# TUMKUR UNIVERSITY

## Board of Studies in Computer Science

## Curriculum Structure and Syllabus for V and VI Semesters

## Bachelor of Computer Applications in Data Science (BCA DS)
## Choice Based Credit System

**2026 - 27 onwards**

## BOS in UG Computer Science Committee Members

| | | |
|---|---|---|
| 1. | **Dr. M. Basavanna**<br>**Professor & Chairman,**<br>Department of Studies in Computer Applications (MCA),<br>Davangere University, Davangere | Chairperson |
| 2. | **Dr. Kusuma Kumari B.M**<br>**Associate Professor**<br>Department of Studies and Research in Computer Applications, Tumkur University, Tumakuru | Member |
| 3. | **Dr. Ramani. R**<br>**Assistant Professor,**<br>Department of Computer Science,<br>University College of Science<br>Tumkur University, Tumakuru | Member |
| 4. | **Dr. M. Ravi Kumar**<br>**Professor**<br>Department of Computer Science<br>Kuvempu University, Shivamogga | Member |
| 5. | **Dr. Sheetalrani R.K**<br>**Assistant Professor**<br>Department of Computer Science & Applications<br>Karnataka State Akkamahadevi Women University,<br>Vijayapura. | Member |
| 6. | **Dr. Girija D. K**<br>**Associate Professor**<br>Department of Computer Science<br>Government First Grade College, Koratagere | Member |
| 7. | **Dr. Nagaraju K V.**<br>**Associate Professor**<br>Department of Computer Science<br>Government First Grade College for Womens, Tumkur. | Member |

**Special Thanks to:**

| | |
|---|---|
| 1. | **Capt. Ramalinga Reddy S**<br>Assistant Professor<br>Department of Computer Science<br>Sri Siddaganga Arts and Commerce Evening College Tumkur. |
| 2. | **Dr. Haridas S.**<br>Associate Professor<br>Department of Computer Science<br>Government First Grade College, Tumkur. |
| 3. | **Dr. Husna Sultana**<br>Associate Professor<br>Department of Computer Science<br>Government First Grade College, Tumkur. |
| 4. | **Dr. Prakash B.R**<br>Assistant Professor and HOD<br>Department of Computer Science<br>Government First Grade College, Tipatur. |
| 5. | **Sri. Mohan Kumar N**<br>Assistant Professor and HOD<br>Department of Computer Science<br>Y.E.R Government First Grade College, Pavagada. |
| 6. | **Dr. Manjunath S**<br>Assistant Professor,<br>Department of Computer Science<br>Y.E.R Government First Grade College, Pavagada. |
| 7. | **Kiran Kumar M**<br>Assistant Professor<br>Department of Computer Science<br>Government First Grade College, Tipatur. |
| 8. | **Mujtaba Farheen**<br>Assistant Professor<br>Department of Computer Science<br>Government First Grade College, Madhugiri. |
| 9. | **Harikumar M E**<br>Assistant Professor<br>Department of Computer Science<br>Government First Grade College, Madhugiri |

## Internal Assessment Marks for Theory and Practical

| Internal Assessment Marks Allotment for Theory | |
|---|---|
| Internal Test 1 | 05 |
| Internal Test 2 | 05 |
| Assignment | 05 |
| Seminar/Quiz | 05 |
| **TOTAL** | **20** |

| Internal Assessment Marks Allotment for Practical | |
|---|---|
| Internal Test | 05 |
| Record and Attendance | 05 |
| **TOTAL** | **10** |

| Internal Assessment Marks Allotment for V Semester SEC Paper | |
|---|---|
| Internal Test 1 | 05 |
| Internal Test 2 | |
| Assignment | 02 |
| Seminar/Quiz | 03 |
| **TOTAL** | **10** |

## Evaluation Scheme for Lab Examination

| Assessment Criteria | |
|---|---|
| Writing 2 Programs | **10** |
| Execution of 2 Programs | **20** |
| Viva | **10** |
| **Total** | **40 Marks** |

**SEMESTER – V**

| Sl. No | Paper | Title of the Paper | Instruction Hrs. per Week | No. of Credits : | Duration of the Exam. | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Internal Assessment | Semester End Exam. | Total |
| 1 | BCADSTA1-501 | Natural Language Processing | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 2 | BCADSTA2-502 | Business Intelligence with Power BI | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 3 | BCADSPA3-503 | Business Intelligence with Power BI Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 4 | BCADSTB1-504 | Software Engineering | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 5 | BCADSTB2-505 | Cloud Computing for Data Analysis | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 6 | BCADSPB3-506 | Mini Project | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 7 | BCADSTC1-507 | C # with Dot Net | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 8 | BCADSTC2-508 | Web Technology | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 9 | BCADSPC3-509 | Web Technology Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 10. | BCADSTSEC-510 | Cyber Law and Ethics | 3 | 2 | 1 1/2 Hrs. | 10 | 40 | 50 |
| **TOTAL** | | | 33 | **26** | | | | **800** |

**NOTE:**

**Theory: 1 Hr. = 1 Credit** **Practical: 2 Hrs. = 1 Credit**

**BCADST**: BCA Data Science Core Paper Theory
**BCADSP**: BCA Data Science Core Paper Practical

**SEMESTER – VI**

| Sl. No | Paper | Title of the Paper | Instruction Hrs. per Week | No. of Credits : | Duration of the Exam. | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Internal Assessment | Semester End Exam. | Total |
| 1 | BCADSTA1-601 | Deep Learning | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 2 | BCADSTA2-602 | Data Visualization | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 3 | BCADSPA3-603 | Data Visualization Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 4 | BCADSTB1-604 | Cryptography and Network Security | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 5 | BCADSTB2-605 | Big Data Analytics | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 6 | BCADSPB3-606 | Big Data Analytics Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 7 | BCADSTC1-607 | Generative AI | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 8 | BCADSTC2-608 | Blockchain Technology | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| 9 | BCADSPC3-609 | Major Project | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 10. | BCADSTSEC-610 | Research Methodology and Survey Project | 3 | 2 | 1 1/2 Hrs. | 10 | 40 | 50 |
| **TOTAL** | | | 33 | **26** | | | | **800** |

**NOTE:**
**Theory: 1 Hr. = 1 Credit** **Practical: 2 Hrs. = 1 Credit**

**BCADST**: BCA Data Science Core Paper Theory
**BCADSP**: BCA Data Science Core Paper Practical

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Natural Language Processing** | | | |
| Subject Code: | **BCADST A1-501** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. Analyze the natural language text.
2. Define the importance of natural language.
3. Understand the concepts Text mining.

**COURSE OUTCOMES :**

Upon completing the course, students demonstrate the following competencies:

1. Fundamental Application: Apply basic NLP concepts, grammar-based models, and statistical-based language models to real-world text.
2. Syntactic & Morphological Modeling: Parse natural language problems using context-free grammars and finite-state transductions.
3. Information Extraction & Sentiment Analysis: Build text classifiers (e.g., Naive Bayes) for sentiment analysis and extract knowledge roles from textual data.
4. Information Retrieval & Semantics: Apply lexical computational semantics (e.g., using WordNet) and classical information retrieval models.

| | | |
|---|---|---|
| **UNIT 1** | **Overview and language modeling** | **Hours 10** |
| | Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model. | |
| **UNIT 2** | **Word level and syntactic analysis** | **Hours 10** |
| | Word Level Analysis: Regular Expressions-Finite State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar Constituency- Parsing-Probabilistic Parsing. | |
| **UNIT 3** | **Extracting Relations from Text: From Word Sequences to Dependency Paths** | **Hours 10** |
| | Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience. | |

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| UNIT 4 | **Evaluating Self-Explanations in Istar** | **Hours 10** |
| | Evaluating Self-Explanations in iSTART:<br>Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures:<br>Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling:<br>Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining. | |
| UNIT 5 | **Information retrieval and lexical resources** | **Hours 08** |
| | Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net Stemmers-POS Tagger-Research Corpora. | |

**TEXT BOOK:**

1. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

**REFERENCE BOOKS:**

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Business Intelligence with Power BI** | | | |
| Subject Code: | **BCADST A2-502** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. Learn the fundamentals of Business intelligence.
2. Learn the concepts of OLTP and OLPA.
3. Learn the concepts of Powe BI.
4. Learn Power Query Editor.

**COURSE OUTCOMES:**

After completing this course, students will be able to:

1. Understand the fundamental concepts of Business Intelligence.
2. Understand Power BI.
3. Use Power Query Editor to transform a dataset.
4. How to use the Donut Chart.

