SARDAR PATEL UNIVERSITY, BALAGHAT

School of Computer Application
Syllabus under NEP

Course: Bachelor of Computer Applications (BCA)   Semester: IV

Branch: Computer Science and Application   w.e.f. Academic Session: 2025-26

Subject: Java Programming (BCAMA401T)

UNIT – I: Fundamentals of Java Programming

Introduction to Java: History and evolution of Java. **Features:** platform independence, robustness, security, portability, JVM, JDK, JRE architecture. **Basic Syntax**: Data types, variables, operators. **Control structures**: if-else, switch, loops (for, while, do-while). **Arrays and Strings**: Single and multidimensional arrays, String class, String methods, StringBuffer and StringBuilder. **Input/Output Basics**: Scanner class, Command-line arguments.

UNIT – II: Object-Oriented Programming Concepts

Classes and Objects: Defining classes, creating objects, Instance variables, methods. **Constructors**: Default, parameterized, copy constructors, Constructor chaining. **Inheritance**: Types: single, multilevel, hierarchical, Method overloading and overriding, Use of super keyword. **Polymorphism**: Compile-time and runtime polymorphism. **Abstract Classes and Interfaces**: Abstract methods, abstract classes, Interfaces and multiple, inheritance through interfaces. **Packages**: Creating and using packages, Access modifiers.

UNIT – III: Exception Handling & Multithreading

Exception Handling: **Types of exceptions:** checked, unchecked, Try-catch-finally, throw, throws, User-defined exceptions. **Multithreading**: Thread lifecycle, **Creating Threads:** extending Thread class, implementing Runnable. **Thread methods:** sleep, join, yield, priority, Synchronization and inter-thread communication. **Applications in AI**: Parallel data processing, Multithreading for training ML models.

UNIT - IV: Java Collections Framework

Introduction to Collections: Need for collections vs arrays, Interfaces: Collection, List, Set, Map. **List Implementations**: ArrayList, LinkedList, Vector. **Set Implementations**: HashSet, LinkedHashSet, TreeSet. **Map Implementations**: HashMap, LinkedHashMap, TreeMap. **Generics**: Type safety in collections, Generic classes and methods. **Iterators**: Iterator and ListIterator. **Applications in AI**: Managing datasets, Graph structures for search algorithms.

UNIT - V: Advanced Java Concepts

Database Connectivity (JDBC): JDBC architecture, Steps to connect Java with databases, Executing queries (insert, update, delete, select). **Networking**: Basics of networking in Java, Socket programming (client-server), URL and HTTP communication. **GUI Programming**: **Swing basics:** JFrame, JButton, JTextField, JLabel, Event handling, JavaFX introduction. **Java in AI**: Overview of Java-based AI libraries (Weka, Deeplearning4j), **Case studies:** using Java for ML preprocessing and visualization.

Textbooks

1. Herbert Schildt – *Java: The Complete Reference* (McGraw Hill)
2. Balagurusamy – *Programming with Java* (McGraw Hill)

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Reference Books
- Cay S. Horstmann – *Core Java Volume I & II*
- Joshua Bloch – *Effective Java*
- Dietel & Dietel – *Java How to Program*
- Patrick Naughton & Herbert Schildt – *The Java Handbook*

Java Programming Lab
1. Write a program to check whether a number is prime.
2. Implement Fibonacci series using recursion.
3. Create a class Student with attributes and display details using constructors.
4. Demonstrate method overloading and overriding with a Shape class.
5. Write a program to implement single and multilevel inheritance.
6. Create an interface Vehicle and implement it in Car and Bike classes.
7. Write a program to handle ArrayIndexOutOfBoundsException.
8. Implement a user-defined exception for invalid age input.
9. Create two threads: one prints even numbers, another prints odd numbers.
10. Demonstrate thread synchronization using a shared resource.
11. Write a program to store and retrieve student records using ArrayList.
12. Implement a program using HashMap to store employee IDs and names.
13. Demonstrate use of TreeSet to store sorted data.
14. Implement a program to demonstrate generics with a collection.
15. Create a program to connect Java with a database (JDBC) and insert records.
16. Write a program to fetch data from a database and display it.
17. Implement a simple chat application using sockets.
18. Create a GUI application using Swing for a calculator.
19. Write a program to demonstrate use of StringBuffer for string manipulation.
20. Implement a program to demonstrate LinkedList operations.

