Vidya Prasarak Mandal's
B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme Code : BUIT

Programme : Bachelor of Science

Specific Programme : Information Technology

[T.Y.B.Sc. (Information Technology)]

Level 5.5

CHOICE BASED GRADING SYSTEM

Revised under NEP

From academic year 2025 - 2026

Preamble

The B.Sc. Information Technology programme is having an aim to make the students employable and impart industry oriented training. The main objectives of the course are:

- to think analytically, creatively and critically in developing robust, extensible and highly maintainable technological solutions to simple and complex problems.

- 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.

- to work effectively as a part of a team to achieve a common stated goal.

- to adhere to the highest standards of ethics, including relevant industry and organizational codes of conduct.

- to communicate effectively with a range of audiences both technical and non-technical.

- to develop an aptitude to engage in continuing professional development.

The students will be ready for the jobs available in different fields like:

- Software Development (Programming)

- Website Development

- Mobile app development

- Embedded Systems Programming

- Embedded Systems Development

- Software Testing

- Networking

- Database Administration

- System Administration

- Cyber Law Consultant

- GIS (Geographic Information Systems)

- IT Service Desk

- Security

Abhijeet A. Kale
Chairman
Board of Studies in Computer Science

PROGRAMME OUTCOMES (PO)

The Undergraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes:

➢ **BACHELOR OF SCIENCE (B.Sc.)**

PO1 - Disciplinary Knowledge
Lay strong foundation of conceptual learning in science. Instil ability to apply science in professional, social and personal life.

PO2 - Inculcation of Research Aptitude
Ignite spirit of inquiry, critical thinking, analytical skills and problem-solving approach which will help learner to grasp concepts related to research methodology and execute budding research ideas.

PO3 - Digital Literacy
Enhance ability to access, select and use a variety of relevant information e-resources for curricular, co-curricular and extracurricular learning process.

PO4 - Sensitization towards Environment
Build cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

PO5 - Individuality and Team work
Encourage learner to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

PO6 - Social and Ethical Awareness
Foster ethical principles which will help in developing rational thinking and becoming socially aware citizens. Build attitude of unbiased, truthful actions and avoid unethical behaviour in all aspects of life.

Program Specific Outcome:

On completion of the B.Sc. (Information Technology) degree the graduates will be able to

- Develop Problem Solving and Programming Skills. (Level 6)

- Design, develop, and manage computer-based systems involving databases, operating systems, computer networks, and web technologies. (Level 6)

- Analyze statistical methods, data analytics, and modern tools to extract insights from data and demonstrate adaptability to emerging technologies. (Level 4)

- Enhance skills and adapt new computing technologies for attaining professional excellence and carrying research. (Level 6)

- Demonstrate professional ethics, teamwork, communication skills, and project management abilities required for successful careers in the IT industry. (Level 3)

- Apply self-directed learning and research skills to adopt emerging technologies and entrepreneurial practices. (Level 3)

VPM's B.N.Bandodkar College of Science (Autonomous), Thane
T.Y.B.Sc. (Information Technology) Revised under NEP
Structure of Programme
Semester V

	Course Code	Course Title	No. of lectures	Credits
Major	25BUIT5T01	Geospatial Science	30	2
	25BUIT5T02	Enterprise JAVA	30	2
	25BUIT5T03	Data Analytics	30	2
	25BUIT5P01	Practical Based on 25BUIT5T01	60	2
	25BUIT5P02	Practical Based on 25BUIT5T02	60	2
	25BUIT5P03	Practical Based on 25BUIT5T03	60	2
Minor	25BUIT5TMN	Game Programming	30	2
Elective	25BUIT5TE1	Advance Databases	30	2
	25BUIT5PE1	Practical Based on 25BUIT5TE1	60	2
	25BUIT5TE2	Real Time Embedded Systems	30	2
	25BUIT5PE2	Practical Based on 25BUIT5TE2	60	2
VSC	25BUIT5VSC	Enterprise Computing Methodologies	30	2
OJT	25BUIT5OJT	OJT in I.T. – I	60	2
OR				
FP	25BUIT5FPR	Field Project in I.T.- I		
Total				22

Semester VI

	Course Code	Course Title	No. of lectures	Credits
Major	25BUIT6T01	Business Intelligence	30	2
	25BUIT6T02	Knowledge Based Systems	30	2
	25BUIT6T03	Cryptography and Network Security	30	2
	25BUIT6P01	Practical Based on 25BUIT6T01	60	2
	25BUIT6P02	Practical Based on 25BUIT6T02	60	2
	25BUIT6P03	Practical Based on 25BUIT6T03	60	2
Elective	25BUIT6TE1	Advanced Web Programming	30	2
	25BUIT6PE1	Practical Based on 25BUIT6TE1	60	2
	25BUIT6TE2	Cloud Technology	30	2
	25BUIT6PE2	Practical Based on 25BUIT6TE2	60	2
IKS	25BUIT6IKS	Indian Knowledge and Technology	30	2
VSC	25BUIT6VSC	Internet of Things	30	2
OJT	25BUIT6OJT	OJT in I.T. - II	60	2
OR				
FP	25BUIT6FPR	Field Project in I.T.- II		
Total				22

Semester V

Course Code	Course Title	Credits	No. of lectures
23BUIT5T01	**Geospatial Science**	02	30

CO1	Define and list the fundamental concepts of Geographic Information Systems (GIS), including spatial data, geoinformation, geographic phenomena, GIS architecture, and spatial databases.	L1
CO2	Explain the principles of geographic representations, including spatial referencing systems, coordinate systems, map projections, data quality measures, and spatial data input methods.	L2
CO3	Analyze spatial data and GIS operations by examining overlay functions, neighbourhood analysis, network analysis, interpolation, terrain modeling, and error propagation in spatial data processing.	L4
CO4	Apply GIS tools and techniques for spatial data handling, storage, querying, classification, visualization, and cartographic representation to solve real-world geographic problems.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	2	-	-
CO2	3	2	2	2	-	-
CO3	3	3	2	2	1	1
CO4	3	2	3	3	2	1

Unit I	**The nature of GIS:** Defining GIS, GISystems, GIScience and GIApplications, Spatial data and Geoinformation. **The real world and representations:** Models and modelling, Maps, Databases, Spatial databases and spatial analysis **Geographic Phenomena:** Defining geographic phenomena, types of geographic phenomena, Geographic fields, Geographic objects, Boundaries **Computer Representations of Geographic Information:** Regular tessellations, irregular tessellations, Vector representations, Topology and Spatial relationships, Scale and Resolution, Representation of Geographic fields, Representation of Geographic objects, Organizing and Managing Spatial Data, the Temporal Dimension, Data Management and Processing Systems Hardware and Software Trends **Geographic Information Systems:** GIS Software, GIS Architecture and functionality, Spatial Data Infrastructure (SDI) **Stages of Spatial Data handling:** Spatial data handling and preparation, Spatial Data Storage and maintenance, Spatial Query and Analysis, Spatial Data Presentation. **Database management Systems:** Reasons for using a DBMS, Alternatives for data management, The relational data model, Querying the relational database. **GIS and Spatial Databases:** Linking GIS and DBMS, Spatial database functionality. **Spatial Referencing:** Reference surfaces for mapping, Coordinate Systems, Map Projections, Coordinate Transformations	**15** **[CO1, CO2]**
Unit II	**Satellite-based Positioning:** Absolute positioning, Errors in absolute positioning, Relative positioning, Network positioning, code versus phase measurements, Positioning technology **Spatial Data Input:** Direct spatial data capture, Indirect spatial data capture, Obtaining spatial data elsewhere **Data Quality:** Accuracy and Positioning, Positional accuracy, Attribute accuracy, temporal accuracy, Lineage, Completeness, Logical consistency **Data Preparation:** Data checks and repairs, Combining data from multiple	**15** **[CO1, CO3, CO4]**

	sources
	Point Data Transformation: Interpolating discrete data, Interpolating continuous data
	Retrieval, classification and measurement: Measurement, Spatial selection queries, Classification
	Overlay functions: Vector overlay operators,Raster overlay operators
	Neighbourhood functions: Proximity computations, Computation of diffusion, Flow computation, Raster based surface analysis
	Analysis: Network analysis, interpolation, terrain modeling
	GIS and Application models: GPS, Open GIS Standards, GIS Applications and Advances
	Error Propagation in spatial data processing: How Errors propagate, Quantifying error propagation
	GIS and Maps, The Visualization Process Visualization Strategies:
	The cartographic toolbox: What kind of data do I have? How can Imap my data? **How to map?** How to map qualitative data, how to map quantitative data, how to map the terrain elevation, how to map time series