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| **UNIT 1** | **Introduction to Business Intelligence** | **Hours 10** |
| | Introduction to Business Intelligence, Business Intelligence Architecture, Transaction Processing vs. Analytical Processing – Major Tools and Techniques of Business Intelligence, Business Intelligence Life Cycle, Role of Data Warehouse, Schema and its types- Star Schema and Snow Flake Schema, Ethics and Business Intelligence. | |
| **UNIT 2** | **Introduction to OLTP and OLAP** | **Hours 10** |
| | Introduction to OLTP and OLAP – Different OLAP Architectures-Data Models, Tools in Business Intelligence-Role of DSS, EIS, MIS and digital Dashboards – Need for Business Intelligence- Business Intelligence value chain-Components applications-roles and responsibilities. | |
| **UNIT 3** | **Introduction to Power BI** | **Hours 8** |
| | Introduction to Power BI : Power BI as a Business Intelligence Applications, Functions of Power BI, Power BI Components, Power BI Environment, Power BI query editor, Introduction to Power BI Dashboard, Dashboard Actions, Dashboard Report, BI Slicer. | |
| **UNIT 4** | **Introduction to DAX** | **Hours 10** |
| | Introduction to DAX; syntax structure, Data Types in DAX, DAX Calculation Types, steps to Create Calculated Columns, Measures in DAX, DAX Syntax, DAX Functions; SUM, AVERAGAE, COUNT, MIN, MAX, DAX Operators, DAX Tables and Filtering- IF, SWITCH, CALCULATE, FILTER, TOTALYTD, DATEDD, | |

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| | SAMEPERIODLASTYEAR | |
| UNIT 5 | **Data Connection in Power BI** | **Hours 10** |
| | Data Connection in Power BI, Understanding Power Query Editor, Loading data from an Excel file , Loading multiple CSV files from a folder , creating table in Power BI, Table formatting , Key Processing Indicators (KPI) , KPI Dashboard. | |

**TEXT BOOKS:**

1. Mastering in Power BI , BPB Publications , India
2. Business Intelligence : A Comprehensive Approach to Information Needs, Technologies and Culture , By Rimvydas Skyrius · 2021

**REFERENCE BOOKS:**

1. Business Intelligence and Applications , By Meenakshi Gupta
2. BUSINESS INTELLIGENCE AND ANALYTICS by Dr. Himanshu Gupta , Dr. Nisha Agarwal

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Business Intelligence with Power BI Lab** | | | |
| Subject Code: | **BCADSP A3-503** | CIE Marks: | 10 |
| No. of Hours/Week: | 4 | SEE Marks: | 40 |
| Total Hours: | 60 | Credits: | 2 |

## LIST OF LAB PROGRAMS

### PART - A

1. Installation and setup of Power BI
2. Import a dataset from an Excel file and clean the data by removing duplicates and handling missing values.
3. Use Power Query Editor to transform a dataset, such as splitting columns, merging tables, or changing data types.
4. Create a bar chart to show the total sales by region.
5. Create a line chart to display the trend of sales over time.
6. Build a report that includes various visualizations, such as pie charts, bar charts, and tables, to analyze sales data.

### PART - B

1. Create a dashboard that combines several key performance indicators (KPIs) to give an overview of business performance.
2. Create a relationship between tables manually through Power BI.
3. Use the DAX expression to add a new column in the data source.
4. Use the Donut Chart for Profit Analysis.
5. Analyse the more profitable day from the sales analysis table using Bar Chart in Power BI.

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Software Engineering** | | | |
| Subject Code: | **BCADST B1-504** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. To Acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices.
2. To Develop proficiency in project management methodologies and strategic decision-making for successful software project execution.
3. To Master the art of software design, development, and testing to produce robust and efficient software solutions.

**COURSE OUTCOMES:**

At the end of the course students will be able to:

1. An ability to understand basic concepts of software engineering.
2. An ability to describe project management methodologies and strategic decision making for successful software project execution.
3. An ability to understand software design, development, and testing to produce robust and efficient software solutions.

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|---|---|---|
| **UNIT 1** | **Introduction** | **Hours 8** |
| | The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process. **Agile software development:** Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process. | |
| **UNIT 2** | **Software Requirements Engineering and Risk Management** | **Hours 10** |
| | **Software Requirements Engineering:** Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management. **Risk Management:** Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. | |

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| UNIT 3 | **Project Planning and Design** | **Hours 10** |
| | **Project Planning-** Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.<br>**Design:** Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams. | |
| UNIT 4 | **Testing and Metrics** | **Hours 10** |
| | **Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.<br>**Product Metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance. | |
| UNIT 5 | **Quality and Release Management** | **Hours 10** |
| | **Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.<br>**Release Management:** Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring.<br>**Product Sustenance:** Maintenance, updates, End of life, migration strategies. | |

**TEXT BOOKS:**

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering a Practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

**REFERENCE BOOKS:**

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Cloud Computing for Data Analysis** | | | |
| Subject Code: | **BCADST B2-505** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES**

1. To introduce the fundamental concepts, characteristics, service models, and deployment architectures of cloud computing and their relevance to data-centric and analytics workflows.
2. To explain the principles of virtualization, cloud infrastructure components, and hands-on management of virtual machines and containers.
3. To describe cloud storage types, database services, and data management strategies suited for large-scale data science applications.
4. To familiarise students with cloud-based machine learning platforms and managed AI services for scalable model training and evaluation.

**COURSE OUTCOMES**

1. Explain cloud computing concepts and identify suitable service and deployment models.
2. Configure virtual machines and understand virtualization techniques.
3. Apply cloud storage solutions to manage and query large datasets.
4. Use cloud platforms to build and train machine learning models.

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|---|---|---|
| **UNIT 1** | **Introduction to Cloud Computing** | **Hours 10** |
| | What is cloud computing definition and evolution, Characteristics: on demand, broad access, pooling, elasticity, metering; Cloud vs traditional computing (mainframe, grid, cluster), Service models: SaaS, PaaS, IaaS with everyday examples. Deployment models: public, private, hybrid, community. Advantages and limitations for data-centric workloads. Major cloud providers: AWS, Azure, GCP overview. Role of cloud in data science and analytics workflows. | |
| **UNIT 2** | **Virtualization and Cloud Infrastructure** | **Hours 10** |
| | Introduction to virtualization concept and need, Types: server, desktop, network, storage, application, data. Hypervisors Type 1 and Type 2, examples, Virtual Machines: creation, configuration, snapshots. Containers vs VMs Docker basics, Load balancing, autoscaling, and elasticity, Identity and Access Management (IAM) basics, Hands-on: create a VM on VMware / cloud console. | |
| **UNIT 3** | **Cloud Storage and Data Management** | **Hours 10** |
| | Cloud storage types: block, file, and object based, Use cases: backup, archiving, disaster recovery, delivery, Relational vs nonrelational (NoSQL) databases in cloud, Key value stores: features, limitations, examples (DynamoDB), Cloud data warehouse: AWS Redshift, GCP BigQuery, Batch vs streaming data for machine learning ,AWS S3: buckets, objects, versioning, access policies, Hands | |

| | | |
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| | on: upload and query a dataset using BigQuery | |
| **UNIT 4** | **Machine Learning on the Cloud** | **Hours 9** |
| | Why use cloud for ML scalability, cost, collaboration, AIaaS and GPUaaS types of managed ML services, Cloud ML platforms: AWS SageMaker, Azure ML Studio, GCP AutoML, Managed vs unmanaged ML environments, Feature engineering and data preparation in the cloud, Training a simple model on SageMaker notebook instance, Model evaluation metrics accuracy, precision, recall, F1, Petuned AI services: Vision API, Natural Language API | |
| **UNIT 5** | **Deploying and Monitoring Data Pipelines.** | **Hours 9** |
| | End-to-end ML project lifecycle on cloud, ETL vs ELT pipelines concepts and tools (Glue, Dataflow), Selecting a cloud ML platform decision criterion, Model deployment: REST endpoints, serverless (AWS Lambda), Monitoring deployed models drift, performance, retraining, Service Level Agreements (SLAs) and cloud billing basics, Data security, privacy, and compliance in analytics Microproject: build and deploy a simple end-to-end pipeline. | |

**TEXT BOOKS:**


1. Mastering Cloud Computing: Foundations and Applications Programming: Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi · Morgan Kaufmann / McGraw Hill · 2013
2. Cloud Computing: A HandsOn Approach Arshdeep Bahga & Vijay Madisetti · University Press (India) · 2014
3. Data Science on the Google Cloud Platform (2nd ed.): Valliappa Lakshmanan, Jordan Tigani · O'Reilly Media · 2022 · ISBN: 9781098118952
4. Machine Learning in the AWS Cloud: Abhishek Mishra · Wiley · 2019 · ISBN: 9781119556718


**REFERENCE BOOKS:**


1. Cloud Computing for Data Analysis: Noah Gift & Alfredo Deza · Pragmatic AI Labs · Available free online Open access book from Duke University instructors covering cloud native data analysis workflows with Python.
2. AWS Documentation & Tutorials (official): Amazon Web Services, docs.aws.amazon.com · Continuously updated, Official AWS getting started guides for EC2, S3, SageMaker, and Glue. SageMaker, Free
3. Google Cloud Skills Boost (Qwiklabs) Google Cloud · cloud skills boost. google · Free tier available, Handson labs covering BigQuery, Vertex AI, Cloud Storage and Dataflow.

