Malad Kandivli Education Society's
NAGINDAS KHANDWALA COLLEGE
OF COMMERCE, ARTS & MANAGEMENT STUDIES
AND SHANTABEN NAGINDAS KHANDWALA COLLEGE OF SCIENCE
(Re-accredited (3rd cycle) by NAAC with 'A' Grade)
ISO 9001 : 2015 Certified
Educational Excellence Award By Indus Foundation, U.S.A.
IMC Ramkrishna Bajaj National Quality Commendation Certificate
Autonomous (2016-17)

Providing Syllabus copy of the courses highlighting the focus on employability/ entrepreneurship/ skill development along with their course outcomes.

Sr. No.	Courses	2016-17	2017-18	2018-19	2019-20	2020-21	Total
1	Bachelor of Commerce (B.COM)	✓	✓	✓	✓	✓	5
2	Bachelor of Arts (B.A)	✓	✓	✓	✓	✓	5
3	Bachelor in Management Studies- (BMS)	✓	✓	✓	✓	✓	5
4	Bachelor of Commerce (Accounts and Finance)- BAF	✓	✓	✓	✓	✓	5
5	Bachelor of Commerce (Banking and Insurance)-BBI	✓	✓	✓	✓	✓	5
6	Bachelor of Commerce (Financial Markets)-BFM	✓	✓	✓	✓	✓	5
7	Bachelor of Science - Information Technology (B.Sc IT)	✓	✓	✓	✓	✓	5
8	Bachelor of Science- Computer Science(B.Sc CS)	✓	✓	✓	✓	✓	5
9	Bachelor of Arts- Multimedia and Mass Communication (B.A.MMC)	✓	✓	✓	✓	✓	5
10	Bachelor of Management Studies- Sports Management (BMS-SM)	X	X	✓	✓	✓	3
11	B. Com. Honours in Actuarial Studies	X	X	X	✓	✓	2
12	B.A. Honours in Apparel Design and Construction	X	X	X	✓	✓	2
13	B. Com. Honours in International Accounting	X	X	X	✓	✓	2
14	Bachelor of Management Studies- E commerce operations	X	X	X	X	✓	1
15	B.Sc. (Honours) in Integrative Nutrition & Dietetics	X	X	X	X	✓	1
16	BBA in Tourism and Travel Management	X	X	X	X	✓	1
17	B.Sc. in Interior Design	X	X	X	X	✓	1
18 19	Master Of Commerce-(M.COM)-Accountancy Master Of Commerce-(M.COM)-Management	✓	✓	✓	✓	✓	5
20	Master of Arts (Economics)	✓	✓	✓	✓	✓	5
21	Master of Arts (Geography)	✓	✓	✓	✓	✓	5
22	Master of Arts (Psychology)	X	X	X	✓	✓	2
23	Master of Science (Information Technology) (M.Sc IT)	✓	✓	✓	✓	✓	5
24	Master's Degree - Sports Management (MSM)	X	X	✓	✓	✓	3
25	Master of Science (Geo-informatics) (M.Sc GeoInformatics)	X	X	X	X	✓	1
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MDatta.

Prof. (Dr.) Moushumi Datta
I/c. Principal

Bhavishya Bharat Campus, S. V. Road, Malad (W), Mumbai - 400 064.
Tel : 022-2807 2262 / 2808 5424 / 2801 3433 / 2808 6427 | Telefax : 2865 0461
E-mail : nagindaskhandwala@hotmail.com | principal@nkc.ac.in
Website : www.nkc.ac.in

Nagindas Khandwala College
(Autonomous)

Syllabus Of
Course
Of

Bachelor of Science Information Technology
(BSC IT) Programme

First Year

Semester I

Under Academic Autonomy and Credit, Grading and Semester System

(To be implemented during Academic Year- 2018-2019)

PRINCIPAL
NAGINDAS KHANDWALA COLLEGE OF COMMERCE
ARTS & MANAGEMENT STUDIES AND SHANTABEN
NAGINDAS KHANDWALA COLLEGE OF SCIENCE
(AUTONOMUS)
MALAD (W), MUMBAI - 400 064

Course Code	Course	Hrs. of Instruction / week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
1711UITBC	Business Communication	3	2 ½ hrs	25	75	100	3

Objectives:

By the end of the course, learners will be able to:

1. To develop effective listening skills in learner so as to enable them to comprehend instructions and become a critical listener
2. To develop effective oral skills so as to enable learner to speak confidently interpersonally as well as in large groups
3. To develop effective writing skills so as to enable learner to write in clear, concise, persuasive and audience centred manner
4. To demonstrate effective use of communication technology

Course Outcome:

After completing this course, learners will be able to:

CO1: Understand the concept, channels, objectives, methods and modes of communication. (Understand)

CO2: Differentiate obstacles to communication in the business world. (Evaluate)

CO3: Sharpen the business correspondence, language and writing skills of the learner.(Remember)

CO4: Effectively use communication technology.(Apply)

CO5: Demonstrate effective presentation, visual communication and impress stage.(Analyse)

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Sr. No.	Modules / Units
1	**UNIT 1**
	(Skill development) **The Seven Cs of Effective Communication**: Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness **Understanding Communication**: Nature and Scope of Communication, Methods of communication, Cross- culturalcommunication, Technology-enabledBusiness Communication
2	**UNIT 2**
	Writing Business Messages and Documents: Business Correspondence: Letter of inquiry, letter of order, letter of complaints, sales letter, business reports, resume writing
3	**UNIT 3**
	Developing Oral Communication Skills: Effective Listening, Business Presentations and Public Speaking, Conversations, Interviews, meetings and conferences, group discussions
4	**UNIT 4**
	Business ethics: Importance of business ethics, personal integrity at work place, computer ethics, corporate social responsibility
5	**UNIT 5**
	Business Presentation: Principles of effective presentation, brain storming and graphic/visual aids, use of graphics in presentation, effective use of presentation tools.

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Reference Books
Business Communication
Reference book: 1. Meenakshi Raman and Prakash Singh, Business Communication, Oxford University Press, 2nd Ed. 2. Aruna Koneru, Professional Communication, Tata McGraw Hill 3. M. S. Rao, Strategies for Improving Your Business Communication, Shroff Publishers and Distributors

Practical (1711UITPR) (Skill development)
1. Communication Origami, Guessing Game, Guessing the emotion 2. Body Language, Follow All Instructions, Effective Feedback Skills 3. The Name Game, Square Talk (Effective Communication), Room 101 (Influential and persuasive skills) 4. Back to Back Communication, Paper Shapes (Importance of two-way communication), Memory Test(Presentation Skills) 5. Exercises on Communication Principles 6. Exercises on communication icebreakers 7. Communication exercises 8. For the following practicals, Microsoft Office, Open Office, Libre Office or any other software suite can be used. 9. Use of word processing tools for communication 10. Use of spreadsheet tools for communication 11. Use of presentation tools for communication

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Syllabus Of
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Bachelor of Science Information Technology
(BSC IT) Programme

Second Year

Semester III

Under Academic Autonomy and Credit, Grading and Semester System

(To be implemented during Academic Year- 2018-2019)

PRINCIPAL
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Course Code	Course	Hrs. of Instruction/ week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
1731UITPP	Python Programming	4	2 ½ hrs	25	75	100	2

Course Objectives –

By the end of the course, learners will be able to:

1. Understand why python is a useful scripting language for developers.
2. Learn how to design UI and program python applications.
3. Connect with the database and perform SQL commands.
4. Learn how to use different data type and its methods/functions in Python
5. Learn how to read and write files and file operations.
6. Write functions and work with String.
7. Learn how to build python modules for reusability.
8. Learn exception handling and object oriented programming

Course Outcome –

After completing this course, learner will be able to:

CO1: Write basic programs with use of Python Data Types and Statements (Create)
CO2: Design UI Applications using Python's TKinter (Create)
CO3: Implement Database Connection with Python Application (Apply)
CO4: Understanding File Operations (Understand)

CO5: Construct python modules for reusability. (Create)

CO6: Carry out exception handling and object oriented programming (Create)

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Course Code	Course	Instruction/Week	Duration (Hours)	CIE	SEE	Total	
1723UITWP	Web Programming	4	2 1/2 Hours	25	75	100	3

Course Objective: By the end of the course, learners will be able to:

1. To Learn basics of web page design
2. To create web application with CSS
3. To use CSS to implement a variety of presentation effects to the web application.
4. Build dynamic web pages using JavaScript
5. To develop web applications with php and mysql.

Course outcome:
After completing this course learners will be able to:
CO1: Apply the different tags in HTML for website creation.(Level: Create)
CO2: Describe the use of CSS with HTML.(Understand)
CO3: Develop a dynamic webpage by the use of java script(Create)
CO4: Recognize the web page creation and working with different tags.(Understand)
CO5: Analyze and study the working of php with MySql(Create)

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Sr.	Modules /

No.	Units
1	**UNIT 1**
	(Skill Development) **Internet and the World Wide Web:** What is Internet? Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address, World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers – internet explorer, Netscape navigator, opera, Firefox, chrome, Mozilla. search engine, web saver – apache, IIS, proxy server, HTTP protocol **HTML5:** Introduction, Why HTML5? Formatting text by using tags, using lists and backgrounds, Creating hyperlinks and anchors. Style sheets, CSS formatting text using style sheets, formatting paragraphs using style sheets.
2	**UNIT 2**
	HTML5 Page layout and navigation: Creating navigational aids: planning site organization, creating text based navigation bar, creating graphics based navigation bar, creating graphical navigation bar, creating image map, redirecting to another URL, creating division based layouts: HTML5 semantic tags, creating divisions, creating HTML5 semantic layout, positioning and formatting divisions. **HTML5 Tables, Forms and Media: Creating tables:** creating simple table, specifying the size of the table, specifying the width of the column, merging table cells, using tables for page layout, formatting tables: applying table borders, applying background and foreground fills, changing cell padding, spacing and alignment, creating user forms: creating basic form, using check boxes and option buttons, creating lists, additional input types in HTML5, Incorporating sound and video: audio and video in HTML5, HTML multimedia basics, embedding video clips, incorporating audio on web page.

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3	**UNIT 3**
	Java Script: Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security, **Operators:** Assignment Operators, Comparison Operators, Arithmetic Operators, % (Modulus), ++(Increment), --(Decrement), -(Unary Negation), Logical Operators, Short-Circuit Evaluation, String Operators, Special Operators, ?: (Conditional operator), , (Comma operator), delete, new, this, void **Statements:** Break, comment, continue, delete, do...while, export, for, for...in, function, if...else, import, labelled, return, switch, var, while, with, Core JavaScript (Properties and Methods of Each) : Array, Boolean, Date, Function, Math, Number, Object, String, regExp Document and its associated objects: document, Link, Area, Anchor, Image, Applet, Layer **Events and Event Handlers** : General Information about Events, Defining Event Handlers, event, onAbort, onBlur, onChange, onClick, onDblClick, onDragDrop, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onMove, onReset, onResize, onSelect, onSubmit, onUnload
4	**UNIT 4**
	PHP: Why PHP and MySQL? Server-side scripting, PHP syntax and variables, comments, types, control structures, branching, looping, termination, functions, passing information with PHP, GET, POST, formatting form variables, superglobal arrays, strings and string functions, regular expressions, arrays, number handling, basic PHP errors/problems
5	**UNIT 5**
	Advanced PHP and MySQL : PHP/MySQL Functions, Integrating web forms and databases, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, E-Mail Introduction to Bootstrap (elementary level) – Introduction to JQuery

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Reference Books

Web Programming

References:

1. Thomas Powell, Web Design: The Complete Reference, Tata McGraw Hill
2. Faithe Wempen, HTML5 Step by Step, Microsoft Press, 2011
3. Ivan Bayross, Sharanam Sha, PHP 5.1 for Beginners, SPD, 2013
4. Sharanam Shah, Vaishali Shah, , PHP Project for Beginners, SPD, 2015
5. Steve Suehring, Tim Converse, Joyce Park, PHP 6 and MySQL Bible, Wiley, 2009
6. Eric Freeman, Head First HTML 5 Programming, O'Reilly, 2013
7. Thomas Powell and Fritz Schneider, JavaScript 2.0: The Complete Reference, Tata McGraw Hill, 2nd Ed.

