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DAVANGERE UNIVERSITY

Syllabus for **Bachelor of Science (Computer Science)**

3rd and 4th Semester

[According to SEP (State Education Policy): 2024-25]

WEF: 2025-26 & onwards

DEPARTMENT OF STUDIES IN COMPUTER SCIENCE,

DAVANAGERE UNIVERSITY, DAVANAGERE – 577007

BOS Chairman
Dept. of Computer Science
Davangere University
Shivagangotri, Davangere

Dean
(Science & Technology)

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Davangere University
Shivagangotri, Davangere

Bachelor of Science(BSc[CS]) Semester Scheme curriculum structure for UnderGraduate(UG) Programme

Semester	Paper Code	Title of the Paper	Subject Category	Teaching Hours/Week	Semester End Exam	Internal Assessment	Total Marks	Credits	Examination Duration
3	24-MC-III	DataBase Management Systems	MC-T	04	80	20	100	03	3Hrs
	Practical-III	SQL Lab	MC-P	04	40	10	50	02	3Hrs
	Elective / Optional-1	i.Artificial Intelligence ii. Cyber Security iii. Computer Architecture	**Elective** (Candidates can select any one subject*)	04	80	20	100	03	3Hrs
	Total			**12**	**200**	**50**	**250**	**08**	--
4	24-MC-IV	Object Oriented Programming with Java	MC-T	04	80	20	100	03	3Hrs
	Practical-IV	Java Programming Lab	MC-P	04	40	10	50	02	3Hrs
	Elective / Optional-2	i. Deep Learning ii. Data Science iii. Theory of Computation	**Elective** (Candidates can select any one subject*)	04	80	20	100	03	3Hrs
	Total			**12**	**200**	**50**	**250**	**08**	--

*The minimum candidates required for each selection are determined by the Govt. orders.

BSc 3rd Semester		*DataBase Management Systems*	
Subject Code :	*24-MC-III*	*Total Teaching Hours :*	*56*
IA Marks :	*20*	*Teaching Hours/Week :*	*04*
Exam Marks :	*80*	*Examination Hours :*	*03*
Credits:	*3*		

Course Learning Objectives

1. Understand the Fundamentals of Database Systems: Gain a comprehensive understanding of the purpose, applications, and architecture of database systems, including the roles of database users and administrators.
2. Master the Relational Model and SQL: Develop proficiency in the structure of relational databases, relational algebra, and the use of SQL for data definition, querying, and manipulation.
3. Apply Database Design Principles: Learn to design databases using the Entity-Relationship (E-R) model, including identifying entities, relationships, and constraints, and translating them into relational schemas.
4. Evaluate and Optimize Relational Database Designs: Explore the principles of good relational design, normalization techniques, and functional dependencies to create efficient and reliable database structures.
5. Comprehend Transaction Management: Understand the concepts of transactions, including
6. Atomicity, durability, isolation, and serializability, and their role in maintaining database integrity.

Learning Outcomes

1. Explain Database Concepts: Students will be able to articulate the purpose, components, and historical evolution of database systems, as well as differentiate between various database languages and architectures.
2. Construct and Query Databases Using SQL: Students will demonstrate the ability to write SQL queries, define database schemas, and perform operations such as joins, set operations, and modifications while handling integrity constraints.
3. Design Effective Database Schemas: Students will create Entity-Relationship diagrams and map them to relational schemas, incorporating complex attributes, cardinalities, and primary keys effectively.
4. Normalize and Decompose Relational Designs: Students will apply normalization techniques and functional dependency theory to evaluate and refine database designs, ensuring they meet desired normal forms.
5. Analyze Transaction Properties: Students will assess transaction models and explain how atomicity, durability, and isolation contribute to reliable database operations.

Course Chapters:

1. **Introduction:** **14Hrs**

Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Design, Database Engine, Database and Application Architecture, Database Users and Administrators, History of Database Systems. **Relational Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, The Relational Algebra.

2. **SQL: :** **14Hrs**

Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, Authorization.

