



**SOPHIA COLLEGE FOR WOMEN
(AUTONOMOUS)**

Affiliated to

UNIVERSITY OF MUMBAI

Programme: Information Technology

Programme Code: SBTTEC

T.Y.B.Sc.IT

2020-2021

(Choice Based Credit System with effect from the year 2018-19)

Programme Outline: TYBscIT (SEMESTER V)

Semester – 5			
Course Code	Unit No	Course Title	Credits
SBTTEC501		Software project Management	2
	1	Introduction, Software Requirements, Software Development Process Models	
	2	Introduction to Software Project Management, Project Evaluation and Programme Management:	
	3	Activity Planning, Resource Allocation, Risk Management	
	4	Verification and Validation, Software Measurement, Software Cost Estimation	
	5	Monitoring and Control, Quality Management, Project Closeout:	
SBTTEC502		Internet of Things	2
	1	The Internet of Things: An Overview, Design Principles for Connected Devices, Internet Principles	
	2	Thinking About Prototyping, Prototyping Embedded Devices:	
	3	Prototyping the Physical Design, Prototyping Online Components	
	4	Techniques for Writing Embedded Code, Business Models	
	5	Moving to Manufacture, Ethics	
SBTTEC503		Advanced Web Programming	2
	1	Introducing .NET, The C# Language ,Types, Objects, and Namespaces	
	2	Web Form Fundamentals, Form Controls ,	
	3	Error Handling, Logging, and Tracing, State Management, Styles, Themes, and Master Pages ,	
	4	ADO.NET Fundamentals, Data Binding	
	5	XML, Security Fundamentals, ASP.NET AJAX	
SBTTEC504		Linux System Administration	2
	1	Introduction to Red Hat Enterprise Linux, Command Line, System Administration Tasks, Managing Software	
	2	Configuring and Managing Storage, Connecting to the Network, Working with Users, Groups, and Permissions	

	3	Securing Server with iptables, Setting Up Cryptographic Services, Configuring Server for File Sharing	
	4	Configuring DNS and DHCP, Setting Up a Mail Server, Configuring Apache on Red Hat Enterprise Linux	
	5	Introducing Bash Shell Scripting, High-Availability Clustering, Setting Up an Installation Server	
SBTTEC505		Enterprise Java	2
	1	Understanding Java EE, Java EE Architecture, Server and Containers Introduction to Java Servlets Servlet API and Lifecycle Working With Servlets Working with Databases	
	2	Request Dispatcher COOKIES SESSION Working With Files Working With Non-Blocking I/O	
	3	Introduction To Java Server Pages Getting Started With Java Server Pages Action Elements Implicit Objects, Scope And Java Server Pages Standard Tag Libraries EL Expressions	
	4	Introduction To Enterprise Javabeans Working With Session Beans Working with Message Driven Beans Interceptors Java Naming and Directory Interface	
	5	Introduction To Enterprise Javabeans Working With Session Beans Working with Message Driven Beans Interceptors Java Naming and Directory Interface Persistence, Object/Relational Mapping And JPA Introduction to Java Persistence API Writing JPA Application	
SBTTECP501		Software project Management practical	2
SBTTECP502		Internet of Things Practical	2
SBTTECP503		Advanced Web Programming Practical	2
SBTTECP504		Linux System Administration Practical	2
SBTTECP505		Enterprise Java Practical	2
		Total Credits	22

Programme Outline: TYBscIT (SEMESTER VI)

Semester – 6			
Course Code	Unit No	Course Title	Credits
SBTTEC601		Software Quality Assurance	2
	1	Introduction to Quality, Software Quality	
	2	Fundamentals of testing, Testing throughout the software life cycle	
	3	Unit Testing: Boundary Value Testing Equivalence Class Testing Decision Table– Based Testing Path Testing Data Flow Testing	
	4	Software Verification and Validation	
	5	Levels of Testing Special Tests	
SBTTEC602		Security in Computing	2
	1	Information Security Overview Risk Analysis Secure Design Principles	
	2	Information Security Overview Risk Analysis Secure Design Principles Authentication and Authorization Encryption Storage Security Database Security	
	3	Secure Network Design Network Device Security Firewalls Wireless Network Security	
	4	Intrusion Detection and Prevention Systems Voice over IP (VoIP) and PBX Security Operating System Security Models	
	5	Virtual Machines and Cloud Computing Secure Application Design Physical Security	
SBTTEC603		Business Intelligence	2
	1	Business intelligence Decision support systems	
	2	Mathematical models for decision making Data mining Data preparation	
	3	Classification Clustering	
	4	Business intelligence applications Marketing models Logistic and production models Data envelopment analysis	
	5	Knowledge Management Artificial Intelligence and Expert Systems	
SBTTEC604		Ethical hacking	2

SBTTEC604		Ethical hacking	2
	1	Knowledge Management Artificial Intelligence and Expert Systems Introduction to information securityTypes of malware Types of vulnerabilities	
	2	Introduction Phases Types of attacks	
	3	Social Engineering	
	4	Denial of Service Session Hijacking	
	5	Hacking Webservers and Hacking Web Applications	
SBTTEC605		Project	2
	1	Objectives Type of the project, software and broad areas of application	
SBTTECP601		Software Quality Assurance Practical	2
SBTTECP602		Security in Computing Practical	2
SBTTECP603		Business Intelligence Practical	2
SBTTECP604		Ethical hacking Practical	2
SBTTECP605		Project Report and Viva	2
		Total Credits	20

Preamble

Information Technology (IT) refers to the use, development, and management of computer systems, software, and networks to process, store, retrieve, and exchange information. It encompasses a broad range of technologies and practices aimed at solving problems, improving efficiency, and enabling communication within and between organizations and individuals.

In an era marked by rapid digital transformation and technological advancements, our program is designed to equip students with a comprehensive understanding of the foundational and emerging concepts in Information Technology.

Our BSc IT curriculum integrates theoretical knowledge with practical skills, preparing students to tackle real-world challenges and excel in a diverse range of IT careers. Through a combination of rigorous coursework, industry-relevant projects, and learning experiences, we aim to develop well-rounded professionals who are adept at problem-solving and equipped with the tools to drive technological innovation.

PROGRAMME OBJECTIVES

PO 1	To think analytically and creatively in developing robust, extensible and maintainable technological solutions to simple and complex problems.
PO 2	To work effectively as a part of a team to achieve a common stated goal.
PO 3	To imbibe quality software development practices.
PO 4	To apply their knowledge and skills to be employed and excel in IT professional careers and/or to continue their education in IT and/or related post graduate programmes.
PO 5	To communicate effectively with a range of audiences both technical and non-technical.

PROGRAMME SPECIFIC OUTCOMES

PSO 1	The Learner will be able to demonstrate a strong understanding of fundamental concepts in information technology including programming, databases, networking, and software engineering principles.
PSO 2	The Learner will be able to apply technical skills in software development, system analysis, and design using contemporary tools and technologies.
PSO 3	The Learner will be able to have proficiency in identifying, formulating, and solving IT-related problems using appropriate techniques, algorithms, and methodologies.
PSO 4	The Learner will be able to have understanding of project management principles and methodologies relevant to IT projects, including planning, scheduling, and resource management
PSO 5	The Learner will be able to have effective communication skills, both oral and written, necessary for articulating technical concepts and collaborating in a team environment.

SEMESTER V

SEMESTER V		
NAME OF THE COURSE	SOFTWARE PROJECTMANAGEMENT	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC501	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES

CO 1	To provide idea of decomposing the given problem into Analysis, Design, Implementation, Testing and Maintenance phases.
CO 2	To provide an idea of using various process models in the software industry according to given circumstances.
CO 3	To learn the various aspects of cost considered by the organization while handling multiple projects
CO 4	To Describe the various methodologies used in testing and to brief about the various cost models
CO 5	To emphasize the importance of quality assurance and brief with the reasons for which the projects fail

COURSE LEARNING OUTCOMES:

CLO 1	Students will be able to decompose the given project in various phases of a lifecycle.
CLO 2	Students will be able to choose appropriate process models depending on the user requirements.
CLO 3	What is net profit and IRR? Explain by giving an example
CLO 4	Compare static and dynamic testing
CLO 5	Describe metrics for measuring software quality