Practical (1723UITPR) (Skill development)

1. Use of Basic Tags

a) Design a web page using different text formatting tags.
b) Design a web page with links to different pages and allow navigation between web pages
c) Design a web page demonstrating all Style sheet types

2. Use of Table tags, attributes and style properties

a) Design a simple table using border & border collapse property
b) Design a table with merge cells
c) Design a table illustrating cell padding, cell spacing & different border styles
d) Design a table illustrating text alignments

3. Image maps, Forms and Media

a) Design a web page with Imagemaps.
b) Design a web page demonstrating different semantics
c) Design a web page with different tables. Design a webpages using table so that the content appears well placed
d) Design a web page with a form that uses all types of controls.
e) Design a web page embedding with multimedia features

4. Java Script

a) Using JavaScript design, a web page that prints factorial/Fibonacci series/any given series
b) Design a form and validate all the controls placed on the form using Java Script.
c) Write a JavaScript program to display all the prime numbers between 1 and 100.
d) Write a JavaScript program to accept a number from the user and display the sum of its digits.
e) Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function).
f) Write a java script program to design simple calculator.

5. Control and looping statements and Java Script references

a) Design a web page demonstrating different conditional statements.
b) Design a web page demonstrating different looping statements.

c) Design a web page demonstrating different Core JavaScript references (Array, Boolean, Date, Function, Math, Number, Object, String, regExp).

6. Basic PHP I

a) Write a PHP Program to accept a number from the user and print it factorial

b) Write a PHP program to accept a number from the user and print whether it is prime or not.

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7. Basic PHP II

Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.

Write a PHP program to display the following Binary Pyramid: 1

0 1

1 0 1

0 1 0 1

8. String Functions and arrays

Write a PHP program to demonstrate different string functions.

Write a PHP program to create one dimensional array.

9. PHP and Database

Write a PHP code to create:

Create a database College

Create a table Department (Dname, Dno, Number_Of_faculty)

Write a PHP program to create a database named "College". Create a table named "Student" with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75 in a tabular format.

Design a PHP page for authenticating a user.

Email, Sessions and Cookies

Write a program to send email with attachment.

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Second Year

Semester IV

Under Academic Autonomy and Credit, Grading and Semester System

(To be implemented during Academic Year- 2018-2019)

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Course Code	Course	Hrs. of Instruction/ week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
1741UITCJ	Core Java	4	2 ½ hrs	25	75	100	2

Course Objectives:
By the end of the course, learners will be able to:

1. Understand the importance of Object Oriented paradigm in Application development.
2. Study Java language Basics.
3. Implement Object oriented concepts using Java.
4. Understand concepts of packages and Multithreading in Java.
5. Explore the importance of Exception handling in program design.
6. To develop GUI Applications using AWT.

Course Outcome:

After successful completion of this course, learners will be able to:

CO1: Acquire knowledge about Java language.(Understand)

CO2: Apply Object Oriented paradigm in Application development.(Apply)

CO3: Develop user defined packages.(Understand)

CO4: Implement Single threaded and Multithreaded programs in Java language.(Apply)

CO5: Create programs using Exception Handling.(Understand)

CO6: Integrate important concepts of OOP to develop GUI applications.(Create)

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Sr. No.	Modules / Units
1	**UNIT 1**
	(Skill development) **Introduction:**History, architecture and its components,Java Class File, Java Runtime Environment, The Java Virtual Machine, JVM Components, The Java API, java platform, java development kit, Lambda Expressions, Methods References, Type Annotations, Method Parameter Reflection, setting the path environment variable, Java Compiler And Interpreter, java programs, java applications, main(), public, static, void, string[] args, statements, white space, case sensitivity, identifiers, keywords, comments, braces and code blocks, variables, variable name **Data types:** primitive data types, Object Reference Types, Strings, Auto boxing, operators and properties of operators, Arithmetic operators, assignment operators, increment and decrement operator, relational operator, logical operator, bitwise operator, conditional operator.
2	**UNIT 2**
	Control Flow Statements: The If...Else If...Else Statement, The Switch...Case Statement **Iterations:** The While Loop, The Do ... While Loop, The For Loop, The Foreach Loop, Labeled Statements, The Break And Continue Statements, The Return Statement **Classes:** Types of Classes, Scope Rules, Access Modifier, Instantiating Objects From A Class, Initializing The Class Object And Its Attributes, Class Methods, Accessing A Method, Method Returning A Value, Method's Arguments, Method Overloading, Variable Arguments [Varargs], Constructors, this Instance, super Instance, Characteristics Of Members Of A Class, constants, this instance, static fields of a class, static methods of a class, garbage collection.
3	**UNIT 3**
	Inheritance: Derived Class Objects, Inheritance and Access Control, Default Base Class Constructors, this and super keywords. Abstract Classes And Interfaces, Abstract Classes, Abstract Methods, Interfaces, What Is An Interface? How Is An Interface Different From An Abstract Class?, Multiple Inheritance, Default Implementation, Adding New Functionality, Method Implementation, Classes V/s Interfaces, Defining An Interface, Implementing Interfaces.

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	Packages: Creating Packages, Default Package, Importing Packages, Using A Package.
4	**UNIT 4**
	Enumerations,Arrays: Two Dimensional Arrays, Multi-Dimensional Arrays, Vectors, Adding Elements To A Vector, Accessing Vector Elements, Searching For Elements In A Vector, Working With The Size of The Vector. **Multithreading:** the thread control methods, thread life cycle, the main thread, creating a thread, extending the thread class. **Exceptions:** Catching Java Exceptions, Catching Run-Time Exceptions, Handling Multiple Exceptions, The finally Clause, The throws Clause **Byte streams:** reading console input, writing console output, reading file, writing file, writing binary data, reading binary data, getting started with character streams, writing file, reading file
5	**UNIT 5**
	Event Handling: Delegation Event Model, Events, Event classes, Event listener interfaces, Using delegation event model, adapter classes and inner classes. **Abstract Window Toolkit:** Window Fundamentals, Component, Container, Panel, Window, Frame, Canvas.Components – Labels, Buttons, Check Boxes, Radio Buttons, Choice Menus, Text Fields, Text, Scrolling List, Scrollbars, Panels, Frames **Layouts:** Flow Layout, Grid Layout, Border Layout, Card Layout.

Reference Books
Core Java
Reference book:

1. Core Java 8 for Beginners , Vaishali Shah, Sharnam Shah SPD 1st edition 2015.
2. Java: The Complete Reference Herbert Schildt McGraw Hill 9th edition 2014
3. Murach's beginning Java with Net Beans Joel Murach , Michael Urban SPD 1st edition 20116
4. Core Java, Volume I: Fundamentals Hortsman Pearson 9th edition 2013.
5. Core Java, Volume II: Advanced Features Gary Cornell and Hortsman Pearson 8th edition 2008
6. Core Java: An Integrated Approach R. Nageswara Rao Dreamtech 1st edition 2008

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Practical1741UITPR)
(Skill development)

1. Java Basics

a. Write a Java program that takes a number as input and prints its multiplication table upto 10.

b. Write a Java program to display the following pattern.

*****
****
***
**
*

c. Write a Java program to print the area and perimeter of a circle.

2. Use of Operators

a. Write a Java program to add two binary numbers.

b. Write a Java program to convert a decimal number to binary number and vice versa.

c. Write a Java program to reverse a string.

3. Java Data Types

a. Write a Java program to count the letters, spaces, numbers and other characters of an input string.

b. Implement a Java function that calculates the sum of digits for a given char array consisting of the digits '0' to '9'. The function should return the digit sum as a long value.

c. Find the smallest and largest element from the array

4. Methods and Constructors

a. Designed a class SortData that contains the method asec() and desc().

b. Designed a class that demonstrates the use of constructor and destructor.

c. Write a java program to demonstrate the implementation of abstract class.

5. Inheritance

a. Write a java program to implement single level inheritance.

b. Write a java program to implement method overriding

c. Write a java program to implement multiple inheritance.

6. Packages and Arrays

a. Create a package, Add the necessary classes and import the package in java class.

b. Write a java program to add two matrices and print the resultant matrix.

c. Write a java program for multiplying two matrices and print the product for the same.

7. Vectors and Multithreading

a. Write a java program to implement the vectors.

b. Write a java program to implement thread life cycle.

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c. Write a java program to implement multithreading.

8. File Handling

a. Write a java program to open a file and display the contents in the console window.

b. Write a java program to copy the contents from one file to other file.

c. Write a java program to read the student data from user and store it in the file.

9. GUI and Exception Handling

a. Design a AWT program to print the factorial for an input value.

b. Design an AWT programto perform various string operations like reverse string, string concatenation etc.

c. Write a java program to implement exception handling.

10. GUI Programming.

a. Design an AWT application that contains the interface to add student information and display the same.

b. Design a calculator based on AWT application.

Design an AWT application to generate result marks sheet.

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Syllabus Of
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Bachelor of Science Information Technology
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Third Year

Semester V

Under Academic Autonomy and Credit, Grading and Semester System

(To be implemented during Academic Year- 2018-2019)

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3. ADVANCED WEB PROGRAMMING

at Semester V
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Modules	No. of lectures
1	Introducing .NET, C# Language, Types, Objects, and Namespaces	9
2	Web Form Fundamentals and Controls	9
3	Error Handling, Logging, and Tracing, State Management, Styles, Themes, and Master Pages	9
4	ADO.NET Fundamentals, Data Binding, Data Controls	9
5	XML, Security Fundamentals, ASP.NET AJAX	9
	Total	45

Course Objective:

By the end of the course, learners will be able to:

1. Understand basic building blocks of Dot Net.
2. Assimilate C# Fundamentals, Exception handling.Design Interfaces and Collections in C#.
3. Defines and discuss major concepts, tool, techniques, and methods of web application development.
4. Create web application using ASP.NET.
5. Implement the the database connectivity with ASP.NET.

