

BBA(CA) CBCS 2019 **Pattern**

TYBBA (CA) Sem V **Syllabus**

Savitribai Phule Pune University
T.Y.B.B.A (C.A.) Semester –V
Course Code: CA-501
Subject Name: Cyber Security

Total Hours : 48 lectures

Total Credits: 03

Prerequisites: -

- A course on Computer Networks.

Course Objectives:

- To understand the fundamentals of cyber security.
- To understand various categories of Cybercrime, Cyber-attacks on mobile, tools and techniques used in Cybercrime and case studies.
- To have an overview of the Cyber laws and concepts of Cyber forensics.

Course Outcome:-

- Have a good understanding of Cyber Security and the Tools.
- Identify the different types of Cyber Crimes.
- Have a good understanding of Cyber laws
- To develop Cyber forensics awareness.
- Identify attacks, security policies and credit card frauds in mobile and Wireless Computing Era.

Unit	Topic	No of lectures
1	<p>Chapter 1:- Introduction to Cyber Crime and Cyber Security</p> <p>1.1 Introduction 1.2 Cybercrime: Definition and Origin of the Word 1.3 Cybercrime and Information Security 1.4 Who are Cybercriminals? 1.5 Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup, Spam/Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, OnlineFrauds, Computer Sabotage, Email Bombing/Mail Bombs, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft 1.6 Definition of Cyber Security 1.7 Vulnerability, Threats and Harmful acts 1.8 CIA Triad 1.9 Cyber Security Policy and Domains of Cyber Security Policy</p>	07
2	<p>Chapter 2 :- Cyber offenses and Cyberstalking</p> <p>2.1 Criminals Plan: Categories of Cybercrime Cyber Attacks: Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, and Classification of Social Engineering. 2.2 Cyberstalking: Types of Stalkers, Cases Reported on Cyberstalking, Working of Stalking 2.3 Real-Life Incident of Cyber stalking 2.4 Cybercafe and Cybercrimes</p>	10

	<p>2.5 Botnets: The Fuel for Cybercrime, Botnet, Attack Vector</p> <p>2.6 Cybercrime: Mobile and Wireless Devices – Proliferation - Trends in Mobility</p> <p>2.7 Credit Card Frauds in Mobile and Wireless Computing Era</p> <p>2.8 Security Challenges Posed by Mobile Devices</p> <p>2.9 Authentication Service Security</p> <p>2.10 Attacks on Mobile/Cell Phones</p>	
3	<p>Chapter 3:- Tools and Methods Used in Cybercrime</p> <p>3.1 Introduction</p> <p>3.2 Proxy Servers and Anonymizers</p> <p>3.3 Phishing</p> <p>3.4 Password Cracking</p> <p>3.5 Keyloggers and Spywares</p> <p>3.6 Virus and Worms</p> <p>3.7 Trojan Horses and Backdoors</p> <p>3.8 Steganography</p> <p>3.9 DoS and DDoS Attacks</p> <p>3.10 SQL Injection</p>	05
4	<p>Chapter 4 :- Cybercrimes and Cyber security: The Legal Perspectives</p> <p>4.1 Introduction</p> <p>4.2 Cybercrime and the Legal Landscape around the World</p> <p>4.3 Why Do We Need Cyberlaws: The Indian Context</p> <p>4.4 The Indian IT Act</p> <p>4.5 Challenges to Indian Law and Cybercrime Scenario in India</p> <p>4.6 Consequences of not Addressing the Weakness in Information Technology Act</p> <p>4.7 Digital Signatures and the Indian IT Act</p> <p>4.8 Amendments to the Indian IT Act</p> <p>4.9 Cybercrime and Punishment</p> <p>4.10 Cyberlaw, Technology and Students: Indian Scenario</p>	07
5	<p>Chapter 5:- Cyber Forensics</p> <p>5.1 Introduction</p> <p>5.2 Historical background of Cyber forensics</p> <p>5.3 Digital Forensics Science</p> <p>5.4 The Need for Computer Forensics</p> <p>5.5 Cyber Forensics and Digital evidence</p> <p>5.6 Forensics Analysis of Email</p> <p>5.7 Digital Forensics Lifecycle</p> <p>5.8 Challenges in Computer Forensics</p>	06
6	<p>Chapter 6:- Cybersecurity: Organizational Implications</p> <p>6.1 Organizational Implications: Cost of cybercrimes and IPR issues</p> <p>6.2 Web threats for organizations</p> <p>6.3 Security and Privacy Implications from Cloud Computing</p> <p>6.4 Social media marketing</p> <p>6.5 Social computing and the associated challenges for organizations, Protecting people’s privacy in the organization</p> <p>6.6 Organizational guidelines for Internet usage and safe computing guidelines and computer usage policy</p> <p>6.7 Incident handling</p>	07