UNIT	SOFTWARE PROJECT MANAGEMENT
UNIT 1	Introduction, Software Requirements, Software Development Process Models (15 LECTURES)
1.1	Introduction: What is software engineering? Software Development Life Cycle, Requirements Analysis, Software Design, Coding, Testing, Maintenance etc.
1.2	Software Requirements: Requirements elicitation and analysis, Requirements Validations, Requirements Management. Functional and Non-functional requirements, User Requirements, System Requirements, Interface Specification, Documentation of the software requirements
1.3	Software Development Process Models. <ul style="list-style-type: none"> • Waterfall Model. • Prototyping. • Spiral Model • Iterative Development. • Rational Unified Process. • The RAD Model • Atern/Dynamic Systems Development Method • Scrum • Lean Software Development
UNIT 2	Introduction to Software Project Management, Project Evaluation and Programme Management (15 LECTURES)
2.1	Introduction to Software Project Management: Introduction, Why is 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.
2.2	Project Evaluation and Programme Management: Introduction, Feasibility study, 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.
UNIT 3	Activity Planning, Resource Allocation, Risk Management (15 LECTURES)
3.1	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. Resource Allocation: Introduction, Nature of Resources, Identifying Resource
3.2	Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence Risk Management: Introduction, Risk, Categories of Risk, Risk
3.3	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.
UNIT 4	Verification and Validation, Software Measurement, Software Cost Estimation (15 LECTURES)
4.1	Verification and Validation: Planning Verification and Validation, Software Inspections, Automated Static Analysis, Verification and Formal Methods. Software Testing: System Testing, Component Testing, Test Case Design, Test Automation.
4.2	Software Measurement: Size-Oriented Metrics, Function-Oriented Metrics, Extended Function Point Metrics
4.3	Software Cost Estimation: Software Productivity, Estimation Techniques, Algorithmic Cost Modelling, Project Duration and Staffing
UNIT 5	Monitoring and Control, Quality Management, Project Closeout(15 LECTURES)
5.1	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).
5.2	Quality Management: Process and Product Quality, Quality assurance and Standards, Quality Planning, Quality Control, Software Measurement and Metrics Project Closeout: Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report

REFERENCES:

1. Hughes ,Bob &others , Software Project management .6th Ed.
2. Sommerville ,Ian , Software engineering .9th ed.
3. Pressman ,Roger S. Software Engineering :A practioner's approach .7th ed.

NAME OF THE COURSE	SOFTWARE PROJECT MANAGEMENT PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP501	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

1	Selection of topic [5]
2	Analysis completed on the topic chosen [5]
3	Presentation of the topic [10]
4	Explanation of UML Diagrams for the selected topic [20]
5	Viva [5]
6	Journal[5]

SEMESTER V		
NAME OF THE COURSE	INTERNET OF THINGS	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC502	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES

CO 1	Student will be able to describe the basic equation of IOT and define its relation with ubiquitous computing
CO 2	Student will be able to recognize the characteristics of different boards used in prototyping.
CO 3	Student will be able to describe and differentiate between the various methods used for physical design prototyping and software prototyping
CO 4	The student will be able to identify the purpose of business model canvas and would be able to propose one.
CO 5	Discover the importance of security while prototyping. And will be able to identify various funding methods for scaling up the production of prototype.

COURSE LEARNING OUTCOMES

CLO 1	State examples IOT device show each component of equation in the stated example-comprehension application
CLO 2	Differentiate between arduino raspberry pi and beaglebone black
CLO 3	Explain the methods of software prototyping with its advantages
CLO 4	Construct a business model canvas taking a suitable example
CLO 5	Explain the factors on deciding which funding methodology to use for mass production

INTERNET OF THINGS	
Unit	Details
UNIT 1	The Internet of Things: An Overview, Design Principles for Connected Devices, Internet Principles (15 LECTURES)
1.1	The Internet of Things: An Overview : The Flavour of the Internet of Things, The “Internet” of “Things”, The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?
1.2	Design Principles for Connected Devices: Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway? Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances.
1.3	Internet Principles: Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols, HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.
UNIT 2	Thinking About Prototyping, Prototyping Embedded Devices(15 LECTURES)
2.1	Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, Climbing into the Cloud, Open Source versus Closed Source, Why Closed? Why Open? Mixing Open and Closed
2.2	Prototyping Embedded Devices: Electronics, Sensors, Actuators, Scaling Up the Electronics, Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness
UNIT 3	Prototyping the Physical Design, Prototyping Online Components (15 LECTURES)
3.1	Prototyping the Physical Design: Preparation, Sketch, Iterate, and Explore, Nondigital Methods, Laser Cutting, Choosing a Laser Cutter, Software, Hinges and Joints, 3D Printing, Types of 3D Printing, Software, CNC Milling, Repurposing/Recycling.
3.2	Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.
UNIT 4	Techniques for Writing Embedded Code, Business Models (15 LECTURES)

4.1	Techniques for Writing Embedded Code: Memory Management, Types of Memory, Making the Most of Your RAM, Performance and Battery Life, Libraries, Debugging,
4.2	Business Models: A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet, Learning from History, The Business Model Canvas, Who Is the Business Model For? Models, Make Thing, Sell Thing, Subscriptions, Customisation, Be a Key Resource, Provide Infrastructure: Sensor Networks, Take a Percentage, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital, Government Funding, Crowdfunding, Lean Startups.
UNIT 5	Moving to Manufacture, Ethics (15 LECTURES)
5.1	Moving to Manufacture: What Are You Producing? Designing Kits, 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.
5.2	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. Adrian McEwen, Hakim Cassimally ,Designing the Internet of Things , WILEY , 1st edition
2. Raj Kamal , Internet of Things – Architecture and Design , McGraw Hill ,1st edition
3. Cuno Pfister ,Getting Started with the Internet of Things , O'Reilly ,6th edition

NAME OF THE COURSE	INTERNET OF THINGS PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP502	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

PRACTICALS

Starting Raspbian OS, Familiarizing with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.
Displaying different LED patterns with Raspberry Pi.
Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi
Raspberry Pi Based Oscilloscope
Controlling Raspberry Pi with WhatsApp.
Setting up Wireless Access Point using Raspberry Pi
Fingerprint Sensor interfacing with Raspberry Pi
Raspberry Pi GPS Module Interfacing
IoT based Web Controlled Home Automation using Raspberry Pi
Visitor Monitoring with Raspberry Pi and Pi Camera
Interfacing Raspberry Pi with RFID.
Building Google Assistant with Raspberry Pi.

Raspberry Pi Kits and components should be made available in the ratio of 1 kit: 3 students minimum.

SEMESTER V		
NAME OF THE COURSE	ADVANCED WEB PROGRAMMING	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC503	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVE:

CO 1	To explore .NET technologies for designing and developing dynamic, interactive and responsive web applications.
CO 2	Provide a consistent, object-oriented programming environment whether object code is stored and executed locally, executed locally but web distributed, or executed remotely.
CO 3	Make the developer experience consistent across widely varying types of apps, such as Windows based apps and Web-based apps.
CO 4	Proficiently develop ASP.NET web applications using C#. Building multi-tier enterprise applications.
CO 5	To explore .NET technologies for designing and developing dynamic, interactive and responsive web applications.

COURSE LEARNING OUTCOMES:

CLO 1	Understand the .NET framework.
CLO 2	Develop a proficiency in the C# programming language. Proficiently develop ASP.NET web applications using C#. Use ADO.NET for data persistence in a web application.
CLO 3	To understand the 3-tier software architecture (presentation/client tier, application tier, data)
CLO 4	Understand the .NET framework.
CLO 5	Develop a proficiency in the C# programming language. Proficiently develop ASP.NET web applications using C#. Use ADO.NET for data persistence in a web application.

	ADVANCED WEB PROGRAMMING
UNIT 1	Introducing .NET, The C# Language ,Types, Objects, and Namespaces (15 LECTURES)
1.1	Introducing .NET: The .NET Framework, C#, VB, and the .NET Languages The Common Language Runtime, The .NET Class Library
1.2	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.
UNIT 2	Web Form Fundamentals, Form Controls (15 LECTURES)
2.1	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.
2.1	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.
UNIT 3	Error Handling, Logging, and Tracing, State Management, Styles, Themes, and Master Pages (15 LECTURES)
3.1	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
3.2	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,
UNIT 4	ADO.NET Fundamentals, Data Binding (15 LECTURES)

4.1	ADO.NET Fundamentals: Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access.
4.2	Data Binding: Introducing Data Binding, 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
UNIT 5	XML, Security Fundamentals, ASP.NET AJAX (15 LECTURES)
5.1	XML: XML Explained, The XML Classes, XML Validation, XML Display and Transforms.
5.2	Security Fundamentals: Understanding Security Requirements, Authentication and Authorization, Forms Authentication, Windows Authentication.
5.3	ASP.NET AJAX: Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.