Course outcome:

After completing this course learners will be able to:

CO1: Implement the basics of C#. (Level:Apply)

CO2: Develop simple file test assembly.(Level:Understand)

CO3: Apply the different tools to create web applications.(Level:Apply)

CO4: Design Web pages with ADO.NET.(Level:Create)

CO5: Develop partial refreshes of web pages using ajax,use of Linq and jQuery (Level:Create)

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NAGINDAS KHANDWALA COLLEGE OF SCIENCE
(AUTONOMOUS)
MALAD (W), MUMBAI - 400 064

Detailed Syllabus:

Module	Topics	No. of Lectures
1	Skill development and Employability **Introducing .NET:** The .NET Framework, C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library. **The C# Language,** C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods. **Types, Objects, and Namespaces:** The Basics About Classes, Building a Basic Class, Value Types and Reference Types, Understanding Namespaces and Assemblies, Advanced Class Programming.	9
2	**Web Form Fundamentals:** Writing Code, Using the Code-Behind Class, Adding Event Handlers, Understanding the Anatomy of an ASP.NET Application, Introducing Server Controls, Using the Page Class, Using Application Events, Configuring an ASP.NET Application. **Form Controls,** Stepping Up to Web Controls, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, Validation, Understanding Validation, Using the Validation Controls, Rich Controls, The Calendar, The AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls, Dynamic Graphics, The Chart Control, Website Navigation, Site Maps, URL Mapping and Routing, The SiteMapPath Control, The TreeView Control, The Menu Control.	9
3	**Error Handling, Logging, and Tracing :** Avoiding Common Errors, Understanding Exception Handling, Handling Exceptions, Throwing Your Own Exceptions, Using Page Tracing **State Management,** Understanding the Problem of State, Using View State, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using Application State, Comparing State Management Options **Styles, Themes, and Master Pages:** Styles, Themes, Master Page Basics, Advanced Master Pages.	9
4	**ADO.NET Fundamentals:** Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access. **Data Binding:** Introducing DataBinding, Using Single-Value Data Binding, Using Repeated-Value Data Binding, Working with Data Source Controls. **The Data Controls:** The GridView, Formatting the GridView, Selecting a GridView Row, Editing with the GridView, Sorting and Paging the GridView, Using GridView Templates, The DetailsView and FormView	9
5	**XML:** XML Explained, The XML Classes, XML Validation, XML Display and Transforms. **Security Fundamentals:** Understanding Security Requirements, Authentication and Authorization, Forms Authentication, Windows Authentication. **ASP.NET AJAX:** Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.	9

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References:

1. Beginning ASP.NET 4.5 in C#, Matthew MacDonald , Apress , 2012
2. C# 2015, Anne Bohem and Joel Murach , Murach , Third , 2016
3. Murach's ASP.NET 4.6 Web Programming in C#2015 , Mary Delamater and Anne Bohem , SPD , Sixth , 2016
4. ASP.NET 4.0 Programming, J.Kanjilal , Tata McGraw-Hill , 2011
5. Programming ASP.NET, D.Esposito , Micosoft Press (Dreamtech) , 2011
6. Beginning Visual C# 2010 , K. Watson , C. Nagel, J.H Padderson , J.D. Ried, M Skinner , Wrox (Wiley) ,2010

Practical: Skill development and Employability

1. **Working with basic C# and ASP.NET**
   a) Create an application that obtains four int values from the user and displays the product.
   b) Create an application to demonstrate string operations.
   c) Create an application that receives the (Student Id, Student Name, Course Name, Date of Birth) information from a set of students. The application should also display the information of all the students once the data entered.
   d) Create an application to demonstrate following operations
      i. Generate Fibonacci series. ii. Test for prime numbers.
      iii. Test for vowels. iv. Use of foreach loop with arrays
      v. Reverse a number and find sum of digits of a number.
2. **Working with Object Oriented C# and ASP .NET**
   a) Create simple application to perform following operations
      i. Finding factorial Value ii. Money Conversion
      iii. Quadratic Equation iv. Temperature Conversion
   b) Create simple application to demonstrate use of following concepts
      i. Function Overloading ii. Inheritance (all types)
      iii. Constructor overloading iv. Interfaces\
   c) Create simple application to demonstrate use of following concepts
      i. Using Delegates and events ii. Exception handling
3. **Working with Web Forms and Controls**
   a) Create a simple web page with various sever controls to demonstrate setting and use of their properties.(Example,AutoPostBack)
   b)Demonstrate the use of Calendar control to perform following operations.
   i) Display messages in a calendar control ii) Display vacation in a calendar control
   iii) Selected day in a calendar control using style
   iv) Difference between two calendar date
   c) Demonstrate the use of Treeview control perform following operations.
   i) Treeview Control and datalist ii) Exception handling
4. **Working with Form Controls**
   a) Create a Registration form to demonstrate use of various Validation controls.
   b) Create Web Form to Demonstrate use of Adrotator Control.
   c) Create Web Form to demonstrate use User Controls

5. Working with Navigation , Beautification and Master page.

a) Create Web Form to demonstrate use of Website Navigation controls and Site map.
b) Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beaufication
c) Create a web application to demonstrate various states of ASP.NET Pages.

6. Working with Database

a) Create a web application bind data in a multiline textbox by querying in another textbox
b) Create a web application to display records by using database.
c) Demonstrate the use of Datalist link control.

7. Working with Database

a) Create a web application to display Databinding using dropdownlist control.
b) Create a web application for to display the phone no of an author using database.
c) Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).

8. Working with data controls

a) Create a web application to demonstrate various uses and properties of SqlDataSource
b) Create a web application to demonstrate data binding using DetailsView and FormView Controls.
c) Create a web application to display Using Disconnected Data Access and Databinding using GridView.

9. Working with GridView control

a) Create a web application to demonstrate use of GridView control template and GridView hyperlink.
b) Create a web application to demonstrate use of GridView button column and GridView Evens.
c) Create a web application to demonstrate GridView paging and Creating own table format using GridView

10. Working with AJAX and XML

a) Create a web application to demonstrate reading and writing operation with XML.
b) Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization Properties.
c) Create a web application to demonstrate use of various Ajax controls.

11. Programs to create and use DLL .

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Syllabus Of
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Project Dissertation Semester V and Project Implementation Semester VI

(Skill Development & Employability)

Chapter 1 to 4 should be submitted in Semester V in spiral binding. These chapter have also to be included in Semester VI report. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the dissertation in semester V and dissertation and viva voce in Semester VI.

I. OBJECTIVES

- Describe the Systems Development Life Cycle (SDLC).
- Evaluate systems requirements.
- Complete a problem definition.
- Evaluate a problem definition.
- Determine how to collect information to determine requirements.
- Perform and evaluate feasibility studies like cost-benefit analysis, technical feasibility, time feasibility and Operational feasibility for the project.
- Work on data collection methods for fact finding.
- Construct and evaluate data flow diagrams.
- Construct and evaluate data dictionaries.
- Evaluate methods of process description to include structured English, decision tables and decision trees.
- Evaluate alternative tools for the analysis process.
- Create and evaluate such alternative graphical tools as systems flow charts and state transition diagrams.
- Decide the S/W requirement specifications and H/W requirement specifications.
- Plan the systems design phase of the SDLC.
- Distinguish between logical and physical design requirements.
- Design and evaluate system outputs.
- Design and evaluate systems inputs.
- Design and evaluate validity checks for input data.
- Design and evaluate user interfaces for input.
- Design and evaluate file structures to include the use of indexes.
- Estimate storage requirements.
- Explain the various file update processes based on the standard file organizations.

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- Decide various data structures.
- Construct and evaluate entity-relationship (ER) diagrams for RDBMS related projects.
- Perform normalization for the unnormalized tables for RDBMS related projects
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.
- Plan for several appendices to be placed in support with the project report documentation.

- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.

• Plan for several appendices to be placed in support with the project report documentation.

• Work effectively as an individual or as a team member to produce correct, efficient, well-organized and documented programs in a reasonable time.

• Recognize problems that are amenable to computer solutions, and knowledge of the tool necessary for solving such problems.

• Develop of the ability to assess the implications of work performed.

• Get good exposure and command in one or more application areas and on the software

• Develop quality software using the software engineering principles

• Develop of the ability to communicate effectively.

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ARTIFICIAL INTELLIGENCE

at Semester V
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Introduction and Intelligent Agent	9
2	Solving problems by searching, beyond classical search	9
3	Adversarial search and logical agents	9
4	FOL and Inference in FOL	9
5	Planning and Knowledge Representation	9
	Total	**45**

Objective:

To create appreciation and understanding of both the achievements of AI Students will able to:

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents and the theory underlying those achievements.
- To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems
- To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
- To create an understanding of the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.

Outcome:

- CO1:Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.(Level:Apply)
- CO2:Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them. (Level:Analyze)
- CO3:Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing(Level:Apply)
- CO4:Compare different AI algorithms in terms of design issues, computational complexity, and assumptions (Level:Understand)
- CO5:Differentiate various learning approaches, and to interpret the concepts of supervised learning(Level:Understand)

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Detailed Syllabus

Module	Topics	No. of Lectures
1	**Introduction:** What is Artificial Intelligence? Foundations of AI, history, the state of art AI today. **Intelligent Agents,** agents and environment, good behavior, nature of environment, the structure of agents.	9
2	**Solving Problems by Searching:** Problem solving agents, examples problems, searching for solutions, uninformed search, informed search strategies, heuristic functions. **Beyond Classical Search:** local search algorithms, searching with non-deterministic action, searching with partial observations, online search agents and unknown environments.	9
3	**Adversarial Search:** Games, optimal decisions in games, alpha-beta pruning, stochastic games, partially observable games, state-of-the-are game programs. **Logical Agents:** Knowledgebase agents, The Wumpus world, logic, Propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic.	9
4	**First Order Logic:** Syntax and semantics, using First Order Logic, Knowledge engineering in First Order Logic. **Inference in First Order Logic:** propositional vs. First Order, unification and lifting, forward and backward chaining, resolution.	9
5	**Planning:** Definition of Classical Planning, Algorithms for planning as state space search, planning graphs, other classical planning approaches, analysis of planning approaches, Time, Schedules and resources, hierarchical planning, Planning and Acting in Nondeterministic Domains, multiagent planning, **Knowledge Representation:** Categories and Objects, events, mental events and objects, reasoning systems for categories, reasoning with default information, Internet shopping world	9

References:

1. Artifical Intelligence, A modern Approach, Stuart Russel and Peter Norving , Pearson , 3rd , 2015
2. A First Course in Artificial Intelligence, Deepak Khemani , TMH , First ,2017
3. Artificial Intelligence, A Rational Approach, Rahul Deva, Shroff Publishers , 1st ,2018
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Practical: (Skill Development & Employability)

1	a)	Write a program to implement depth first search algorithm.
	b)	Write a program to implement breadth first search algorithm.
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8	a)	Solve the block of World problem.
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9	a)	Derive the expressions based on Associative law
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10	a)	Write a program to derive the predicate. (for e.g., Sachin is batsman , batsman is cricketer) - > Sachin is Cricketer.
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ARTIFICIAL INTELLIGENCE

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ENTERPRISE JAVA

at Semester V
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Modules	No. of lectures
1	Java EE, Servlet and Database	9
2	Cookies and Working with Files	9
3	JSP	9
4	Enterprise JavaBeans	9
5	JPA and Hibernate	9
	Total	45

Course objectives –

By the end of the course, learners will be able to:

1. Understand how to develop applications using Java.
2. Get an understanding on Enterprise Java and the servlet technology.
3. Explain the database connection using JDBC.
4. Understand the concept of cookies and session tracking in java.
5. Work with JSP, EJB, JPA, Hibernate and implement it.