	6.8 Intellectual property in the cyberspace of cyber security.	
7	Chapter 7:- Cybercrime: Illustrations, Examples and Mini-Cases 7.1 Real-Life Examples 7.2 Mini-Cases 7.3 Illustrations of Financial Frauds in Cyber Domain 7.4 Digital Signature-Related Crime Scenarios 7.5 Digital Forensics Case Illustrations 7.6 Online Scams	06

References Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives – Nina Godbole, Sunit Belapure, Wiley: April 2011 India Publications Released.
2. Principles of Information Security, -Michael E Whitman, Herbert J Mattord, 3rd Edition, 2011.
3. Computer Security: Principles and Practice -William Stallings and Lawrie Brown, 3rd edition, Pearson, 2015.
4. Cyber Security Essentials- James Graham Richard Howard Ryan Olson

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Semester –V
Course Code: CA-502
Subject: Object Oriented Software Engineering

Total Hours: 48

Total Credits: 03

Pre Requisite: Students shall have the Basic Knowledge of Software Engineering

OBJECTIVES:

1. To understand the fundamentals of object modeling
2. To understand and differentiate Unified Process from other approaches.
3. To design with static UML diagrams.
4. To design with the UML dynamic and implementation diagrams.
5. To improve the software design with design patterns.
6. To test the software against its requirements specification.

Outcomes:

1. Students will be able to give Design Specifications for Project.
2. Students will acquire Knowledge in Basic Modeling.
3. Students will acquire Project Management Skills.

Chapter	Course Content	No of lectures
1	Introduction and basics of Software Modelling 1.1 Software Life Cycle Models (Revision of SE) 1.2 System Concepts 1.3 Project Organization 1.4 Communication in Project Management 1.5 Risk management in Project Management	4
2	SRS Documentation 2.1 SRS Specification 2.2 Requirement Elicitation 2.3 Business Engineering	4
3	Introduction to UML 3.1 Concept of UML 3.2 Advantages of UML	2
4	Object Oriented Concepts and Principles 4.1 What is Object Orientation? - Introduction , Object , Classes and Instance , Polymorphism, Inheritance 4.2 Object Oriented System Development- Introduction, Function/Data Methods (With Visibility), Object Oriented Analysis, Object Oriented Construction 4.3 Identifying the Elements of an Object Model 4.4 Identifying Classes and Objects 4.5 Specifying the Attributes (With Visibility)	4

	<p>4.6 Defining Operations 4.7 Finalizing the Object Definition</p>	
5	<p>Structural Modeling 5.1 Classes 5.2 Relationship 5.3 Common Mechanism 5.4 Class Diagram (Minimum three examples should be covered) 5.5 Advanced Classes 5.6 Advanced Relationship 5.7 Interface 5.8 Types and Roles 5.9 Packages 5.10 Object Diagram (Minimum three examples should be covered)</p>	10
6	<p>Basic Behavioural Modeling 6.1 Interactions 6.2 Use Cases and Use Case Diagram with stereo types (Minimum three examples should be covered) 6.3 Interaction Diagram (Minimum two examples should be covered) 6.4 Sequence Diagram (Minimum two examples should be covered) 6.5 Activity Diagram (Minimum two examples should be covered) 6.6 State Chart Diagram (Minimum two examples should be covered)</p>	10
7	<p>Architectural Modelling 7.1 Component 7.2 Components Diagram (Minimum two examples should be covered) 7.3 Deployment Diagram (Minimum two examples should be covered) 7.4 Collaboration Diagram (Minimum two examples should be covered)</p>	6
8	<p>Object Oriented Analysis 8.1 Iterative Development and the Rational Unified Process 8.2 Inception 8.3 Understanding Requirements 8.4 Use Case Model From Inception to Elaboration 8.5 Elaboration</p>	4
9	<p>Object Oriented Design 9.1 The Booch Method, The Coad and Yourdon Method and Jacobson Method and Raumbaugh Method 9.2 The Generic Components of the OO Design Model</p>	4