REFERENCES:

1. ASP.NET 4.0 programming by Kanjilal, Joydip
2. Murach's ASP.NET 4.6 web programming with C# 2015 by Delamater, Mary, Boehm Anne
3. Beginning Visual C# 2010 by Karl Watson, Chritain Nagel, Jacob Hammer Pederson and others

NAME OF THE COURSE	ADVANCED WEB PROGRAMMING PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP503	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

	List of Practical
1.	Working with basic C# and ASP .NET
1.1	Create an application that obtains four int values from the user and displays the product.
1.2	Create an application to demonstrate string operations.
1.3	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.
1.4	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
2.1	Create simple application to perform following operations i. Finding factorial Value ii. Money Conversion iii. Quadratic Equation iv. Temperature Conversion
2.2	Create simple application to demonstrate use of following concepts i. Function Overloading ii. Inheritance (all types) iii. Constructor overloading iv. Interfaces
2.3	Create simple application to demonstrate use of following concepts i. Using Delegates and events ii. Exception handling
3.	Working with Web Forms and Controls
3.1	Create a simple web page with various sever controls to demonstrate setting and use of their properties. (Example : AutoPostBack)
3.2	Demonstrate the use of Calendar control to perform following operations. a) Display messages in a calendar control b) Display vacation in a calendar control c) Selected day in a calendar control using styled) Difference between two calendar dates
3.3	Demonstrate the use of Treeview control perform following operations. a) Treeview control and datalist b) Treeview operations
4.	Working with Form Controls
4.1	Create a Registration form to demonstrate use of various Validation controls.
4.2	Create Web Form to demonstrate use of Adrotator Control.
4.3	Create Web Form to demonstrate use User Controls.
5.	Working with Navigation, Beautification and Master page.
5.1	Create Web Form to demonstrate use of Website Navigation controls and Site Map.
5.2	Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification.
5.3	Create a web application to demonstrate various states of ASP.NET Pages.
6.	Working with Database
6.1	Create a web application bind data in a multiline textbox by querying in another textbox.
6.2	Create a web application to display records by using database.
	Demonstrate the use of Datalist link control.

7	<p>Working with Database</p> <p>Create a web application to display Databinding using dropdownlist control.</p> <p>Create a web application for to display the phone no of an author using database.</p> <p>Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).</p>
8	<p>Working with data controls</p> <p>Create a web application to demonstrate various uses and properties of SqlDataSource.</p>
	<p>Create a web application to demonstrate data binding using DetailsView and FormView Control.</p> <p>Create a web application to display Using Disconnected Data Access and Databinding using GridView.</p>
9	<p>Working with GridView control</p> <p>a. Create a web application to demonstrate use of GridView control template and GridView hyperlink.</p> <p>b. Create a web application to demonstrate use of GridView button column and GridView events.</p> <p>Create a web application to demonstrate GridView paging and Creating own tableformat using GridView.</p>
10	Working with AJAX and XML
10.1	Create a web application to demonstrate reading and writing operation with XML.
10.2	Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization properties.
10.3	Create a web application to demonstrate use of various Ajax controls.

SEMESTER V		
NAME OF THE COURSE	LINUX SYSTEM ADMINISTRATION	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC504	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES:

CO 1	The course objective is to analyze fundamentals of the Linux operating system, including installation, configuration, administration, file management, and security.
CO 2	Students will learn to operate running Linux systems by managing the boot process, scheduling jobs, updating the system, monitoring system performance and managing security.
CO 3	Develop scripting skills using bash (Bourne Again SHell) scripting language to automate system administration tasks and improve efficiency.
CO 4	Gain skills in managing user accounts, groups, permissions, and authentication mechanisms on Linux systems.
CO 5	Learn to monitor system performance, analyze system resource usage, and optimize Linux systems for performance.

COURSE LEARNING OUTCOMES:

CLO 1	To create basic filesystem and manage system administration task
CLO 2	To manage users, groups and permissions.
CLO 3	To setup firewalls and cryptographic services.
CLO 4	To configure DNS, mail & Apache server

CLO 5	To Design a high availability cluster
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Unit	LINUX SYSTEM ADMINISTRATION
UNIT 1	Introduction to Red Hat Enterprise Linux, Command Line, System Administration Tasks, Managing Software (15 LECTURES)
1.1	Introduction to Red Hat Enterprise Linux: Linux, Open Source and Red Hat, Origins of Linux, Distributions, Duties of Linux System Administrator. Command Line: Working with the Bash Shell, Getting the Best of Bash, Useful Bash Key Sequences, Working with Bash History, Performing Basic File System Management Tasks, Working with Directories, Piping and Redirection, Finding Files
1.2	System Administration Tasks: Performing Job Management Tasks System and Process Monitoring and Management, Managing Processes with ps, Sending Signals to Processes with the kill Command, Using top to Show Current System Activity, Managing Process Niceness, Scheduling Jobs, Mounting Devices, Working with Links, Creating Backups, Managing Printers, Setting Up System Logging, Setting Up Rsyslog, Common Log Files, Setting Up Logrotate
1.3	Managing Software: Understanding RPM, Understanding Meta Package Handlers, Creating Your Own Repositories, Managing Repositories, Installing Software with Yum, Querying Software, Extracting Files from RPM Packages.
UNIT 2	Configuring and Managing Storage, Connecting to the Network, Working with Users, Groups, and Permissions (15 LECTURES)
2.1	Configuring and Managing Storage: Understanding Partitions and Logical Volumes, Creating Partitions, Creating File Systems, File Systems Overview, Creating File Systems, Changing File System Properties, Checking the File System Integrity, Mounting File Systems Automatically Through fstab, Working with Logical Volumes, Creating Logical Volumes, Resizing Logical Volumes, Working with Snapshots, Replacing Failing Storage Devices, Creating Swap Space, Working with Encrypted Volumes
2.2	Connecting to the Network: Understanding NetworkManager, Working with Services and Runlevels, Configuring the Network with NetworkManager, Working with system-config-network, NetworkManager

	Configuration Files, Network Service Scripts, Networking from the Command Line, Troubleshooting Networking, Setting Up IPv6, Configuring SSH, Enabling the SSH Server, Using the SSH Client, Using PuTTY on Windows Machines, Configuring KeyBased SSH Authentication, Using Graphical Applications with SSH, Using SSH Port Forwarding, Configuring VNC Server Access
2.3	Working with Users, Groups, and Permissions: Managing Users and Groups, Commands for User Management, Managing Passwords, Modifying and Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, Using External Authentication Sources, the Authentication Process, sssd, nsswitch, Pluggable Authentication Modules, Managing Permissions, the Role of Ownership, Basic Permissions: Read, Write, and Execute, Advanced Permissions, Working with Access Control Lists, Setting Default Permissions with umask, Working with Attributes
UNIT 3	Securing Server with iptables, Setting Up Cryptographic Services, Configuring Server for File Sharing (15 LECTURES)
3.1	Securing Server with iptables: Understanding Firewalls, Setting Up a Firewall with system-config-firewall, Allowing Services, Trusted Interfaces, Masquerading, Configuration Files, Setting Up a Firewall with iptables, Tables, Chains, and Rules, Composition of Rule, Configuration Example, Advanced iptables Configuration, Configuring Logging, The Limit Module, Configuring NAT
3.2	Setting Up Cryptographic Services: Introducing SSL, Proof of Authenticity: the Certificate Authority, Managing Certificates with openssl, Creating a Signing Request, Working with GNU Privacy Guard, Creating GPG Keys, Key Transfer, Managing GPG Keys, Encrypting Files with GPG, GPG Signing, Signing RPM Files
3.3	Configuring Server for File Sharing: What is NFS? Advantages and Disadvantages of NFS, Configuring NFS4, Setting Up NFSv4, Mounting an NFS Share, Making NFS Mounts Persistent, Configuring Automount, Configuring Samba, Setting Up a Samba File Server, Samba Advanced Authentication Options, Accessing Samba Shares, Offering FTP Services.
UNIT 4	Configuring DNS and DHCP, Setting Up a Mail Server, Configuring Apache on Red Hat Enterprise Linux (15 LECTURES)
4.1	Configuring DNS and DHCP: Introduction to DNS, The DNS Hierarchy, DNS Server Types, The DNS Lookup Process, DNS Zone Types, Setting Up a DNS Server, Setting Up a Cache-Only Name Server, Setting Up a Primary Name Server, Setting Up a Secondary Name Server, Understanding DHCP, Setting Up a DHCP Server
4.2	Setting Up a Mail Server: Using the Message Transfer Agent, the Mail Delivery Agent, the Mail User Agent, Setting Up Postfix as an SMTP Server, Working with Mutt, Basic Configuration, Internet Configuration, Configuring Dovecot for POP and IMAP.
4.3	Configuring Apache on Red Hat Enterprise Linux: Configuring the Apache Web Server, Creating a Basic Website, Understanding the Apache Configuration Files, Apache Log Files, Working with Virtual Hosts, Securing the Web Server with TLS Certificates, Configuring Authentication, Setting Up Authentication

	with .htpasswd, Configuring LDAP Authentication, Setting Up MySQL
5	Introducing Bash Shell Scripting, High- Availability Clustering, Setting Up an Installation Server (15 LECTURES)
5.1	Introducing Bash Shell Scripting: Introduction, Elements of a Good Shell Script, Executing the Script, Working with Variables and Input, Understanding Variables, Variables, Subshells, and Sourcing, Working with Script Arguments, Asking for Input, Using Command Substitution, Substitution Operators, Changing Variable Content with Pattern Matching, Performing Calculations, Using Control Structures, Using if...then...else, Using case, Using while, Using until, Using for, Configuring booting with GRUB.
	High-Availability Clustering: High-Availability Clustering, The Workings of High Availability, High-Availability Requirements, Red Hat High-Availability Add-on Software, Components, Configuring Cluster-Based Services, Setting Up Bonding, Setting Up Shared Storage, Installing the 12
5.2	Red Hat High Availability Add-On, Building the Initial State of the Cluster, Configuring Additional Cluster Properties, Configuring a Quorum Disk, Setting Up Fencing, Creating Resources and Services, Troubleshooting a Nonoperational Cluster, Configuring GFS2 File Systems
5.3	Setting Up an Installation Server: Configuring a Network Server as an Installation Server, Setting Up a TFTP and DHCP Server for PXE Boot, Installing the TFTP Server, Configuring DHCP for PXE Boot, Creating the TFTP PXE Server Content, Creating a Kickstart File, Using a Kickstart File to Perform an Automated, Installation, Modifying the Kickstart File with, system-config-kickstart, Making Manual Modifications to the Kickstart File