Course Outcome –

After completing this course learner will be able to:

CO1: Understand Enterprise Application and Java EE architecture. (Understand)
CO2: Explain the concept of servlet, JDBC and apply it through coding. (Understand)
CO3: Learn and analyse the concept of cookies and session tracking in Java. (Analyze)
CO4: Create applications using servlet, JSP, EJB along with implementation of database. (Create)
CO5: Basic understanding of JavaBean and their applications. (Understand)
CO6: Explain the concept of and create applications using JPA, Hibernate. (Understand)

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1	**Understanding Java EE:** What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server **Java EE Architecture, Server and Containers:** Types of System Architecture, Java EE Server, Java EE Containers. **Introduction to Java Servlets:** The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do? **Servlet API and Lifecycle:** Java Servlet API, The Servlet Skeleton, The Servlet Life Cycle, A Simple Welcome Servlet **Working With Servlets:** Getting Started, Using Annotations Instead of Deployment Descriptor. **Working with Databases:** What Is JDBC? JDBC Architecture, Accessing Database, The Servlet GUI and Database Example.	9
2	**Request Dispatcher:** Request dispatcher Interface, Methods Requestdispatcher, Requestdispatcher Application. **COOKIES:** Kinds Of Cookies, Where Cookies Are Used? CreatingCookies Using Servlet, Dynamically Changing The Colors Of A Page **SESSION:** What Are Sessions? Lifecycle Of Http Session, SessionTracking With Servlet API, A Servlet Session Example **Working With Files:** Uploading Files, Creating an Upload FileApplication, Downloading Files, Creating a Download File Application. **Working With Non-Blocking I/O:** Creating a Non-Blocking ReadApplication, Creating The Web Application, Creating Java Class,Creating Servlets, Retrieving The File, Creating index.jsp	9
3	**Introduction To Java Server Pages:** Why use Java Server Pages? Disadvantages Of JSP, JSP v\s Servlets, Life Cycle of a JSP Page, How does a JSP function? How does JSP execute? About Java Server Page **Getting Started With Java Server Pages:** Comments, JSP Document,JSP Elements, JSP GUI Example. **Action Elements:** Including other Files, Forwarding JSPPage toAnother Page, Passing Parameters for other Actions, Loading a Javabean. **Implicit Objects, Scope And El Expressions:** Implicit Objects,Character Quoting Conventions, Unified Expression Language [UnifiedEl], Expression Language. **Java Server Pages Standard Tag Libraries:** What is wrong in using JSP Scriptlet Tags? How JSTL Fixes JSP Scriptlet's Shortcomings? Disadvantages Of JSTL, Tag Libraries.	9
4	**Introduction To Enterprise Javabeans:** Enterprise Bean Architecture,Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans **Working With Session Beans:** When to use Session Beans? Types of Session Beans, Remote and Local Interfaces,Accessing Interfaces, Lifecycle of Enterprise Beans, Packaging Enterprise Beans, Example of Stateful Session Bean, Example of Stateless Session Bean, Example of Singleton Session Beans. **Working with Message Driven Beans:** Lifecycle of a Message DrivenBean, Uses of Message Driven Beans, The Message Driven BeansExample. **Interceptors,** Request And Interceptor, Defining An Interceptor, Around Invoke Method, Applying Interceptor, Adding An Interceptor To An	9

	Enterprise Bean, Build and Run the Web Application. **Java Naming and Directory Interface:** What is Naming Service? What is Directory Service? What is Java Naming and Directory interface? Basic Lookup, JNDI Namespace in Java EE, Resources and JNDI, Data source Resource Definition in Java EE	.
5	**Persistence, Object/Relational Mapping And JPA:** What is Persistence? Persistence in Java, Current Persistence Standards in Java, Why another Persistence Standards? Object/Relational Mapping, **Introduction to Java Persistence API:** The Java Persistence API, JPA, ORM, Database and the Application, Architecture of JPA, How JPA Works? JPA Specifications. **Writing JPA Application:** Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database And Tables in Mysql, Creating a Web Application, Adding the Required Library Files, Creating a Javabean Class, CreatingPersistence Unit [Persistence. Xml], Creating JSPS, The JPAApplication Structure, Running The JPA Application. **Introduction to Hibernate:** What is Hibernate? Why Hibernate? Hibernate, Database and The Application, Components of Hibernate, Architecture of Hibernate, How Hibernate Works? **Writing Hibernate Application:** Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database and Tables in Mysql, Creating a Web Application, Adding The Required Library Files, Creating a Javabean Class, Creating Hibernate Configuration File, Adding a Mapping Class, Creating JSPS, Running The Hibernate Application.	9

References:

1. Java EE 7 For Beginners ,Sharanam Shah, Vaishali Shah , SPD , First , 2017
2. Java EE 8 Cookbook , Build reliable applications with the most or robust and mature technology for enterprise development , Elder Moraes , Packt , First , 2018
3. Advanced Java Programming ,Uttam Kumar Roy , Oxfrod Press , 2015

Practical: (Skill Development & Employability)

1. Implement the following Simple Servlet applications.

a. Create a simple calculator application using servlet.
b. Create a servlet for a login page. If the username and password are correct then it says message "Hello <username>" else a message "login failed"
c. Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database.

2. Implement the following Servlet applications with Cookies and Sessions.

a. Using Request Dispatcher Interface create a Servlet which will validate the password
b. entered by the user, if the user has entered "Servlet" as password, then he will be

c. forwarded to Welcome Servlet else the user will stay on the index.html page and an
d. error message will be displayed.
e. Create a servlet that uses Cookies to store the number of times a user has visited servlet.
f. Create a servlet demonstrating the use of session creation and destruction. Also check
g. whether the user has visited this page first time or has visited earlier also using sessions.

3. Implement the Servlet IO and File applications.

a. Create a Servlet application to upload and download a file.
b. Develop Simple Servlet Question Answer Application using Database.
c. Create simple Servlet application to demonstrate Non-Blocking Read Operation.

4. Implement the following JSP applications.

a. Develop a simple JSP application to display values obtained from the use of intrinsic objects of various types.
b. Develop a simple JSP application to pass values from one page to another with validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
c. Create a registration and login JSP application to register and authenticate the user based on username and password using JDBC

5. Implement the following JSP JSTL and EL Applications.

a. Create an html page with fields, eno, name, age, desg, salary. Now on submit this
    i. data to a JSP page which will update the employee table of database with matching
    ii. eno.
b. Create a JSP page to demonstrate the use of Expression language.
c. Create a JSP application to demonstrate the use of JSTL.

6. Implement the following EJB Applications.

a. Create a Currency Converter application using EJB.
b. Develop a Simple Room Reservation System Application Using EJB.
c. Develop simple shopping cart application using EJB [Stateful Session Bean].

7. Implement the following EJB applications with different types of Beans.

a. Develop simple EJB application to demonstrate Servlet Hit count using Singleton Session Beans.
b. Develop simple visitor Statistics application using Message Driven Bean [Stateless Session Bean].
c. Develop simple Marks Entry Application to demonstrate accessing Database using EJB.

8. Implement the following JPA applications.

a. Develop a simple Inventory Application Using JPA.
b. Develop a Guestbook Application Using JPA.
c. Create simple JPA application to store and retrieve Book details.

9. Implement the following JPA applications with ORM and Hibernate.

a. Develop a JPA Application to demonstrate use of ORM associations.
b. Develop a Hibernate application to store Feedback of Website Visitor in MySQL Database.
c. Develop a Hibernate application to store and retrieve employee details in MySQL Database.

10. Implement the following Hibernate applications.

a. Develop an application to demonstrate Hibernate One- To -One Mapping Using
    a. Annotation.
b. Develop Hibernate application to enter and retrieve course details with ORM Mapping.

Develop a five page web application site using any two or three Java EE Technologies

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Third Year

Semester V

Under Academic Autonomy and Credit, Grading and Semester System

(To be implemented during Academic Year- 2018-2019)

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INTERNET OF THINGS

at Semester V
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Internet of Things, Design Principles for Connected Devices, Internet Principles	9
2	Thinking About Prototyping, Prototyping Embedded Devices	9
3	Prototyping the Physical Design, Prototyping Online Components	9
4	Techniques for Writing Embedded Code, Business Models	9
5	Moving to Manufacture, Ethics	9
	Total	**45**

Course Objective:

1. To assess the vision and introduction of IoT.
2. To Understand IoT Market perspective.
3. To Implement Data and Knowledge Management and use of Devices in IoT Technology.
4. To Understand State of the Art - IoT Architecture.
5. To classify Real World IoT Design Constraints, Industrial Automation in IoT

Course Outcome:

After the successful completion of this course, learners will be able to:

CO1: Describe the meaning and different components of Internet of Things, also the principles of Internet (Understand)

CO2: Explain and prototype an embedded product. (Understand)

CO3: Illustrate the physical design of the system and work with online components API for security, polling, etc. (Analyse and Apply)

CO4: Describe the the memory management of an embedded system and write the codes for embedded product (Understand)

CO5: To create a small model representing the automation in IoT. (Create)

	Designing Printed circuit boards, Software Choices, The Design Process, Manufacturing Printed Circuit Boards, Etching Boards, Milling Boards. Assembly, Testing, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software, Deployment, Correctness and Maintainability, Security, Performance, User Community. **Ethics:** Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, The Internet of Things as Part of the Solution, Cautious Optimism, The Open Internet of Things Definition.	

References:

1. Designing the Internet of Things , Adrian McEwen, Hakim Cassimally, WILEY, First, 2014
2. Internet of Things – Architecture And Design , Raj Kamal , McGraw Hill , First , 2017
3. Getting Started with the Internet of Things ,Cuno Pfister , O'Reilly , Sixth , 2018
4. Getting started with RespberryPi , Matt Richardson and Shawn Wallace , SPD , Thir , 2016

Practical: (Skill Development & Employability)

1. Starting Raspbian OS, Familiarising with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.
2. Displaying Different LED patterns with Raspberry Pi
3. Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.
4. Raspberry Pi Based Oscilloscope
5. Controlling Raspberry Pi with WhatsApp.
6. Setting up Wireless Access Point using Raspberry Pi
7. Fingerprint Sensor Interfacing with Raspberry Pi
8. Raspberry Pi GPS Module Interfacing
9. IoT based Web Controlled Home Automation using Raspberry Pi
10. Visitor Monitoring with Raspberry Pi and Pi Camera
11. Interfacing Raspberry Pi with RFID.

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SOFTWARE PROJECT MANAGEMENT

at Semester V
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Introduction, Project Evaluation and Programme Management, An Overview of Project Planning	9
2	Selection of an Appropriate Project Approach, Software Effort Estimation	9
3	Activity Planning, Risk Management, Resource Allocation	9
4	Monitoring and Control, Managing Contracts, Managing People in Software Environments	9
5	Working in Teams, Software Quality, Project Closeout	9
	Total	45

Course Objectives :

By the end of the course, learners will be able to:

1. To understand the methods used to evaluate and select projects for investment of funds.
2. To gain knowledge on the principles and techniques of software project management.
3. To introduce organization behavior and general management techniques used for project management
4. Will be able to do the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.
5. Analyze the architecture of a model based software and the process flow.