3. **Database Design Using the E-R Model: :** **14Hrs**

Overview of the Design Process, The Entity-Relationship Model, Complex Attributes, Mapping Cardinalities, Primary Key, Extended E-R Features, Entity-Relationship Design Issues, Alternative Notations for Modeling Data.

4. Relational Database Design: : **14Hrs**

Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Normal Forms, Functional-Dependency Theory, Algorithms for Decomposition Using Functional Dependencies, Decomposition Using Multivalued Dependencies, More Normal Forms. **Transactions**: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability.

Text book:

1. Database System Concepts, 7th Edition-Abraham Silberschatz, Henry F. Korth, S. Sudarshan
2. "Database Management Systems", A Practical Approach (DBMS) by Rajiv Chopra.
3. Oracle Database SQL Language Quick Reference - Oracle

References:

1. Navathe and Elmarri "fundamentals of database Systems"-Addison Wesley-200.
2. C.j. Date "introduction to Database systems" Addison-wesley.
3. Ullman "Principals of Data base systems" computer science press".
4. Bipin C Desai "Introduction to Data base system" Galotia.

BSc 3rd Semester		*SQL Lab*	
Subject Code :	*Practical-III*	*Total Teaching Hours :*	*56*
IA Marks:	*10*	*Teaching Hours/Week :*	*04*
Exam Marks:	*40*	*Examination Hours :*	*03*
Credits:	*2*		

Consider the following database :

1. employee(emp_id, first_name, last_name, job_id, doj, salary, dept_id, manager_id)
2. departments (dept_id, dept_name, manager_id)
3. customer (cust_id, first_name, last_name, address, city, phone, email)
4. salgrade (grade, highsal, lowsal)

Insert values into tables depending on the requirements for the queries. Each of these Following Subtopics should have at least 4 Queries Each.

1. Working with Table and data using another table.
2. Modifying table structure and updating data.
3. Queries adding deleting and verifying Keys.
4. Using Where Clause(Comparison, between and set comparision).
5. Using Where Clause(Matching Characters and NULL values).
6. Using Where Clause (Using Logical operators to join more than one conditions).
7. Formatting the output Result by putting Column aliases, using expressions and ordering the Data.
8. Using SubQueries in where Clause. (Set Membership, Set comparison, Test for Empty Relations)
9. Sub Queries in From Clause.
10. Aggregate Functions.
11. Joining Tables using SQL Joins (Inner Join, Outer Joins).
12. Set Operators.
13. Creating and working with views.
14. Using Group By & having clause and Order by clause.
15. Using Inner queries / Sub queries

Examination:

- Implementation may be done in any Database software Like Oracle, MySQL depending on the availability.
- No Graphical Query design is allowed in the examination, all queries must be through commands only.
- Any Two questions may be given to student for examination, Required tables has to be created by the student during examination, At least 5 rows or as required for generating output of the queries.

Examination:

- Two Questions has to be given from the above list
- Student has to write and execute both of the programs

Marks Distribution:

Practical Proper	Writing & Execution of both of the Programs	30(Each 15 marks)
	Total	**30 marks**
Viva		10 marks
Total		**40 marks**

Elective Title: **Artificial Intelligence**	
Course Code:BSC	Total Teaching Hours : 56
Semester: 3rd	Teaching Hours Per Week: 4hrs
IA Marks: 20	Examination Hours:3hrs
Exam Marks: 80	Course Credits: 3

Course Learning objectives: The course aims to:

1. To introduce the fundamental concepts and techniques of Artificial Intelligence.
2. To develop the ability to solve AI problems using heuristic and algorithmic approaches.
3. To provide insights into knowledge representation, reasoning, and learning in AI.
4. To equip students with practical skills using AI tools and libraries (e.g., Python, NLTK, sci)

Course Outcomes: After successful completion of this course, students will be able to:

- **CO1**: Describe the foundational principles and approaches of Artificial Intelligence.
- **CO2**: Apply AI algorithms such as search strategies, logic, and knowledge representation.
- **CO3**: Implement machine learning models using Python-based libraries.
- **CO4**: Analyze real-world problems and propose AI-based solutions.