REFERENCES:

1. Red Hat Enterprise Linux 6 Administration Sander van Vugt John Wiley and Sons 2013
2. Red hat Linux Networking and System Administration Terry Collings and Kurt Wall Wiley 3rd
3. Linux :The complete reference by Petersen, Richard

NAME OF THE COURSE	LINUX SYSTEM ADMINISTRATION PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP504	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

Practical No	Details
0	Installation of RHEL 6.X
1	Graphical User Interface and Command Line Interface and Processes
1.1	Exploring the Graphical Desktop
1.2	The Command Line Interface
1.3	Managing Processes
2	Storage Devices and Links, Backup and Repository
B	Working with Storage Devices and Links
2.1	Making a Backup
2.2	Creating a Repository
3	Working with RPMs Storage and Networking
3.1	Using Query Options
3.2	Extracting Files From RPMs
3.3	Configuring and Managing Storage
3.4	Connecting to the Network
4	Working with Users, Groups, and Permissions
5	Firewall and Cryptographic services
5.1	Securing Server with iptables
5.2	Setting Up Cryptographic Services
6	Configuring Server for File Sharing
6.1	Configuring NFS Server and Client
6.2	Configuring Samba
6.3	Configuring FTP
7	DNS, DHCP and Mail Server
7.1	Configuring DNS
7.2	Configuring DHCP
7.3	Setting Up a Mail Server
8	Web Server
8.1	Configuring Apache on Red Hat Enterprise Linux
8.2	Writing a Script to Monitor Activity on the Apache Web Server
8.3	Using the select Command
9	Shell Scripts and High-Availability Clustering
9.1	Writing Shell Scripts
9.2	Configuring Booting with GRUB
9.3	Configuring High Availability Clustering
10	Setting Up an Installation Server
10.1	Configuring Network Server as an Installation Server
10.2	Setting Up a TFTP and DHCP Server for PXE Boot

SEMESTER V		
NAME OF THE COURSE	ENTERPRISE JAVA	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC505	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES:

CO 1	To gain knowledge about Enterprise Application, Java EE Technologies, Java EEArchitecture, Server and Containers, Servlet Technology
CO 2	To learn the concept of Request Dispatcher, Cookies, Sessions, Non-Blocking I/O
CO 3	To learn the concept of Java Server Page, JSP Action Elements and Implicit Objects,JSTL.
CO 4	To learn the concept of Enterprise JavaBeans, Session Beans, Message Driven Beans, JavaNaming and Directory Interface
CO 5	To learn the concept Persistence, Object/Relational Mapping And JPA, Hibernate, WritingHibernate Application.

COURSE LEARNING OUTCOMES:

CLO 1	Create dynamic web pages using Servlets, Databases application with servlet.
CLO 2	Apply the concepts of Request Dispatcher, Cookies, Session, Working with Non-Blocking I/O with servlet.
CLO 3	Create dynamic web pages using Java Server Pages. Make a reusable software component, using Java Bean.
CLO 4	Map Java classes and object associations to relational database tables with Hibernatemapping files.
CLO 5	Create dynamic web pages using Servlets, Databases application with

	servlet.
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Unit	ENTERPRISE JAVA
UNIT I	Understanding Java EE, Java EE Architecture, Server and Containers Introduction to Java Servlets Servlet API and Lifecycle Working With Servlets Working with Databases (15 LECTURES)
1.1	Understanding Java EE: What is an Enterprise Application? What is javaenterprise edition? Java EE Technologies, Java EE evolution, Glassfish server
1.2	Java EE Architecture, Server and Containers: Types of System Architecture, Java EE Server, Java EE Containers.
1.3	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
1.4	Working With Servlets: Getting Started, Using Annotations Instead of Deployment Descriptor.
1.5	Working with Databases: What Is JDBC? JDBC Architecture, Accessing Database, The Servlet GUI and Database Example.
UNIT 2	Request Dispatcher COOKIES SESSION Working With Files Working With Non-Blocking I/O (15 LECTURES)
2.1	Request Dispatcher: Resquestdispatcher Interface, Methods of Requestdispatcher, Requestdispatcher Application.
2.2	COOKIES: Kinds Of Cookies, Where Cookies Are Used? Creating Cookies Using Servlet, Dynamically Changing The Colors Of A Page
2.3	SESSION: What Are Sessions? Lifecycle Of Http Session,Session Tracking With Servlet API, A Servlet Session Example
2.4	Working With Files: Uploading Files, Creating an Upload File Application, Downloading Files, Creating a Download File Application.
2.5	Working With Non-Blocking I/O: Creating a Non-Blocking Read Application, Creating The Web Application, Creating Java Class, Creating Servlets, Retrieving The File, Creating index.jsp
UNIT 3	Introduction To Java Server Pages Getting Started With Java Server Pages Action Elements,Implicit Objects, Scope And Java Server Pages Standard Tag Libraries El Expressions (15 LECTURES)
3.1	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? Howdoes JSP execute? About Java Server Pages
3.2	Getting Started With Java Server Pages: Comments, JSP Document, JSPElements, JSP GUI Example.
3.3	Action Elements: Including other Files, Forwarding JSP Page to Another Page, Passing Parameters for other Actions, Loading a Javabean.

	Implicit Objects, Scope And El Expressions: Implicit Objects, Character Quoting Conventions, Unified Expression Language [Unified El], Expression Language.
3.5	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.
UNIT 4	Introduction To Enterprise Javabeans Working With Session Beans Working with Message Driven Beans Interceptors Java Naming and Directory Interface (15 LECTURES)
4.1	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
4.2	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.
4.3	Working with Message Driven Beans: Lifecycle of a Message Driven Bean, Uses of Message Driven Beans, The Message Driven Beans Example.
4.4	Interceptors: Request And Interceptor, Defining An Interceptor, AroundInvoke Method, Applying Interceptor, Adding An Interceptor To An Enterprise Bean, Build and Run the Web Application.
4.5	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, Datasource Resource Definition in Java EE.
UNIT 5	Introduction To Enterprise Javabeans Working With Session Beans Working with Message Driven Beans Interceptors Java Naming and Directory Interface Persistence, Object/Relational Mapping And JPA Introduction to Java Persistence API Writing JPA Application (15 LECTURES)
5.1	Persistence, Object/Relational Mapping And JPA: What is Persistence? Persistence in Java, Current Persistence Standards in Java, Why another PersistenceStandards? 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.
5.2	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 Javabeans Class, Creating Persistence Unit [Persistence.Xml], Creating JSPS, The JPA Application Structure, Running TheJPA Application.
5.3	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 Javabeans Class, Creating Hibernate Configuration File, Adding a Mapping Class, Creating JSPS, Running The

NAME OF THE COURSE	ENTERPRISE JAVA	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP505	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

List of Practical	
1.	Implement the following Simple Servlet applications.
1.1	Create a simple calculator application using servlet.
1.2	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"
1.3	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.
2.1	Using Request Dispatcher Interface create a Servlet demonstrating the use of session creation and destruction. Also check whether the user t which will validate the password entered by the user, if has visited this page first time or has visited earlier also using sessions. he user has entered "Se vlet" a password, then he will be forwarded to Welcome Servlet else the user will stay on the index.html page and an error message will be displayed.
3.	Implement the Servlet IO and File applications.
3.1	Create a servlet that uses Cookies to store the number of times a user has visited servlet. Create a Servlet application to upload and download a file.
3.2	Develop Simple Servlet Question Answer Application using Database.
3.3	Create simple Servlet application to demonstrate Non-Blocking Read Operation.
4.	Implement the following JSP applications.
4.1	Develop a simple JSP application to display values obtained from the use of intrinsic objects of various types.
4.2	Develop a simple JSP application to pass values from one page to another with validations. (Nametxt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
4.3	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.
5.1	Create an html page with fields, eno, name, age, desg, salary. Now on submit this data to a JSPpage which will update the employee table of database with matching eno.
5.2	Create a JSP page to demonstrate the use of Expression language.
5.3	Create a JSP application to demonstrate the use of JSTL.
6.	Implement the following EJB Applications.
6.1	Create a Currency Converter application using EJB.
6.2	Develop a Simple Room Reservation System Application Using EJB.
6.3	Develop simple shopping cart application using EJB [Stateful Session Bean].
7.	Implement the following EJB applications with different types of Beans.
7.1	Develop simple EJB application to demonstrate Servlet Hit count using Singleton Session Beans.
7.2	Develop simple visitor Statistics application using Message Driven Bean [Stateless Session Bean].
7.3	Develop simple Marks Entry Application to demonstrate accessing Database using EJB.
8.	Implement the following JPA applications.
8.1	Develop a simple Inventory Application Using JPA.
8.2	Develop a Guestbook Application Using JPA.
8.3	Create simple JPA application to store and retrieve Book details.
9.	Implement the following JPA applications with ORM and Hibernate.
9.1	Develop a JPA Application to demonstrate use of ORM associations.
9.2	Develop a Hibernate application to store Feedback of Website Visitor in MySQL Database.