References:
1. Principles of Geographic Information Systems-An Introductory TextBook Editors: Otto Huisman and Rolf A. The International Institute of Geoinformation Science and Earth Observation   Fourth 2009
2. Principles of Geographic Information Systems P.A Burrough and R.A.McDonnell Oxford University Press Third 1999
3. Fundamentals of Spatial Information Systems, R.Laurini and D. Thompson, Academic Press 1994
4. Fundamentals of Geographic Information Systems Michael N.Demers Wiley Publications Fourth 2009
5. Introduction to Geographic Information Systems Chang Kang-tsung (Karl), McGrawHill 3rd Edition 2013 7th Edition
6. GIS Fundamentals: AFirst Text on Geographic Information Systems Paul Bolsatd XanEdu Publishing Inc 5th Edition

Course Code	Course Title	Credits	No. of lectures
23BUIT5T02	Enterprise JAVA	02	30

CO1	Recall and define the fundamental concepts of Java EE, including enterprise applications, Java EE architecture, servers, containers, servlets, JSP, EJB, JNDI, and persistence technologies.	L1
CO2	Apply Java EE technologies such as Servlets, JSP, JDBC, cookies, sessions, and JSTL to develop dynamic, database-driven web applications.	L3
CO3	Analyze Java EE components and architectures by comparing Servlets vs JSP, different EJB types, session management techniques, and persistence frameworks (JPA vs Hibernate) for suitable enterprise application design.	L4
CO4	Evaluate and justify the selection of appropriate Java EE technologies and frameworks (EJB, JPA, Hibernate, JNDI, MDBs) based on performance, scalability, maintainability, and transactional requirements of enterprise applications.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	-	-
CO2	3	2	3	-	2	-
CO3	2	3	2	-	1	1
CO4	2	3	2	-	2	2

Unit I	**Understanding Java EE:** What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server **Java EE Architecture, Server and Containers:** Types of SystemArchitecture, Java EE Server, Java EE Containers. **Introduction to Java Servlets:** The Need for Dynamic Content, JavaServlet Technology, Why Servlets? What can Servlets do? **Servlet API and Lifecycle:** Java Servlet API, The Servlet Skeleton, TheServlet Life Cycle, A Simple Welcome Servlet **Working with Servlets:** Getting Started, Using Annotations Instead of Deployment Descriptor. **Working with Databases:** What Is JDBC? JDBC Architecture,Accessing Database, The Servlet GUI and Database Example. **Request Dispatcher:** Resquestdispatcher Interface, Methods of Requestdispatcher, Requestdispatcher Application. **COOKIES:** Kinds of Cookies, Where Cookies Are Used? CreatingCookies Using Servlet, Dynamically Changing the Colors of A Page **SESSION:** What Are Sessions? Lifecycle of Http Session, Session Tracking With Servlet API, A Servlet Session Example	**15** **[CO1, CO2]**
Unit II	**Introduction To Java Server Pages:** Why use Java Server Pages?Disadvantages Of JSP, JSP v\s Servlets, Life Cycle of a JSP Page, Howdoes a JSP function? How does JSP execute? About Java Server Pages **Getting Started With Java Server Pages:** Comments, JSP Document,JSP Elements, JSP GUI Example. **Action Elements:** Including other Files, Forwarding JSP Page to Another Page, Passing Parameters for other Actions, Loading a Javabean. **Implicit Objects, Scope,** **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. **Introduction To Enterprise Javabeans:** Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans	**15** **[CO1, CO3, CO4]**

Working with Session Beans: When to use Session Beans? Types of Session Beans, Remote and Local Interfaces, Accessing Interfaces, Lifecycle of Enterprise Beans, Packaging Enterprise Beans, Example of Stateful Session Bean, Example of Stateless Session Bean, Example of Singleton Session Beans

Working with Message Driven Beans: Lifecycle of a Message Driven Bean, Uses of Message Driven Beans, The Message Driven Beans Example.

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 andJNDI, Datasource Resource Definition in Java EE. **Persistence,Object/Relational Mapping And JPA:** What isPersistence?

Persistence in Java, Current Persistence Standards in Java,Why another Persistence Standards? Object/Relational Mapping, **Introduction to Java Persistence API:** The Java Persistence API, JPA,ORM, Database and the Application, Architecture of JPA, How JPAWorks? JPA Specifications.

Introduction to Hibernate: What is Hibernate? Why Hibernate? Hibernate, Database and The Application, Components of Hibernate, Architecture of Hibernate, How Hibernate Works?

References:

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

Course Code	Course Title	Credits	No. of lectures
23BUIT5T03	**Data Analytics**	**02**	**30**

CO1	Define and list the fundamental concepts of data analytics and big data, including characteristics of data, types of analytics, big data evolution, challenges, and data warehouse environments.	L1
CO2	Explain the processes, methodologies, advantages, disadvantages, and applications of descriptive, diagnostic, predictive, and prescriptive analytics, as well as qualitative and quantitative data analysis methods.	L2
CO3	Analyze analytical models and methods such as clustering, association rules, regression, classification, time-series analysis, and text analytics by evaluating model behavior, diagnostics, and performance.	L4
CO4	Design and develop data analytics solutions by integrating big data concepts, analytical techniques, and text analytics methods to extract insights and support decision-making in real-world applications.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	-	-
CO2	2	2	2	-	-	1
CO3	2	3	2	-	1	1
CO4	2	3	3	-	2	2

Unit I	Characteristics of Data, Process of Data Analytics, Types of analytics : Descriptive Analytics - advantages and Disadvantages, Importance, Applications. Diagnostic Analytics - advantages and Disadvantages, Importance, Applications. Predictive Analytics - advantages and Disadvantages, Importance, Applications. Prescriptive Analytics - Methodology, advantages and Disadvantages, Importance, Applications , Methods of Data Analytics : Qualitative Data Analytics And Quantitative Data Analysis, Data Analytics Jobs, Importance and Usage of Data Analytics, Introduction to Big Data, and Big Data Evolution of Big Data, Definition of Big Data, Challenges with big data, Why Big data? Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of big Data Analytics.	**15** **[CO1, CO2]**
Unit II	Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models. Analytical Theory and Methods: Classification, Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods, Time Series Analysis, Box Jenkins methodology, ARIMA Model, Additional methods. Text Analysis, Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments	**15** **[CO2, CO3, CO4]**

References:
1. Big Data and Analytics Subhashini Chellappan Seema Acharya Wiley First
2. Data Analytics with Hadoop An Introduction for Data Scientists Benjamin Bengfort and Jenny Kim O'Reilly 2016
3. Big Data and Hadoop V.K Jain Khanna Publishing First 2018
4. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis,Wiley,First Edition, 2009
5. Decision support and Business Intelligence Systems,Efraim Turban,Ramesh harda,Dursu Delen Pearson, Ninth Edition, 2011
6. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer, First Edition, 2015

Course Code 25BUIT5P01	Course Title Practicals based upon 25BUIT5T01	Credits 02	No. of lectures 60

CO1	Use Quantum GIS (QGIS) to install the software, load vector and raster datasets, visualize maps, and explore map layers for practical GIS applications.	L3
CO2	Create, manage, and manipulate spatial data by working with vector layers, raster layers, attributes, projections, WMS data, and georeferencing scanned maps or aerial imagery.	L3
CO3	Perform spatial data analysis using table joins, spatial joins, points-in-polygon analysis, nearest neighbor analysis, raster sampling, and interpolation to derive meaningful geographic information.	L4
CO4	Design and automate GIS workflows using batch processing, processing modeler, print composer atlas, and map validation techniques to produce accurate, efficient, and reliable spatial outputs.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	1	-	-
CO2	2	2	3	2	1	-
CO3	3	3	2	2	1	1
CO4	2	3	3	1	2	1