Unit I: : Introduction to Artificial Intelligence **14hrs**

History and Evolution of AI, Foundations and Applications of AI, Intelligent Agents and Environments. Types of Agents, Problem-solving Agents. AI vs Machine Learning vs Deep Learning, Turing Test and Rationality.

Unit II: Search Strategies and Problem Solving **14hrs**

Problem Formulation, Search Strategies: Uninformed: BFS, DFS, UCS, Informed: Greedy Search, A*. Heuristics and Evaluation Functions, Game Playing: Minimax and Alpha-Beta Pruning, Constraint Satisfaction Problems.

Unit III: Knowledge Representation & Reasoning **14hrs**

Propositional Logic & Predicate Logic, Inference Rules, Forward and Backward Chaining, Ontologies and Semantic Web, Knowledge Representation using Graphs and Frames, Uncertainty: Bayesian Networks, Fuzzy Logic.

Unit IV: Machine Learning and AI Applications **14hrs**

Introduction to Machine Learning: Supervised, Unsupervised, and Reinforcement Learning. Basic ML Algorithms: k-NN, Decision Trees, Naive Bayes. AI Tools and Libraries (scikit-learn, Tensor Flow basics). Applications of AI in NLP, Robotics, and Vision. Ethical and Social Implications of AI.

Textbooks & References

1. **Elaine Rich, Kevin Knight, Shivashankar B Nair**-*Artificial Intelligence* – Tata McGraw-Hill, 3rd Edition
2. **Artificial Intelligence" by Dr. Saroj Kaushik Publisher:** Cengage Learning.
3. **Stuart Russell and Peter Norvig-** *AI: A Modern Approach* – Pearson Education, 3rd Ed
4. **Ethem Alpaydin** – *Introduction to Machine Learning* – MIT Press
5. **Tom M. Mitchell** – *Machine Learning* – McGraw-Hill Education
6. **Dan W. Patterson** – *Introduction to AI and Expert Systems* – Pearson
7. **Sebastian Raschka and Vahid Mirjalili** – *Python Machine Learning* – Packt Publishing

Elective Title: **Cyber Security**	
Course Code:BSC	Total Teaching Hours : 56
Semester: 3rd	Teaching Hours Per Week: 4hrs
IA Marks: 20	Examination Hours:3hrs
Exam Marks: 80	Course Credits: 3

Course Learning objectives: The course aims to:

5. Introduce students to the fundamental principles and concepts of cybersecurity.
6. Familiarize students with common cyber threats, vulnerabilities, and mitigation strategies.
7. Enable students to apply cybersecurity tools, technologies, and legal practices in real-world scenarios.

Course Outcomes: After successful completion of this course, students will be able to:

- **CO1:** Explain the key concepts, goals, and terminology of cybersecurity.
- **CO2:** Identify various types of cyberattacks and apply basic defence mechanisms.
- **CO3:** Use essential cybersecurity tools to detect and prevent threats.
- **CO4:** Demonstrate understanding of cybersecurity laws, ethics, and best practices.

Unit I: Introduction to Cybersecurity **14hrs**

Fundamentals of Cybersecurity, Security Goals: Confidentiality, Integrity, Availability (CIA Triad), Difference between Cybersecurity and Information Security, Threats, Vulnerabilities, and Risk, Types of Hackers: White hat, Black hat, Grey hat, Security Architecture and Security Models, Cybersecurity Policy and Governance.

Unit II: Cyber Threats and Attacks **14hrs**

Malware: Viruses, Worms, Trojans, Spyware, Ransomware, Phishing, Social Engineering, Identity Theft, Denial of Service (DoS), Distributed DoS (DDoS), SQL Injection, Cross-Site Scripting (XSS), Brute Force Attacks, Advanced Persistent Threats (APT), Case Studies of Real Cyberattacks.