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Mini Project** | | | |
| Subject Code: | **BCADSP B3-506** | CIE Marks: | 10 |
| No. of Hours/Week: | 4 | SEE Marks: | 40 |
| Total Hours: | 60 | Credits: | 2 |

1. Apply acquired knowledge in chosen technology for project development.
2. Identify and justify technical aspects of the chosen project systematically.
3. Reproduce, improve, and refine technical aspects for engineering projects.
4. Work individually or in a team to develop technical projects.
5. Communicate and report project activities and findings effectively.

**Project Planning**

The topic must be selected at the beginning of the V semester. Related reading, training and discussions of first internal project viva voce should be completed in the first week of the V Semester.

**Types of Project Work (Only Suggestive):** Real Life Problem Solution on Statistics, Visualization, Survey, NLP, Finance, Classification, Clustering, Health

**Team Selection**

- Team size: 3 to 5 members; a team leader must be selected.
- Meeting minutes must be maintained and included in the final project report.
- Tasks must be assigned to each member in writing.
- Each member must work on a separate module and submit an independent report.

**Tools & Platform**

No restrictions on platform, tools, or languages. Open-Source tools are strongly recommended. Tool selection does not affect evaluation.

**Documentation**

Final mini-project to be submitted as a report + code notebook.

Two copies of the project report must be submitted: one for the department library and one for the student. Format of report is as per the suggested format given in Major project

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: C# with Dot Net** | | | |
| Subject Code: | **BCADST C1-507** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. Understand the architecture and core components of the .NET Framework, including CLR, CTS, and CLS.
2. Develop C# programs using variables, data types, control structures, arrays, methods, and object-oriented programming concepts.
3. Apply object-oriented principles such as encapsulation, inheritance, polymorphism, abstraction, and interfaces to design efficient applications.
4. Design Windows-based graphical user interfaces and perform database connectivity using ADO.NET for real-world software development.

**COURSE OUTCOMES:**

At the end of the course, students will be able to:

1. Explain the architecture and features of the .NET Framework and write basic C# programs using appropriate language constructs and data types.
2. Develop modular C# applications using methods, arrays, strings, exception handling, delegates, and multithreading concepts.
3. Apply object-oriented programming principles including classes, objects, inheritance, polymorphism, abstraction, encapsulation, and interfaces to create reusable software components.
4. Design event-driven Windows Forms applications and implement database operations using ADO.NET to build simple desktop applications.

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to .NET Framework** | **Hours 10** |
| | Evolution of the .NET Framework and its applications. Features and advantages of the .NET Framework. Architecture of the .NET Framework. Components of the .NET Framework including Common Language Runtime (CLR), Common Type System (CTS), and Common Language Specification (CLS). Intermediate Language (IL) and Just-In-Time (JIT) compilation. Understanding the Common Type System (CTS) and Common Language Specification (CLS). Role and services provided by the Common Language Runtime (CLR). Overview of .NET-supported programming languages and the .NET Framework Class Library (FCL). | |
| **UNIT 2** | **Introduction to C#** | **Hours 12** |
| | **Basics of C # :** Introduction to C# and its features, need for C# in application development, structure of a C# console application, compilation and execution process, and C# preprocessor directives.<br>**Language fundamentals**: Identifiers, keywords, literals, constants, variables, data types, value types, reference types, implicit and explicit type conversions, boxing, and unboxing. | |

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| | **Operators and Expressions: A**rithmetic, relational, logical, assignment, and bitwise operators, operator precedence and associativity, null coalescing (??) operator, scope resolution (::) operator, and type checking using is and as operators.<br>**Control flow statements:** Selection statements (if, if-else, switch), iteration statements (for, while, do-while, foreach), and jump statements (break, continue, goto, return).<br>**Arrays and strings**: One-dimensional arrays, multidimensional arrays, jagged arrays, string manipulation, and the StringBuilder class.<br>**Methods: M**ethod declaration and invocation, method overloading, pass by value, pass by reference, output parameters (out), variable-length parameters (params), and command-line arguments. |
| **UNIT 3** | **Object-Oriented Programming in C# — Hours 10**<br>**Classes and Objects:** Namespaces, classes, and objects including creating classes and objects, use of this keyword, arrays of objects, nested classes, returning values from methods, and access modifiers.<br>**Static Members and Properties:** Static classes and static class members, read-only properties, and static properties.<br>**Encapsulation**: Data hiding, accessors and mutators, constructors, and constructor overloading.<br>**Inheritance:** Its concept and benefits, types of inheritance, base and derived classes, sealed classes, and sealed methods.<br>**Polymorphism**: Compile-time polymorphism (method overloading) and run-time polymorphism (method overriding).<br>**Abstraction and Interfaces**: Abstraction using abstract classes and abstract methods. Interfaces including interface syntax, implementation of interfaces, and multiple interface implementation.<br>**Exception handling: T**ypes of exceptions and the use of try, catch, finally, and throw statements, along with an introduction to custom exception handling. **Threads and delegates**: Including introduction to threads, main and child threads, thread life cycle, multithreading concepts, delegates, and their applications in C# programming. |
| **UNIT 4** | **Graphical User Interface with Visual C#.NET — Hours 08**<br>**Introduction to Windows Forms:** Windows forms applications and the Visual Studio IDE, including the menu bar, toolbar, Solution Explorer, Toolbox, Properties window, and integrated help feature.<br>**Windows Form Controls:** Design and development of Windows Forms using common controls such as Label, TextBox, Button, CheckBox, RadioButton, and ComboBox, along with control properties, layout management, and form design techniques.<br>**Event Handling:** Event-driven programming concepts including button click events, mouse event handling, keyboard event handling, and writing event handlers for user interactions.<br>**Dialogs and Menus:** Working with Windows dialog boxes, creating and managing menus using the Menu Strip control, and developing Multiple Document Interface (MDI) applications for desktop-based graphical user interfaces. |

| | Data Access with ADO.NET | Hours 08 |
|---|---|---|
| UNIT 5 | **Introduction to ADO.NET:** Architecture and components of ADO.NET, Connected and disconnected data models.<br>**Database Connectivity:** Creating connection strings, SQL Server database connections, ODBC data source connections, Opening and closing database connections.<br>**Command Objects:** Creating and executing command objects, Basic SQL command execution.<br>**Data Access Components:** DataAdapter, DataSet, Filling and updating data, managing disconnected data.<br>**Database Operations:** Retrieving records, Inserting, updating, and deleting data, best practices for connection management | |

**TEXT BOOKS:**

1. E. Balagurusamy, **Programming in C#**, 4th Edition, McGraw Hill Education (India), 2017. ISBN: 978-9352607251.
2. Paul Deitel and Harvey Deitel, **Visual C# 2012: How to Program**, 5th Edition, Pearson Education, 2014. ISBN: 978-0133379336.
3. Andrew Troelsen and Philip Japikse, **Pro C# 10 with .NET 6: Foundational Principles and Practices in Programming**, 11th Edition, Apress, 2022. ISBN: 978-1484278682.

**REFERENCE BOOKS:**

1. Arthur Gittleman, **Computing with C# and the .NET Framework**, 2nd Edition, Jones & Bartlett Learning, 2011. ISBN: 978-0763779704.
2. Joseph Albahari and Ben Albahari, **C# 12 in a Nutshell: The Definitive Reference**, O'Reilly Media, 2024. ISBN: 978-1098147442.
3. Mark J. Price, **C# 12 and .NET 8 – Modern Cross-Platform Development Fundamentals**, Packt Publishing, 2023. ISBN: 978-1837635872.

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Web Technology** | | | |
| Subject Code: | **BCADST C2-508** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. To understand the concepts and architecture of the World Wide Web, Markup languages along with Cascading Style Sheets.
2. To understand the concepts of event handling and data validation mechanisms.
3. To understand the concepts of embedded dynamic scripting on client and server side Internet Programming and basic full stack web development.
4. To develop modern interactive web applications.

**COURSE OUTCOMES:**

At the end of the course students will be able to:

1. Learn about WWW and webpage.
2. Understand domain and assigning name to them.
3. Understand basic web languages and its components.
4. Perform simple web page designing for practical exposure.