Practical 1	Familiarizing Quantum GIS: Installation of QGIS, datasets for both Vector and Raster data, Maps.
Practical 2	Creating and Managing Vector Data: Adding vector layers, setting properties, formatting, calculating line lengths and statistics
Practical 3	Exploring and Managing Raster data: Adding raster layers, raster styling and analysis, raster mosaicking and clipping
Practical 4	Making a Map, Working with Attributes, Importing Spreadsheets or CSV files Using Plugins, Searching and Downloading OpenStreetMap Data.
Practical 5	Working with attributes, terrain Data
Practical 6	Working with Projections and WMS Data
Practical 7	Georeferencing Topo Sheets and Scanned MapsGeoreferencing Aerial Imagery Digitizing Map Data
Practical 8	Managing Data Tables and Saptial data Sets: Table joins, spatial joins, points in polygon analysis, performing spatial queries
Practical 9	Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data
Practical 10	Advance GIS Operations 2:Batch Processing using Processing FrameworkAutomating Complex Workflows using Processing Modeler Automating Map Creation with Print Composer Atlas
Practical 11	Validating Map data

Course Code 25BUIT5P02	Course Title Practicals based upon 25BUIT5T02	Credits 02	No. of lectures 60

CO1	Develop dynamic web applications using Java Servlets and JSP to handle user input, perform calculations, and interact with web forms for real-time applications.	L3
CO2	Implement database connectivity using JDBC in Servlet and JSP applications to perform CRUD operations and manage user registration, login, and session management.	L3
CO3	Analyze and implement web session management and state tracking mechanisms using cookies, sessions, and request dispatcher to maintain user-specific data across multiple requests.	L4
CO4	Design and develop enterprise-level applications using EJB for real-world scenarios such as currency converters and room reservation systems, integrating web, database, and business logic components.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	1
CO2	3	2	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	2	-	3	2

Practical 1	Create a simple calculator application using servlet.
Practical 2	Create a simple servlet application to find entered number is Even or Odd.
Practical 3	Create a simple servlet application to find Factorial of entered.
Practical 4	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"
Practical 5	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.
Practical 6	Using Request Dispatcher Interface create a Servlet which will validate the password entered by the user, if the user has entered "Servlet" as 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.
Practical 7	Create a servlet that uses Cookies to store number of times a user has visited servlet.
Practical 8	Create a servlet demonstrating use of session creation and destruction. Also check whether user has visited this page first time or has visited earlier also using sessions.
Practical 9	Develop Simple Servlet Question Answer Application using Database.
Practical 10	Develop simple JSP application to display values obtained from use of intrinsic objects.
Practical 11	Develop a simple JSP application to pass values from one page to another with validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
Practical 12	Create a registration and login JSP application to register and authenticate the user using JDBC.
Practical 13	Create an html page with fields, eno, name, age, desg, salary. Now on submit this data to a JSP page which will update the employee table of database with matching eno.
Practical 14	Create a Currency Converter application using EJB.
Practical 15	Develop a Simple Room Reservation System Application Using EJB.

Course Code 25BUIT1P03	Course Title Practicals based upon 25BUIT5T03	Credits 02	No. of lectures 60

CO1	Develop and implement data analytics dashboards and predictive models using tools like Google Data Studio and Google Colab for tasks such as regression, classification, and clustering.	L3
CO2	Perform CRUD operations and advanced data manipulations using NoSQL databases such as MongoDB and Cassandra, including aggregation, indexing, and joining collections for meaningful insights.	L3
CO3	Analyze large datasets using Big Data technologies such as Hive, Pig, and MapReduce, performing queries, aggregations, and ETL workflows to extract patterns and summarize information.	L4
CO4	Design and develop end-to-end data processing pipelines integrating data analytics, NoSQL databases, and Big Data frameworks to solve real-world problems and generate actionable insights.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	-	2	1
CO2	3	2	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	3	-	3	2

Practical 1	Create a descriptive analytics dashboard using Google Data Studio for superstore data.
Practical 2	Implement logistic regression on the Iris dataset to classify flower species using google colab.
Practical 3	Build a linear regression model on California Housing dataset to predict house prices using google colab.
Practical 4	Perform K-Means clustering on customer segmentation dataset to group customers based on purchasing behavior using google colab.
Practical 5	Perform CRUD operations in MongoDB using MongoDB Atlas on student records dataset.
Practical 6	Use MongoDB Aggregation Pipeline to generate sales summaries from transaction data.
Practical 7	Create indexes in MongoDB and measure query performance improvement using explain().
Practical 8	Use MongoDB $lookup to join customers and order collections for combined reporting.
Practical 9	Create and query tables in Cassandra for an e-commerce orders dataset.
Practical 10	Work with Cassandra collections (Set/List/Map) to store and retrieve product attributes.
Practical 11	Create Hive tables and run DDL/DML queries on movie ratings dataset.
Practical 12	Perform aggregation queries in Hive to analyze average ratings by genre.
Practical 13	Implement an ETL workflow in Pig to filter, group, and count word occurrences in text data.
Practical 14	Implement MapReduce in Python to count word frequency in a given text corpus.

Course Code	Course Title	Credits	No. of lectures
23BUIT5T04	**Game Programming**	**02**	**30**

CO1	Recall and define the fundamental mathematical concepts for computer graphics, including Cartesian coordinates, vectors, matrices, transformations, projections, and basic GPU and DirectX terminology.	L1
CO2	Apply vector algebra, matrix transformations, and projection techniques to perform geometric transformations, lighting calculations, and back-face detection in 2D and 3D graphics.	L3
CO3	Explain the architecture and working of modern graphics systems, including GPU vs CPU architectures, DirectX 11 pipeline stages, rendering engines, and Unity engine components.	L2
CO4	Evaluate graphics pipelines, rendering engines, and XR technologies (VR, AR, MR) to justify appropriate tools, SDKs, and platforms for real-time graphics and immersive applications.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	1	1	1
CO2	3	2	2	1	2	1
CO3	3	2	3	1	1	1
CO4	3	3	3	1	2	2

Unit I	**Mathematics for Computer Graphics, DirectX Kick start:** **Cartesian Coordinate system:** The Cartesian XY-plane, Function Graphs, Geometric Shapes, Polygonal Shapes, Areas of Shapes, Theorem of Pythagoras in 2D, Coordinates, Theorem of Pythagoras in 3D, 3D Polygons. **Vectors:** Vector Manipulation, multiplying a Vector by a Scalar, Vector Addition and Subtraction, Position Vectors, Unit Vectors, Cartesian Vectors, Vector Multiplication, Scalar Product, Example of the Dot Product, The Dot Product in Lighting Calculations, The Dot Product in Back-Face Detection, The Vector Product, The Right-Hand Rule, deriving a Unit Normal Vector for a Triangle Areas, Calculating 2D Areas **Transformations:** 2D Transformations, Matrices, Homogeneous Coordinates, 3D Transformations, Change of Axes, Direction Cosines, rotating a Point about an Arbitrary Axis, Transforming Vectors, Determinants, Perspective Projection, Interpolation **DirectX:** Understanding GPU and GPU architectures. How they are different from CPU Architectures? Understanding how to solve by GPU?	**15** **[CO1, CO2, CO3]**
Unit II	**DirectX Pipeline and Programming:** **Introduction To DirectX 11:** COM, Textures and Resources Formats, The swap chain and Page flipping, Depth Buffering, Texture Resource Views, Multisampling Theory and MS in Direct3D, Feature Levels **Direct3D 11 Rendering Pipeline:** Overview, Input Assembler Stage (IA), Vertex Shader Stage (VS), The Tessellation Stage (TS), Geometry Shader Stage(GS), Pixel Shader Stage (PS), Output merger Stage (OM) Understanding Meshes or Objects, Texturing, Lighting, Blending. **Introduction to Rendering Engines:** Understanding the current market Rendering Engines. Understanding AR, VR and MR. Depth Mappers, Mobile Phones, Smart Glasses, HMD's **Unity Engine: Multi-platform publishing, VR + AR:** Introduction and	**15** **[CO2, CO3, CO4]**

	working in Unity, 2D, Graphics, Physics, Scripting, Animation, Timeline, Multiplayer and Networking, UI, Navigation and Path finding, XR, Publishing. **XR:** VR, AR, MR, Conceptual Differences. SDK, Devices	