Unit III: Security Technologies and Practices **14hrs**

Network Security: Firewalls, IDS/IPS, VPN, Authentication Mechanisms: Passwords, Biometrics, Multi-factor Authentication, Encryption Basics: Symmetric vs Asymmetric Cryptography, Secure Software Development & Patch Management, Backup and Disaster Recovery Strategies, Cybersecurity Tools: Wireshark, Kali Linux, Antivirus, Password Managers.

Unit IV: Cyber Laws, Ethics, and Industry Standards **14hrs**

Cybersecurity Laws in India: IT Act 2000 and Amendments, Global Standards: GDPR, ISO/IEC 27001, Cyber Ethics and Responsible Use of Technology, Intellectual Property Rights and Digital Piracy, Incident Response and Reporting, Roles and Responsibilities of a Cybersecurity Professional

- **Textbooks:**
  - *Computer Security: Principles and Practice* by William Stallings
  - *Cybersecurity Essentials* by Charles J. Brooks
- **Online Platforms:**
  - NPTEL Cybersecurity Lectures
  - Cybrary, Cisco Networking Academy, Coursera

Elective Title: **Computer Architecture**	
Course Code:BSC	Total Teaching Hours : 56
Semester: 3rd	Teaching Hours Per Week: 4hrs
IA Marks: 20	Examination Hours:3hrs
Exam Marks: 80	Course Credits: 3

Course Learning Objectives:

1. Understand fundamental principles of computer organization and architecture.
2. Learn how data is transferred and processed at the register and microoperation level.
3. Gain knowledge of CPU design, instruction formats, and addressing modes.
4. Explore memory systems and I/O organization in computer systems.

Course Outcomes: After successful completion of this course, students will be able to:

- **CO1:** Understand basic computer architecture and instruction execution.
- **CO2:** Apply register transfer and microoperations in system design.
- **CO3:** Analyze CPU structure, instruction formats, and addressing modes.
- **CO4:** Explain memory hierarchy and I/O organization techniques.

Unit I: Basic Computer Organisation and Design: **14hrs**

Instruction Codes, Computer registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instructions, Input-Output and Interrupt, Design of Basic computer, Design of accumulator logic.

Unit II: Register Transfer and Microoperations: **14hrs**

Register Transfer Language (RTL), register transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit, Microprogrammed Control: Control memory; address sequencing, microprogram sequencer, Design of Control Unit

Unit III: Central Processing Unit: **14hrs**

General registers Organization, Stack Organization, Instruction formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Program Interrupt, RISC, CISC.

Unit IV: Memory & I/O Organization: **14hrs**

Memory hierarchy, Auxiliary Memory, Associative Memory, Interleaved memory, Cache memory, Virtual Memory, Memory Management Hardware,

Input Output Organization : Peripheral devices , Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access(DMA),Input-Output Processor(IOP).

Reference Books:

1. **M. Morris Mano** – *Computer System Architecture*, Pearson Education
2. **Carl Hamacher, Zvonko Vranesic, Safwat Zaky** – *Computer Organization*, McGraw Hill Education
3. **P. Pal Chaudhuri** – *Computer Organization and Design*, Prentice-Hall India (PHI)
4. **Govindarajalu** – *Computer Architecture and Organization*, Tata McGraw-Hill

BSc 4th Semester		Object Oriented Programming with Java	
Subject Code :	24MC-IV	Total Teaching Hours :	56
IA Marks:	20	Teaching Hours/Week :	04
Exam Marks:	80	Examination Hours :	03
Credits:	3		

Course Learning Objectives: Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and understand the principles of inheritance, packages and interfaces, exception handling mechanisms and applets and Graphical User Interface.

Course Outcomes: On successful completion of the course, the students will be able to

- Implement Object Oriented programming concept using basic syntaxes of control structures, strings and function for developing skills of logic building activity.
- Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
- Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.
- Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.