Course Outcomes:

After completing this course learners will be able to:

CO1: Identify the different project contexts and suggest an appropriate management strategy. (Remember)

CO2: Analyze and design the software architecture. (Analyze)

CO3: Have an exposure for organizing and managing a software project. (Create)

CO4: Apply, analyze, design and develop the software project. (Apply,Analyze,Create)

CO5: Design various estimation levels of cost and effort. (Create)

Detailed Syllabus

Module	Topics	Lectures
1	(Skill Development) **Introduction to Software Project Management: Introduction**, Why is Software Project Management Important? What is a Project? Software Project Management Important? What is a Project? Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure. What is Management? Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices. **Project Evaluation and Programme Management:** Introduction, Business Case, Project Portfolio Management, Evaluation of Individual Projects, Cost–benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programmes, Strategic Programme Management, Creating a Programme, Aids to Programme Management, Some Reservations about Programme Management, Benefits Management. **An Overview of Project Planning:** Introduction to Step Wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyse Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Effort for Each Activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review/Publicize Plan, Steps9 and 10: Execute Plan/Lower Levels of Planning	9
2	**Selection of an Appropriate Project Approach:** Introduction, Build or Buy? Choosing Methodologies and Technologies, Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, The Waterfall Model, The Spiral Model, Software Prototyping, Other Ways of Categorizing Prototypes, Incremental Delivery, Atern/Dynamic Systems Development Method, Rapid Application Development, Agile Methods, Extreme Programming (XP), Scrum, Lean Software Development, Managing Iterative Processes, Selecting the Most Appropriate Process Model. **Software Effort Estimation:** Introduction, Where are the Estimates Done? Problems with Over- and Under-Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom-up Estimating, The Top-down Approach and Parametric Models, Expert Judgment, Estimating by Analogy, Albrecht Function Point Analysis, Function Points	9

	Mark II, COSMIC Full Function Points, COCOMO II: A Parametric Productivity Model, Cost Estimation, Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.	
3	**Activity Planning:** Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Networks. **Risk Management:** Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Boehm's Top 10 Risks and Counter Measures, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts. **Resource Allocation:** Introduction, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence.	9
4	**Monitoring and Control:** Introduction, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM). **Managing Contracts:** Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance. **Managing People in Software Environments:** Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress, Stress Management, Health and Safety, Some Ethical and Professional Concerns.	9
5	**Working in Teams:** Introduction, Becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership. **Software Quality:** Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans. **Project Closeout:** Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report.	9

References:

1. Software Project Management - Bob Hughes, Mike Cotterell , Rajib Mall – THM – 6th Edition 2018
2. Project Management and Tools & Technologies – An overview, Shailesh Mehta : SPD 1st edition : 2017
3. Software Project Management, Walker Royce, Pearson, 2005

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ADVANCED MOBILE PROGRAMMING

Practical: (Skill development & Employability)

1. **Introduction to Android, Introduction to Android Studio IDE, Application Fundamentals**, Creating a Project, Android Components, Activities, Services, Content Providers, Broadcast Receivers, Interface overview, Creating Android Virtual device, USB debugging mode, Android Application Overview. Simple "Hello World" program.
2. **Programming Resources**
   Android Resources, (Color, Theme, String, Drawable, Dimension, Image)
3. **Programming Activities and fragments**
   Activity Life Cycle, Activity methods, Multiple Activities, Life Cycle of fragments and multiple fragments.
4. **Programs related to different Layouts**
   Coordinate, Linear, Relative, Table, Absolute, Frame, List View, Grid View.
5. **Programming UI elements**
   AppBar, Fragments, UI Components
6. **Programming menus, dialog, dialog fragments**
7. **Programs on Intents, Events, Listeners and Adapters**
   The Android Intent Class, Using Events and Event Listeners
8. **Programs on Services, notification and broadcast receivers**
9. **Database Programming with SQLite**
10. **Programming threads, handles and asynchronized programs**
11. **Programming Media API and Telephone API**
12. **Programming Security and permissions**
13. **Programming Network Communications and Services (JSON)**

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BUSINESS INTELLIGENCE

at Semester VI
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Modules	No. of lectures
1	Business intelligence, Decision support systems	9
2	Mathematical models for decision making, Data mining, Data preparation	9
3	Classification, Clustering	9
4	Business intelligence applications, Logistic and production models, Data envelopment analysis:	9
5	Knowledge Management, Artificial Intelligence and Expert Systems	9
	Total	45

Course objectives –

By the end of the course, learners will be able to:

- Create an understanding of the decision support systems
- Describe Business intelligence application models
- Understand and apply classification techniques
- Apply different operations on legacy data practically.
- Understand knowledge management.

Course Outcome –

After completing this course learner will be able to:

CO1: Create an understanding of Decision support systems, Mathematical models for decision making, Data envelopment analysis, Knowledge Management and AI and Expert systems. (Create)

CO2: Analyse and describe Business intelligence application models. (Analyze,Understand)

CO3: Assess and identify the best model to solve a given business problem. (Evaluate)

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CO4: Work with legacy data and perform various operations on it using Business Intelligence softwares. (Apply)

CO5: Apply different data mining algorithms to solve the given business problem. (Apply)

CO6: Create designs/solutions/algorithms to solve the given business problem.(Create)

Detailed Syllabus:

Modules	Topics	No of Lectures
1	**(Skill Development & Employability)** **Business intelligence:** Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence **Decision support systems:** Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system	9
2	**Mathematical models for decision making:** Structure of mathematical models, Development of a model, Classes of models **Data mining**: Definition of data mining, Representation of input data,Data mining process, Analysis methodologies. **Data preparation**: Data validation, Data transformation, Data reduction	9
3	**Classification**: Classification problems, Evaluation of Classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines **Clustering**: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models	9
4	**Business intelligence applications**: Marketing models: Relational marketing, Sales force management **Logistic and production models:** Supply chain optimization, Optimization models for logistics planning, Revenue management systems. **Data envelopment analysis**: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices	9
5	**Knowledge Management:** Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management **Artificial Intelligence and Expert Systems**: Concepts and	9

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	Definitions of Artificial Intelligence, Artificial Intelligence versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems	

References:

1. Business Intelligence ,Data Mining and Optimization for Decision Making , Carlo Vercellis , Wiley , First edition , 2009
2. Decision support and Business Intelligence System, Efraim Turban, Ramesh Sharda, Dursun Delen , Pearson , 9th edition , 2011
3. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer, First Edition ,2015

Practical: (Skill Development & Employability)

1 Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system. (You can download sample database such as Adventureworks, Northwind, foodmart etc.)

2 Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver.

3 a. Create the Data staging area for the selected database.
b. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.

4 a.Create the ETL map and setup the schedule for execution.
b. Execute the MDX queries to extract the data from the datawarehouse.

5 a. Import the datawarehouse data in Microsoft Excel and create the Pivot table and Pivot Chart.
b. Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart to perform data analysis.

6 Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.

7 Perform the data classification using classification algorithm.

8 Perform the data clustering using clustering algorithm.

9 Perform the Linear regression on the given data warehouse data.

10 Perform the logistic regression on the given data warehouse data.

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CYBER LAWS

at Semester VI
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Power of Arrest Without Warrant Under the IT Act, 2000, Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000	9
2	Contracts in the Infotech World, Jurisdiction in the Cyber World	9
3	Battling Cyber Squatters and Copyright Protection in the Cyber World, Battling Cyber Squatters and Copyright Protection in the Cyber World	9
4	E-Commerce Taxation, Real Problems in the Virtual World, Digital Signature, Certifying Authorities and E-Governance	9
5	The Indian Evidence Act of 1872 v. Information Technology Act, 2000, Protection of Cyber Consumers in India	9
	Total	45

Course objectives –

By the end of the course, learners will be able to:

1. Enable Learner To Understand, Explore, And Acquire A Critical Understanding Cyber Law.
2. Develop Competencies For Dealing With Frauds And Deceptions (Confidence Tricks, Scams) And Other Cyber Crimes For Example, Child Pornography Etc. That Are Taking Place Via The Internet.

Course Outcome –

After completing this course learner will be able to:

CO1: Make Learner Conversant With The Social And Intellectual Property Issues Emerging From 'Cyberspace. (Understand)
CO2: Explore The Legal And Policy Developments In Various Countries To Regulate Cyberspace (Analyze)
CO3: Develop The Understanding Of Relationship Between Commerce And Cyberspace (Create)
CO4: Give Learners In Depth Knowledge Of Information Technology Act And Legal Frame Work Of Right To Privacy, Data Security And Data Protection. (Remember)
CO5: Make Study On Various Case Studies On Real Time Crimes. (Apply)

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Detailed Syllabus:

Module	Modules / Units	No of Lectures
1	**(Employability)** **Power of Arrest Without Warrant Under the IT Act, 2000,** A Critique, Crimes of this Millennium, Section 80 of the IT Act, 2000 – A Weapon or a Farce? Forgetting the Line Between Cognizable and Non- Cognizable Offences, Necessity of Arrest without Warrant from Any Place, Public or Otherwise, Check and Balances Against Arbitrary Arrests, Arrest for "About to Commit" an Offence Under the IT Act, A Tribute to Draco, Arrest, But NO Punishment! **Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000,** Concept of "Cyber Crime " and the IT Act , 2000, Hacking, Teenage Web Vandals, Cyber Cheating, Virus on the Internet, Defamation, Harassment and E- mail Abuse, Cyber Pornography, Other IT Act Offences, Monetary Penalties, Adjudication and Appeals Under IT Act , 2000, Network Service Providers, Jurisdiction and Cyber Crime, Nature of Cyber Criminality, Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications on Cyber Crime.	9
2	**Contracts in the Infotech World,** Contracts in the Infotech World, Click-Wrap and Shrink-Wrap Contract, Status under the Indian Contract Act, 1872, Contract Formation Under the Indian Contract Act, 1872, Contract Formation on the Internet, Terms and Conditions of Contracts. **Jurisdiction in the Cyber World,** Questioning the Jurisdiction and Validity of the Present Law of Jurisdiction, Civil Law of Jurisdiction in India, Cause of Action, Jurisdiction and the Information Technology Act,2000, Foreign Judgements in India, Place of Cause of Action in Contractual and IPR Disputes, Exclusion Clauses in Contracts, Abuse of Exclusion Clauses, Objection of Lack of Jurisdiction, Misuse of the Law of Jurisdiction, Legal Principles on Jurisdiction in the United State of America, Jurisdiction Disputes w.r.t. the Internet in the United State of America.	9
3	**Battling Cyber Squatters and Copyright Protection in the Cyber World,** Concept of Domain Name and Reply to Cyber Squatters, Meta- Tagging, Legislative and Other Innovative Moves Against Cyber Squatting, The Battle Between Freedom and Control on the Internet, Works in Which Copyright Subsists and meaning of Copyright, Copyright Ownership and Assignment, License of Copyright, Copyright Terms and Respect for Foreign Works, Copyright **Battling Cyber Squatters and Copyright Protection in the Cyber World,** Concept of Domain Name and Reply to Cyber Squatters, Meta- Tagging, Legislative and Other Innovative Moves Against Cyber Squatting, The Battle Between Freedom and Control on the Internet, Works in Which Copyright Subsists and meaning of Copyright, Copyright Ownership and Assignment, License of Copyright, Copyright Terms	9
4	**E-Commerce Taxation, Real Problems in the Virtual World,** A Tug of War on the Concept of 'Permanent Establishment', Finding the PE in Cross Border E-Commerce, The United Nations Model Tax Treaty, The Law of Double Taxation Avoidance Agreements and Taxable Jurisdiction Over Non-Residents, Under the Income Tax Act, 1961, Tax Agents of Non-Residents under the Income Tax Act,1961 and the Relevance to E-Commerce, Source versus Residence and Classification between Business Income and Royalty, The Impact of the Internet	9

	on Customer Duties, Taxation Policies in India, At a Glance. **Digital Signature, Certifying Authorities and E-Governance,** Digital Signatures, Digital Signature Certificate, Certifying Authorities and Liability in the Event of Digital Signature Compromise, E-Governance in India, A Warning to Babudom!	
5	**The Indian Evidence Act of 1872 v. Information Technology Act, 2000,** Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages, Other Amendments in the Indian Evidence Act by the IT Act, Amendments to the Bankers Books Evidence Act, 1891 and Reserve Bank of India Act, 1934. **Protection of Cyber Consumers in India,** Are Cyber Consumers Covered Under the Consumer Protection Act? Goods and Services, Consumer Complaint, Defect in Goods and Deficiency in Services, Restrictive and Unfair Trade Practices, Instances of Unfair Trade Practices, Reliefs Under CPA, Beware Consumers, Consumer Foras, Jurisdiction and Implications on cyber Consumers in India, Applicability of CPA to Manufacturers, Distributors, Retailers and Service Providers Based in Foreign Lands Whose Goods are Sold or Services Provided to a Consumer in India. Amendments in Indian IT Act 2000	9