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Subject: VB.Net Programming (BCAMI402T)

UNIT - I: Introduction to VB.NET

Overview of .NET Framework and CLR (Common Language Runtime), Features of VB.NET compared to traditional Visual Basic, Structure of a VB.NET program, Data types, variables, constants, operators, Input/Output functions (Console and GUI basics). **Decision-making statements:** If…Else, Select Case. **Looping statements:** For, While, Do…Loop.

UNIT - II: Procedures, Functions, and Error Handling

Subroutines and Functions in VB.NET. **Parameter passing:** ByVal and ByRef. **Scope of variables:** Local, Module-level, Global, Built-in functions (Math, String, Date functions), Exception handling using Try…Catch…Finally, Debugging basics in VB.NET IDE.

UNIT - III: Object-Oriented Programming in VB.NET

Concept of classes and objects, Constructors and destructors, Properties, methods, and events, Inheritance and polymorphism, Interfaces and abstract classes, Encapsulation and access specifiers (Public, Private, Protected, Friend).

UNIT - IV: Windows Forms and Controls

Introduction to Windows Forms applications. **Common controls:** TextBox, Label, Button, CheckBox, RadioButton, ComboBox, ListBox. **Event-driven programming:** Handling events (Click, Change, Load), Menus and dialog boxes, MessageBox and InputBox usage, Layout management (GroupBox, Panel, TabControl).

UNIT - V: Advanced Features and Database Connectivity

File handling: Reading and writing text files. **Collections:** ArrayList, List, Dictionary. Introduction to ADO.NET, Connecting VB.NET applications with databases (SQL Server/Access), Executing queries (Insert, Update, Delete, Select), DataGridView control for displaying records, Basics of deploying VB.NET applications.

Reference Books

1. **Mastering VB.NET** – Evangelos Petroutsos
2. **VB.NET Programming Black Book** – Steven Holzner
3. **Programming in VB.NET** – Julia Case Bradley & Anita Millspaugh
4. **Beginning VB.NET** – Richard Blair & Jonathan Crossland
5. **Visual Basic .NET How to Program** – Deitel & Deitel

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Practical Problem List

1. Write a program to display "Hello World" on the console.
2. Write a program to perform arithmetic operations (addition, subtraction, multiplication, division).
3. Write a program to check whether a number is even or odd.
4. Write a program to find the largest of three numbers using If…Else.
5. Write a program to generate multiplication table of a given number using loops.
6. Write a program to calculate factorial of a number using a function.
7. Write a program to demonstrate ByVal and ByRef parameter passing.
8. Write a program to find the sum of digits of a number using a function.
9. Write a program to handle divide-by-zero exception using Try…Catch.
10. Write a program to demonstrate use of built-in string functions (Len, Mid, UCase, LCase).
11. Write a program to create a class Student with properties (Name, RollNo) and display details.
12. Write a program to demonstrate constructor and destructor in a class.
13. Write a program to implement inheritance (e.g., Person → Employee).
14. Write a program to demonstrate polymorphism using method overloading.
15. Write a program to implement an interface in VB.NET.
16. Create a Windows Form application to accept user input (Name, Age) and display it in a Label.
17. Create a Windows Form application with buttons to perform arithmetic operations.
18. Create a Windows Form application using RadioButtons and CheckBoxes to select options.
19. Create a Windows Form application with a MenuStrip and MessageBox.
20. Create a Windows Form application to display items in a ListBox and ComboBox.

Subject: Internet of Things (IoT) (BCADSE403AT)

UNIT - I: Introduction to IoT

Definition and scope of IoT, Evolution of IoT and enabling technologies. **Characteristics:** Connectivity, intelligence, scalability, security, heterogeneity, **IoT architecture:** Perception layer, Network layer, Application layer. **IoT ecosystem:** Devices, gateways, cloud, applications. **Examples of IoT systems:** Smart homes, smart cities, healthcare, agriculture, industry. **Challenges in IoT adoption:** Interoperability, cost, privacy.