Syllabus structure for Each Core Course (Paper)	**56 Hours**
Unit-I	**14 Hrs.**

Basic concepts of OOP's, Object-oriented paradigm, Basic concepts of object-oriented programming, Benefits of OOP, Application of OOP, JVM.
Java Fundamentals Features of Java, Java Features, overview of java language, Constants, Variables, Data types, operators and Expressions, Decision making and Branching, Decision making and looping, Arrays-types of arrays.

Unit-II	**14 Hrs.**

Objects and Classes
Defining a class, Adding Variables, Adding Methods, creating objects, Accessing Class members, Constructors, finalize() method, Method Overloading, Overriding Methods, Final Variables and methods, Final Classes, Abstract classes and methods, Visibility control, Strings, and Vectors, Abstract classes, Static classes, Wrapper classes, This, Super,

Unit-III	**14 Hrs.**

Inheritance, Exception handling and Multi-threaded Programming:
Defining inheritance, types of inheritance, extending a Class, Multiple inheritance, interfaces, packages: Java API Packages, Creating Packages, accessing a package, using a package.
Exception handling: Exception as objects, Exception hierarchy Try, catch, finally, Throw.
Multi-threading: Thread Life cycle, multi-threading advantages and issues, Simple thread program, Thread synchronization.

Unit-IV	**14 Hrs.**

Java Server Pages: JSP: Introduction, Architecture of JSP, Life Cycle of JSP, Scripting elements (Scriplets, JSP Declarations, JSP Expression), Directive Elements (page, include, taglib), JSP Actions (include, setproperty, getproperty, forward, text), Implicit objects (request,

response, out, page, Exception), including HTML in JSP. Introduction to JDBC.

Text Books:

1. Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies

Reference:

1. The complete reference JAVA, Herbert Scheldt. TMH
2. Herbert Schildt, The Complete Reference Java2.0, Fifth edition, TATA McGraw-Hill Company.
3. Debasish Jana, Java and Object-Oriented programming Paradigm, PHI.
4. Jana, Java and Object Oriented Programming Paradigm, PHI (2007).

BSc 4th Semester		**Java Programming Lab**	
Subject Code:	**Practical-IV**	**Total Teaching Hours: 39**	
IA Marks:	**10**	**Teaching Hours/Week:**	**04**
Exam Marks:	**40**	**Examination Hours:**	**03**
Credits:	**2**		

JAVA PROGRAMMING LAB

PART-A

1. Programs Using Different Control Structures (Switch, If, While, Do, For etc.,)
2. Programs Using Arrays.
3. Programs Using Strings, String Buffer Classes. And Vectors.
4. Programs using constructor and destructor
5. Creation of classes and use of different types of functions
6. Count the number of objects created for a class using static member function
7. Write programs on interfaces
8. Write programs on packages
9. Write programs using function overloading
10. Programs using inheritance

PART-B

1. Write a program using exception handling mechanism.
2. Java Program to Handle multiple exception.
3. Java Program to Display Dates in following Format: Tuesday, 03 Nov 2025
4. Java program to multiply two matrices.
5. Java program to demonstrate thread states.
6. JSP program to print current date & time.
7. JSP Program to validate username and password.
8. JSP Program to select record from database.
9. JSP Program to display given number in words.
10. Write an application that displays deadlock between threads. Program to display data from database table using JDBC.

Examination:

- Two Questions has to be given from the above list A and B(one each).
- Student has to write and execute both of the programs

Marks Distribution:

Criteria	**Marks**
	Questions from The List

Practical Proper	Writing & Execution of Program one from PART-A & one from PART-B	30 (Each 15 marks)
	Total	**30**
Viva		10
Total		**40**

Elective Title: **Deep Learning**	
Course Code:BSC	Total Teaching Hours : 56
Semester: 4th	Teaching Hours Per Week: 4hrs
IA Marks: 20	Examination Hours:3hrs
Exam Marks: 80	Course Credits: 3

Course Learning Objectives:

1. To introduce the fundamental concepts of machine learning and deep learning..
2. To explain the architecture and functioning of neural networks.
3. To train students in designing, optimizing, and evaluating deep learning models.
4. To expose learners to advanced models like CNN, RNN, LSTM, and Transformers for real-world applications.