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| **UNIT 1** | **Basics of Internet and Web** | **Hours 10** |
| | **The basics of Internet**, World Wide Web, Web page, Home page, Web site, Static, Dynamic and Active web page, Overview of Protocols – Simple Mail Transfer Protocol, Gopher, Telnet, Emails, TFTP, Simple Network Management Protocol, Hyper Text Transfer Protocol, Client server computing concepts. **Working of Websites**, Webpages, Front End, Back End, Client and Server Scripting Languages, Responsive Web Designing, Types of Websites (Static and Dynamic Websites). Editors Downloading free Editors like Notepad++, Sublime Text Editor, making use of Editors, File creation and editing, saving. | |
| **UNIT 2** | **Introduction to HTML** | **Hours 10** |
| | Introduction to HTML, Essential Tags, Tags and Attributes, Text Styles and Text Arrangements, Text, Effects, Exposure to Various Tags (DIV, MARQUEE, NOBR, DFN, HR, LISTING, Comment, IMG), Color and Background of Web Pages, Lists and their Types, Attributes of Image Tag, Hypertext, Hyperlink and Hypermedia, Links, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Footnote and eMailing, Creating Table, Frame, Form and Style Sheet. Dynamic HTML, Document Object Model, Features of DHTML | |

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| UNIT 3 | **CSS** | **Hours 8** |
| | **CSS**: Introduction to CSS, Types of CSS, CSS Selectors: Universal Selector, ID selector, Tag Selector, Class Selector, Sub Selector, Attribute Selector, Group Selector, CSS Properties: Back Ground properties, Block Properties, Box properties, List properties, Border Properties, Positioning Properties, CSS Lists CSS Tables, CSS Menu Design CSS Image Gallery, CSS Framework Web Site Development using W3.CSS Framework, W3.CSS Intro, W3.CSS Colors, W3.CSS Containers, W3.CSS Panels, W3. CSS Borders, W3.CSS Fonts, W3.CSS Text, W3.CSS Tables, W3.CSS List, W3.CSS Images, W3.CSS Grid | |
| UNIT 4 | **Java Script** | **Hours 8** |
| | Introduction to Client Side Scripting Language, Literals , Operators, Data Types, Functions, Methods, Type Casting and Objects in JavaScript, Conditions Statements, JS Popup Boxes, JS Events, Basic Form Validations in JavaScript. Introduction to Angular JS: Expressions, Modules and Directives. Relating JavaScript to DHTML, Dynamically Changing Text, Style, and Content. | |
| UNIT 5 | **PHP** | **Hours 12** |
| | Server Side Programming , Introduction to PHP, Basic Programming Concepts of PHP: Variables, Data-types, Constants, Scope of Variables, Type of Variables, Type Casting, Operators, Operators Precedence, References, Arrays; Control Structures: Branching, If statement, Switch statement; Looping: for Loop, while Loop, do while Loop, for each Loop; Functions: User Defined Functions, Built-in Function, Functions for Variables; Script Controlling Functions, Array Functions, Date and Time Functions, Mathematical Functions, String Functions, PHP Server Variables; Working with form, Database Connectivity using PHP (CRUD Operations: Create, Read, Update, Delete).Building a simple dynamic web application such as Student Registration, Login System, or Employee Management System. | |

**TEXT BOOKS**:


1. **Kogent Learning Solutions Inc.** – *HTML5 Black Book*, Dreamtech Press.
   *Comprehensive guide covering HTML5, CSS3, JavaScript, and modern web development concepts.*
2. **Luke Welling & Laura Thomson** – *PHP and MySQL Web Development*, Addison-Wesley.
   *Well-known textbook for learning PHP programming and MySQL database integration.*
3. **Jon Duckett** – *HTML & CSS: Design and Build Websites*, Wiley.
   *Beginner-friendly book with visual explanations of HTML5 and CSS3 concepts.*
4. **Jon Duckett** – *JavaScript and jQuery: Interactive Front-End Web Development*, Wiley.
   *Covers JavaScript fundamentals and techniques for creating interactive web pages.*


**REFERENCE BOOKS**:


1. **Robin Nixon** – *Learning PHP, MySQL & JavaScript*, O'Reilly Media.
   *Practical reference for full-stack web application development using PHP and JavaScript.*

2. **David Flanagan –** *JavaScript: The Definitive Guide*, O'Reilly Media.
   *Authoritative reference covering modern JavaScript programming and browser APIs.*
3. **Elisabeth Robson & Eric Freeman –** *Head First HTML and CSS*, O'Reilly Media.
   *Concept-oriented book with hands-on examples for learning HTML and CSS*

| FIFTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Web Technology Lab** | | | |
| Subject Code: | **BCADSP C3-509** | CIE Marks: | 10 |
| No. of Hours/Week: | 4 | SEE Marks: | 40 |
| Total Hours: | 60 | Credits: | 2 |

## LIST OF LAB PROGRAMS
## PART - A

1. Design a personal portfolio webpage using HTML5 semantic elements, including profile photo, education, skills, hobbies, and contact information.
2. Create a student admission form using HTML5 with text boxes, radio buttons, checkboxes, date picker, email, password, file upload, and submit/reset buttons.
3. Develop a college timetable using HTML tables with row span, column span, captions, and styling.
4. Design a multimedia webpage by embedding images, audio, video, hyperlinks, and Google Maps or YouTube content.
5. Create a responsive webpage using CSS3, applying external style sheets, Flexbox/Grid layouts, colors, fonts, borders, and media queries.
6. Design a professional navigation menu with drop-down items and hover effects using CSS.
7. Develop a JavaScript calculator to perform addition, subtraction, multiplication, division, and modulus operations.
8. Create a JavaScript program to accept marks in five subjects and display total, percentage, grade, and pass/fail status.

## PART - B

1. Validate a registration form using JavaScript for mandatory fields, email format, mobile number, password strength, and confirmation password.
2. Create a digital clock and display the current date and time dynamically using JavaScript Date objects.
3. Demonstrate JavaScript arrays by performing insertion, deletion, searching, sorting, and reversing of student records.
4. Implement light mode and dark mode switching using JavaScript and DOM manipulation.
5. Dynamically modify webpage content, images, styles, and CSS classes in response to button clicks and user interactions.
6. Develop an interactive webpage demonstrating mouse events, keyboard events, and form events using JavaScript.
7. Create a PHP program to process an HTML form and display the submitted user information on another webpage.
8. Build a PHP-MySQL application to perform CRUD (Create, Read, Update, Delete) operations on a Student or Employee database.
9. Develop a secure user login system using PHP sessions and logout functionality.
10. Create a PHP application that uploads image or document files to the server and stores file details in a MySQL database.

| FIFTH SEMESTER - SEC | | | |
|---|---|---|---|
| **Subject Name: Cyber Law and Ethics** | | | |
| Subject Code: | **BCADST SEC-510** | CIE Marks: | 10 |
| No. of Hours/Week: | 3 | SEE Marks: | 40 |
| Total Hours: | 45 | Credits: | 2 |

**COURSE OBJECTIVES:**

1. Understand the fundamentals of cyber law, cyber ethics, and cyberspace governance.
2. Explain the provisions of the Information Technology Act and identify common cyber crimes and legal remedies.
3. Describe intellectual property rights and legal issues related to digital content and online activities.
4. Analyze legal and security aspects of e-commerce and electronic transactions.

**COURSE OUTCOMES:**

Upon completion of this course, students will be able to:

1. **Understand the fundamentals of cyber law and cyber ethics**, including the legal and ethical issues associated with the use of information and communication technologies.
2. **Familiarize themselves with the Information Technology Act and related legal frameworks**, enabling them to recognize cyber crimes, digital evidence, and legal responsibilities in cyberspace.
3. **Develop knowledge of intellectual property rights and electronic commerce laws**, including copyright, trademarks, patents, digital contracts, and online transactions.
4. **Analyze legal, social, and ethical challenges in emerging technologies** such as Artificial Intelligence, blockchain, and digital platforms, and understand the importance of responsible technology use.

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| **UNIT 1** | **Introduction to Cyber Law and Cyber Ethics** | **Hours 10** |
| | Evolution of computers and cyberspace, concept of cyber law, cyber jurisprudence, cyber ethics, cyber jurisdiction, hierarchy of courts, internet governance, domain names, web hosting, and legal aspects of cyberspace. | |
| **UNIT 2** | **Information Technology Act and Cyber Crimes** | **Hours 10** |
| | Overview of the Information Technology Act, 2000 and amendments, electronic records, digital signatures, cryptography, certifying authorities, electronic governance, cyber crimes and offences, penalties, adjudication, and liability of network service providers. | |
| **UNIT 3** | **Intellectual Property Rights and Legal Frameworks** | **Hours 10** |
| | Copyright, patents, trademarks, software protection, domain name disputes, database protection, relevant provisions of the Indian Evidence Act, Indian Penal Code, Civil and Criminal Procedure Codes, RBI regulations, employee internet usage policies, and online dispute resolution. | |

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| **UNIT 4** | **Electronic Commerce and Digital Transactions** | **Hours 08** |
| | Introduction to e-commerce, paperless contracts, e-commerce models (B2B, B2C), electronic payments, e-security, taxation issues, Electronic Data Interchange (EDI), supply chain management, digital markets, and emerging trends in electronic business. | |
| **UNIT 5** | **Emerging Technologies and Ethical Issues** | **Hours 07** |
| | Importance of cyber regulations and ethics, ethics in the information society, introduction to Artificial Intelligence ethics, fairness and accountability in AI, blockchain ethics, responsible use of digital technologies, privacy, and future challenges in cyberspace. | |

**TEXT BOOKS:**


1. **Kumar, K.** *Cyber Laws: Intellectual Property and E-Commerce Security*. Dominant Publishers and Distributors Pvt. Ltd., New Delhi.
2. **Stuckelberger, Christoph** and **Duggal, Pavan**. *Cyber Ethics 4.0: Serving Humanity with Values*. Globethics Publications, Geneva.
3. **Seth, Karnika**. *Computers, Internet and New Technology Laws: A Comprehensive Reference for Cyber Laws*. LexisNexis Butterworths Wadhwa, Nagpur.


