1 will be compulsory covering all the units and shall carry 7 small questions of two marks each. The rest of the eight questions will beset from all the four units. The examiner will set two questions from each unit out of which the candidate shallattempt four questions selecting one question from each unit. All questions shall carry 14 marks each.

Course Learning Outcomes (CLO):
CLO 1: Students will be able to understand the significance of accounting, including its meaning, objectives, scope, limitations, and the diverse users of accounting information.
CLO 2: To learn the principles and practices of the double-entry system and gain proficiency in recording various transactions in the journal.
CLO 3: Develop the ability to manage different subdivisions of the journal, including specialized books like the cash book, purchase book, sales book, and understand their role in accounting.
CLO 4: Demonstrate competency in preparing a trial balance to ensure accuracy and in generating key financial statements like the trading account, profit and loss account, and balance sheet for a sole proprietary business, incorporating necessary adjustments.

Unit 1
Accounting: (i) Meaning, Objectives, Scope, Limitations and Users of Accounting Information (ii) Basic Accounting Terms; (iii) Accounting Principles.

Unit 2
(i) Double Entry System (ii) Recording of Transactions in Journal; (iii) Ledger

Unit 3
(i)Sub-Division of Journal: Cash Book, Single Column Cash Book and Cash Book with Bank Column, Petty Cash Book (ii) Purchase Book, Sales Book, Purchase Return Book, Sales Return Book, Journal Proper

Unit 4
(i) Trial Balance; (ii) Financial Statements:Trading Account, Profit and LossAccountandBalanceSheet of sole proprietarybusiness (With Adjustment)

References:

- D.K. Goyal: Financial Accounting, Arya Publication Ltd.
- S.N. Maheshwari: An introduction to Accounting, Vikas Publishing House Pvt. Ltd.
- NishatAzmat and Andy Lymer: Basic Accounting: The step-by-step course in elementary accountancy, Kindle

Semester:II
Session: 2024-2025

Name of Program		**Program Code**	
Name of the Course	**Environmental issues**	**Course Code**	**24EVSX02MD01**
Hours per Week	**3**	**Credits**	**3**
Maximum Marks	**75**	**Time of Examinations**	**3 Hours**

Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO): After completing this course, the learner will be able to:

CLO1. Gain knowledge about major global environmental issues related to industrialization and urbanization and internationalefforts for environmental protection.

CLO2. Understand the issues related to exploitation of resources, degradation and pollution

CLO3.Understand the issues related to different types of pollution and their effect on environment in total.

Unit 1: Significant global environmental issues: acid rain, climate change, biodiversity loss, ozone layer depletion, Deforestation, resource depletion and conservation,Sustainable development, International concerns and efforts for environmental protection, Role of United Nations, Stockholm Summit, Rio Summit.

Unit 2: Regional Environmental Issues: Forest and Wildlife management, desertification, reclamation of degraded land; Human intervention on wetlands, siltation and eutrophication, reclamation of wetlands, Mining and Environment, Open cast mining, Oil exploration and transportation, Deforestation and their impact on environment.

Unit 3: Pollution: Air Pollution: Causes of air pollution, Some important pollutants of air (CO, SOX, NOX and HC and Particulates) – their sources and effects on living and non-living organisms. Water Pollution: Sources of pollution of surface and ground water, Types of water pollutants. Solid Waste – Sources, characterization, disposal and management. Soil Pollution sources of soil pollution, Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers; Soil erosion.

References:

1. Singh, J.S., Singh, S.P. & Gupta, S.R. (2017). Ecology, Environment and Conservation.S.Chand (G/L) & Company Ltd.
2. Kumar, A. & Roy, P. K. (2008). Environmental Issues and Solutions. Daya Publishing House,New Delhi
3. Vashishsta, A. &Johari, S. (2020). Case Studies: Contemporary Environmental Issues and Challenges. Bloomsbury Publishing.
4. Sudhir, M.A. &Masillamani, M.A. (2003). Environmental Issues. Reliance Publishing House.
5. Gope, A., Sarkar, A., Sarkar, P., Majumdar, S. &Gosai. K. (2019). Environmental Issues & Sustainable Development. Notion Press Media Pvt Ltd.

Syllabus for Value Added Courses under NEP 2020

Name of the Program	Common for all Four year UG/Five Year Integrated Programs	**Program Code**	-----
Name of the Course	Digital and Technological Solutions	**Course Code**	23CSAX01VA01
Hours/Week	2	**Credits**	2
Max. Marks.	50	**Time of end term examination**	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting with short answer from all the units. The candidate has to attempt one question each from each unit alongwith the compulsory question (5 x 7 = 35 marks)

Course Objectives:

1. To gain familiarity with digital paradigms
2. To sensitize about role & significance of digital technology
3. To provide know how of communications &networks
4. To bring awareness about the e-governance and Digital India initiatives
5. To provide a flavour of emerging technologies - Cloud, Big Data, AI,ML, Blockchain, Robotics, 3D printing.

Course Outcomes:

On successful completion of this course, the student will be able to have a knowledge regarding

1. Knowledge about digital paradigm.
2. Realization of importance of digital technology, digital financial tools, e-commerce.
3. Know-how of communication and networks.
4. Familiarity with the e-governance and Digital India initiatives
5. An understanding of use & applications of digital technology.
6. Basic knowledge of all machine learning and big data

Unit - I

Introduction & Evolution of Digital Systems: Role & Significance of Digital Technology; Information and Communication Technology (ICT) & Tools; Computer System &its working, Software and its types. *Operating Systems:* Types and Functions. *Problem Solving:* Algorithms and Flowcharts

Unit – II

Communication Systems: Principles, Model & Transmission Media.
Computer Networks & Internet: Concepts & Applications, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. *Computer Based Information System:* Significance & Types.
E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges

Unit – III

*Emerging Technologiesand their applications:*Overview of Artificial Intelligence, Machine Learning, Deep Learning; Big Data, Data Science and Big Data Analytics; Internet of Things (IoT) and Industrial Internet of Things (IIoT), Robotics and 3D Printing; Blockchain Technology; Quantum Computing; Cloud computing and its service models.

Unit – IV

Digital India & e-Governance: Initiatives, Infrastructure, Services and Empowerment.
Digital Financial Tools: Unified Payment Interface, AadharEnabled Payment System, USSD, Credit / Debit Cards, e-Wallets, Internet Banking, NEFT/RTGS and IMPS, Online Bill Payment and POS.
Cyber Security: Threats, Significance, Challenges, Precautions, Safety Measures and Tools.

Suggested Readings:

1. P. Kumar, A. Tomar, R. Sharmila: Emerging Technologies in Computing: Theory, Practice, and Advances, CRC/Chapman & Hall, eBook.
2. Nasib Singh Gill: Handbook of Computer Fundamentals, Khanna Book Publishing Company(P) Limited, New Delhi.
3. Behrouz A. Forouzan:Data Communications and Networking, McGraw Hill.
4. E Balagurusamy: Fundamentals of Computers, Tata McGraw Hill.
5. Buvya, Broberg, and Gosciniski: Cloud Computing- Principals and Paradigms, Wiley.