UNIT - II: IoT Devices and Hardware

Sensors: Temperature, humidity, motion, light, GPS, biometric sensors. **Actuators:** Motors, relays, alarms, LEDs. **Embedded systems and microcontrollers:** Arduino. **Communication modules:** Wi-Fi, Bluetooth, ZigBee, RFID, NFC, GSM. **Power management in IoT devices:** Battery, solar, low-power design. **Device interfacing basics:** GPIO pins, analog vs. digital signals. **Case study:** Smart sensor networks.

UNIT - III: IoT Communication and Networking

IoT communication models: Device-to-device, Device-to-cloud, Device-to-gateway, Back-end data sharing. **IoT protocols:** MQTT, CoAP, HTTP/HTTPS, AMQP, XMPP. **Wireless communication technologies:** Wi-Fi, Bluetooth Low Energy (BLE), ZigBee, LoRaWAN, Cellular (3G/4G/5G). **Cloud platforms for IoT:** AWS IoT, Google Cloud IoT, Microsoft Azure IoT Hub, Edge computing and fog computing concepts, IoT gateways and middleware. **Case study:** Smart home communication system.

UNIT - IV: IoT Data Management and Security

Data collection, storage, and processing in IoT systems. **IoT data lifecycle:** Sensing $\rightarrow$ Transmission $\rightarrow$ Storage $\rightarrow$ Analysis $\rightarrow$ Action, Big data and IoT analytics. **Security challenges in IoT:** Device security, network security, data privacy, Encryption techniques and authentication methods, Secure communication protocols (TLS/SSL), Case studies of IoT security breaches and solutions, Regulatory and ethical issues in IoT.

UNIT - V: IoT Applications and Future Trends

Smart homes: Home automation, energy management, smart appliances. **Smart cities:** Traffic monitoring, waste management, surveillance, smart grids. **Healthcare:** Remote patient monitoring, wearable devices, telemedicine. **Agriculture:** Smart irrigation, crop monitoring, livestock tracking. **Industrial IoT (IIoT):** Predictive maintenance, supply chain optimization, robotics. **Future trends:** AI + IoT, 5G and IoT, autonomous vehicles, robotics, blockchain in IoT. **Case studies:** Real-world IoT applications in India and globally.

Reference Books

1. **Internet of Things: A Hands-On Approach** – Arshdeep Bahga & Vijay Madisetti
2. **Architecting the Internet of Things** – Dieter Uckelmann, Mark Harrison, Florian Michahelles
3. **Designing the Internet of Things** – Adrian McEwen & Hakim Cassimally
4. **Internet of Things (IoT): Principles and Paradigms** – Rajkumar Buyya, Amir Vahid Dastjerdi

Subject: Big Data Analytics (BCADSE403BT)

UNIT - I: Introduction to Big Data

Definition and evolution of Big Data. **Characteristics:** Volume, Velocity, Variety, Veracity, Value, Importance of Big Data in decision-making and competitive advantage, Traditional data management vs. Big Data approaches. **Data generation sources:** social media, sensors, IoT, transactions, logs, Big Data applications in healthcare, finance, retail, government, and education. **Challenges:** scalability, storage, processing, integration, and privacy.

UNIT - II: Big Data Technologies and Tools

Hadoop ecosystem overview: HDFS architecture and data replication, MapReduce programming model, YARN resource management. **Apache Spark framework**: RDDs, DataFrames, Spark SQL, Spark Streaming for real-time analytics, MLlib for machine learning. **NoSQL databases:** Key-value stores (Redis), Document stores (MongoDB), Column-oriented databases (Cassandra, HBase). **Data ingestion and workflow tools:** Sqoop, Flume, Kafka, Airflow, **Cloud-based Big Data platforms:** AWS EMR, Azure HDInsight, Google BigQuery.

UNIT - III: Data Analytics and Processing

Data preprocessing: cleaning, normalization, integration, transformation. **Types of analytics:** Descriptive analytics (summarizing past data), Predictive analytics (forecasting future trends), Prescriptive analytics (decision optimization). **Machine learning basics for Big Data:** Classification (Decision Trees, Naïve Bayes), Clustering (K-Means, Hierarchical), Regression (Linear, Logistic). Real-time analytics vs. batch processing, **Case studies:** recommendation systems (Netflix, Amazon), fraud detection in banking, sentiment analysis in social media.