References:
1. Mathematics for Computer Graphics, John Vince, Springer-Verlag London, 5th Edition,2017
2. Mathematics for 3D Game Programming and Computer Graphic, Eric Lengyel, Delmar Cengage Learning, Delmar Cengage Learning,2011
3. Introduction To 3D Game Programming With Directx® 11,Frank D Luna, Mercury Learning And Information,2012.
4. https://docs.unity3d.com/Manual/index.html - Free

Course Code	Course Title	Credits	No. of lectures
23BUIT5PE1	**Advance Database Management Systems**	**02**	**30**

CO1	Identify and define the core concepts of Object-Oriented Databases, including object models, inheritance, polymorphism, and key features of object databases	L1
CO2	Explain and differentiate between RDBMS, OORDBMS, parallel databases, distributed databases, and their architectures, advantages, and limitations	L2
CO3	Apply database design concepts such as data partitioning, fragmentation, replication, and allocation to model parallel and distributed database systems.	L3
CO4	Evaluate and justify the selection of appropriate database systems and indexing techniques for multimedia and spatial database applications based on performance, scalability, and data complexity.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	1	1	1
CO2	3	2	2	1	1	1
CO3	3	3	2	1	2	1
CO4	3	3	3	1	2	2

Unit I	Concepts of Object-Oriented Databases, Key Features of Object Databases, Drawbacks of Object Databases, Object Model, Inheritance, Polymorphism Object-Oriented Relational Database Management System (OORDBMS), RDBMS and OORDBMS Parallel Database: Introduction, Three architectures shared memory, shared disk, shared nothing, Partitioning the data	**15 [CO1, CO2]**
Unit II	Distributed Database: Introduction, Data Fragmentation, Data Replication and Allocation. Multimedia Database: Requirement of Multimedia Database, Challenges of Multimedia Database, Application of Multimedia Database. Spatial Database: Spatial Database Concept, Spatial DBMS Data Models, Different Indexing Techniques	**15 [CO3, CO4]**

References:
  1. Principles of Distributed Database Systems. Author: M. Tamer Özsu
  2. Distributed System: Concepts, Design, and Applications Publisher: O, Reilly, Author: S.K.Singh
  3. Multimedia Database Management Systems, Author: Prabhakaran, Publisher: Springer
  4. Multimedia Database Management Systems, Author: Guojun Li
  5. Spatial Databases: With Application to GIS, by Michel O. Scholl
  6. Spatial Data Management by Nikos Mamoulis

Course Code 25BUIT5PE1	Course Title Practicals based upon 25BUIT5TE1	Credits 02	No. of lectures 60

CO1	Implement various database fragmentation techniques such as horizontal and vertical fragmentation, and create replicated databases to improve performance and reliability.	L3
CO2	Develop and manage specialized databases including temporal databases, active databases using triggers, OODBMS, and ORDBMS applications to handle complex data and operations.	L6
CO3	Retrieve and analyze spatial data from spatial databases and evaluate database designs for efficiency and accuracy.	L4
CO4	Design and implement XML-based applications to store, manipulate, and exchange structured data effectively across database systems.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	1	2	1
CO2	3	3	3	1	2	2
CO3	3	3	2	1	1	2
CO4	3	2	3	1	2	1

Practical 1	Horizontal fragmentation of database.
Practical 2	Vertical fragmentation of database
Practical 3	Creating Replica of database.
Practical 4	Create Temporal Database.
Practical 5	Implement Active database using Triggers
Practical 6	Create OODBMS Application
Practical 7	Create ORDBMS Application
Practical 8	Implement and retrieve records from a Spatial Database
Practical 9	XML Application

Course Code	Course Title	Credits	No. of lectures
23BUIT5TE2	**Real Time Embedded Systems**	**02**	**30**

CO1	Define and recall the concepts of firmware, bootloaders, memory management, and real-time task scheduling techniques in embedded and real-time systems	L1
CO2	Apply real-time task scheduling algorithms such as clock-driven, event-driven, earliest deadline first, and rate monotonic to manage tasks efficiently in real-time systems.	L3
CO3	Evaluate resource-sharing protocols and priority inversion handling mechanisms such as priority inheritance, priority ceiling, and highest locker protocols to ensure real-time task reliability and performance.	L5
CO4	Design and develop real-time communication systems over LANs and packet-switched networks with appropriate QoS frameworks, routing, and resource reservation strategies for soft and hard real-time requirements.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	1
CO2	3	3	2	-	2	2
CO3	3	3	2	-	2	2
CO4	3	3	3	-	3	2

Unit I	**Firmware** Firmware and Bootloader, Example: Sandstone **Memory Management** Moving from an MPU to an MMU, How Virtual Memory Works, Details of the ARM MMU, Page Tables, The Translation Lookaside Buffer, Domains and Memory Access Permission, The Caches and Write Buffer. **Real Time Task Scheduling** Types of real time task and their characteristics, Task Scheduling, Clock driven scheduling, Hybrid Schedulers, Event Driven Scheduling, Earliest Deadline first scheduling, Rate Monotic Algorithm.	**15 [CO1, CO2]**
Unit II	**Handling Resource Sharing and Dependencies** Resource sharing among real time task, Priority Inversion, Prioroty inheritance protpcol, Highest locker protocol, prioroty ceiling protocol, Different types of priority inversion Under PCP, Important features of PCP, Resource sharing Protocol, Handling Task Dependencies. **Real Time Communication** Basic Concept, Real Time Communication in Lan, Soft/Hard Real Time communication in a Lan, Bounded Access Protocol for Lans, Performance comparison, Real time communication over Packet Switched networks, QoS framework, Routing,Resource reservation, Rate Control, QoS Model-Integrated services and Differentiated Services.	**15 [CO3, CO4]**

References:
1. Real-Time Systems: Theory and Practice.   Rajib Mall First Pearson Publication
2. ARM system developer's guide: designing and optimizing system.(Ch-8,Ch-9,Ch-12, Ch-14) software/Andrew N. Sloss, Dominic Symes, Chris Wright. First Elsevier Publication
3. Embedded Systems Design   S. Heath Second Edition   Newnes Publication
4. Real-Time Systems: Theory and Practice.   Rajib Mall First Pearson Publication

Course Code 25BUIT5PE2	Course Title Practicals based upon 25BUIT5TE2	Credits 02	No. of lectures 60

CO1	Implement periodic and non-periodic task scheduling in real-time systems, handling timing constraints and jitter effectively.	L3
CO2	Manage shared resources among concurrent tasks using synchronization mechanisms like semaphores and mutexes to prevent race conditions and ensure data integrity.	L3
CO3	Implement and compare scheduling algorithms such as FIFO, Round Robin, and Rate Monotonic to evaluate system performance and task prioritization.	L4
CO4	Design and develop inter-process communication mechanisms using pipes, named pipes, mailboxes, and client-server sockets (TCP/UDP), demonstrating kernel-level and user-level communication concepts.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	-	2	2
CO2	3	3	2	-	3	2
CO3	3	3	2	-	2	2
CO4	3	3	3	-	3	2

Practical 1	Schedule a task periodically; after 5 min xyz task has to perform (Hint JITTER).
Practical 2	Schedule a task non periodically; no specific time stamp is set for any task.
Practical 3	Shared resources management using SEMAPHORE.
Practical 4	Shared resources management using MUTEX.
Practical 5	Implement scheduling algorithm FIFO.
Practical 6	Implement scheduling algorithm ROUND ROBIN.
Practical 7	Implement scheduling algorithm RATE MONOTONIC.
Practical 8	Implement Inter process communication (IPC) using NAMED PIPES.
Practical 9	IPC using simple PIPES.
Practical 10	IPC using MAIL BOXES.
Practical 11	Using Client Socket & Server Socket (UDP/TCP) maintain data received from client node.
Practical 12	Small demonstration of Kernel Level & User Level Communications

Course Code	Course Title	Credits	No. of lectures
23BUIT5VSC	**Enterprise Computing Methodologies**	**02**	**30**