Course Outcomes: After successful completion of this course, students will be able to:

- CO1: Understand the difference between traditional machine learning and deep learning techniques.
- CO2: Apply deep learning algorithms using tools such as neural networks and backpropagation..
- CO3: Design and implement convolutional and recurrent neural networks..
- CO4: Use transfer learning and modern deep learning frameworks for solving practical problems in vision and NLP.

Unit 1: **Introduction to Deep Learning** **14hrs**

Basics of machine learning, types of learning (supervised, unsupervised), difference between ML and deep learning, neural networks, biological vs artificial neuron, perceptron and MLP, input, hidden, and output layers, activation functions (sigmoid, tanh, ReLU), feedforward networks, advantages, limitations, applications (image classification, speech recognition, recommendations).

Unit 2: **Training Deep Neural Networks** **14hrs**

Forward pass, activation, loss functions (MSE, cross-entropy), backpropagation, weight updates, gradient descent methods (stochastic, batch, mini-batch), optimizers (momentum, Adam, RMSProp), performance metrics (accuracy, precision, recall, F1-score), confusion matrix.

Unit 3: **CNN and Transfer Learning** **14hrs**

Need for CNN, CNN structure, convolution, filters, feature maps, stride, padding, pooling (max, average), layers (conv, pooling, fully connected), transfer learning, pretrained models (VGG, ResNet, MobileNet), applications (image recognition, object detection).

Unit 4:**RNN, LSTM, and Transformers**	**14hrs**
Recurrent neural networks (RNN), handling sequences, vanishing gradient problem, LSTM (gates: forget, input, output), GRU, attention, encoder-decoder, transformers, BERT, GPT, NLP tasks.	

Reference Books:

1. **Fundamentals of Deep Learning** – Nikhil Buduma & N. Srinivas
2. **Deep Learning** – Charu C. Aggarwal
3. **Artificial Intelligence and Deep Learning** – Rajiv Chopra
4. **Deep Learning** – Ian Goodfellow, Yoshua Bengio, Aaron Courville
5. **Deep Learning with Python** – François Chollet

Elective Title: **Data Science**	
Course Code:BSC	Total Teaching Hours : 56
Semester: 4th	Teaching Hours Per Week: 4hrs
IA Marks: 20	Examination Hours:3hrs
Exam Marks: 80	Course Credits: 3

Course Learning Objectives:

5. Understand the fundamental concepts and scope of Data Science.
6. Learn methods for data collection, cleaning, and preprocessing.
7. Explore techniques for data exploration and visualization.
8. Study basic statistical methods used in data analysis.

Course Outcomes: After successful completion of this course, students will be able to:

- CO1: Describe key concepts of Data Science and its real-world applications.
- CO2: Apply data collection and cleaning techniques on sample datasets.
- CO3: Perform exploratory data analysis and create basic visualizations.
- CO4: Use statistical methods to interpret data and derive insights.

UNIT I: **Introduction to Data Science** **14hrs**

Data, Information, Knowledge, Evolution of Data Science, Data Science Life Cycle, Applications of Data Science, Role of Data Scientist, Tools and Technologies in Data Science, Data Ethics and Privacy.

Unit II:Data Collection and Cleaning **14hrs**

Structured and Unstructured Data, Data Collection Methods, Data Cleaning Techniques, Handling Missing Data, Removing Duplicates, Data Transformation, Tools: Excel, Pandas, NumPy.

Unit III: Data Exploration and Visualization **14hrs**

General registers Organization, Stack Organization, Instruction formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Program Interrupt, RISC, CISC.

Unit IV: Statistical Analysis 14hrs
Measures of Central Tendency, Measures of Dispersion, Probability Distributions, Hypothesis Testing, t-test, z-test, Chi-square Test, Correlation, Regression Analysis, Statistical Libraries in Python.