UNIT - IV: Big Data Visualization and Applications

Importance of visualization in understanding Big Data. **Visualization tools and techniques:** Tableau, Power BI, D3.js, Matplotlib, Seaborn, Dashboards and interactive reports. **Storytelling with data:** communicating insights effectively. **Applications:** Business intelligence and decision support, Social media analytics and trend prediction, IoT and smart city analytics, Healthcare analytics (patient monitoring, disease prediction). **Ethical issues:** bias in data, privacy concerns, responsible AI.

UNIT - V: Big Data Security and Future Trends

Security challenges in Big Data environments: Data privacy, authentication, authorization, Encryption and secure data transmission, Role-based access control in distributed systems. Blockchain applications in Big Data security. **Emerging trends:** AI-driven analytics and automation, Edge computing for faster processing, Quantum computing and its potential impact, Integration of Big Data with cloud-native architectures. **Future scope:** Big Data in Industry 4.0, autonomous systems, and personalized services.

Reference Books

1. Anil Maheshwari – *Data Analytics*, 2nd Edition, McGraw Hill, 2023
2. Viktor Mayer-Schönberger & Kenneth Cukier – *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, Houghton Mifflin Harcourt, 2013
3. Tom White – *Hadoop: The Definitive Guide*, 4th Edition, O'Reilly Media, 2015
4. Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia – *Learning Spark*, O'Reilly Media, 2015
5. Wes McKinney – *Python for Data Analysis*, 3rd Edition, O'Reilly Media, 2022
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman – *The Elements of Statistical Learning*, Springer, 2009
7. Cole Nussbaumer Knaflic – *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley, 2015
8. Scott Murray – *Interactive Data Visualization for the Web*, O'Reilly Media, 2017
9. Arun K. Somani & Ganesh Chandra Deka – *Big Data Analytics: Tools and Technology for Effective Planning*, CRC Press, 2017
10. Rajkumar Buyya et al. – *Big Data Principles and Paradigms*, Elsevier, 2016

Subject: E-Accounting and GST (BCADSE403CT)

UNIT - I: Fundamentals of E-Accounting

Meaning, objectives, and scope of accounting, Principles of double-entry system and accounting cycle, Difference between manual and computerized accounting. **Introduction to E-Accounting:** definition, features, and importance. **Components of E-Accounting systems:** hardware, software, database, and networking. **Advantages of E-Accounting:** accuracy, speed, real-time reporting, integration with GST, Limitations and challenges of E-Accounting, Overview of popular accounting software (Tally, Busy, Zoho Books, QuickBooks), Role of E-Accounting in modern business decision-making.

UNIT - II: Computerized Accounting Systems

Features and benefits of computerized accounting systems, Installation and configuration of accounting software (Tally ERP, Busy, etc.), Creating company accounts, ledgers, groups, and cost centers. **Voucher entry:** sales, purchase, payment, receipt, journal, contra, debit note, credit note. **Inventory management:** stock groups, stock items, units of measure, godowns. **Payroll management:** employee records, salary structures, payslips. **Generating financial reports:** trial balance, profit & loss account, balance sheet, cash flow statement, Exporting and printing reports for compliance and audit purposes.

UNIT - III: Introduction to GST (Goods and Services Tax)

Concept and evolution of GST in India, **Objectives of GST:** one nation, one tax, transparency, ease of compliance. **Structure of GST:** CGST, SGST, IGST, UTGST. **GST registration process:** eligibility, documents required, online procedure. **GST rates:** standard rates, concessional rates, exempted goods and services. **Input Tax Credit (ITC):** concept, eligibility, restrictions, and utilization, GST compliance requirements for businesses, Comparison of GST with previous indirect tax system (VAT, Service Tax, Excise).

UNIT - IV: GST Accounting and Returns

Recording GST transactions in accounting software (sales, purchase, returns), **GST invoice preparation:** mandatory fields, invoice types (tax invoice, bill of supply), **Reverse charge mechanism:** concept, applicability, accounting treatment. **Filing GST returns:** GSTR-1 (outward supplies), GSTR-3B (summary return), GSTR-9 (annual return). **Online GST portal usage:** login, dashboard, filing process. **E-payment of GST:** challan generation, payment modes. Penalties, late fees, and interest under GST law. **Practical exercises:** filing sample returns using GST portal.