CO1	Define and recall the concepts of ERP, CRM, SCM, and ASP, and describe the functional areas of information systems in organizations.	L1
CO2	Explain the development and implementation of ERP systems, including modules for manufacturing, marketing, production, materials management, accounting, finance, and human resources	L2
CO3	Use ERP and business modeling techniques to simulate organizational processes and support decision-making through tools such as spreadsheet modeling.	L3
CO4	Analyze the integration of ERP with the World Wide Web and e-commerce, evaluating how business solutions and organizational processes can be optimized using ERP systems.	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	2	1
CO2	3	2	2	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	3	-	2	2

Unit I	Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM), Application Service Provider (ASP), Review of Information Systems in an Organization: Functional Areas of Business, Business Processes	**15 [CO1, CO2]**
Unit II	The Development of Enterprise Resource Planning Systems: Manufacturing Roots of ERP, SAP, Marketing Information Systems, Production and Materials Management Information Systems, Accounting and Finance, Human Resources: PeopleSoft ERP and the World Wide Web: Business Solutions, E-Commerce Advanced Computer Business Modeling Techniques: Spreadsheet Modeling	**15 [CO3, CO4]**

References:
1. Concepts in Enterprise Resource Planning by Brady, Monk and Wagner, Course Technology, A division of Thomson Learning
2. Advanced Cases in MIS by Brady, & Monk, Course Technology, A division of Thomson Learning

Course Code 25BUIT5OJT	Course Title **ON-JOB TRAINING / FIELD PROJECT IN I.T.**	Credits 02	No. of hours 120

CO1	Apply theoretical knowledge in real workplace situations	L3
CO2	Demonstrate professional workplace skills and ethics	L3
CO3	Use industry tools, technologies, and procedures competently	L3
CO4	Evaluate work performance and identify areas for improvement	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	2	1
CO2	2	1	1	1	3	3
CO3	2	2	3	1	2	1
CO4	2	3	2	1	2	2

General Guidelines:
- The OJT/FP topic may be undertaken from any topic relevant to course
- Each of the learners must undertake an OJT/FP individually based on field-work/field-survey/laboratory work.
- Learners must remain presented at the time of review meeting scheduled by research guide.
- Structure of report should contain the following chapter: Title; Abstract; Aim, Objectives, and Rationale; Introduction and Review of Literature; Materials and Methodology; Observation and Result; Discussion and Conclusion; References.
- Learners should prepare a PowerPoint presentation (PPT) of research project and it should be presented in front of external examiner.
- Duly signed hard copy of report and PPT should be submitted to the Department
- In case of OJT, detail report of attendance, record and acknowledgement /certificate issued from the organization to be submitted in college.

Semester VI

Course Code	Course Title	Credits	No. of lectures
23BUIT6T01	**Business Intelligence**	**02**	**30**

CO1	Explain the concepts, architectures, and ethical considerations of Business Intelligence and Decision Support Systems, including the role of data, information, knowledge, and mathematical models in organizational decision making.	L2
CO2	Apply data preparation and data mining techniques such as validation, transformation, reduction, classification, and clustering to analyze business datasets.	L3
CO3	Apply analytical and optimization models including marketing, logistics, production, revenue management, and data envelopment analysis to support business and operational decisions.	L3
CO4	Evaluate the effectiveness of Business Intelligence, Knowledge Management, and Expert System solutions by assessing model performance, decision quality, efficiency, and organizational impact.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	2	3
CO2	3	3	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	3	-	2	3

Unit I	**Business intelligence:** Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence **Decision support systems:** Definition of system, Representation of the decision- making process, Evolution of information systems, Definition of decision support system, Development of a decision support system **Mathematical models for decision making:** Structure of mathematical models, Development of a model, Classes of models **Data mining:** Definition of data mining, Representation of input data, Data mining process, Analysis methodologies **Data preparation**: Data validation, Data transformation, Data reduction **Classification**: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines **Clustering:** Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models	**15 [CO1, CO2, CO3]**
Unit II	**Business intelligence applications**: **Marketing models:** Relational marketing, Sales force management **Logistic and production models:** Supply chain optimization, Optimization models for logistics planning, Revenue management systems. **Data envelopment analysis:** Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices **Knowledge Management:** Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management Artificial	**15 [CO2, CO3, CO4]**

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 by Carlo Vercellis, Wiley First Edition 2009.
2. Decision support and Business Intelligence Systems Efraim Turban, Ramesh Sharda, Dursun Delen Pearson Ninth Edition 2011.
3. Fundamental of Business Intelligence Grossmann W, Rinderle-Ma Springer First Edition 2015

Course Code		Course Title		Credits	No. of lectures
23BUIT6T02		**Knowledge Based Systems**		**02**	**30**

CO1	Explain fundamentals of Artificial Intelligence, its history, foundations, applications, and the architecture and functioning of expert systems.	L2
CO2	Apply expert system concepts such as rule-based systems, blackboard systems, truth maintenance systems, and expert system shells to model and solve domain-specific problems.	L3
CO3	Explain concepts of intelligent agents, machine learning, agent architectures, single, multi-agent systems, learning paradigms, machine learning models.	L2
CO4	Apply machine learning paradigms and techniques such as supervised and unsupervised learning, feature selection, clustering, and support vector machines to analyze and solve real-world problems.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	2	2
CO2	3	3	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	3	-	2	3

Unit I	**Introduction to Artificial Intelligence**: History, foundation and Applications Expert System and Applications: Phases in Building Expert System, Expert System Architecture, Expert System versus Traditional Systems, Rule based Expert Systems, Blackboard Systems, Truth Maintenance System, Application of Expert Systems, Shells and Tools **Intelligent Agents**: Agents vs. software programs, classification of agents, working of an agent, single agent and multi-agent systems, performance evaluation, architecture, agent communication language, applications	**15** **[CO1, CO2]**
Unit II	**Introduction to Machine Learning**: Examples of Machine Learning Problems, Structure of Learning, learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, **Machine learning Models:** Geometric Models, Logical Models, and Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection. **Machine Learning Paradigms:** Machine Learning systems, supervised and un-supervised learning, inductive learning, deductive learning, clustering, support vector machines, cased based reasoning and learning.	**15** **[CO3, CO4]**

References:
Artificial Intelligence:
1. A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010.
2. Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press ,2017.
3. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017
4. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman,

Machine Learning:
1. The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press, 2015
2. Introduction to Statistical Machine Learning with Applications in R, Hastie, Tibshirani, Friedman, Springer 2nd Edition, 2015
3. Introduction to Machine Learning, Ethem Alpaydin, PHI, 2nd Edition, 2013

Course Code	Course Title	Credits	No. of lectures
23BUIT6T03	**Cryptography and Network Security**	**02**	**30**

CO1	Understand the fundamentals of security and basic categories of threats to computers and networks	L2
CO2	Understand basic cryptographic algorithms, message and web authentication and security issues	L2
CO3	Understand theory of fundamental cryptography encryption and decryption algorithms	L2
CO4	Understand various network security applications, IPSec, Firewall, IDS, Web Security, Email Security and Malicious software	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	1	1	2
CO2	3	2	2	1	1	2
CO3	3	2	1	1	1	2
CO4	3	2	3	1	2	3

Unit I	**Introduction to Security Concepts**, The need for Security, Security Approaches, Principles of Security, Types of Attacks **Cryptographic Techniques**, Plain text and Cipher Text, Substitution techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric key cryptography, Stenography, Key Range and Key Size, Possible types of attacks DES Algorithm, IDEA, RC4, RC5, Blowfish, RSA Algorithm, Digital Signatures	**15 [CO1, CO2]**
Unit II	Internet Security Protocols, SSL, TLS, SHTTP, SET, Email Security User Authentication Mechanism, Passwords, Biometric Authentication, Kerberos Network Security, TCP/IP Protocol, Firewalls, IP Security, VPN, Intrusion	**15 [CO3, CO4]**

References:
1. Cryptography and Network Security by Atul Kahate, 3rd Edition, McGraw Hill Education
2. Cryptography and Network Security by Behrouz Forouzan, Debdeep Mukhopadhyay, 2nd edition, McGraw Hill Education
3. Network Security, A Beginner's Guide by Eric Maiwald, 2nd Edition
4. Cryptography and Network Security by William Stallings, 5th Edition, Pearson

Course Code 25BUIT6P01	Course Title Practicals based upon 25BUIT6T01	Credits 02	No. of lectures 60