SEMESTER VI

Semester – VI		
NAME OF THE COURSE	SOFTWARE QUALITY ASSURANCE	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC601	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES

CO 1	To brief different concepts related to quality of a project and process
CO 2	To describe the testing process challenges and the cost of testing
CO 3	To brief various testing methodology
CO 4	To describe the concepts related to verification and validation
CO 5	To explore various testing strategies depending on the System in

COURSE LEARNING OUTCOMES

CLO 1	What is continuous improvement quality cycle. Describe traceability matrix giving an example.
CLO 2	Compare the white box and Blackbox strategies used in testing.
CLO 3	For an attendance application developed, state various V&V activities undertaken. Compare web application testing and mobile application testing.
CLO 4	What is continuous improvement quality cycle. Describe traceability matrix giving an example.
CLO 5	Compare the white box and Blackbox strategies used in testing.

SOFTWARE QUALITY ASSURANCE	
UNIT 1	Introduction to Quality, Software Quality (15 LECTURES)
1.1	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.
1.2	Software Quality: Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, Organisation 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.
UNIT 2	Fundamentals of testing, Testing throughout the software life cycle (15 LECTURES)
2.1	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,
2.2	Testing throughout the software life cycle, Software development models, Test levels, Test types, the targets of testing, Maintenance testing
UNIT 3	Unit Testing: Boundary Value Testing Equivalence Class Testing, Decision Table– Based Testing Path Testing, Data Flow Testing (15 LECTURES)
3.1	Unit Testing: Boundary Value Testing: Normal Boundary Value Testing, 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.
3.2	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.
UNIT 4	Software Verification and Validation (15 LECTURES)
4.1	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
4.2	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
UNIT 5	Levels of Testing Special Tests (15 LECTURES)
5.1	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.
5.2	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, TestingAdequacy 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.

REFERENCES:

1. Naik Kshirasagar & Trpathy, Priyadarshi , Software testing and quality assurance : Theory and practice .
2. Limaye ,M.G. , Software testing : Principles, Techniques and tools .
3. Black ,Rex & others , Foundations of software testing :ISTQB certification .

NAME OF THE COURSE	SOFTWARE QUALITY ASSURANCE PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP601	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

1. You have got the brilliant idea of setting up a company that sells testing services to software houses. Make a strategic plan for your company, taking into account the following issues:

What is the testing process that will be followed in the company? What is the focus of the testing services?

What kind of people are you going to hire as staff for the company?

How are you going to validate that a testing project carried out in the company has been beneficial to the customer?

What kind of automated tools will the company use?

2. Prepare a small project and submit SRS, design, coding and test plan.

3. The program reads an arbitrary number of temperatures (as integer numbers) within the range - 60°C ... +60°C and prints their mean value. Design test cases for testing the program with the black- box strategy.

4. When getting a person's weight and height as input, the program prints the person's body weight index. The weight is given in kilograms (as a real number, for instance: 82,0) and the height in meters (as a real number, for instance: 1,86). The body weight index equals weight divided by height squared: $\text{weight} / (\text{height}^2)$. Design test cases for testing the program with the black-box strategy.

5. Let us study the following program:

```
x=0; read(y);
```

```
while (y > 100) { x=x+y; read(y); } if  
(y < 200) print(x) else print(y);
```

5.1 Construct a control-flow graph for the program.

5.2 Design test cases for reaching complete branch coverage over the program. Use as few test cases as possible.

6. **Design test cases for the following program with the “simple loop” strategy:**

```
x=0; read(y);
```

```
while ((y > 100) && (x < 10)) { x=x+1; read(y); } print(y);
```

6.1 Construct a data-flow graph for the program with respect to variable x.

6.2 Which execution paths have to be traversed during testing, in order to reach complete alldefinitions

coverage with respect to variable x?

6.3 Minimize the number of paths and tests.

6.4 Which execution paths have to be traversed during testing, in order to reach complete alluses

coverage with respect to variable x? Minimize the number of paths and tests.

6.5 Design test cases for reaching the (minimal) complete all-uses coverage with respect to variable x.

7. **MANUAL TESTING** for the project

7.1 Walkthrough

7.2 Whitebox Testing

7.3 Blackbox Testing

7.4 Unit Testing

7.5 Integration Testing

8. **Functional Testing**

8.1 Boundary value Testing

8.2 Equivalence class testing

8.3 Decision Table based testing

8.4 Cause-effect graphs

9. **Regression Testing using automated testing for website.**

10. **AUTOMATED TESTING for websites**

10.1 Load Testing

10.2 Performance Testing

Semester – VI		
NAME OF THE COURSE	SECURITY IN COMPUTING	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC602	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBR OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES

CO 1	The main objective of this course is to enable students to learn the Importance of Information Protection and study how to build a security program.
CO 2	Students will be able to distinguish between Authentication and Authorization. Introduction to cryptography.
CO 3	To acquire basic knowledge of Secure Network Design, Firewalls and Wireless Network Security.
CO 4	Students will be able to explain the Intrusion Detection and Prevention Systems. Will learn overview of Operating System Security Models
CO 5	Understanding Virtual Machines, Cloud Computing and Physical Security concepts along with learning how to Secure Application Design

COURSE LEARNING OUTCOMES

CLO 1	State and explain the Importance of Information Protection. Define CIA triad.
CLO 2	Explain the importance of Authentication and Authorization. Discuss Encryption in brief. Explain General Database and Storage Security Concepts
CLO 3	State Network Device and wireless security measures and Explain Firewalls
CLO 4	State and explain the features of Intrusion detection and Security Information and Event Management. Explain VoIP Vulnerabilities and Countermeasures
CLO 5	State and explain Virtual Machines and Cloud Computing concept in detail. Explain Secure Development Lifecycle

	SECURITY IN COMPUTING
UNIT 1	Information Security Overview Risk Analysis Secure Design Principles (15 LECTURES)
1.1	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.
1.2	Risk Analysis: Threat Definition, Types of Attacks, Risk Analysis.
1.3	Secure Design Principles: The CIA Triad and Other Models, Defense Models, Zones of Trust, BestPractices for Network Defense.
UNIT 2	Information Security Overview Risk Analysis,Secure Design Principles Authentication and Authorization Encryption ,Storage Security,Database Security (15 LECTURES)
2.1	Authentication and Authorization: Authentication, Authorization Encryption: A Brief History of Encryption, Symmetric-Key Cryptography, Public Key Cryptography, Public Key Infrastructure. Storage Security: Storage Security Evolution, Modern Storage Security, Risk Remediation, Best Practices.
2.2	Database Security: General Database Security Concepts, Understanding Database Security Layers, Understanding DatabaseLevel Security, Using Application Security, Database Backup and Recovery, Keeping Your Servers Up to Date, Database Auditing and Monitoring.
UNIT 3	Secure Network Design Network Device Security Firewalls Wireless Network Security (15 LECTURES)
3.1	Secure Network Design: Introduction to Secure Network Design, Performance,Availability, Security.
3.2	Network Device Security: Switch and Router Basics, Network Hardening. Firewalls: Overview, The Evolution of Firewalls, Core Firewall Functions, Additional Firewall Capabilities, Firewall Design., Security Features, Flaws, and Threats, Wireless Vulnerabilities and Mitigations, Wireless Wireless Network Security: Radio Frequency Security Basics, DataLink Layer Wireless
UNIT 4	Intrusion Detection and Prevention Systems Voice over IP (VoIP) and PBX Security Operating System Security Models (15 LECTURES)
4.1	Intrusion Detection and Prevention Systems: IDS Concepts, IDS Types and Detection Models, IDS Features, IDS Deployment Considerations, Security Information and Event Management (SIEM).