	9.3 The System Design Process - Partitioning the Analysis Model, Concurrency and Sub System Allocation, Task Management Component, The Data Management Component, The Resource Management Component, Inter Sub System Communication	
	Total	48

Reference Books:

Sr. No.	Title of the Book	Author's Name	Publication
1	The Unified Modeling Language User/Reference Guide,	Grady Booch, James Rumbaugh	Pearson Education Inc
2	The Unified software development Process	Ivar Jacobson, Grady Booch, James Rumbaugh	Pearson Education
3	Agile Software development	Alistair Cockbair	Pearson Education

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Semester –V
Course Code: CA-503
Subject: Core Java

Total Hours : 48

Total Credits: 03

Prerequisite:

- Student should know basics of object oriented programming.

Course Objectives:

- To introduce the object oriented programming concepts.
- To understand object oriented programming concepts, and apply them in solving problems.
- To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce the concepts of exception handling and multithreading.
- To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes:

- Able to solve real world problems using OOP techniques.
- Able to understand the use of abstract classes.
- Able to solve problems using java collection framework and I/o classes.
- Able to develop multithreaded applications with synchronization.
- Able to develop applets for web applications.
- Able to design GUI based applications

Unit No.	Topic	No. of Lectures	Reference Books
1	Java Fundamentals 1.1 Introduction to Java. 1.1 Features of Java 1.2 Basics of Java: - Data types, variable, expression, operators, constant. 1.3 Structure of Java Program. 1.4 Execution Process of java Program. 1.5 JDK Tools. 1.6 Command Line Arguments. 1.7 Array and String: 1.7.1 Single Array & Multidimensional Array 1.7.2 String, String Buffer 1.8 Built In Packages and Classes : 1.8.1 java.util:- Scanner, Date, Math etc. 1.8.2 java.lang	8	1,2
2	Classes, Objects and Methods 2.1 Class and Object 2.2 Object reference 2.3 Constructor: Constructor Overloading 2.4 Method: Method Overloading, Recursion, Passing and Returning object form Method 2.5 new operator, this and static keyword, finalize() method 2.6 Nested class, Inner class, and Anonymous inner class	8	1,2

3	<p>Inheritance, Package and Collection</p> <p>3.1 Overview of Inheritance</p> <p>3.2 inheritance in constructor</p> <p>3.3 Inheriting Data members and Methods,</p> <p>3.4 Multilevel Inheritance – method overriding Handle multilevel constructors</p> <p>3.5 Use of super and final keyword</p> <p>3.6 Interface:</p> <p>3.7 Creation and Implementation of an interface, Interface reference</p> <p>3.8 Interface inheritance</p> <p>3.9 Dynamic method dispatch</p> <p>3.10 Abstract class</p> <p>3.11 Comparison between Abstract Class and interface</p> <p>3.12 Access control</p> <p>3.13 Packages</p> <p>3.13.1 Packages Concept</p> <p>3.13.2 Creating user defined packages</p> <p>3.13.3 Java Built inpackages</p> <p>3.13.4 Import statement, Static import</p> <p>3.14 Collection</p> <p>3.14.1 CollectionFramework.</p> <p>3.14.2 Interfaces: Collection, List, Set</p> <p>3.14.3 Navigation: Enumeration, Iterator, ListIterator</p> <p>3.14.4 Classes: LinkedList, ArrayList, Vector, HashSet</p>	10	
4	<p>File and Exception Handling</p> <p>Exception</p> <p>4.1 Exception and Error</p> <p>4.2 Use of try, catch, throw, throws and finally</p> <p>4.3 Built in Exception</p> <p>4.4 Custom exception</p> <p>4.5 Throwable Class.</p> <p>File Handling</p> <p>4.6 Overview of Different Stream (Byte Stream, Character stream)</p> <p>4.7 Readers and Writers class</p> <p>4.8 File Class</p> <p>4.9 File Input Stream , File Output Stream</p> <p>4.10 Input Stream Reader and Output Stream Writer class</p> <p>4.11 FileReader and FileWriter class</p> <p>4.12 Buffered Reader class.</p>	8	1,2,3
5	<p>Applet, AWT, Event and Swing Programming</p> <p>Applet</p> <p>5.1 Introduction</p> <p>5.2 Typesapplet</p> <p>5.3 Applet Lifecycle</p> <p>5.3.1 Creatingapplet</p> <p>5.3.2 Applet tag</p>	14	1,2,3,4