UNIT - V: Advanced Topics in E-Accounting and GST

Integration of GST with E-Accounting software (Tally ERP with GST module), Audit trail and compliance in computerized accounting systems. **E-way bills:** concept, generation, validity, and compliance requirements. **Role of technology in GST compliance:** automation, AI, cloud-based solutions, Digital taxation and its global perspective, Blockchain applications in accounting and taxation, Challenges in E-Accounting and GST implementation (technical, legal, operational). **Future trends:** AI-driven compliance, predictive analytics in taxation, digital economy taxation.

Reference Books

1. Tally Education Pvt. Ltd. – *Official Guide to Tally ERP 9 with GST*, 2018
2. B. K. Goyal & J. P. Goyal – *E-Accounting and Business Accounting*, Himalaya Publishing House, 2020
3. V. Balachandran – *Indirect Taxes including GST*, Sultan Chand & Sons, 2021
4. S. S. Gupta – *GST – How to Meet Your Obligations*, Taxmann Publications, 2017
5. Arpita Ghose – *E-Accounting and Digital Finance*, McGraw Hill, 2022
6. Girish Ahuja & Ravi Gupta – *GST & Customs Law*, Wolters Kluwer, 2021

Subject: Technical Communication (BCAASE404T)

UNIT - I: Fundamentals of Technical Communication

Definition, scope, and importance of technical communication. **Features of technical communication:** clarity, conciseness, accuracy, objectivity. Difference between general communication and technical communication. **Communication process:** sender, message, channel, receiver, feedback. Barriers to effective communication and strategies to overcome them. Role of technical communication in IT, business, and professional settings.

UNIT - II: Written Communication in Technical Contexts

Principles of effective writing: coherence, cohesion, tone, style. **Structure of technical documents:** reports, proposals, manuals, project documentation. **Writing business correspondence:** emails, memos, notices, circulars. Technical descriptions and definitions. Writing instructions and procedures. Summarizing and abstracting technical information. Common errors in technical writing and how to avoid them.

UNIT - III: Oral and Non-Verbal Communication

Oral communication skills: presentations, meetings, interviews, group discussions. Techniques for effective public speaking. **Listening skills:** active listening, barriers to listening. **Non-verbal communication:** body language, gestures, facial expressions, eye contact. **Role of visuals in communication:** charts, graphs, diagrams, infographics. Cross-cultural communication in technical contexts.

UNIT - IV: Technical Reports and Documentation

Types of technical reports: informational, analytical, feasibility, progress reports. **Structure of reports:** title page, abstract, introduction, methodology, findings, conclusion, references. Documentation standards and practices in IT and software industry. **User manuals and guides:** writing for end-users. Research papers and project documentation. Use of referencing styles (APA, MLA, IEEE). Plagiarism and ethics in technical writing.

UNIT - V: Modern Tools and Trends in Technical Communication

Role of technology in technical communication. **Digital communication platforms:** email, collaborative tools, project management software. Technical communication in social media and professional networking sites. Use of multimedia in technical communication (audio, video, animations). Content management systems and documentation tools (MS Word, LaTeX, Markdown, GitHub). **Emerging trends:** AI-assisted writing, chatbots, cloud-based documentation. Importance of continuous learning and adaptability in technical communication.

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Reference Books

1. Meenakshi Raman & Sangeeta Sharma – *Technical Communication: Principles and Practice*, Oxford University Press, 2017
2. R.C. Sharma & Krishna Mohan – *Business Correspondence and Report Writing*, Tata McGraw Hill, 2016
3. M. Ashraf Rizvi – *Effective Technical Communication*, Tata McGraw Hill, 2010
4. Lesikar & Flatley – *Basic Business Communication*, Tata McGraw Hill, 2015
5. John M. Lannon – *Technical Communication*, Pearson Education, 2016
6. Paul V. Anderson – *Technical Communication: A Reader-Centered Approach*, Cengage Learning, 2014