4.2	Voice over IP (VoIP) and PBX Security: Background, VoIP Components, VoIP Vulnerabilities and Countermeasures, PBX, TEM:Telecom, Expense Management.
4.3	Operating System Security Models: Operating System Models, Classic Security Models, Reference Monitor, Trustworthy Computing, International Standards for Operating System Security.
UNIT 5	Virtual Machines and Cloud Computing Secure Application Design Physical Security (15 LECTURES)
5.1	Virtual Machines and Cloud Computing: Virtual Machines, Cloud Computing. Application Security Practices, Web Application Security, Client Application Security, Remote Administration Security.
5.2	Physical Security: Classification of Assets, Physical Vulnerability Assessment, Choosing Site Location for Security, Securing Assets: Locks and Entry Controls, Physical Intrusion Detection.

REFERENCES

1. The Complete Reference: Information Security Mark Rhodes Ousley McGraw-Hill 2nd2013
2. Essential Cybersecurity Science Josiah Dykstra O'Reilly Fifth 2017
3. Principles of Computer Security: CompTIA Security+ and Beyond Wm.Arthur Conklin, Greg White McGraw Hill Second 2010

NAME OF THE COURSE	SECURITY IN COMPUTING PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP602	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

Practical No	Details
1	Configure Routers
1.1	OSPF MD5 authentication.
1.2	NTP.
1.3	to log messages to the syslog server.
1.4	to support SSH connections.
2	Configure AAA Authentication
2.1	Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA
2.2	Verify local AAA authentication from the Router console and the PC-A client
3	Configuring Extended ACLs
3.1	Configure, Apply and Verify an Extended Numbered ACL
4	Configure IP ACLs to Mitigate Attacks and IPV6 ACLs
4.1	Verify connectivity among devices before firewall configuration.
4.2	Use ACLs to ensure remote access to the routers is available only from management station PC-C.
4.3	Configure ACLs on to mitigate attacks.
4.4	Configuring IPv6 ACLs
5	Configuring a Zone-Based Policy Firewall
6	Configure IOS Intrusion Prevention System (IPS) Using the CLI
6.1	Enable IOS IPS.
6.2	Modify an IPS signature.
7	Layer 2 Security
7.1	Assign the Central switch as the root bridge.
7.2	Secure spanning-tree parameters to prevent STP manipulation attacks.
7.3	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
10.1	Configure basic ASA settings and interface security levels using CLI
10.2	Configure routing, address translation, and inspection policy using CLI
10.3	Configure DHCP, AAA, and SSH
10.4	Configure a DMZ, Static NAT, and ACLs

SEMESTER VI		
NAME OF THE COURSE	BUSINESS INTELLIGENCE	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC603	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES:

CO 1	To introduce students with concepts of business intelligence by creating a background of data
CO 2	warehousing and data mining.
CO 3	The entire purpose of Business Intelligence is to support and facilitate better business decisions.
CO 4	BI allows organizations access to information that is critical to the success of multiple areas including sales, finance, marketing, and a multitude of other areas and departments.
CO 5	Identify the technological architecture that makes up BI systems

COURSE LEARNING OUTCOMES:

CLO 1	Define Business intelligence architectures and Ethics
CLO 2	Critically evaluate use of BI for supporting decision making in an organization
CLO 3	Evaluate classification models
CLO 4	To design business intelligence applications
CLO 5	To construct an expert system

	BUSINESS INTELLIGENCE
UNIT 1	Business intelligence Decision support systems (15 LECTURES)
1.1	Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence
1.2	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
UNIT 2	Mathematical models for decision making Data mining Data preparation (15 LECTURES)
2.1	Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models
2.2	Data mining: Definition of data mining, Representation of input data , Data mining , process, Analysis methodologies
2.3	Data preparation: Data validation, Data transformation, Data reduction
UNIT 3	Classification Clustering (15 LECTURES)
3.1	Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines
3.2	Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models
UNIT 4	Business intelligence applications Marketing models, Logistic and production models, Data envelopment analysis (15 LECTURES)
4.1	Business intelligence applications: Marketing models: Relational marketing, Sales force management, Logistic and production models: Supply chain optimization,
4.2	Optimization models for logistics planning, Revenue management systems. Dataenvelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices
UNIT 5	Knowledge Management Artificial Intelligence and Expert Systems (15 LECTURES)
5.1	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
5.2	Systems Implementation, Roles of People in Knowledge Management Artificial Intelligence and Expert Systems: Concepts and 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 1st 2009
2. Decision support and Business Intelligence Systems (Efraim Turban, Ramesh Sharda, Dursun Delen) Pearson 9th 2011
3. Fundamentals of Business Intelligence, Grossmann W, Rinderle-MA, Springer F First edition 2015

NAME OF THE COURSE	BUSINESS INTELLIGENCE PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP603	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

Practical No	Details
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.

SEMESTER VI		
NAME OF THE COURSE	ETHICAL HACKING	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC604	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	5	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

COURSE OBJECTIVES:

CO 1	To understand the procedures for identification, preservation, and extraction of electronic evidence
CO 2	To prepare for all stages of an investigation – planning, detection, initial response and management interaction,
CO 3	To understand the procedures for auditing and investigation of network and host system intrusions, analysis and documentation of information gathered.
CO 4	To prepare for investigation of various media to collect evidence, report them in a way that would be acceptable in the court of law.
CO 5	To Find vulnerabilities and security loopholes that facilitate attackers

COURSE LEARNING OUTCOMES:

CLO 1	Conduct digital investigations that conform to accepted professional standards and are based on the investigative process:
CLO 2	Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards;
CLO 3	identification, preservation, examination, analysis, and reporting;

Unit	ETHICAL HACKING
UNIT 1	Knowledge Management Artificial Intelligence and Expert Systems Introduction to information security Types of malware,Types of vulnerabilities (15 LECTURES)
1.1	Introduction to information security : Asset, Access Control, CIA, Authentication, Authorization, Risk, Threat, Vulnerability, Attack, Attack Surface, Malware, Security-Functionality-Ease of Use Triangle Types of malware :Worms, viruses, Trojans, Spyware, Rootkits
1.2	Types of vulnerabilities: cross-site scripting(XSS), cross site request forgery (CSRF/XSRF), SQL injection, input parameter
1.3	manipulation, broken authentication, sensitive information disclosure, XML External Entities, Broken access control, Security Misconfiguration, Using components with known vulnerabilities, Insufficient Logging and monitoring.
UNIT 2	Introduction Phases ,Types of attacks (15 LECTURES)
2.1	Introduction: Black Hat vs. Gray Hat vs. White Hat (Ethical) hacking, Why is Ethical hacking needed?, How is Ethical hacking different from security auditing and digital forensics?, Signing NDA, Compliance and Regulatory concerns, Black box vs. White box vs. Black box, Vulnerability assessment and Penetration Testing.
2.2	Phases: Footprinting and Reconnaissance, Scanning Networks, Enumeration Types of attacks : Keystroke Logging, Denial of Service (DoS /DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping,
2.3	Man-in-the-middle, Session Hijacking, Clickjacking, Cookie Theft, URL Obfuscation, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs
UNIT 3	Social Engineering (15 LECTURES)
3.1	Social Engineering:-Technical Non Technical techniques,preventive measures,Denial of Service :- DOS and DDOS,Tools and Techniques, sed,Preventive measures,
3.2	Session Hijacking :-What is session Id,What is session hijacking, Tools and Techniques used,Preventive measures
UNIT 4	Denial of Service Session Hijacking (15 LECTURES)
4.1	Hacking Webservers and Hacking Web Applications, Buffer Overflows SQL Injection Attacks, Hacking Wireless Networks, Hacking Mobile Platforms,
UNIT 5	Hacking Webservers and Hacking Web Applications (15 LECTURES)
5.1	IDS, Firewalls and Honeypots, Cryptography, Penetration Testing

REFERENCES:

1. Certified Ethical Hacker Study Guide v9 Sean-Philip Oriyano Sybex Study Guide Edition 2016
2. Certified Ethical Hacker Michael Gregg Pearson Education 1 st Edition 2013
3. Certified Ethical Hacker Matt Walker TMH 2011

NAME OF THE COURSE	ETHICAL HACKING PRACTICAL	
CLASS	TYBSCIT	
COURSE CODE	SBTTECP604	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	---	50
PASSING MARKS	---	20

Practical No.	Details
1	Using the tools for whois, traceroute, email tracking, google hacking.
2	Demonstrating BufferOverflow Attack.
3	Demonstrating Format String Attack
4	Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords
5	Use NMap scanner to perform port scanning of various forms – ACK, SYN, FIN, NULL, XMAS
6	Use Wireshark (Sniffer) to capture network traffic and analyze
7	Perform SQL injection attack

8	Study of Denial of Service attack tools
9	Study of Web server attack tools
10	Using cryptanalysis tool.

SEMESTER VI		
NAME OF THE COURSE	PROJECT	
CLASS	TYBSc IT	
COURSE CODE	SBTTEC605	
NUMBER OF CREDITS	4	
NUMBER OF LECTURES PER WEEK	8	
TOTAL NUMBER OF LECTURES PER SEMESTER	120	
EVALUATION METHOD	PROJECT IMPLEMENTATION	PROJECT VIVA - VOCE
TOTAL MARKS	100	50
PASSING MARKS	40	20

Project Implementation Semester VI

Semester VI report has to be hard bound with golden embossing. Students will be evaluated based

on the implementation, report 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 check 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.