	<p>5.4 AppletClasses</p> <p>5.4.1 Color</p> <p>5.4.2 Graphics</p> <p>5.4.3 Font</p> <p>AWT</p> <p>5.5 Components and container used inAWT</p> <p>5.6 Layoutmanagers</p> <p>5.7 Listeners and Adapterclasses</p> <p>5.8 Event Delegationmodel</p> <p>Swing</p> <p>5.9 Introduction to Swing Componentand Container Classes</p> <p>5.10Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JTable, JComboBox, Swing Menus, Dialogs,JFileOpen,JColorChooser.</p>		
	Total Lectures	48	

Reference Books:

1. Programming with JAVA - EBalgurusamy
2. The Complete Reference – JAVA HerbertSchildt
3. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.
4. Java Programming and Object-oriented Application Development, R. A. Johnson, Ceng

T.Y.B.B.A.(C.A.) Semester –V
Course Code: CA-504
Subject: MongoDB

Total Hours: 48

Total Credits:03

Prerequisites:

- Knowledge of database concepts
- Basic understanding of Big Data platforms

Objectives:

1. Understand importance of NoSQL Databases.
2. Learn various MongoDB commands and MongoDB design goals.
3. Design basic and general-purpose database using MongoDB.

Outcomes:

- Learned to work with MongoDB shell and MongoDB tools.
- Able to do Schema design, Data modelling and all sorts of CRUD Operations.
- Learned to optimize query performance.
- Become capable to analyze the data stored in MongoDB.

Unit	Topic	No. of lectures
1	Introduction to NoSQL Databases 1.1 Introduction to NoSQL Databases 1.2 Difference between NoSQL and RDBMS 1.3 Need of NoSQL Databases 1.4 Application of NoSQL Databases 1.5 Types of NoSQL Databases 1.6 What is MongoDB? 1.7 Features of MongoDB	5
2	MongoDB Basics 2.1 Installing MongoDB 2.2 MongoDB Server and Database, MongoDB tools 2.3 Collection, Documents and Key-Values 2.4 Data Modeling Concepts 2.4.1 Why Data Modeling? Data Modeling Approach 2.4.2 Analogy between RDBMS & MongoDB Data Model, MongoDB Data 2.4.3 Model (Embedding & Linking) 2.4.4 Challenges for Data Modeling in MongoDB 2.4.5 Data Model Examples and Patterns 2.5 Mongo shell Commands to create, delete database, collection & documents 2.6 MongoDB Datatypes 2.7 Inserting and saving documents 2.7.1 Batch Insert 2.7.2 Insert Validation 2.8 MongoDB GUI like compass	12
3	MongoDB CRUD Operations	14