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1. Cyber Law Simplified, Vivek Sood , TMH Education , 2001
2. Cybersecurity Law , Jeff Kosseff , Wiley , 2017

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MALAD (W), MUMBAI - 400 064

Nagindas Khandwala College
(Autonomous)

Syllabus Of
Course
Of

Bachelor of Science Information Technology (BSC IT) Programme

Third Year

Semester VI

Under Academic Autonomy and Credit, Grading and Semester System

(To be implemented during Academic Year- 2018-2019)

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NAGINDAS KHANDWALA COLLEGE OF COMMERCE
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MALAD (W), MUMBAI - 400 064

ENTERPRISE NETWORKING

at Semester VI

(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Network Design Models	9
2	Enterprise LAN Design, Data Center Design	9
3	Wireless LAN Design, WAN Technologies and the Enterprise Edge	9
4	Internet Protocol Version 4	9
5	Managing Security	9
	Total	45

Course Objective:
By the end of the course, learners will be able to:

- Understand and apply the networking knowledge in the industrial applications

Course Outcome:
After successfully completing this course, learners will be able to:

CO1: Implementing the computer network.(Apply)

CO2: Manage complicated networking problems. (Analyse)

CO3: Apply the knowledge in building secure networks. (Apply)

CO4: Understand WAN design. (Understand)

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Detailed Syllabus

Modules	Topics	No. of Lectures
1	**General Network Design:** Network Design Methodology, Architectures for the Enterprise, Borderless Networks Architecture, Collaboration and Video Architecture, Data Center and Virtualization Architecture, Design Lifecycle: Plan, Build, Manage Plan Phase Build Phase Manage Phase Prepare, Plan, Design, Implement, Operate, and Optimize Phases Prepare Phase Plan Phase Design Phase Implement Phase Operate Phase Optimize Phase Summary of PPDIOO Phases Project Deliverables Design Methodology Identifying Customer Design Requirements Characterizing the Existing Network Steps in Gathering Information Network Audit Tools Network Checklist Designing the Network Topology and Solutions Top-Down Approach Pilot and Prototype Tests Design Document **Network Design Models:** Hierarchical Network Models Benefits of the Hierarchical Model, Hierarchical Network Design, Core Layer, Distribution Layer, Access Layer, Hierarchical Model Examples, Hub-and-Spoke, Design Collapsed Core, Design Enterprise Architecture model, Enterprise Campus Module, Enterprise Edge Area, E- Commerce Module, Internet Connectivity Module, VPN/Remote Access, Enterprise WAN, Service Provider Edge Module, Remote Modules, Enterprise Branch Module, Enterprise Data Center Module, Enterprise Teleworker Module, High Availability Network Services, Workstation-to-Router Redundancy and LAN, High Availability Protocols, ARP Explicit Configuration, RDP, RIP, HSRP, VRRP, GLBP, Server Redundancy, Route Redundancy, Load Balancing, Increasing Availability, Link Media Redundancy	9
2	**Enterprise LAN Design:** LAN Media, Ethernet Design Rules, 100Mbps Fast Ethernet Design Rules, Gigabit Ethernet Design Rules, 1000BASE-LX Long-Wavelength Gigabit Ethernet, 1000BASE-SX Short-Wavelength Gigabit Ethernet, 1000BASE-CX Gigabit Ethernet over Coaxial Cable, 1000BASE-T Gigabit Ethernet over UTP 86, 10 Gigabit Ethernet Design Rules, 10GE Media Types, EtherChannel, Comparison of Campus Media LAN Hardware, Repeaters, Hubs, Bridges, Switches, Routers, Layer 3 Switches, Campus LAN Design and Best Practices Best Practices for Hierarchical Layers, Access Layer Best Practices, Distribution Layer Best Practices, Core Layer Best Practices, STP Design Considerations, STP Toolkit, Port Fast, Uplink Fast, Backbone Fast, Loop Guard, Root Guard, BPDU Guard, BPDU Filter, VLAN and Trunk Considerations, Unidirectional Link Detection (UDLD) Protocol, Large-Building LANs, Enterprise Campus LANs, Edge Distribution, Medium-Size LANs, Small and Remote Site LANs, Server Farm Module, Server Connectivity Options, Enterprise Data Center Infrastructure, Campus LAN QoS Considerations, Multicast Traffic Considerations, CGMP, IGMP Snooping. **Data Center Design:** Enterprise DC Architecture, Data Center Foundation Components, Data Center Topology Components, Data Center Network Programmability, SDN, Controllers, APIs, ACI, Challenges in the DC, Data Center Facility Aspects, Data Center Space, Data Center Power, Data Center Cooling, Data Center Heat, Data Center Cabling, Enterprise DC Infrastructure, Data Center Storage, Data Center Reference Architecture, Defining the DC Access Layer, Defining the DC Aggregation Layer, Defining the DC Core	9

	Layer, Security in the DC, Fabric Extenders, Virtualization Overview, Challenges, Defining Virtualization and Benefits, Virtualization Risks, Types of Virtualization, Virtualization Technologies, VSS, VRF, vPC, Device Contexts, Server Virtualization, Server Scaling, Virtual Switching, Network Virtualization Design Considerations, Access Control, Path Isolation, Services Edge, Data Center Interconnect, DCI Use Cases, DCI Transport Options, DCI L2 Considerations, Load Balancing in the DC, Application Load Balancing, Network Load Balancing.	
3	**Wireless LAN Design:** Wireless LAN Technologies, WLAN Standards, ISM and UNII Frequencies, Summary of WLAN Standards, Service Set Identifier, WLAN Layer 2 Access Method, WLAN Security, Unauthorized Access, WLAN Security Design Approach, IEEE 802.1X-2001 Port-Based Authentication, Dynamic WEP Keys and LEAP, Controlling WLAN Access to Servers, WLAN Authentication, Authentication Options, WLAN Controller Components, WLC Interface Types, AP Controller Equipment Scaling, Roaming and Mobility Groups, Intracontroller Roaming, Layer 2Intercontroller Roaming, Layer 3 Intercontroller Roaming, Mobility Groups, WLAN Design, Controller Redundancy Design: Deterministic 12 vs. Dynamic, N+1 WLC Redundancy, N+N WLC Redundancy, N+N+1 WLC Redundancy, Radio Management and Radio Groups, RF Groups, RF Site Survey, Using EoIP Tunnels for Guest Services, Wireless Mesh for Outdoor Wireless, Mesh Design Recommendations, Campus Design Considerations, Power over Ethernet (PoE), Wireless and Quality of Service (QoS), Branch Design Considerations, Local MAC, REAP, Hybrid REAP, Branch Office Controller Options. **WAN Technologies and the Enterprise Edge:** WAN and Enterprise Edge Overview, Definition of WAN, WAN Edge Module, Enterprise Edge Modules, WAN Transport Technologies, ISDN, ISDN BRI Service, ISDN PRI Service, Digital Subscriber Line, Cable, Wireless, Frame Relay, Time-Division Multiplexing, Metro Ethernet, SONET/SDH, Multiprotocol Label Switching (MPLS), Dark Fiber, Dense Wavelength-Division Multiplexing, Ordering WAN Technology and Contracts, WAN and Edge Design Methodologies, Response Time, Throughput, Reliability, Bandwidth Considerations, WAN Link Categories, Optimizing Bandwidth Using QoS, Queuing, Traffic Shaping and Policing, Classification, Congestion Management, Priority Queuing, Custom Queuing, Weighted Fair Queuing, Class-Based Weighted Fair Queuing, Low-Latency Queuing, Traffic Shaping and Policing, Link Efficiency, Window Size, DMZ Connectivity, Segmenting DMZs, DMZ Services, Internet Connectivity, Centralized Internet (Branch) vs. Direct Internet (Branch), High Availability for the Internet Edge, VPN Network Design. **WAN Design** Traditional WAN Technologies Hub-and-Spoke Topology Full-Mesh Topology Partial-Mesh Topology Point-to-Point Topology Remote Site Connectivity Enterprise VPN vs. Service Provider VPN Enterprise Managed VPN: IPsec IPsec Direct Encapsulation Generic Routing Encapsulation IPsec DMVPN IPsec Virtual Tunnel Interface Design GETVPN Service Provider–Managed Offerings, Metro Ethernet Service Provider VPNs: L2 vs. L3 ,Virtual Private Wire Services VPWS L2 VPN Considerations ,Virtual Private LAN Services VPLS L2 VPN Considerations ,MPLS, MPLS Layer 3 Design Overview MPLS L3 VPN Considerations ,VPN Benefits WAN Backup Design WAN Backup over the Internet Enterprise WAN Architecture Cisco Enterprise MAN/WAN Enterprise WAN/MAN Architecture Comparison ,Enterprise WAN Components Comparing Hardware	9