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.

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.

II. Type of the Project

The majority of the students are expected to work on a real-life project preferably in some industry/

Research and Development Laboratories/Educational Institution/Software Company. Students are

encouraged to work in the areas listed below. However, it is not mandatory for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. Approval of the project proposal is mandatory. If approved, the student can commence working on it, and complete it. Use the latest versions of the software packages for the development of the project.

III. SOFTWARE AND BROAD AREAS OF APPLICATION

FRONT END / GUI Tools	.Net Technologies,Java
DBMS/BACK END	Oracle, SQL Plus, MY SQL, SQL Server,
LANGUAGES	C, C++, Java, VC++, C#, R,Python
SCRIPTING LANGUAGES	PHP,JSP, SHELL Scripts (Unix), Tcl/TK,

.NET Platform	F#,C#. Net, Visual C#. Net, ASP.Net
MIDDLE WARE (COMPONENT) TECHNOLOGIES	COM/DCOM, Active-X, EJB
UNIX INTERNALS	Device Drivers, RPC, Threads, Socket programming

B. Sc. (Information Technology)		Semester – VI	
Course Name: Project Report and Viva		Course Code:SBTTECP605	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	60 min	50
	Internal	--	--

	<p style="text-align: center;">Introduction</p> <p>The project report should be documented with scientific approach to the solution of the problem that the students have sought to address. The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. The student should start the documentation process from the first phase of software development so that one can easily identify the issues to be focused upon in the ultimate project report. The student should also include the details from the project diary, in which they will record the progress of their project throughout the course. The project report should contain enough details to enable examiners to evaluate the work. The important points should be highlighted in the body of the report, with details often referred to appendices.</p>
1.1	<p style="text-align: center;">PROJECT REPORT:</p> <p>Title Page Original Copy of the Approved Proforma of the Project Proposal Certificate of Authenticated work Role and Responsibility Form Abstract Acknowledgement Table of Contents Table of Figures</p>
CHAPTER 1:	<p>INTRODUCTION Background Objectives Purpose, Scope, and Applicability Purpose Scope Applicability Achievements</p>

	Organisation of Report
CHAPTER 2:	SURVEY OF TECHNOLOGIES
CHAPTER 3:	REQUIREMENTS AND ANALYSIS Problem Definition Requirements Specification Planning and Scheduling Software and Hardware Requirements Preliminary Product Description Conceptual Models
CHAPTER 4:	SYSTEM DESIGN Basic Modules Data Design Schema Design Data Integrity and Constraints Procedural Design Logic Diagrams Data Structures Algorithms Design User interface design Security Issues Test Cases Design
CHAPTER 5:	IMPLEMENTATION AND TESTING Implementation Approaches Coding Details and Code Efficiency Code Efficiency Testing Approach Unit Testing Integrated Testing Beta Testing Modifications and Improvements Test Cases
CHAPTER 6:	RESULTS AND DISCUSSION Test Reports User Documentation
CHAPTER 7:	CONCLUSIONS Conclusion Significance of the System Limitations of the System Future Scope of the Project REFERENCES GLOSSARY APPENDIX A APPENDIX B

EXPLANATION OF CONTENTS

Title Page

Sample format of Title page is given in Appendix 1 of this block. Students should follow the given format.

Original Copy of the Approved Proforma of the Project Proposal

Sample Proforma of Project Proposal is given in Appendix 2 of this block. Students should follow the given format.

Certificate of Authenticated work

Sample format of Certificate of Authenticated work is given in Appendix 3 of this block. Students should follow the given format.

Role and Responsibility Form

Sample format for Role and Responsibility Form is given in Appendix 4 of this block. Students should follow the given format.

Abstract

This should be one/two short paragraphs (100-150 words total), summarising the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Acknowledgements

This should express student's gratitude to those who have helped in the preparation of project.

Table of Contents: The table of contents gives the readers a view of the detailed structure of the report.

The students would need to provide section and subsection headings with associated pages.

The formatting details of these sections and subsections are given below.

Table of Figures: List of all Figures, Tables, Graphs, Charts etc. along with their page numbers in a table of figures.

Chapter 1: Introduction

The introduction has several parts as given below:

Background: A description of the background and context of the project and its relation to work already done in the area. Summarise existing work in the area concerned with the project work.

Objectives: Concise statement of the aims and objectives of the project. Define exactly what is going to be done in the project; the objectives should be about 30 /40 words.

Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:

- **Purpose:** Description of the topic of the project that answers questions on why this project is being done. How the project could improve the system its significance and theoretical framework.
- **Scope:**

A brief overview of the methodology, assumptions and limitations. The students should answer the question: What are the main issues being covered in the project? What are the main functions of the project?

- **Applicability:** The student should explain the direct and indirect applications of their work.

Briefly discuss how this project will serve the computer world and people.

Achievements: Explain what knowledge the student achieved after the completion of the work. What contributions has the project made to the chosen area? Goals achieved - describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

Organisation of Report: Summarising the remaining chapters of the project report, in effect, giving the

reader an overview of what is to come in the project report.

Chapter 2: Survey of Technologies

In this chapter Survey of Technologies should demonstrate the students awareness and understanding

of Available Technologies related to the topic of the project. The student should give the detail of all the

related technologies that are necessary to complete the project. The should describe the technologies

available in the chosen area and present a comparative study of all those Available Technologies. Explain

why the student selected the one technology for the completion of the objectives of the project.

Chapter 3: Requirements and Analysis

Problem Definition: Define the problem on which the students are working in the project.

Provide details of the overall problem and then divide the problem into sub-problems. Define each sub-problem clearly.

Requirements Specification: In this phase the student should define the requirements of the system,

independent of how these requirements will be accomplished. The Requirements Specification describes the things in the system and the actions that can be done on these things. Identify the operation and problems of the existing system.

Planning and Scheduling: Planning and scheduling is a complicated part of software development.

Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, known as constraints, which control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether

adequate resources are available to carry out the plan. The student should show the Gantt chart and

Program Evaluation Review Technique (PERT).

Software and Hardware Requirements: Define the details of all the software and hardware needed for the development and implementation of the project.

- **Hardware Requirement:** In this section, the equipment, graphics card, numeric co-processor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.
- **Software Requirements:** In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.

Preliminary Product Description: Identify the requirements and objectives of the new system.

Define the functions and operation of the application/system the students are developing as project.

Conceptual Models: The student should understand the problem domain and produce a model of the

system, which describes operations that can be performed on the system, and the allowable sequences

of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams,

Object-oriented diagrams, System Flowcharts etc.

Chapter 4: System Design

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.

Basic Modules: The students should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, the student should integrate all the modules into one system. In this phase, the student should briefly describe all the modules and the functionality of these modules.

Data Design: Data design will consist of how data is organised, managed and manipulated.

- **Schema Design:** Define the structure and explanation of schemas used in the project.
- **Data Integrity and Constraints:** Define and explain all the validity checks and constraints provided to maintain data integrity.

Procedural Design: Procedural design is a systematic way for developing algorithms or procedurals.

- **Logic Diagrams:** Define the systematical flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.
- **Data Structures:** Create and define the data structure used in procedures.
- **Algorithms Design:** With proper explanations of input data, output data, logic of processes, design and

explain the working of algorithms.

User Interface Design: Define user, task, environment analysis and how to map those requirements in order to develop a “User Interface”. Describe the external and internal components and the architecture of user interface. Show some rough pictorial views of the user interface and its components.

Security Issues: Discuss Real-time considerations and Security issues related to the project and explain how the student intends avoiding those security problems. What are the security policy plans and architecture?

Test Cases Design: Define test cases, which will provide easy detection of errors and mistakes with in a minimum period of time and with the least effort. Explain the different conditions in which the students wish to ensure the correct working of the project.

Chapter 5: Implementation and Testing

Implementation Approaches: Define the plan of implementation, and the standards the students have used in the implementation.

Coding Details and Code Efficiency: Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

The student can explain the function of the code with a shot of the output screen of that program code.

- **Code Efficiency:** The student should explain how the code is efficient and how the students have

handled code optimisation.

Testing Approach: Testing should be according to the scheme presented in the system design chapter

and should follow some suitable model – e.g., category partition, state machine-based. Both functional

testing and user-acceptance testing are appropriate. Explain the approach of testing.

- **Unit Testing:** Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.
- **Integrated Testing:** Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements: Once the students finish the testing they are bound to be faced with bugs, errors and they will need to modify your source code to improve the system. Define what modification are implemented in the system and how it improved the system.