	3.1 MongoDB Development Architecture 3.2 MongoDB Production Architecture 3.3 MongoDB CRUD Introduction, MongoDB CRUD Concepts 3.4 MongoDB CRUD Concerns (Read & Write Operations) 3.5 Concern Levels, Journaling 3.6 Cursor Query Optimizations, Query behaviour in MongoDB 3.7 Distributed Read & Write Queries 3.8 MongoDB CRUD Syntax & Queries	
4	MongoDB Index and Aggregation 4.1 Index Introduction, Index Concepts, Index Types, Index Properties 4.2 Index Creation and Indexing Reference 4.3 Introduction to Aggregation 4.4 Approach to Aggregation 4.5 Types of Aggregation (Pipeline, MapReduce & Single Purpose) 4.6 Performance Tuning.	8
5	MongoDB Administration 5.1 Administration concepts in MongoDB 5.2 Monitoring issues related to Database 5.3 Monitoring at Server, Database, Collection level, and various Monitoring tools related to MongoDB 5.4 Database Profiling, Locks, Memory Usage, No of connections, page fault 5.5 Backup and Recovery Methods for MongoDB 5.6 Export and Import of Data to and from MongoDB 5.7 Run time configuration of MongoDB 5.8 Production notes/ best practices 5.9 Data Managements in MongoDB (Capped Collections/ Expired data from TTL), Hands on Administrative Tasks.	9
Total		48

Reference books:

1. MongoDB Basics by Peter Membrey, David Hows, Eelco Plugge
2. MongoDB Recipes With Data Modeling and Query Building Strategies by Subhashini Chellappan, Dharanitharan Ganesan
3. MongoDB Simply In Depth by Ajit Singh, Sultan Ahmad

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Sem-V

Subject Code: 504

Subject: Python

Total Hours :- 48

Total Credits: 03

Prerequisites:

1. Experience with a high level language (C/C++, Java, MATLAB) is suggested.
2. Prior knowledge of a scripting language (Perl, UNIX/Linux shells) and Object-Oriented concepts is helpful but not mandatory.

Course Objectives:

1. To learn and understand Python programming basics and paradigm.
2. To learn and understand python looping, control statements and string manipulations.
3. Students should be made familiar with the concepts of GUI controls and designing GUI applications.
4. To learn and know the concepts of file handling, exception handling.

Course Outcomes: On completion of the course, student will be able

1. Define and demonstrate the use of built-in data structures “lists” and “dictionary”.
2. Design and implement a program to solve a real world problem.
3. Design and implement GUI application and how to handle exceptions and files.

Unit	Details	Lectures
I	Unit 1: Introduction to Python 1.1 History, feature of Python, setting up path, working with python Interpreter, basic syntax, variable and data types, operators 1.2 Conditional statements -If, If-Else, nested if-else, Examples. 1.3 Looping -For, While, Nested loops, Examples 1.4 Control Statements -Break, Continue, Pass. 1.5 String Manipulation -Accessing String, Basic Operations, String Slices, Function and Methods, Examples. 1.6 Lists -Introduction, accessing list, operations, working with lists, function & methods. 1.7 Tuple -Introduction, Accessing tuples, operations working, function & methods, Examples. 1.8 Dictionaries -Introduction, Accessing values in dictionaries, working with dictionaries, properties, function, Examples. 1.9 Functions -Defining a function, calling a function, types of function, function arguments, anonymous function, global & local variable, Examples.	16
II	Unit 2: Modules and Packages 2.1 Built in Modules 2.1.1 Importing modules in python program 2.1.2 Working with Random Modules. 2.1.3 E.g. - built-ins, time, date time, calendar, sys, etc 2.2 User Defined functions 2.2.1 Structure of Python Modules 2.3 Packages 2.3.1 Predefined Packages 2.3.2 User defined Packages	6
III	Unit 3: Classes ,Objects and Inheritance 3.1 Classes and Objects 3.1.1 Classes as User Defined Data Type 3.1.2 Objects as Instances of Classes 3.1.3 Creating Class and Objects 3.1.4 Creating Objects By Passing Values 3.1.5 Variables & Methods in a Class 3.2 Inheritance 3.2.1 Single Inheritance 3.2.2 Multilevel Inheritance	8