CO1	Perform extraction, transformation, and loading (ETL) processes to integrate data from multiple sources (Excel, SQL Server, Oracle) into a target database and construct a data warehouse.	L3
CO2	Design and implement OLAP cubes (ROLAP, MOLAP, HOLAP), create dimensions and fact tables, execute MDX queries, and analyze data using pivot tables and pivot charts in Microsoft Excel.	L6
CO3	Apply data mining techniques such as classification and clustering, and perform regression analysis (linear and logistic) on data warehouse datasets to extract insights and identify patterns.	L3
CO4	Perform "What-if" analysis, generate reports, and visualize data using dashboards, pivot charts, and other analytical tools to support decision-making based on warehouse and cube data.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	-	2	2
CO2	3	3	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	2	3	-	2	2

Practical 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 Adventure works, Northwind, foodmart etc.)
Practical 2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver.
Practical 3	Create the Data staging area for the selected database
Practical 4	Create the cube with suitable dimension and fact tables based on ROLAP, MOLAPand HOLAP model.
Practical 5	Create the ETL map and setup the schedule for execution.
Practical 6	Execute the MDX queries to extract the data from the datawarehouse
Practical 7	Import the datawarehouse data in Microsoft Excel and create the Pivot table andPivot Chart
Practical 8	Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart toperform data analysis
Practical 9	Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
Practical 10	Perform the data classification using classification algorithm.
Practical 11	Perform the data clustering using clustering algorithm.
Practical 12	Perform the Linear regression on the given data warehouse data.
Practical 13	Perform the logistic regression on the given data warehouse data.

Course Code 25BUIT6P02	Course Title Practicals Based upon 25BUIT6T02	Credits 02	No. of lectures 60

CO1	Recall and describe fundamental concepts of search algorithms, machine learning paradigms, hypothesis learning, regression models, dataset types, and basic Python libraries used in artificial intelligence and machine learning.	L1
CO2	Apply uninformed and informed search techniques such as Breadth First Search, Depth First Search, Hill Climbing, and A algorithms, and implement basic machine learning algorithms including Find-S, Candidate Elimination, and simple linear regression using Python	L2
CO3	Apply Python libraries such as NumPy, SciPy, Pandas, Matplotlib, and Seaborn to create, load, preprocess datasets, handle missing values and outliers, compute statistical measures, and visualize data through univariate and bivariate plots.	L3
CO4	Analyze datasets and machine learning models by interpreting regression coefficients, evaluating model performance using metrics such as R-squared and MSE, exploring feature relationships, and addressing issues such as feature selection and multicollinearity.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	1	-	-	-
CO2	3	3	2	-	2	-
CO3	2	3	3	1	1	-
CO4	2	3	2	-	1	2

Practical 1	Write a Program to Implement Breadth First Search.
Practical 2	Write a Program to Implement Depth First Search
Practical 3	Write a program to implement Hill Climbing Algorithm
Practical 4	Write a program to implement A* Algorithm
Practical 5	Write a program to implement Tic-Tac-Toe game
Practical 6	Implementation of Python basic Libraries such as Math, Numpy and Scipy
Practical 7	Implementation of Python Libraries for ML application such as Pandas andMatplotlib
Practical 8	Creation AND Loading different datasets in Python.
Practical 9	Write a python program to compute Mean, Median, Mode, Variance and Standard Deviation using Datasets
Practical 10	Implementation of Find S Algorithm
Practical 11	Implementation of Candidate elimination Algorithm
Practical 12	Write a program to implement simple Linear Regression and Plot the graph
Practical 13	Load a CSV dataset. Handle missing values, inconsistent formatting, and outliers
Practical 14	Load a dataset, calculate descriptive summary statistics, create visualizations using different graphs, and identify potential features and target variables Note: ExploreUnivariate and Bivariate graphs (Matplotlib) and Seaborn for visualization.
Practical 15	Create or Explore datasets to use all pre-processing routines like label encoding, scaling, and binarization.
Practical 16	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from CSV file and generate the final specific hypothesis. (Create your dataset)
Practical 17	Fit a linear regression model on a dataset. Interpret coefficients, make predictions, and evaluate performance using metrics like R-squared and MSE
Practical 18	Extend linear regression to multiple features. Handle feature selection and potential Multicollinearity

Course Code 25BUIT6P03	Course Title Practicals based upon 25BUIT6T03	Credits 02	No. of lectures 60

CO1	Recall and describe fundamental concepts of cryptography and network security, including substitution and transposition ciphers, symmetric and asymmetric encryption, hashing algorithms, key management, and firewall basics.	L3
CO2	Apply classical and modern cryptographic algorithms such as Caesar, Monoalphabetic, Vernam, Playfair, Rail Fence, Columnar Transposition, DES, AES, Diffie–Hellman, and MD5 to encrypt, decrypt, and secure data.	L6
CO3	Analyze the security strength, limitations, and use cases of different cryptographic techniques and key exchange mechanisms by comparing algorithm behavior, key sizes, and resistance to attacks.	L4
CO4	Evaluate and implement appropriate security mechanisms, including encryption algorithms and firewall configurations, to protect systems, applications, and network resources against security threats.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	-	2
CO2	3	2	2	-	2	2
CO3	2	3	1	-	1	3
CO4	2	3	2	-	2	3

Practical 1	Write programs to implement the following Substitution Cipher Techniques: Caesar Cipher
Practical 2	Write programs to implement the following Substitution Cipher Techniques: Monoalphabetic Cipher
Practical 3	Write programs to implement the following Substitution Cipher Techniques: Vernam Cipher
Practical 4	Write programs to implement the following Substitution Cipher Techniques: Playfair Cipher
Practical 5	Write programs to implement the following Transposition Cipher Techniques: Rail Fence Cipher
Practical 6	Write programs to implement the following Transposition Cipher Techniques: Simple Columnar Technique
Practical 7	Write program to encrypt and decrypt strings using: DES Algorithm
Practical 8	Write program to encrypt and decrypt strings using: AES Algorithm
Practical 9	Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.
Practical 10	Write a program to implement the MD5 algorithm compute the message digest.
Practical 11	Configure Windows Firewall to block: A port, A program, A website

Course Code	Course Title	Credits	No. of lectures
23BUIT6TE1	**Advanced Web Programming**	**02**	**30**

CO1	Define and recall the components of the .NET Framework, C# language basics, and ASP.NET architecture, including CLR, class libraries, namespaces, and web form fundamentals.	L1
CO2	Explain the use of classes, objects, namespaces, web controls, state management, and error handling techniques in developing .NET and ASP.NET applications.	L2
CO3	Analyze and implement data access, data binding, and XML operations using ADO.NET, Grid View, Details View, Form View, and other data controls to design dynamic and data-driven web applications.	L4
CO4	Evaluate security mechanisms, AJAX integration, and advanced web application features such as themes, master pages, and session management to enhance the performance, usability, and security of ASP.NET applications.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	1
CO2	3	2	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	3	-	2	3

Unit I	**Introducing .NET**: The .NET Framework, C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library. **The C# Language**: C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods. **Types, Objects, and Namespaces**: The Basics About Classes, Building a Basic Class, Value Types and Reference Types, Understanding Namespaces and Assemblies, Advanced Class Programming. **Web Form Fundamentals**: Writing Code, Using the Code-Behind Class, Adding Event Handlers, Understanding the Anatomy of an ASP.NET Application, Introducing Server Controls, Using the Page Class, Using Application Events, Configuring an ASP.NET Application. **Form Controls**: Stepping Up to Web Controls, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, Validation, Understanding Validation, Using the Validation Controls, Rich Controls, The Calendar, The AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls, Dynamic Graphics,The Chart Control, Website Navigation: Site Maps, URL Mapping and Routing, The SiteMapPath Control, The TreeView Control, The MenuControl. **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 ViewState, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using ApplicationState, Comparing State Management Options	**15** **[CO1, CO2, CO3]**
Unit II	**Styles, Themes, and Master Pages**: Styles, Themes, Master Page Basics, Advanced Master Pages, **ADO.NET Fundamentals**: Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access. **Data Binding**: Introducing Data Binding, Using Single-Value Data Binding,	**15** **[CO2, CO3, CO4]**

Using Repeated-Value Data Binding, Working with Data Source Controls, **The Data Controls**: The Grid View, Formatting the Grid View, selecting a Grid View Row, Editing with the Grid View, Sorting and Paging the Grid View, Using Grid View Templates, The Details View and Form View **XML**: XML Explained, The XML Classes, XML Validation, XML Display and Transforms.