**REFERENCE BOOKS:**


1. **NIIT**. *Information Security Policy and Implementation Issues*. Prentice Hall of India (PHI Learning), New Delhi.
2. **Verma, S. K.** and **Mittal, Raman**. *Legal Dimensions of Cyberspace*. Indian Law Institute, New Delhi.
3. **Rosenoer, Jonathan**. *Cyber Law: The Law of the Internet*. Springer-Verlag, New York.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Deep Learning** | | | |
| Subject Code: | **BCADST A1-601** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVE:**

1. To expose the student of this course from fundaments of neural networks to most advanced topics of the deep learning architectures.

**COURSE OUTCOMES:**

At the end of the course students will be able to:

1. Understand the types of neural networks with their topologies.
2. Understand and apply training of deep neural network architectures.
3. Understand and apply Radial Basis Function Networks.
4. Understand and apply Restricted Boltzmann Machines and recurrent networks.

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| **UNIT 1** | **Introduction to Neural Networks and Learning with Shallow Networks** | **Hours 10** |
| | The basic architecture of neural networks, training a neural network with back-propagation, Practical issues in neural network training, 8 Common neural network architectures, Neural architectures for binary classification models, Neural architectures for multiclass models, Backpropagated saliency for feature selection, Matrix factorization with Autoencoders, Word2Vec, Neural networks for graph embeddings. | |
| **UNIT 2** | **Training Deep Neural Networks and Teaching Deep Learners to Generalize** | **Hours 10** |
| | Back-propagation, Setup and initialization issues, The vanishing and exploding gradient problems, Gradient-descent strategies, Batch normalization, The bias-variance trade-off, Generalization issues in model tuning and evaluation, Penalty based regularization, Ensemble methods, Early stopping, Unsupervised pretraining, Continuation and Curriculum learning, Parameter sharing. | |
| **UNIT 3** | **Radial Basis Function (RBF) Networks** | **Hours 8** |
| | Training an RBF network, Variations and special cases of RBF networks, Relationship with kernel methods. | |
| **UNIT 4** | **Restricted Boltzmann Machines (RBM) Recurrent Neural Networks (RNNs)** | **Hours 10** |
| | Restricted Boltzmann Machines (RBM): Hopfield networks, The Boltzmann machine, Restricted Boltzmann Machines, Applications of | |

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| | Restricted Boltzmann Machines, Using RBMs beyond binary data types, Stacking RBMs. Recurrent Neural Networks (RNNs): The architecture of RNN, The challenges in training recurrent networks, Echo-state networks, Long Short-Term Memory (LSTM), Gated Recurrent UNITs (GRUs), Applications of RNN. | |
| **UNIT 5** | **Convolutional Neural Networks (CNN)<br>Deep Reinforcement Learning** | **Hours 10** |
| | Convolutional Neural Networks (CNN): The basic structure of Convolutional network, Training a Convolutional network, Case studies of Convolutional architectures, Visualization and unsupervised learning, Applications of CNN. Deep Reinforcement Learning: Stateless algorithms, The basic framework of reinforcement learning, Bootstrapping for value function training, Policy gradient methods, Monte Carlo tree search, Case studies of reinforcement learning. | |

**TEXT BOOK:**

1. Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer.

**REFERENCE BOOKS:**

1. Ian Goodfelllow, Yoshua Benjio, Aaron Courville, "Deep Learning", The MIT Press.
2. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", John Wiley & Sons Inc.
3. Richard S. Sutton, Andrew G. Barto, and Francis Bach, "Reinforcement Learning: An Introduction", MIT Press, ISBN 978-0262039246.
4. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, "Mathematics For Machine Learning", Cambridge University Press, ISBN 978-1108455145.
5. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, and Jonathan Taylor, "An Introduction to Statistical Learning: with Applications in Python", Springer Publication, ISBN 978-3031387463.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: DATA VISUALIZATION** | | | |
| Subject Code: | **BCADST A2-602** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. Understand the concepts, importance, and applications of data visualization.
2. Learn to create effective visual representations of data using modern visualization tools.
3. Develop skills in designing dashboards and communicating insights through data storytelling.
4. Apply visualization principles to analyze business and real-world datasets.
5. Build interactive reports and dashboards for decision-making.

**COURSE OUTCOMES:**

Upon successful completion of the course, students will be able to:

1. Explain the fundamentals and importance of data visualization in various domains.
2. Select suitable visualization techniques based on different data types and analytical needs.
3. Use tools such as Excel, Tableau, Power BI, or Python to create effective visualizations.
4. Design interactive dashboards and communicate insights through data storytelling.
5. Apply visualization best practices to solve real-world business and analytical problems.

| | **Fundamentals of Data Visualization** | **Hours 10** |
|---|---|---|
| **UNIT 1** | **Introduction to Data Visualization:** Definition and Importance of Data Visualization, History and Evolution of Data Visualization, Role of Visualization in Data Science and Analytics, Applications of Data Visualization in Business, Healthcare, Finance, Education, and Social Media.<br>**Understanding Data:** Types of Data: Numerical Data, Categorical Data, Ordinal Data, Temporal Data, and Geospatial Data. Structured, Semi-Structured, and Unstructured Data.<br>**Data Visualization Process:** Data Collection and Integration, Data Cleaning and Pre-processing, Exploratory Data Analysis (EDA), Visualization Design and Development, Interpretation and Communication of Insights.<br>**Challenges and Limitations:** Data Quality Issues, Visual Clutter and Information Overload, Bias and Misrepresentation, Ethical Considerations in Visualization. | |

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| UNIT 2 | **Visualization Tools and Data Storytelling** | **Hours 10** |
| | **Visualization Tools:** Overview of Visualization Software, Microsoft Excel for Data Visualization, Tableau Fundamentals, Power BI Fundamentals, Introduction to Python Visualization Ecosystem.<br>**Python Libraries for Visualization:** Matplotlib, Seaborn, Plotly, Bokeh.<br>**Data Storytelling:** Concept and Importance of Data Storytelling, Storytelling Frameworks, Building Narratives with Data, Audience-Centred Visualization Design.<br>**Dashboard Design:** Dashboard Components, KPI-Based Reporting, Interactive Dashboard Design, Best Practices for Dashboard Layout and User Experience. | |
| UNIT 3 | **Visualization Design Principles and Techniques** | **Hours 10** |
| | **Principles of Effective Visualization:** Simplicity and Clarity, Accuracy and Integrity, Consistency and Readability, Visual Hierarchy and Emphasis.<br>**Color Theory and Visual Perception:** Importance of Color in Visualization, Color Models and Color Schemes, Accessibility and Color-Blind Friendly Design, Psychological Effects of Colors.<br>**Chart Selection and Design:** Bar Charts, Column Charts, Line Charts, Area Charts, Pie and Donut Charts, Histograms, Box Plots.<br>**Data Modelling for Visualization:** Data Relationships, Data Aggregation, Dimensional Modelling Concepts, Data Transformation for Reporting. | |
| UNIT 4 | **Advanced Visualization and Interactive Dashboards** | **Hours 10** |
| | **Advanced Visualization Techniques:** Scatter Plots and Bubble Charts, Heat Maps, Tree Maps, Waterfall Charts, Funnel Charts, Radar Charts.<br>**Geospatial Visualization:** Maps and Spatial Analytics, Choropleth Maps, Geographical Dashboards, Location-Based Data Analysis.<br>**Interactive Visualizations:** Filters and Slicers, Drill-Down and Drill Through, Tooltips and Dynamic Labels, Interactive Reports and Dashboards.<br>**Dashboard Development:** Dashboard Planning and Design, KPI Visualization, Real-Time Dashboard Concepts, Dashboard Performance Optimization. | |
| UNIT 5 | **Data Visualization Applications and Emerging Trends** | **Hours 08** |
| | **Visualization for Data Science:** Exploratory Data Analysis (EDA), Feature Analysis and Selection, Data Pattern Discovery, Outlier Detection Visualization.<br>**Visualization in Machine Learning:** Confusion Matrix Visualization, ROC and Precision-Recall Curves, Feature Importance Visualization, Clustering and Classification Visualizations.<br>**Big Data Visualization:** Challenges in Visualizing Large Datasets, Streaming Data Visualization, Real-Time Analytics Dashboards.<br>**Emerging Trends:** AI-Assisted Visualization, Augmented Analytics, Self-Service Business Intelligence, Predictive and Prescriptive Analytics Visualization.<br>**Case Studies:** Healthcare Analytics Dashboard, Financial Market Visualization, Social Media Analytics, E-Commerce Sales Dashboard. | |

**TEXT BOOKS:**


1. **Cole Nussbaumer Knaflic** - *Storytelling with Data: A Data Visualization Guide for Business Professionals* - Wiley.
2. **Claus O. Wilke** - *Fundamentals of Data Visualization* - O'Reilly Media.
3. **Alberto Cairo** - *The Truthful Art: Data, Charts, and Maps for Communication* - New Riders.
4. **Steve Wexler, Jeffrey Shaffer & Andy Cotgreave** - *The Big Book of Dashboards* - Wiley.
5. **Mico Yuk & Kurt Buhler** - *Data Visualization for Dummies* - Wiley.