Subject: Cloud Computing (BCASEC405T)

UNIT - I: Introduction to Cloud Computing

Definition of cloud computing and its evolution from distributed computing and grid computing. **Essential characteristics:** on-demand self-service, broad network access, resource pooling, rapid elasticity, measured service. **Service models explained with examples: IaaS** (e.g., AWS EC2, Google Compute Engine), **PaaS** (e.g., Google App Engine, Microsoft Azure App Services), **SaaS** (e.g., Gmail, Salesforce, Office 365). **Deployment models:** Public, Private, Hybrid, Community clouds — advantages and limitations. **Benefits:** cost efficiency, scalability, flexibility, disaster recovery, collaboration. **Challenges:** data security, vendor lock-in, compliance, downtime risks. **Applications in real-world domains:** e-commerce, healthcare, education, banking, entertainment.

UNIT - II: Cloud Architecture and Technologies

Cloud architecture layers: physical layer, virtualization layer, control layer, application layer. **Virtualization:** Concept and importance in cloud computing, Types: server virtualization, storage virtualization, network virtualization. **Hypervisors:** Type 1 (bare-metal) and Type 2 (hosted). **Cloud storage systems:** object storage (Amazon S3), block storage, file storage. **Cloud networking basics:** virtual private cloud (VPC), load balancing, content delivery networks (CDN). **Resource provisioning and elasticity:** auto-scaling, dynamic resource allocation. **Overview of major cloud service providers:** AWS, Microsoft Azure, Google Cloud Platform — key services and market positioning.

UNIT - III: Cloud Services and Applications

Infrastructure as a Service (IaaS): compute instances, storage, networking, virtualization. **Platform as a Service (PaaS):** application development platforms, middleware, runtime environments, DevOps support. **Software as a Service (SaaS):** subscription-based applications, CRM, ERP, collaboration tools. **Cloud-based applications:** E-commerce platforms (Amazon, Flipkart), Social media (Facebook, Instagram), Online collaboration (Google Workspace, Slack, Zoom). **Case studies of cloud adoption in industry:** startups, SMEs, and large enterprises. **Cloud application development basics:** APIs, SDKs, RESTful services.

UNIT - IV: Cloud Security and Compliance

Security challenges in cloud computing: multi-tenancy, data breaches, insider threats. **Data privacy and protection:** encryption at rest and in transit, secure key management. **Identity and Access Management (IAM):** authentication, authorization, role-based access control. **Security tools:** firewalls, intrusion detection/prevention systems, VPNs. **Compliance standards and regulations:** GDPR, HIPAA, ISO/IEC 27001, SOC 2. **Risk management strategies:** backup, disaster recovery, business continuity planning. Shared responsibility model in cloud security (provider vs. customer responsibilities)

UNIT - V: Future Trends in Cloud Computing

Emerging technologies: Edge computing: processing data closer to source devices. Fog computing: intermediate layer between edge and cloud. Serverless computing: function-as-a-service (AWS Lambda, Azure Functions). **Role of AI and machine learning in cloud services:** predictive analytics, automated scaling, intelligent monitoring. **Cloud-native applications:** microservices, containerization (Docker, Kubernetes). **Blockchain integration with cloud computing:** secure transactions, decentralized storage, **Cloud economics:** pay-as-you-go model, cost optimization strategies. **Sustainability in cloud computing:** green data centers, energy-efficient architectures. **Future scope:** Industry 4.0, IoT integration, smart cities, autonomous systems.

Reference Books (Consolidated List)

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi – *Mastering Cloud Computing*, McGraw Hill, 2013
2. Thomas Erl – *Cloud Computing: Concepts, Technology & Architecture*, Prentice Hall, 2013
3. Toby Velte, Anthony Velte, Robert Elsenpeter – *Cloud Computing: A Practical Approach*, McGraw Hill, 2010
4. Michael J. Kavis – *Architecting the Cloud: Design Decisions for Cloud Computing Service Models*, Wiley, 2014
5. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra – *Distributed and Cloud Computing: From Parallel Processing to the Internet of Things*, Morgan Kaufmann, 2012
6. Srinivasan – *Cloud Computing: Theory and Practice*, Pearson Education, 2014