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	and Software Enterprise Branch Architecture Branch Design Branch Connectivity Redundancy for Branches Single WAN Carrier vs. Dual WAN Carriers Single MPLS Carrier Site ,Dual MPLS Carriers Hybrid WAN: L3 VPN with IPsec VPN ,Internet for Branches Flat Layer 2 vs. Collapsed Core ,Enterprise Branch Profiles Small Branch Design Medium Branch Design Large Branch Design Enterprise Teleworker Design ,ISRs for Teleworkers	
4	Internet Protocol Version 4 Design,IPv4 Header ToS IPv4 Fragmentation IPv4 Addressing ,IPv4 Address Classes Class A Addresses Class B Addresses ,Class C Addresses Class D Addresses Class E Addresses ,IPv4 Address Types IPv4 Private Addresses NAT ,IPv4 Address Subnets Mask Nomenclature IP Address Subnet Design Example Determining the Network Portion of an IP Address Variable-Length Subnet Masks, Loopback Addresses IP Telephony Networks ,IPv4 Addressing Design Goal of IPv4 Address Design , Plan for Future Use of IPv4 Addresses , Performing Route Summarization , Plan for a Hierarchical IP Address Network , Private and Public IP Address and NAT Guidelines , Steps for Creating an IPv4 Address Plan Case Study: IP Address Subnet Allocation , Address Assignment and Name Resolution , Recommended Practices of IP Address Assignment ,BOOTP DHCP DNS , Internet Protocol Version 6 Design, IPv6 Header IPv6 Address Representation IPv4-Compatible IPv6 Addresses IPv6 Prefix Representation IPv6 Address Scope Types and Address Allocations IPv6 Address Allocations IPv6 Unicast Address Global Unicast Addresses Link-Local Addresses , Unique Local IPv6 Address Global Aggregatable IPv6 Address , IPv4-Compatible IPv6 Address IPv6 Anycast Addresses , IPv6 Multicast Addresses IPv6 Mechanisms ICMPv6 , IPv6 Neighbor Discovery Protocol IPv6 Name Resolution , Path MTU Discovery IPv6 Address-Assignment Strategies , Manual Configuration SLAAC of Link-Local Address , SLAAC of Globally Unique IPv6 Address DHCPv6 , DHCPv6 Lite IPv6 Security IPv6 Routing Protocols RIPng OSPFv3 , BGP4 Multiprotocol Extensions (MP-BGP) for IPv6, IPv6 Addressing Design , Planning for Addressing with IPv6 , Route Summarization with IPv6 IPv6 Private Addressing IPv6 for the Enterprise IPv6 Address Allocation , Partly Linked IPv4 Address into IPv6, Whole IPv4 Address Linked into IPv6 IPv6 Addresses Allocated Per Location and/or Type , IPv4-to-IPv6 Transition Mechanisms and Deployment Models , Dual-Stack Mechanism IPv6 over IPv4 Tunnels , Protocol Translation Mechanisms IPv6 Deployment Models , Dual-Stack Model Hybrid Model Service Block Model ,IPv6 Deployment Model Comparison IPv6 Comparison with IPv4 ,OSPF, BGP, Route Manipulation, and IP Multicast,OSPFv2 OSPFv2 Metric OSPFv2 Adjacencies and Hello Timers , OSPFv2 Areas OSPF Area Design Considerations OSPF Router Types OSPF DRs LSA Types Autonomous System External Path Types OSPF Stub Area Types Stub Areas Totally Stubby Areas , NSSAs Virtual Links OSPFv2 Router Authentication , OSPFv2 Summary OSPFv3 OSPFv3 Changes from OSPFv2, OSPFv3 Areas and Router Types OSPFv3 LSAs OSPFv3 Summary BGP BGP Neighbors eBGP iBGP Route Reflectors Confederations BGP Administrative Distance , BGP Attributes, Weight, and the BGP Decision Process BGP Path Attributes Next-Hop Attribute Local Preference Attribute Origin Attribute Autonomous System Path Attribute MED Attribute Community Attribute Atomic Aggregate and Aggregator Attributes Weight BGP Decision Process , BGP Summary , Route Manipulation PBR Route Summarization Route Redistribution Default Metric OSPF Redistribution Route Filtering Transit Traffic Routing Protocols on the Hierarchical Network Infrastructure IP Multicast Review , Multicast Addresses Layer 3 to Layer 2 Mapping IGMP , IGMPv1 IGMPv2 IGMPv3 CGMP IGMP Snooping , Sparse Versus Dense Multicast Multicast Source and Shared	**9**

5	**Managing Security** Network Security Overview Security Legislation Security Threats Reconnaissance and Port Scanning Vulnerability Scanners Unauthorized Access Security Risks Targets Loss of Availability Integrity Violations and Confidentiality Breaches , Security Policy and Process Security Policy Defined , Basic Approach of a Security Policy Purpose of Security Policies, Security Policy Components Risk Assessment , Risk Index Continuous Security Integrating Security Mechanisms into Network Design Trust and Identity Management , Trust Domains of Trust Identity Passwords Tokens Certificates , Network Access Control Secure Services Encryption Fundamentals Encryption Keys VPN Protocols , Transmission Confidentiality Data Integrity Threat Defense , Physical Security Infrastructure Protection Security Management Solutions Security Solution Network Security Platforms , Trust and Identity Technologies Firewall Fundamentals Types of Firewalls Next-Gen Firewalls NAT Placement , Firewall 12 Guidelines Firewall ACLs , Identity and Access Control Deployments Detecting and Mitigating Threats IPS/IDS Fundamentals IPS/IDS Guidelines , Threat Detection and Mitigation Technologies , Threat-Detection and Threat-Mitigation Solutions , FirePOWER IPS Security Management Applications , Security Platform Solutions Security Management Network Integrating Security into Network Devices IOS Security , ISR G2 Security Hardware Options Securing the Enterprise , Implementing Security in the Campus Implementing Security in the Data Center Implementing Security in the Enterprise Edge Network Management Protocols, Simple Network Management Protocol SNMP Components , MIB SNMP Message Versions SNMPv1 SNMPv2 SNMPv3 , Other Network Management Technologies RMON , RMON2 NetFlow Compared to RMON and SNMP , CDP LLDP Syslog	9

References:

1. CCDA200-310 Offical Cert Guide, ANTHONY BRUNO, CCIE No. 2738 STEVE JORDAN, CCIE No 11293, Cisco Press
2. Network Warrior, Gary A Donabue , O Reilly , 2nd ediion 2011

Practical: (Employability)

1 Configuring OSPF – I

a Single-Area OSPF Link Costs and Interface Priorities

b Multi-Area OSPF with Stub Areas and Authentication

2 Configuring OSPF – II

a OSPF Virtual Links and Area Summarization

b OSPF over Frame Relay

3 Redistribution and Administrative Distances

a Redistribution Between RIP and OSPF

b Manipulating Administrative Distances

4 BGP

a Configuring BGP with Default Routing

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b Using the AS_PATH Attribute
c BGP Route Reflectors and Route Filters

5 IPv6
a Configuring OSPF for IPv6
b Configuring 6to4 Tunnels

6 VLANs and EtherChannel
a Static VLANS, VLAN Trunking, and VTP Domains and Modes
b Configuring EtherChannel

7 Spanning Tree Protocol
a Spanning Tree Protocol (STP) Default Behavior
b Modifying Default Spanning Tree Behavior

8 VLAN and Spanning Tree
a Per-VLAN Spanning Tree Behavior
b Multiple Spanning Tree

9 Internal VLAN Routing
a Inter – VLAN Routing with an External Router
b Inter- VLAN Routing with an Internal Route Processor

10 Configure NAT services

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PRINCIPLES OF GEOGRAPHIC INFORMATION SYSTEMS

at Semester VI
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Gentle Introduction to GIS	9
2	Data Management and Processing Systems	9
3	Spatial Referencing and Positioning	9
4	Spatial Data Analysis	9
5	Data Visualization	9
	Total	**45**

Course Objective:

By the end of the course, learners will be able to:

1. To gain basic understanding of Geographic Information Systems
2. To understand the process and tools required for data management.
3. To perform the spatial georeferencing by understanding the positioning systems
4. To perform different analysis techniques on spatial data
5. To create a map.

Course Outcome:

After successfully completing this course, learners will be able to:

CO1: Describe the meaning and basic components of Geographic Information Systems. (Understand)
CO2: Execute different tools which will be used for managing and processing the data. (Analyse and Apply)
CO3: Perform Georeferencing (Analyse and Apply)
CO4: Write different queries or use different types of tools for spatial data analysis (Create)
CO5: Create Maps. (Create)

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Detailed Syllabus

Module	Topics	No. of Lectures
1	**A Gentle Introduction to GIS** **The nature of GIS:** Some fundamental observations, Defining GIS, GISystems, GIScience and GIApplications, Spatial data and Geoinformation. **The real world and representations of it:** Models and modelling, Maps, Databases, Spatial databases and spatial analysis **Geographic Information and Spatial Database Models and Representations of the real world Geographic Phenomena:** Defining geographic phenomena, types of geographic phenomena, Geographic fields, Geographic objects, Boundaries Computer Representations of Geographic Information: Regular tessellations, irregular tessellations, Vector representations, Topology and Spatial relationships, Scale and Resolution, Representation of Geographic fields, Representation of Geographic objects Organizing and Managing Spatial Data The Temporal Dimension	9
2	**Data Management and Processing Systems** **Hardware and Software Trends** **Geographic Information Systems:** GIS Software, GIS Architecture and functionality, Spatial Data Infrastructure (SDI) **Stages of Spatial Data handling:** Spatial data handling and preparation, Spatial Data Storage and maintenance, Spatial Query and Analysis, Spatial Data Presentation. **Database management Systems**: Reasons for using a DBMS, Alternatives for data management, The relational data model, Querying the relational database. **GIS and Spatial Databases:** Linking GIS and DBMS, Spatial database functionality.	9
3	**Spatial Referencing and Positioning** **Spatial Referencing:** Reference surfaces for mapping, Coordinate Systems, Map Projections, Coordinate Transformations **Satellite-based Positioning:** Absolute positioning, Errors in absolute positioning, Relative positioning, Network positioning, code versus phase measurements, Positioning technology **Data Entry and Preparation** **Spatial Data Input:** Direct spatial data capture, Indirect spatial data captiure, Obtaining spatial data elsewhere **Data Quality:** Accuracy and Positioning, Positional accuracy, Attribute accuracy, Temporal accuracy, Lineage, Completeness, Logical consistency **Data Preparation:** Data checks and repairs, Combining data from multiple sources **Point Data Transformation:** Interpolating discrete data, Interpolating continuous data	9
4	**Spatial Data Analysis** **Cassification of analytical GIS Capabilities** **Retrieval, classification and measurement**: Measurement, Spatial selection queries, Classification **Overlay functions**: Vector overlay operators, Raster overlay operators Neighborhood functions: Proximity computations, Computation of diffusion, Flow computation, Raster based surface analysis	9

	Analysis: Network analysis, interpolation, terrain modeling **GIS and Application models**: GPS, Open GIS Standards, GIS Applications and Advances **Error Propagation in spatial data processing:** How Errors propagate, Quantifying error propagation	
5	**Data Visualization** **GIS and Maps, The Visualization Process** **Visualization Strategies: Present or explore?** **The cartographic toolbox:** What kind of data do I have?, How can I map my data? **How to map :**How to map qualitative data, How to map quantitative data, how to map the terrain elevation, How to map time series **Map Cosmetics, Map Dissemination**	**9**

References:

1. Principles of Geographic information Systems- An Introductory Text Book, Editors , Otto Huisman and Rofl A. , The International institue of Geoinformation Science and Earth Observation , 4th edition , 2009
2. Principles of Geographic Information Systems , P.A Burrough and R.A. McDonell , Oxford University Press ,Third , 1999
3. Fundamentals of Spatial Information Systems, R. Laurini and D.Thompson, Academic Press , 1994
4. Fundamentals of Geographic Information System, Michael N.Demers , Wiley publications , Fourth , 2009
5. Introduction to Geographic Information Systems, Chang Kang-tsung (Karl), McGrawHill , Any above 3rd edition , 2013
6. GIS Fundamentals, A First Text on Geographic Information Systems, Paul Bolsatd, XanEdu Publishing Inc, 5th edition

Practical: (Employability)

1. Familiarizing Quantum GIS: Installation of QGIS, datasets for both Vector And Raster data, Maps.
2. Creating and Managing Vector Data: Adding vector layers, setting properties, formatting, calculating line lengths and statistics
3. Exploring and Managing Raster data: Adding raster layers, raster styling and Analysis, raster mosaicking and clipping
4. Making a Map, Working with Attributes, Importing Spreadsheets or CSV files Using Plugins, Searching and Downloading Open StreetMap Data
5. Working with attributes, Terrain Data
6. Working with projection and WMS data
7. Georeferencing Topo Sheets and Scanned Maps, Georeferencing Aerial Imagery, Digitizing Map Data
8. Managing Data Tables and Saptial data Sets: Table joins, spatial joins, points in polygon analysis, performing spatial queries
9. Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data
10. Advance GIS Operations 2: Batch Processing using Processing Framework. Automating Complex Workflows using Processing Modeler, Automating Map Creation with Print Composer Atlas , Validating Map data

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SECURITY IN COMPUTING

at Semester VI
(Implemented during Academic Year **2018-19)**

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Risk Analysis	9
2	Authentication and Authorization, Database Security	9
3	Network design and security	9
4	Voice over IP (VoIP) and PBX Security	9
5	Virtual Machines and Cloud Computing	9
	Total	**45**

Course Objective:

By the end of the course, learners will be able to:

1. Define key terms and critical concepts of information
2. Define risk management, risk identification and risk control
3. Describe a security blueprint and identify its major components.
4. Understand Secure Design Principles.
5. Describe security technology and Identify Security tools.
6. Describe cryptographic tools and techniques and identify the major protocols used for secure communications.
7. Understand the relationship between information security and physical security.