**REFERENCE BOOKS:**


1. **Cole Nussbaumer Knaflic** - *Storytelling with Data: Let's Practice!* - Wiley.
2. **Andy Kirk** - *Data Visualisation: A Handbook for Data Driven Design* - Sage Publications.
3. **Ben Jones** - *Communicating Data with Tableau* - O'Reilly Media.
4. **Marco Russo & Alberto Ferrari** - *Analyzing Data with Microsoft Power BI and Power Pivot for Excel* - Microsoft Press.
5. **Wayne Winston** - *Microsoft Excel Data Analysis and Business Modeling* - Microsoft Press.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Data Visualization Lab** | | | |
| Subject Code: | **BCADSP A3-603** | CIE Marks: | 10 |
| No of Hours/Week | 4 | SEE Marks: | 40 |
| Total Hours: | 60 | Credits: | 2 |

**LIST OF LAB PROGRAMS**
**PART - A**

1. Install Microsoft Power BI Desktop and explore its interface, including the Ribbon, Report View, Data View, and Model View.
2. Navigate the Power BI workspace by identifying the Report Canvas, Fields Pane, Visualizations Pane, and Filters Pane.
3. Import data from an Excel workbook and create a simple report using a table visualization.
4. Import data from a CSV file and compare it with data imported from Excel.
5. Connect Power BI to multiple data sources and combine them into a single report.
6. Create a basic report containing bar charts, tables, and slicers, and save the report file.

7. Use Power Query Editor to inspect and transform imported datasets.
8. Clean data by removing duplicate records and replacing or removing missing values.
9. Change data types, rename columns, split columns, and merge multiple columns using Power Query.
10. Merge two related tables using a common key and append multiple datasets into a single table.

**PART - B**

1. Create custom columns and calculated columns using Power Query and DAX expressions.
2. Create relationships between multiple tables and build a star schema data model.
3. Identify and resolve data inconsistencies by validating relationships and correcting data issues.
4. Create calculated columns and measures using DAX to compute totals, averages, and percentages.
5. Build a data model involving Customers, Products, and Sales tables and verify relationship behavior.
6. Create bar charts, column charts, line charts, pie charts, and area charts to visualize business data.
7. Format and customize visualizations by modifying colors, labels, titles, legends, tooltips, and themes.
8. Design an interactive dashboard by combining multiple visuals with slicers and filters.
9. Publish a Power BI report to the Power BI Service and create an online dashboard.
10. Share reports and dashboards with users, configure scheduled data refresh, and manage access permissions for collaborative reporting.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Cryptography and Network Security** | | | |
| Subject Code: | **BCADST B1-604** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. To understand the fundamental concepts of network security, types of threats, and the principles underlying secure communication.
2. To introduce classical and modern cryptographic techniques including substitution, transposition, symmetric, and asymmetric encryption methods.
3. To study block cipher design principles, Data Encryption Standard (DES), and Advanced Encryption Standard (AES) in depth.
4. To explain public key cryptography, RSA, key exchange protocols, digital signatures, message authentication, and user authentication mechanisms.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

1. Describe the need for network security, identify various types of attacks, and explain security principles and services.
2. Apply classical cryptographic techniques such as Caesar cipher, Playfair cipher, Rail Fence, and columnar transposition for encryption and decryption.
3. Analyse the structure and working of block ciphers, DES, and AES transformation functions.
4. Evaluate public key cryptosystems including RSA and Diffie-Hellman, and implement digital signature and user authentication mechanisms.

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| **UNIT 1** | **Foundations of Cyber Security and Network Protection** | **Hours 10** |
| | Introduction to cybersecurity and information security, security goals and the CIA Triad, authentication, authorization, and non-repudiation. Threats, vulnerabilities, risks, and attack surfaces. Malware including viruses, worms, Trojans, ransomware, and spyware. Network attacks such as phishing, spoofing, DoS/DDoS, man-in-the-middle attacks, and social engineering. Security models, defense-in-depth strategy, risk management, and emerging trends in cyber threats. | |
| **UNIT 2** | **Fundamentals of Cryptography and Secure Communication** | **Hours 10** |
| | Introduction to cryptography, cryptographic terminology, plaintext, ciphertext, encryption, decryption, and key management. Symmetric and asymmetric encryption concepts, cryptanalysis techniques, and brute-force attacks. Classical encryption methods including Caesar, Vigenère, Playfair, Rail Fence, and Columnar Transposition ciphers. Introduction to | |

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| | steganography, hybrid cryptography, and applications of cryptography in digital systems. | |
| UNIT 3 | **Modern Encryption Standards and Data Protection** | **Hours 9** |
| | Stream and block ciphers, Data Encryption Standard (DES), Triple DES, and Advanced Encryption Standard (AES). AES architecture, key expansion, encryption and decryption processes, and transformation functions. Secure key management practices and real-world applications of encryption in banking, cloud storage, e-commerce, IoT devices, and digital payments. | |
| UNIT 4 | **Public Key Infrastructure and Digital Trust** | **Hours 10** |
| | Principles of public key cryptography, RSA algorithm, Diffie-Hellman Key Exchange, and Elliptic Curve Cryptography (ECC). Cryptographic hash functions, SHA family, Message Authentication Codes (MAC), digital signatures, digital certificates, Public Key Infrastructure (PKI), blockchain fundamentals, and secure communication protocols. Applications in secure transactions and identity verification. | |
| UNIT 5 | **Network Security Technologies and Cyber Laws** | **Hours 9** |
| | Authentication mechanisms including passwords, biometrics, tokens, Kerberos, and Multi-Factor Authentication (MFA). Firewalls, Intrusion Detection and Prevention Systems (IDS/IPS), Virtual Private Networks (VPN), Zero Trust Architecture, cloud security, web security (HTTPS, SSL/TLS), wireless and mobile security, email security, and endpoint protection. Cybercrime, digital privacy, intellectual property rights, ethical hacking concepts, and the Information Technology Act (India) with current cybersecurity best practices. | |

**TEXT BOOKS:**


1. **William Stallings** – *Cryptography and Network Security: Principles and Practice*, Pearson.
2. **Charles P. Pfleeger & Shari Lawrence Pfleeger** – *Security in Computing*, Pearson.
3. **Nina Godbole & SUNIT Belapure** – *Cyber Security*, Wiley India.


**REFERENCE BOOKS:**


1. **Atul Kahate** – *Cryptography and Network Security*, McGraw Hill.
2. **Behrouz A. Forouzan & Debdeep Mukhopadhyay** – *Cryptography and Network Security*, McGraw Hill.
3. **Joseph Migga Kizza** – *Guide to Computer Network Security*, Springer.
4. **William Stallings & Lawrie Brown** – *Computer Security: Principles and Practice*, Pearson.
5. **Parag Diwan** – *Cyber Laws in India*, Allahabad Law Agency.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Big Data Analytics** | | | |
| Subject Code: | **BCADST B2-605** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. To understand the fundamentals of Big Data, its characteristics, and the architecture of Big Data systems.
2. To learn distributed data storage and processing using the Hadoop ecosystem and MapReduce programming.
3. To explore NoSQL databases and apply MongoDB for modern data management.
4. To develop data analytics solutions using Apache Spark and its SQL capabilities.
5. To apply text mining, web analytics, and recommendation system techniques for real-world data insights.

**COURSE OUTCOMES:**

**Upon completion of this course, students will be able to:**

1. Explain the types, characteristics, and challenges of Big Data and compare it with traditional data systems.
2. Utilize Hadoop ecosystem tools and implement MapReduce programs for distributed data processing.
3. Choose appropriate NoSQL data stores based on the CAP theorem and real-world business requirements.
4. Build data processing pipelines using Apache Spark, RDDs, and Spark SQL for scalable analytics.
5. Apply text mining, web analytics, and recommendation techniques to extract insights from large datasets.