Security Fundamentals: Understanding Security Requirements, Authentication and Authorization, Forms Authentication, Windows Authentication.

ASP.NET AJAX: Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.

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

Course Code 25BUIT6PE1	Course Title Practicals based upon 25BUIT6TE1	Credits 02	No. of lectures 60

CO1	Develop C# console and desktop applications to perform arithmetic operations, string manipulation, loops, conditional statements, and fundamental programming constructs.	L6
CO2	Implement object-oriented programming concepts such as classes, objects, inheritance, interfaces, function overloading, delegates, events, exception handling to design modular, reusable C# app.	L3
CO3	Design and implement ASP.NET web applications using web forms, server controls, navigation controls, validation controls, master pages, themes, and AJAX to create interactive and user-friendly interfaces.	L6
CO4	Develop data-driven ASP.NET applications using ADO.NET, SQL Server, data controls, disconnected data access, XML handling, and implement security features including authentication and authorization to support robust and secure web solutions.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	-	2	1
CO2	3	3	3	-	2	2
CO3	3	3	3	-	2	2
CO4	3	3	3	-	2	3

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

4.	**Working with Form Controls**
a.	Create a Registration form to demonstrate use of various Validation controls.
b.	Create Web Form to demonstrate use of Adrotator Control.
c.	Create Web Form to demonstrate use User Controls.
5.	**Working with Navigation, Beautification and Master page.**
a.	Create Web Form to demonstrate use of Website Navigation controls and Site Map.
b.	Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification.
c.	Create a web application to demonstrate various states of ASP.NET Pages.
6.	**Working with Database**
a.	Create a web application bind data in a multiline textbox by querying in another textbox.
b.	Create a web application to display records by using database.
c.	Demonstrate the use of Datalist link control.
7.	**Working with Database**
a.	Create a web application to display Databinding using dropdownlist control.
b.	Create a web application for to display the phone no of an author using database.
c.	Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).
8.	**Working with data controls**
a.	Create a web application to demonstrate various uses and properties of SqlDataSource.
b.	Create a web application to demonstrate data binding using DetailsView and FormView Control.
c.	Create a web application to display Using Disconnected Data Access and Databinding using GridView.
9.	**Working with GridView control**
a.	Create a web application to demonstrate use of GridView control template and GridView hyperlink.
b.	Create a web application to demonstrate use of GridView button column and GridView events.
c.	Create a web application to demonstrate GridView paging and Creating own table format using GridView.
10.	**Working with AJAX and XML**
a.	Create a web application to demonstrate reading and writing operation with XML.
b.	Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization properties.
c.	Create a web application to demonstrate use of various Ajax controls.

Course Code	Course Title	Credits	No. of lectures
23BUIT6TE2	**Cloud Technology**	**02**	**30**

CO1	Define cloud computing, describe its key characteristics, and summarize the history and evolution of cloud technology.	L1
CO2	Recall different cloud deployment models (public, private, hybrid, community) and service models (IaaS, PaaS, SaaS, FaaS), and identify the advantages and challenges of adopting cloud computing.	L1
CO3	Explain virtualization technologies, compare VMs and containers, describe cloud storage types, load balancing, high availability, disaster recovery, and cloud networking concepts including VPCs, CDNs, and networking services.	L2
CO4	Apply cloud security principles, identify security threats and risks, implement best practices including identity and access management and encryption, and analyze compliance requirements for secure cloud deployment.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2	-	1	1
CO2	3	1	2	-	1	1
CO3	3	2	3	-	2	2
CO4	3	2	3	-	2	3

Unit I	**Cloud Computing Fundamentals:** Definition and Key Characteristics, Understanding the core principles and defining features of cloud computing. History and Evolution: Tracing the development of cloud technology over time. Benefits and Challenges: Examining the advantages and disadvantages of adopting cloud computing. Deployment Models: Exploring different deployment options, including public, private, hybrid, and community clouds. Service Models: Understanding the different cloud service models (IaaS, PaaS, SaaS, FaaS) and their applications. **Virtualization and Cloud Infrastructure:** Virtualization Technologies: Introduction to virtualization concepts and technologies like VMware, Hyper-V, and KVM. Virtual Machines (VMs) vs. Containers: Comparing and contrasting VM and container technologies like Docker and Kubernetes. Cloud Storage: Exploring different types of cloud storage (block, object, file) and their uses. Load Balancing, High Availability, and Disaster Recovery: Understanding these essential concepts for building robust and reliable cloud infrastructures.	**15 [CO1, CO2, CO3]**
Unit II	**Cloud Security:** Cloud Security Fundamentals: Principles of cloud security, including confidentiality, integrity, and availability. Security Threats and Risks: Identifying common security threats and vulnerabilities in cloud environments. Cloud Security Best Practices: Learning about security policies, identity and access management, and encryption. Compliance and Regulations: Understanding industry regulations and standards for cloud security. **Cloud Networking:** Virtual Networking: Exploring concepts like Virtual Private Clouds (VPCs), load balancing, and content delivery networks (CDNs). Cloud Networking Services: Understanding networking services offered by cloud providers. Network Security: Implementing security measures for cloud networks.	**15 [CO2, CO3, CO4]**

References: 1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, MK Publication.
2. Cloud Computing by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, Prentice Hall

Course Code	Course Title	Credits	No. of lectures
23BPIT6PE2	**Practicals Based on 6TE2**	**02**	**60**

CO1	Apply server virtualization technologies by implementing and configuring VMware ESXi, XEN, and Hyper-V environments for effective resource utilization.	L3
CO2	Analyze and manage virtualized infrastructures using tools such as vCenter Server and Xen Center, and evaluate blade server architectures using Cisco UCS/HP EVA simulators.	L4
CO3	Analyze system reliability and availability by implementing Windows Server 2012, configuring failover clustering, and assessing fault-tolerance mechanisms.	L4
CO4	Evaluate and implement distributed computing solutions by developing web services and applying RMI, RPC, and socket programming for efficient network-based communication.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	1	3
CO2	3	2	2	-	1	3
CO3	3	2	1	-	1	3
CO4	3	2	2	-	2	3

Practical 1	Implement vmware ESXi,for server virtualization
Practical 2	Implement XEN for server virtualization
Practical 3	Implement Hyper-V server virtualization using Windows Server 2k12
Practical 4	Manage vmware ESXi with vCentre server
Practical 5	Manage Xen server Xen center
Practical 6	Understanding blade server with cisco UCS/HP eva simulator
Practical 7	Installation of Windows Server 2k12
Practical 8	Implement Failover cluster using Windows Server 2k12
Practical 9	Show the implementation of web services
Practical 10	Implementation of RMI, RPC and Socket Programming

Course Code	Course Title	Credits	No. of lectures
23BUIT6IKS	**Indian Knowledge and Technology**	**02**	**30**

CO1	Recall and list the key concepts of Indian Knowledge Systems (IKS), including ancient mathematical systems, logic traditions, early computational devices, and their relationship with modern Information Technology.	L1
CO2	Explain the relevance of ancient Indian mathematical foundations, such as the decimal system, zero, binary concepts, Sulba Sutras, and classical algorithms, in the development of modern computing and algorithmic thinking.	L2
CO3	Describe the principles of Indian logic and reasoning systems, including Nyaya logic, Arthashastra strategies, and syllogistic reasoning, and explain their influence on programming paradigms, artificial intelligence, and decision systems.	L2
CO4	Explain the contribution of Indian Knowledge Systems to emerging technologies, including AI, machine learning, cryptography, combinatorics, and knowledge preservation through digitization and cloud computing.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	2
CO2	3	3	1	1	1	2
CO3	3	3	2	1	1	3
CO4	3	3	3	2	1	3