Chapter 6: Results and Discussion

Test Reports: Explain the test results and reports based on the test cases, which should show that the project is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation: Define the working of the software; explain its different functions, components with screen shots. The user document should provide all the details of the product in such a way that

any user reading the manual, is able to understand the working and functionality of the document.

Chapter 7: Conclusions

Conclusion: The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that would have made in the other chapters.

Limitations of the System: Explain the limitations encountered during the testing of the project that the students were not able to modify. List the criticisms accepted during the demonstrations of the project.

Future Scope of the Project describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts.

REFERENCES

It is very important that the students acknowledge the work of others that they have used or adapted in their own work, or that provides the essential background or context to the project. The use of

references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material. The citation is mandatory in both the reports. E.g:

Linhares, A., & Brum, P. (2007). Understanding our understanding of strategic scenarios: What role do chunks play? *Cognitive Science*, 31(6), 989-1007.

<https://doi.org/doi:10.1080/03640210701703750>

Lipson, Charles (2011). *Cite right : A quick guide to citation styles; MLA, APA, Chicago, the sciences, professions, and more* (2nd ed.). Chicago [u.a.]: University of Chicago Press. p. 187.

ISBN 9780226484648.

Elaine Ritchie, J Knite. (2001). *Artificial Intelligence*, Chapter 2 , p.p 23 - 44. Tata McGrawHill.

GLOSSARY

If you the students any acronyms, abbreviations, symbols, or uncommon terms in the project report

then their meaning should be explained where they first occur. If they go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

In particular, if there are technical details of the work done that might be useful to others who wish to build on this work, but that are not sufficiently important to the project as a whole to justify being discussed in the main body of the project, then they should be included as appendices.

V. SUMMARY

Project development usually involves an engineering approach to the design and development of a software system that fulfils a practical need. Projects also often form an important focus for discussion at interviews with future employers as they provide a detailed example of what the students are capable of achieving. In this course the students can choose your project topic from the lists given in

Unit 4: Category-wise Problem Definition.

VI. FURTHER READINGS

1. Modern Systems Analysis and Design; Jeffrey A. Hoffer, Joey F. George, Joseph, S. Valacich; Pearson

Education; Third Edition; 2002.

2. ISO/IEC 12207: Software Life Cycle Process

(<http://www.software.org/quagmire/descriptions/iso-iec12207.asp>).

3. IEEE 1063: Software User Documentation (<http://ieeexplore.ieee.org>).

4. ISO/IEC: 18019: Guidelines for the Design and Preparation of User Documentation for Application

Software.

5. <http://www.sce.carleton.ca/squall>.

6. <http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html>. 7.

<http://www.sei.cmu.edu/cmm/>

PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be summarily rejected.)

PNR No.: Roll no: _____

1. Name of the Student

2. Title of the Project

3. Name of the Guide

4. Teaching experience of the Guide _____

5. Is this your first submission?

Yes

No

Signature of the Student

Signature of the Guide

Date:

Date:

Signature of the Coordinator

Date:

(All the text in the report should be in times new roman)

TITLE OF THE PROJECT
(NOT EXCEEDING 2 LINES, 24 BOLD, ALL CAPS)

A Project Report (12 Bold)

Submitted in partial fulfillment of the Requirements for the award of the Degree of (size-12)

**BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)(14
BOLD, CAPS)**

By(12 Bold)

Name of The Student (size-15, title case)

Seat Number (size-15)

Under the esteemed guidance of (13 bold)

**Mr./Mrs. Name of The Guide (15
bold, title case)**

Designation (14 Bold, title case)

COLLEGE LOGO

**DEPARTMENT OF INFORMATION TECHNOLOGY(12 BOLD,
CAPS)**

COLLEGE NAME (14 BOLD, CAPS)
*(Affiliated to University of Mumbai) (12, Title
case, bold, italic)* **CITY, PIN CODE(12 bold,
CAPS)**

MAHARASHTRA (12 bold, CAPS)

YEAR (12 bold)

COLLEGE NAME (14 BOLD, CAPS)
*(Affiliated to University of Mumbai) (13,
bold, italic)*

**CERTIFICATE (14 BOLD, CAPS,
underlined, centered)**

This is to certify that the project entitled, "**Title of The Project**", is bonafied work of **NAME OF THE STUDENT** bearing Seat.No: **(NUMBER)** submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in INFORMATION

TECHNOLOGY from University of Mumbai. (12, times new roman, justified)

Internal Guide (12 bold)

Coordinator

External Examiner

Date:

College Seal

ACKNOWLEDGEMENT

(20, BOLD, ALL CAPS, CENTERED)

The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, justified.

(Declaration page format)

DECLARATION (20 bold, centered, allcaps)

Content (12, justified)

I here by declare that the project entitled, “**Title of the Project**” done at **place where the project is done**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Name and Signature of the Student

TABLE OF CONTENTS (20bold, caps, centered)

Should be generated automatically using word processing software.

Chapter 1: Introduction	01(no bold)
1.1Background	02(no bold)
1.2Objectives	
.....	
1.3Purpose and Scope
1.2.1 Purpose
1.2.2 Scope	

.....

Chapter 2: System Analysis	
2.1Existing System	
2.2Proposed System	
2.3Requirement Analysis	
2.4Hardware Requirements	
2.5Software Requirements	
2.6Justification of selection of Technology	

Chapter 3: System Design	
3.1Module Division	
3.2Data Dictionary	
3.3ER Diagrams	
3.4DFD/UML Diagrams	

Chapter 4: Implementation and Testing	
4.1 Code (Place Core segments)	
4.2 Testing Approach	
4.2.1 Unit Testing (Test cases and Test Results)	
4.2.2 Integration System (Test cases and Test Results)	

Chapter 5: Results and Discussions (Output Screens)	
Chapter 6: Conclusion and Future Work	
Chapter 7: References	

List of Tables (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

List of Figures (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

(Project Introduction page format)

Chapter 1

Introduction (20 Bold, centered)

Content or text (12, justified)

Note: Introduction has to cover brief description of the project with minimum 4 pages.

Chapter 2

System Analysis (20 bold, Centered)

Subheadings are as shown below with following format (16 bold, CAPS)

2.1 Existing System (16 Bold)

2.1.1 (14 bold, title case)

2.1.1.1 (12 bold, title case)

2.2 Proposed System

2.3 Requirement Analysis

2.4 Hardware Requirements

2.5 Software Requirements

2.6 Justification of Platform – (how h/w & s/w satisfying the project)

Table 2.1: Caption

Chapter 3

System Design (20 bold, centered)

Subheadings are as shown below with following format (16 bold, CAPS)
Specify figures as Fig 11.1 – caption

3.1 Module Division

3.2 Data Dictionary

3.3 E-R Diagrams

3.4 Data Flow Diagrams / UML

Note: write brief description at the bottom of all diagrams

Sample Figure

Fig. 3.1: Caption

Chapter 4

Implementation and Testing (20 bold, centered)

4.1 Code (Place Core segments)

Content includes description about coding phase in your project (Font-12)

(* don't include complete code-----just description)

4.2 Testing Approach Subheadings are as shown below with following format (16 bold, CAPS)

4.2.1 Unit Testing

4.2.2 Integration Testing

Note:

- Explain about above testing methods
- Explain how the above techniques are applied in your project
Provide Test plans, test cases, etc. relevant to your project

Chapter 5

Results and Discussions(20 bold, centered)

Note: Place Screen Shots and write the functionality of each screen at the bottom

Chapter 6

Conclusion and Future Work (20 bold, centered)

The conclusions can be summarized in a fairly short chapter around 300 words. Also include limitations of your system and future scope (12, justified)

*** NOTE ABOUT PROJECT VIVA VOCE:**

Student may be asked to write code for problem during VIVA to demonstrate his coding capabilities and he/she may be asked to write any segment of coding used in the in the project. The project can be done in group of at most four students. However, the length and depth of the project should be justified for the projects done in group. A big project can be modularised and different modules can be assigned as separate project to different students.

Marks Distribution:

Semester VI: 150 Marks

Documentation and Viva Voce: 50 Marks:

Implementation: 100 Marks

The plagiarism should be maintained as per the UGC guidelines.

ASSESSMENT DETAILS :(This will be same for all the theory papers)

THEORY

- i) 50 Marks online MCQ exam.
- ii) Question paper contained 40 questions in total.
- iii) Duration of exam was 60 minutes
- iv) Breakup of 50 Marks = 30 MCQ's of 1 marks and 10 MCQ's of 2 marks

INTERNAL

50 Marks Continuous Internal assessment

Test modes could be any of the given below

2 Quiz + 1 Assignment + 1 PPT

PRACTICAL

50 Marks online practical exams to be conducted

for the new academic year 2020-2021 due to Covid 19 pandemic.

i) 10 Marks for journal preparation.

40 Marks viva questions to be asked.

Or

ii) 25 Marks for journal preparation.

25 Marks viva questions to be asked.