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|---|---|---|
| **UNIT 1** | **Foundations of Big Data** | **Hours 10** |
| | **Types of Digital Data:** Classification of Digital Data.<br>**Introduction to Big Data:** What is Big Data? Definition of Big Data, Characteristics of Data, Evolution of Big Data, Challenges with Big Data, Architecture of Big Data Systems, Core Layers of Big Data, Service Layers, Differences between Traditional and Big Data Systems. Advantages and Challenges of Big Data<br>**Big Data Analytics:** What are Big Data Analytics? Classification of Analytics, Terminologies Used in Big Data Environments. | |
| **UNIT 2** | **Hadoop Ecosystem and MapReduce Programming** | **Hours 12** |
| | Hadoop: Introduction; What is Hadoop, Why Hadoop, Hadoop Goals, Hadoop Assumptions, Core Hadoop Components, Hadoop Common Package, Hadoop Distributed File System (HDFS), Processing Data with Hadoop, Yet Another Resource Negotiator (YARN), Hadoop Ecosystem; | |

| | | |
|---|---|---|
| | HBase, Hive, HCatalog, Pig, Sqoop, Oozie, Mahout, ZooKeeper. Physical Architecture, Hadoop Limitations; Security Concerns, Vulnerable by Nature, Not Fit for Small Data, Potential Stability Issues, General Limitations.<br>**Introduction to MAPREDUCE Programming:** Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. | |
| **UNIT 3** | **NoSQL Databases and Data Architectural Patterns** | **Hours 08** |
| | What is NoSQL, Learning Objectives, Why NoSQL, CAP Theorem, NoSQL Business Drivers, Volume, Velocity, Variability, Agility, NoSQL Case Studies; Amazon DynamoDB, Google's BigTable, MongoDB, Neo4j. NoSQL Data Architectural Patterns, Types of NoSQL Data Stores. | |
| **UNIT 4** | **MongoDB and Apache Spark Analytics** | **Hours 10** |
| | **Introduction to MongoDB:** What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.<br>**Introduction to Data Analysis with Spark:** What is a Apache Spark? A unified Spark, who uses Spark and for what? A Brief History of Spark, Spark version and releases, Storage layers for Spark.<br>**Programming with RDDs:** RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence.<br>**Spark SQL:** Linking with Spark SQL, Using Spark SQL in Applications, Loading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance. | |
| **UNIT 5** | **Web Mining, Text Analytics and Recommendation Systems** | **Hours 8** |
| | **Text, Web Content and Link Analytics:** Introduction, Text Mining, Web Mining, Web Content and Usage Analytics, Page Rank, Structure of Web and Analysing a Web Graph.<br>**Recommendation Systems:** Introduction, A Model for Recommendation Systems, Collaborative Filtering System and Content Based Recommendations | |

**TEXT BOOKS:**

1. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.

**REFERENCE BOOKS:**

1. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'Reilly Media, 2015.
3. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data

| SIXTH SEMESTER | | | |
|---|---|---|---|
| Subject Name: **Big Data Analytics Lab** | | | |
| Subject Code: | **BCADSP B3-606** | CIE Marks: | 10 |
| No. of Hours/Week: | 4 | SEE Marks: | 40 |
| Total Hours: | 60 | Credits: | 2 |

## LIST OF LAB PROGRAMS

### PART - A

1. Install, configure and run python, numPy and Pandas.
2. Install, configure and run Hadoop and HDFS.
3. Visualize data using basic plotting techniques in Python.
4. Use a dataset of customer product reviews (e.g., Amazon reviews) to classify the sentiment of each review as positive, negative, or neutral using a pre-trained machine learning model (e.g., Naïve Bayes). Evaluate the accuracy of your sentiment classifier. (use Python/R/any other tool).
5. Use text mining techniques to analyse a collection of news articles. Identify the most frequent terms and perform topic modelling using Latent Dirichlet Allocation (LDA) to find hidden topics within the articles. (use Python/R/any other tool).
6. Given a dataset representing a social network (e.g., Twitter follower data), create a graph and perform Social Network Analysis (SNA) to find the most influential users using centrality measures like degree, closeness, and betweenness centrality. (use Python/R/any other tool).

### PART - B

1. Using web scraping tools, extract the content from a set of web pages (e.g., news, blogs). Analyse the text to identify trends and topics. (use Python/R/any other tool).
2. Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB.
3. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
4. Implement word count / frequency programs using MapReduce.
5. Implement a MapReduce program that processes a dataset.
6. Implement clustering techniques using SPARK.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Generative AI** | | | |
| Subject Code: | **BCADST C1-607** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. Understand the core differences between traditional/discriminative AI and generative AI.
2. Master the basics of prompt engineering and interacting with Large Language Models (LLMs).
3. Explore the architecture and applications of image, audio, and video generation models.
4. Learn to build basic GenAI applications using frameworks like LangChain and Retrieval-Augmented Generation (RAG).

**COURSE OUTCOMES:**

1. Differentiate traditional discriminative AI from generative models.
2. Formulate effective prompts to interact with Large Language Models (LLMs)
3. Evaluate the architecture and use cases of multimodal models (image, audio, video).
4. Develop foundational Generative AI applications using APIs and vector databases.

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|---|---|---|
| **UNIT 1** | **Introduction to Generative AI** | **Hours 10** |
| | Introduction to Generative AI, What Is Generative AI? Components of AI, Domains of Generative AI, Text Generation, Image Generation, Audio Generation, Video Generation, Generative AI: Current Players and Their Models, Generative AI Applications | |
| **UNIT 2** | **Data Handling with Python** | **Hours 10** |
| | **Evolution of Neural Networks to Large Language Models:** Natural Language Processing Tokenization, N-grams, Language Representation and Embedding's, Probabilistic Models, Neural Network–Based Language Models, Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), Gated Recurrent UNIT (GRU) Encoder-Decoder Networks, Transformer, Large Language Models (LLMs). | |
| **UNIT 3** | **LLMs and Transformers** | **Hours 10** |
| | The Power of Language Models, Transformer Architecture, Motivation for Transformer, Architecture, Encoder-Decoder Architecture, Attention, Position-wise Feed-Forward Networks Advantages and Limitations of Transformer Architecture | |
| **UNIT 4** | **Prompt engineering** | **Hours 10** |

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|---|---|---|
| | Importance of prompt, prompt engineering process, setting objectives, prompt design, evaluation of responses, prompt refining, prompt templating, **Large Language Model Frame work**: Introduction, introduction to long chain, prototype; **Large language operations**: introduction to LLMOps**, LLMOps phase 1**- data preparation, model training and fine tuning, pre-training, AI alignment **LLMOps phase 2**- model serving, inference optimization. | |
| **UNIT 5** | **Addressing Ethical Considerations** | **Hours 08** |
| | Ethical norms and values in the context of generative AI, Investigating and minimizing bias in generative LLMs and generative image models, Constrained generation and eliciting trustworthy outcomes, Understanding jailbreaking and harmful behaviors | |

**TEXT BOOKS:**

1. Akshay Kulkarni, Adarsha Shivanaanda, Anoosh Kulkarni, Dilip Gudivada, "Applied Generative AI for Beginners" ISBN-13 (pbk): 978-1-4842-9993-7, apress publication, 2023(UNIT 1, 2,3,)

2. Karthikeyan Sabesan, Sivagamisundari, Nilip Dutta, "Generative AI for everyone" BPB Publications 2025 edition (UNIT 1, 4, 5)

3: Omar Sansevieria , Pedro Cuenca, Apolinário Passos, Jonathan Whitaker "Hands-On Generative AI with Transformers and Diffusion Models" O'Reilly Media, edition 2024 (UNIT 5)

**REFERENCE BOOKS:**

1. Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach" Second edition, Pearson Education 2013.

2. Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artificial Intelligence" Tata McGraw Hill 3rd Edition, 2013

3. Generative AI: Foundations, Models, and Applications by Munesh Chandra Trivedi, Nandita Goyal, and Ankit Srivastava. (Khanna Publishing House).

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Blockchain Technology** | | | |
| Subject Code: | **BCADST C2-608** | CIE Marks: | 20 |
| No. of Hours/Week: | 3 | SEE Marks: | 80 |
| Total Hours: | 48 | Credits: | 3 |

**COURSE OBJECTIVES:**

1. Introduce students to the foundational principles and historical evolution of blockchain technology and its disruptive potential in traditional business networks.
2. Develop a conceptual and working understanding of cryptographic primitives — including hash functions, digital signatures, and Merkle trees — that underpin blockchain security.
3. Explain the mechanisms of decentralized consensus, proof-of-work, and the incentive structures that sustain public blockchain networks such as Bitcoin.
4. Familiarize students with Bitcoin's transaction model, scripting language, block structure, and network operation.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to:

1. Explain the origin, evolution, and core architectural components of blockchain technology, and articulate its advantages over traditional centralised business networks.
2. Apply cryptographic concepts — including SHA-256 hashing, hash pointers, Merkle trees, and elliptic curve digital signatures — to describe how blockchain data integrity and identity are maintained.
3. Differentiate between centralised and decentralised systems, and demonstrate understanding of distributed consensus protocols and proof-of-work mechanisms.
4. Describe the structure and flow of Bitcoin transactions and blocks, interpret basic Bitcoin scripts, and explain how the Bitcoin peer-to-peer network operates.