Unit I	**Introduction**: Overview of Indian Knowledge Systems (IKS), Relation Between Indian Knowledge Systems and Information Technology **Mathematical foundations in ancient India and its relevance to IT**: Evolution of Decimal System, Binary systems and Zero, Sulba Sutras and early algorithmic geometry, Aryabhata's Algorithm for Square Roots and algorithmic thinking **Indian Logic and Its Application in IT**: Basic principles of Nyaya logic and Inference systems, Kautilya's Arthashastra: Algorithmic Thinking and Strategy, Influence of Indian syllogism and deductive reasoning on modern programming languages and AI decision systems	**15** **[CO1, CO2]**
Unit II	**AI and ML in ancient India:** Automata and Artificial Entities in Indian Mythology, Cognitive Models and Simulated Learning in Vedanta and Yoga, Aryabhata's and Madhava's Prediction and Data-Driven Models, Pattern Recognition and Classification in Ancient India **Mechanical Devices and early computing applications:** The Antikythera Mechanism, Indian Astronomy and Early Computational Models, Early Forms of Cryptography and Logic, Chaturanga, Abacus, Combinatorics and recursion **Present, Innovations and Future Directions:** Role of digitization, cloud computing, and knowledge management systems in preserving traditional knowledge, Bridging the Gap: Ancient Knowledge and Modern IT, Integration of IKS with emerging technologies	**15** **[CO1, CO3, CO4]**

References:
1. A Modern Introduction to Ancient Indian Mathematics**,** T. S. Bhanu Murthy, New Age International (P), Limited. First Edition, 1992
2. https://www.researchgate.net/publication/383541219_Sanskrit's_Role_in_Advancing_AI_A_Comprehensive_Study
3. Computing Science in Ancient India, T.R.N Rao and Subhash Kak, Center for Advanced Computer Studies, University of Southwestern Louisiana, First Edition, 1998

Course Code	Course Title	Credits	No. of lectures
25BUIT6VSC	**Internet of Things**	**02**	**30**

CO1	Explain IoT concepts including architecture, physical and logical design, enabling technologies, IoT stack, and major application domains.	L2
CO2	Apply sensor, actuator, and networking fundamentals to interface IoT hardware with network devices using TCP/IP, IPv6, and socket-based communication.	L3
CO3	Implement wireless communication and IoT protocols such as MQTT, CoAP, and HTTP/HTTPS to enable data exchange in IoT systems.	L3
CO4	Evaluate IoT cloud platforms and communication technologies with respect to scalability, security, data management, and suitability for real-world IoT applications.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	1	1
CO2	3	3	3	1	2	1
CO3	3	3	3	1	2	1
CO4	3	3	3	2	2	2

Unit I	IoT Introduction and Concepts: IoT Architecture, Physical &Logical IoT design Basics, IoT Enabling Technologies, IoT Stack, IoT Applications Sensors & Actuators: Sensor working, Sensor Characteristics, Types of sensors and working principle, Sensors used in IoT Networking Fundamentals: TCP/IP Basics, IPV6, Network devices and configurations, Web servers and Socket programming	**15** **[CO1, CO2, CO3]**
Unit II	Wirelessfor IoT: Overview of Wireless Sensor Networks, IEEE standards for IoT, Overview of Wireless Modems(RF, GSM/GPRS, Bluetooth, RFID, Wi-Fi etc.) IoT Protocols: IoT Protocol overview, MQTT, COAP, HTTP/HTTPS Cloud platforms for IoT: IoT dashboards, Introduction to various cloud platforms, Device and data management from Cloud Platforms, Uploading data from hardware platforms to cloud	**15** **[CO2, CO3, CO4]**

References:

1. Internet of Things – A hands on Approach, ArshdeepBahga, Vijay Madisetti, University Press 2015
2. Designing the Internet of Things by Adrian McEwen, Hakim Cassimally, John Wiley

Course Code	Course Title	Credits	No. of hours
25BUIT6OJT	**ON-JOB TRAINING / FIELD PROJECT IN Computer Science**	**02**	**120**

CO1	Apply theoretical knowledge in real workplace situations	L3
CO2	Demonstrate professional workplace skills and ethics	L3
CO3	Use industry tools, technologies, and procedures competently	L3
CO4	Evaluate work performance and identify areas for improvement	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	2	1
CO2	2	1	1	1	3	3
CO3	2	2	3	1	2	1
CO4	2	3	2	1	2	2

General Guidelines:

- The OJT/FP topic may be undertaken from any topic relevant to course
- Each of the learners must undertake an OJT/FP individually based on field-work/field-survey/laboratory work.

- Learners must remain presented at the time of review meeting scheduled by research guide.
- Structure of report should contain the following chapter: Title; Abstract; Aim, Objectives, and Rationale; Introduction and Review of Literature; Materials and Methodology; Observation and

  Result; Discussion and Conclusion; References.

- Learners should prepare a PowerPoint presentation (PPT) of research project and it should be presented in front of external examiner.

- Duly signed hard copy of report and PPT should be submitted to the Department
- In case of OJT, detail report of attendance, record and acknowledgement /certificate issued from the organization to be submitted in college.

Evaluation and Examination Scheme

Evaluation Scheme 30:20
Internals Based on Unit 1 / Unit 2 / Unit 3/ Unit 4

Assignments/ Tutorials/Class Test	Seminar or any other activities	Active Participation & Leadership qualities	Total
10	05	05	20

Suggested Format for Mandatory Question paper

Duration: 1.30Hours   **Total Marks: 30**

N. B.:   1. All the questions are compulsory
2. Figures to the right indicate full marks.
3. Answer to the same question must be written together.
4.Use of non-programmable calculator is allowed.

Q.1   Attempt any Two   8
(A)
(B)
(C)
(D)
Q.2   (A)   Attempt any One   4
i)
ii)
(B)   Attempt any One   3
i)
ii)
Q.3   Attempt any Two   8
(A)
(B)
(C)
(D)
Q.4 (A) Attempt any One   4
i)
ii)
(B) Attempt any One   3
i)
ii)

Semester End Practical Examination:
Practical examination of each paper for 50 marks will be held for 2 or 3 hours.

VPM's B. N. Bandodkar College of Science (Autonomous), Thane
Curriculum Structure for the Undergraduate Degree Programme T.Y.B.Sc. Information Technology

	Course Code	SEMESTER – V	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
		Course Title	EM	EN	SD	PE	GE	HV	ES
Major	25BUIT5T01	Geospatial Science	√	√	√				
Major	25BUIT5T02	Enterprise JAVA	√	√	√				
Major	25BUIT5T03	Data Analytics	√	√	√				
Major	25BUIT5P01	Geospatial Science Practical	√	√	√				
Major	25BUIT5P02	Enterprise JAVA Practical	√	√	√				
Major	25BUIT5P03	Data Analytics Practical	√	√	√				
MN	25BUIT5TMN	Game Programming	√	√	√				
E1	25BUIT5TE1	Advance Databases	√	√	√				
E1	25BUIT5PE1	Advance Databases Practical	√	√	√				
E2	25BUIT5TE2	Real Time Embedded Systems	√	√	√				
E2	25BUIT5PE2	Real Time Embedded Systems Practical	√	√	√				
VSC	25BUIT5VSC	Enterprise Computing Methodologies	√	√	√				
OJT	25BUIT5OJT	OJT in IT – I	√	√	√		√	√	
FP	25BUIT5FPR	Field Project in IT - I	√	√	√		√	√	

	Course Code	SEMESTER – VI	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
		Course Title	EM	EN	SD	PE	GE	HV	ES
Major	25BUIT6T01	Business Intelligence	√	√	√				
	25BUIT6T02	Knowledge Based Systems	√	√	√				
	25BUIT6T03	Information and Network Security	√	√	√				
	25BUIT6P01	Business Intelligence Practical	√	√	√				
	25BUIT6P02	Knowledge Based Systems Practical	√	√	√				
	25BUIT6P03	Information and Network Security Practical	√	√	√				
DSE_E1	25BUIT6TE1	Advanced Web Programming	√	√	√				
	25BUIT6PE1	Advanced Web Programming Practical	√	√	√				
DSE_E2	25BUIT6TE2	Cloud Technology	√	√	√				
	25BUIT6PE2	Cloud Technology Practical	√	√	√				
IKS	25BUIT6IKS	Indian Knowledge and Technology	√	√	√	√	√		
VSC	25BUIT6VSC	Internet of Things	√	√	√				
OJT	25BUIT6OJT	OJT in I.T. – II	√	√	√		√		
FP	25BUIT6FPR	Field Project in I.T. – II	√	√	√		√		

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