	3.2.3 Multiple Inheritance 3.2.4 Hybrid Inheritance 3.2.5 Hierarchical Inheritance 3.2.6 IS-A Relationship and HAS-A Relationship	
IV	Unit 4: Exception Handling 4.1 Python Exception 4.2 Common Exception 4.3 Exception handling in Python (try-except-else) 4.4 The except statement with no exception 4.5 Multiple Exception 4.6 The try-finally clause 4.7 Custom Exception and assert statement	4
V	Unit 5: GUI Programming 5.1 Introduction 5.2 Tkinter programming 5.4 Tkinter widgets 5.5 Frame 5.6 Button 5.7 Label 5.8 Entry	10
VI	Unit 6: Python Libraries 6.1 Statistical Analysis- NumPy, SciPy, Pandas, StatsModels 6.2 Data Visualization- Matplotlib, Seaborn, Plotly 6.3 Data Modelling and Machine Learning- Scikit-learn, XGBoost, Eli5 6.4 Deep Learning- TensorFlow, Pytorch, Keras 6.5 Natural Language Processing (NLP)- NLTK, SpaCy, Gensim	4

Reference Books:

1. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
2. Dive into Python, Mike
3. Learning Python, 4th Edition by Mark Lutz
4. Programming Python, 4th Edition by Mark Lutz
5. Python Programming: An introduction to computer, John Zelle, 3rd Edition.

Savitribai Phule Pune University
T.Y.B.B.A.(C.A.) Sem-V
Subject Code: 505

Subject: (DSE) Project

Total Credits: 04

For the evaluation/ conduction of project separate guidelines will be provided.

T.Y.B.B.A.(C.A.) Sem-V

Subject Code: 506

Subject: Computer Laboratory Based on 503 and 504(2 credits each)

Total Credits: 04

For the conduction of practicals, practical assignments are given in the lab book.

Savitribai Phule Pune University

T.Y.B.B.A.(C.A.)Sem-V (CBCS 2019 Pattern)

Subject Code: CA-507

Subject: Internet of Things (IoT)

Total Hours: 30

Total Credits: 02

Prerequisite:

Basic knowledge of Internet, Networking, and Electronics.

Course Objectives:

1. To understand Technical aspects of Internet of things.
2. To describe smart objects and IoT Architecture.
3. To study and compare different Application protocols of IoT.
4. To understand IoT platform using Arduino Uno.

Course Outcomes: Students will be able

1. To explain key technologies, smart objects, IoT Architecture and security in Internet of Things.
2. To illustrate the role of IoT protocols for efficient network communication.
3. To understand IoT platform such as Arduino Uno.

Unit No.	Contents Theory	No. of Lectures
1	Fundamentals of IoT 1.1 Basic Concepts of IoT 1.2 Major components of IoT devices 1.3 IOT Architecture 1.4 Pros & Cons of IOT	03
2	Communication Technologies 2.1 Wireless Communication: Bluetooth, ZigBee, WiFi, RF Links 2.2 Wired Communication: Ethernet 2.3 IOT Protocol: MQTT, CoAP, XMPP, OSGi	05
3	Microcontroller Fundamental and Arduino uno 3.1 System on Chip & Microcontroller 3.2 Arduino UNO: Introduction to Arduino, Arduino UNO, Arduino Board, The Anatomy of an Arduino Board 3.3 The Development Environment of Arduino Board 3.4 Writing Arduino Software, The Arduino Sketch 3.5 Fundamentals of Arduino Programming 3.6 Trying the code on an Arduino Emulator 3.7 Arduino Libraries 25 Programming & Interfacing 3.8 Application of IoT 3.9 Case studies: Home Automation, Smart Parking, etc.	07
Total		15
Practical Please Refer Lab Book		15

Reference Books:

1. Learning internet of things by Waher, Peter -Packt Publishing Ltd, 2015
2. "Fundamentals of Wireless Sensor Networks: Theory and Practice" by WalteneusDargie,

Christian Poellabauer

3. Internet of Things (A Hands-on-Approach) by Vijay Madiseti , ArshdeepBahga
4. Designing the Internet of Things by Adrian McEwen, Hakim Cassimally
5. Internet of Things with Arduino Cookbook by Schwartz, M. - Packt Publishing Ltd.
6. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint)
7. "Internet of Things" by Srinivasa K G, CENGAGE Learning India, 2017
8. Computer Networks by Tanenbaum, Andrew S - Pearson Education Pte. Ltd., Delhi, 4th Edition
9. Data and Computer Communications; By: Stallings, William - Pearson Education Pte. Ltd., Delhi, 6th Edition