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|---|---|---|
| **UNIT 1** | **Blockchain Fundamentals and Cryptography** | **Hours 12** |
| | Tracing Blockchain's Origin, traditional vs. distributed systems, Revolutionizing the Traditional Business Network, How Blockchain Works, What Makes a Blockchain Suitable for Business? **Introduction to Cryptography:** Cryptographic Hash Functions, SHA256, Hash Pointers and Data Structures, Merkle tree. | |
| **UNIT 2** | **Digital Signatures** | **Hours 10** |
| | Elliptic Curve Digital Signature Algorithm (ECDSA), Public Keys as Identities, A Simple Crypto currency model, Mechanics of Bit coin: Bitcoin transaction structure, Bitcoin scripts and their applications, Bitcoin blocks and network. | |

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|---|---|---|
| **UNIT 3** | **Centralization vs. Decentralization** | **Hours 10** |
| | Centralisation vs. decentralisation, distributed consensus, proof-of-work, The Task of Bit coin miners, Mining Hardware, Mining pools, Mining incentives and strategies. | |
| **UNIT 4** | **Storage of and Usage of Bit coins:** | **Hours 08** |
| | Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets. Anonymity basics, coin mixing, Zerocoin and Zerocash. | |
| **UNIT 5** | **Smart Contracts, Ethereum, and Blockchain Applications** | **Hours 8** |
| | Ethereum architecture, EVM and smart contracts, Solidity basics, DeFi and tokens (ERC-20), enterprise blockchains (Hyperledger Fabric overview), blockchain use cases across industries, regulatory and ethical considerations | |

**TEXT BOOKS:**

1. Blockchain Technology: From Theory to Practice Prof. Sudeep Tanwar (Senior Member, IEEE), Full Professor at Nirma University, Ahmedabad, authored this textbook published by Springer (2022).
2. Blockchain Technology Authored by Chandramouli Subramanian (Associate Director, Cognizant Technology Solutions, Chennai), Asha A George, Abhilash K A (Solution Architect, Bengaluru), and Meena Karthikeyan, and published by Universities Press (India) Private Limited, Hyderabad (2021).
3. Blockchain Technology By J. Indumathi, published by Oxford University Press India (2024).

**REFERENCE BOOKS:**

1. Mastering Blockchain- Imran Bashir, *Mastering Blockchain*, 4th Edition, Packt Publishing, 2023.
2. Blockchain Basics- Daniel Drescher, *Blockchain Basics: A Non-Technical Introduction in 25 Steps*, Apress, 2017.
3. Blockchain Revolution- Don Tapscott and Alex Tapscott, *Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business, and the World*, Portfolio, 2018.
4. Introducing Blockchain with Lisp-David R. Kopec, *Introducing Blockchain with Lisp: Implement and Extend Blockchains with the Racket Language*, Apress, 2019.

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Major Project** | | | |
| Subject Code: | **BCADSP C3-609** | CIE Marks: | 10 |
| No. of Hours/Week: | 4 | SEE Marks: | 40 |
| Total Hours: | 60 | Credits: | 2 |

## PROJECT GUIDELINES

**Project Instructions:**

- The aim of the Project work is to acquire practical knowledge on the implementation of the programming concepts studied.
- **Type of the Project**
  - ✓ The project report should be documented with scientific approach to the solution of the problem that the students have sought to address.
  - ✓ The majority of the students are expected to work on a latest real-life project.
  - ✓ The project 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.
  - ✓ Use the latest versions of the software packages for the development of the project.
- Project work may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea.
- Project should be carried out in batch with minimum of three and maximum of five students. Each member must work on a separate module and submit an independent report. Tasks must be assigned to each member in writing.
- Brief synopsis not more than two pages to be submitted during V semester in prescribed format by the team as per the format given.
- It is recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects.
- The student should also include the details from the project diary, in which they will record the meeting minutes, progress of their project throughout the course.
- The Project work should be compulsorily done in the College/ Software Industry /R&D Centres/ only under the supervision of the concerned department staff.
- Students should be encouraged to visit software industry to experience the real time environment.
- University Exam will be conducted as follows.
  Viva-voce will be conducted at the end of VI semester.
  Both the Examiners (50%+50%) should conduct the Viva-Voce Examination during practical exam session. Out of the 50 marks, 25 for Project Evaluation and 15 for Project

Report and 10 for Viva. For awarding a pass, a candidate should have obtained 40% of the Total marks.

- Report Preparation: The content of the Project report must be paid utmost attention, which is being submitted in partial fulfilment of the requirements of Degree. 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.
  - ✓ Paper: Report should be done on A4 Size paper
  - ✓ Text: Times new roman with 1.5-line spacing. Running text font is 12, Sub heading 14 pt. bold. Chapter Heading is 20 pts. Justified
  - ✓ Margins: Left margin 1.5, right, top, bottom is 1 inch. Header, footer, no page border
  - ✓ Fig: Tables, graph, diagrams should have respective number, caption and source.
  - ✓ Student shall maintain project diary and get signatures from both guide and department head.
  - ✓ Two copies of the project report must be submitted: one for the department library and one for the student.

**Recommended Chapter Sequence**

1. Cover Page
2. Inner Title Page
3. Original Copy of the Approved Proforma of the Project Proposal
4. Certificate of Authenticated work
5. Role and Responsibility Form
6. Certificate
7. Acknowledgement
8. Abstract
9. Table of Contents
10. List of Figures
11. List of Tables
12. Introduction
13. Literature Survey / Review
14. System Analysis & Design
15. Implementation / Methodology
16. Results & Discussion
17. Conclusion & Future Work
18. References
19. Appendices

| SIXTH SEMESTER | | | |
|---|---|---|---|
| **Subject Name: Research Methodology and Survey Project** | | | |
| Subject Code: | **BCADST SEC-610** | CIE Marks: | 10 |
| No. of Hours/Week: | 3 | SEE Marks: | 40 |
| Total Hours: | 45 | Credits: | 2 |

**COURSE OBJECTIVES:**

1. Understand the fundamental concepts, objectives, significance, and process of research.
2. Identify and formulate research problems, literature review and develop appropriate research designs.
3. Learn various methods of data collection and select suitable techniques for research studies.
4. Develop skills in research report writing, presentation, and documentation.

**COURSE OUTCOMES:**

**After studying this course, students will be able to:**

1. Explain research concepts, types, approaches, methodologies, and the importance of research in various domains.
2. Identify research problems, formulate objectives, literature review and design suitable research plans and sampling strategies.
3. Apply appropriate primary data collection methods such as observation, interviews, questionnaires, and schedules.
4. Prepare and present research reports following standard formats, ethical practices, and reporting guidelines.

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **Hours 10** |
| | Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. | |
| **UNIT 2** | **Research Problem and Literature Review** | **Hours 10** |
| | What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem Reviewing the literature: Place of the literature review in research, how to review the literature, searching the existing literature, reviewing the selected literature, writing about the literature reviewed. | |
| **UNIT 3** | **Research Design and Data Collection** | **Hours 10** |
| | Meaning of Research Design, Need for Research Design, Features of a Good Design, Steps in Sampling Design. Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules. | |

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|---|---|---|
| **UNIT 4** | **Report Writing** | **Hours 08** |
| | Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics and precautions for Writing a Research Report. | |
| **UNIT 5** | **Computer Role in Research** | **Hours 07** |
| | Introduction, The Computer and Computer Technology, The Computer System, Important Characteristics, Computer Applications, Computers and Researcher. | |

**TEXT BOOKS:**


1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018
2. Ranjit Kumar, Research Methodology- A step by step guide for beginners, Pearson Education, Australia, 2005
3. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students', Juta & Company, 1996.


**REFERENCE BOOKS:**


1. Robert P. Merges, Peter S. Menell and Mark A. Lemley, "Intellectual Property in New Technological Age", Aspen Publishers, 2016.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.


**Note: Students must prepare a survey Report (including Literature Review and Data Collection Details) on their major project topic and submit it to the concerned department for internal assessment of this subject. Five marks are allotted for this activity.**

| **Internal Assessment Marks Allotment for Research Methodology and Survey Project** | |
|---|---|
| Internal Test 1 | 03 |
| Internal Test 2 | |
| Assignment | 02 |
| Survey Report Submission | 05 |
| **TOTAL** | **10** |

**Question Paper Pattern for Semester End Examination (SEE)**
**(Common for V and VI Semester)**
**SUBJECT NAME**

**Time: 3 Hrs** **Max. Marks: 80**

**Instruction to Candidate: Answer all the Sections**

**SECTION A**

**I. Answer any ten of the following questions (10X2 = 20)**

**1.**
**2.**
**3.**
**4.**
**5.**
**6.**
**7.**
**8.**
**9.**
**10.**
**11.**
**12.**

**SECTION B**

**II. Answer any five of the following questions (5X5 = 25)**

**13.**
**14.**
**15.**
**16.**
**17.**
**18.**
**19.**

**SECTION C**

**III. Answer any five of the following questions (5X7 = 35)**

**20.**
**21.**
**22.**
**23.**
**24.**
**25.**
**26.**

**Question Paper Pattern for Semester End Examination (SEC)**
**(Common for V and VI Semester)**
**SUBJECT NAME**

**Time: 1 1/2 Hrs** **Max. Marks: 40**

**Instruction to Candidate: Answer all the Sections**

**SECTION A**

**I. Answer any ten of the following questions** **(10X2 = 20)**

**1.**
**2.**
**3.**
**4.**
**5.**
**6.**
**7.**
**8.**
**9.**
**10.**
**11.**
**12.**

**SECTION B**

**II. Answer any four of the following questions** **(4X5 = 20)**

**13.**
**14.**
**15.**
**16.**
**17.**
**18.**