Course Outcome:

After completing this course learners will be able to:

CO1: Understands the basics of information security.(Understand)

CO2: Study various aspects of risk management.(Analyze)

CO3: Compare various Security Models.(Analyze)

CO4: Understand Different Security Layers.(Understand)

CO5: Design and Simulate different networks using Security protocols.(Apply)

Detailed Syllabus

Module	Topics	No. of Lectures
1	**(Skill Development & Employability)** **Information Security Overview:** The Importance of Information Protection, The Evolution of Information Security, Justifying Security Investment, Security Methodology, How to Build a Security Program, The Impossible Job, The Weakest Link, Strategy and Tactics, Business Processes vs. Technical Controls. **Risk Analysis:** Threat Definition, Types of Attacks, Risk Analysis. Secure Design Principles: The CIA Triad and Other Models, Defense Models, Zones of Trust, Best Practices for Network Defense.	9
2	**Authentication and Authorization:** Authentication, Authorization Encryption:A Brief Histor ofEncryption,Symmetric-KeyCryptography,Public KeyCryptography,Public Key Infrastructure. Storage Security: Storage Security Evolution, Modern Storage Security, Risk Remediation, Best Practices. **Data base Security:** Understanding Database Security Layers, Understanding Database-Level Security, Using Application Security, Database Backup and Recovery, Keeping Your Servers Up to Date, Database Auditing and Monitoring.	9
3	**Secure Network Design:** Introduction to Secure Network Design, Performance, Availability, Security. **Network Device Security:** Switch and Router Basics, Network Hardening. Firewalls: Overview, The Evolution of Firewalls, Core Firewall Functions, Additional Firewall Capabilities, Firewall Design. **Wireless Network Security:** Radio Frequency Security Basics, Data- Link Layer Wireless Security Features, Flaws, and Threats, Wireless Vulnerabilities and Mitigations, Wireless Network Hardening Practices and Recommendations, Wireless Intrusion Detection and Prevention, Wireless Network Positioning and Secure Gateways.	9
4	**Intrusion Detection and Prevention Systems:** IDS Concepts, IDS Types and Detection Models, IDS Features, IDS Deployment Considerations, Security Information and Event Management (SIEM). **Voice over IP (VoIP) and PBX Security:** Background, VoIP Components, VoIP Vulnerabilities and Countermeasures, PBX, TEM Telecom Expense Management. **Operating System Security Models:** Operating System Models, Classic Security Models, Reference Monitor, Trustworthy Computing, International Standards for Operating System Security.	9
5	**Virtual Machines and Cloud Computing:** Virtual Machines, Cloud Computing. **Secure Application Design:** Secure Development Lifecycle, Application Security Practices, Web Application Security, Client Application Security, Remote Administration Security. **Physical Security:** Classification of Assets, Physical Vulnerability Assessment, Choosing Site Location for Security, Securing Assets: Locks and Entry Controls, Physical Intrusion Detection.	9

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References:

1. The Complete Reference, Information Security, Mark Rhodes-Ousley, McGraw-Hill, 2nd edition, 2013
2. Essential Cybersecurity Science, Josiah Dykstra, O'Reilly, 5th Edition, 2017
3. Principles of Computer Security, CompTIA Security + and Beyond, Wm Arthur Conklin, Greg White , McGraw Hill Second 2010

Practical: (Skill development & Employability)

1 Configure Routers

a) OSPF MD5 authentication.
b) NTP.
c) to log messages to the syslog server.
d) to support SSH connections.

2 Configure AAA Authentication

a) Configure a local user account on Router and configure authenticate on the console
b) and verify lines using local AAA
c) Verify local AAA authentication from the Router console and the PC-A client

3 Configuring Extended ACLs

a) Configure, Apply and Verify an Extended Numbered ACL

4 Configure IP ACLs to Mitigate Attacks and IPV6 ACLs

a) Verify connectivity among devices before firewall configuration.
b) Use ACLs to ensure remote access to the routers is available only from
c) management station PC-C.
d) Configure ACLs on to mitigate attacks.
e) Configuring IPv6 ACLs

5 Configuring a Zone-Based Policy Firewall

6 Configure IOS Intrusion Prevention System (IPS) Using the CLI

a) Enable IOS IPS.
b) Modify an IPS signature.

7 Layer 2 Security

a) Assign the Central switch as the root bridge.
b) Secure spanning-tree parameters to prevent STP manipulation attacks.
c) Enable port security to prevent CAM table overflow attacks.

8 Layer 2 VLAN Security

9 Configure and Verify a Site-to-Site IPsec VPN Using CLI

10 Configuring ASA Basic Settings and Firewall Using CLI

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SOFTWARE QUALITY ASSURANCE

at Semester VI
(Implemented during Academic Year 2018-19)

Modules at a Glance

Sr. No.	Topics	No. of lectures
1	Introduction to Quality, Software Quality	9
2	Fundamentals of Testing	9
3	Unit Testing: Boundary Value Testing	9
4	Software Verification and Validation	9
5	Levels of Testing	9
		45

Course Objectives :

By the end of the course, learners will be able to:

1. Present effective testing techniques (both black-box and whitebox) for ensuring high quality software.
2. Learn metrics for managing quality assurance and understand capabilities of test tools.
3. Understand quality management processes.
4. Distinguish between the various activities of quality assurance, quality planning and quality control.
5. Understand the importance of standards in the quality management process and their impact on the final product.

Course Outcomes:

After completing this course learners will be able to:

CO1: know the definition of quality, cost of quality, quality model (Understand)

CO2: apply white-box testing, black-box testing, and inspection techniques (Apply)

CO3: Understand how test tools can be used in the testing life cycle (Understand)

CO4: Design testing metrics for product and process (Create)

CO5: Understand how to do performance testing and usability testing (Understand)

Detailed Syllabus

Module	Topics	No. of Lectures
1	(Skill development & Employability) **Introduction to Quality:** Historical Perspective of Quality, What is Quality? (Is it a fact or perception?), Definitions of Quality, Core Components of Quality, Quality View, Financial Aspect of Quality, Customers, Suppliers and Processes, Total Quality Management (TQM), Quality Principles of Total Quality Management, Quality Management Through Statistical Process Control, Quality Management Through Cultural Changes, Continual (Continuous) Improvement Cycle, Quality in Different Areas, Benchmarking and Metrics, Problem Solving Techniques, Problem Solving Software Tools. **Software Quality:** Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, Organization Culture, Characteristics of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, Important Aspects of Quality Management.	9
2	**Fundamentals of testing:** Introduction, Necessity of testing, What is testing? Fundamental test process, The psychology of testing, Historical Perspective of Testing, Definitions of Testing, Approaches to Testing, Testing During Development Life Cycle, Requirement Traceability Matrix, Essentials of Software Testing, Workbench, Important Features of Testing Process, Misconceptions About Testing, Principles of Software Testing, Salient Features of Good Testing, Test Policy, Test Strategy or Test Approach, Test Planning, Testing Process and Number of Defects Found in Testing, Test Team Efficiency, Mutation Testing, Challenges in Testing, Test Team Approach, Process Problems Faced by Testing, Cost Aspect of Testing, Establishing Testing Policy, Methods, Structured Approach to Testing, Categories of Defect, Defect, Error, or Mistake in Software, Developing Test Strategy, Developing Testing Methodologies (Test Plan), Testing Process, Attitude Towards Testing (Common People Issues), Test Methodologies/Approaches, People Challenges in Software Testing, Raising Management Awareness for Testing, Skills Required by Tester, Testing throughout the software life cycle, Software development models, Test levels, Test types, the targets of testing, Maintenance testing.	9
3	**Unit Testing: Boundary Value Testing:** Normal Boundary Value Testing,	9

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MALAD (W), MUMBAI - 400 064

	Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Special Value Testing, Examples, Random Testing, Guidelines for Boundary Value Testing, Equivalence Class Testing: Equivalence Classes, Traditional Equivalence Class Testing, Improved Equivalence Class Testing, Edge Testing, Guidelines and Observations. Decision Table–Based Testing: Decision Tables, Decision Table Techniques, Cause-and-Effect Graphing, Guidelines and Observations, Path Testing: Program Graphs, DD-Paths, Test Coverage Metrics, Basis Path Testing, Guidelines and Observations, Data Flow Testing: Define/Use Testing, Slice-Based Testing, Program Slicing Tools.	
4	**Software Verification and Validation**: Introduction, Verification, Verification Workbench, Methods of Verification, Types of reviews on the basis of Stage Phase, Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation, Software development verification and validation activities. **V-test Model**: Introduction, V-model for software, Testing during Proposal stage, testing during requirement stage, Testing during test planning phase, testing during design phase, Testing during coding, VV Model, Critical Roles and Responsibilities.	9
5	**Levels of Testing:** Introduction, Proposal Testing, Requirement Testing, Design Testing, Code Review, Unit Testing, Module Testing, Integration Testing, Big-Bang Testing, Sandwich Testing, Critical Path First, Sub System Testing, System Testing, Testing Stages. **Special Tests:** Introduction, GUI testing, Compatibility Testing, Security Testing, Performance Testing, Volume Testing, Stress Testing, Recovery Testing, Installation Testing, Requirement Testing, Regression Testing, Error Handling Testing, Manual Support Testing, Intersystem Testing, Control Testing, Smoke Testing, Adhoc Testing, Parallel Testing, Execution Testing, Operations Testing, Compliance Testing, Usability Testing, Decision Table Testing, Documentation Testing, Training testing, Rapid Testing, Control flow graph, Generating tests on the basis of Combinatorial Designs, State Graph, Risk Associated with New Technologies, Process maturity level of Technology, Testing Adequacy of Control in New technology usage, Object Oriented Application Testing, Testing of Internal Controls, COTS Testing, Client Server Testing, Web Application Testing, Mobile Application Testing, eBusiness eCommerce Testing, Agile Development Testing, Data Warehousing Testing.	9

References:

1. Software Testing and continuous Quality Improvement, William E. Lewis CRC press, Third Edition,2016
2. Software Testing, principles, Techniques and Tools, M. G. Limaye TMH,2017
3. Foundations of Software Testing, Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, Cengage Learning, 3rd edition
4. Software Testing, A craftsman's Approach, Paul C. Jorgenson , CRC Press , 4th Edition , 2017.

Practical: Refer to appendix 1

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