Reference Books:

1. **Data Science** by **V.K. Jain** – Khanna Publishing
2. **Fundamentals of Data Science** by **Niraj Kumar** – BPB Publications
3. **Doing Data Science** by Cathy O'Neil and Rachel Schutt – O'Reilly Media
4. **Python for Data Analysis** by Wes McKinney – O'Reilly Media
5. **The Elements of Statistical Learning** by Trevor Hastie, Robert Tibshirani, and Jerome Friedman – Springer

Elective Title: **Theory of Computation**	
Course Code:BSC	Total Teaching Hours : 56
Semester: 4th	Teaching Hours Per Week: 4hrs
IA Marks: 20	Examination Hours:3hrs
Exam Marks: 80	Course Credits: 3

Course Learning Objectives:

1. Introduce core concepts of automata, grammars, and formal languages.
2. Build foundational skills in modeling computation using abstract machines.
3. Explain regular and context-free languages and their properties.
4. Provide insight into language recognition and parsing techniques.

Course Outcomes: After successful completion of this course, students will be able to:

- Understand and construct deterministic and nondeterministic finite automata.
- Apply regular expressions and grammars to define formal languages.
- Analyze and design context-free grammars and derivation trees.
- Simulate pushdown automata for context-free language processing.

UNIT – I Introduction to the Theory of computation 14 Hours

Mathematical Preliminaries and Notation: Sets, Functions and Relations, Graphs and Trees, Proof Techniques. Three Basic Concepts: Languages, Grammars, Automata. Some Applications

UNIT – II Finite Automata 14 Hours

Deterministic Finite Accepters: Deterministic Accepters and Transition Graphs, Languages and Dfa's Regular Languages. Nondeterministic Finite Accepters: Definition of a Nondeterministic Accepter, Why Nondeterminism?. Equivalence of Deterministic and Nondeterministic Finite

Accepters. Reduction of the Number of States in Finite Automata.
UNIT – III Regular Languages and Regular Grammars 14 Hours Regular Expressions: Formal Definition of a Regular Expression, Languages Associated with Regular Expressions. Connection Between Regular Expressions and Regular Languages: Regular Expressions Denote Regular Languages, Regular Expressions for Regular Languages, Regular Expressions for Describing Simple Patterns. Regular Grammars: Right- and Left-Linear Grammars, Right-Linear Grammars Generate Regular Languages, Right-Linear Grammars for Regular Languages, Equivalence of Regular Languages and Regular Grammars.
UNIT – IV Context-Free Languages 14 Hours Context-Free Grammars: Examples of Context-Free Languages, Leftmost and Rightmost Derivations Derivation Trees, Relation Between Sentential Forms and Derivation Trees. Parsing and Ambiguity: Parsing and Membership, Ambiguity in Grammars and Languages, Context-Free Grammars and Programming Languages. Introduction to Pushdown Automata.

Reference Books:

1. An Introduction to Formal Languages and Automata By Peter Linz Fourth Edition
2. Introduction to Automata Theory, Languages, and Computation By John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman.
3. Finite Automata and Formal Languages: A Simple Approach By A. M. Padma Reddy

Main Examination Question Paper Pattern

Third/Fourth Semester BSc Degree Examinations-2025

COMPUTER SCIENCE

Paper :< Subject>

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

SECTION-A

Answer **all of the following questions:** **(2×10= 20)**

1.

a.
b.
c.
d.
e.
f.
g.
h.
i.
j.

SECTION-B

Answer **any Six** of the following: **(5×6= 30)**

2. From Unit-1
3. From Unit-1
4. From Unit-2
5. From Unit-2
6. From Unit-3
7. From Unit-3
8. From Unit-4
9. From Unit-4

PART-C

Answer **any Three** of the following: **(10×3= 30)**

10. From Unit-1
11. From Unit-2
12. From Unit-3
13. From Unit-4

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Shivagangotri, Davangere

Main Examination Question Paper Pattern

Third/Fourth Semester BSc Degree Examinations-2025

COMPUTER SCIENCE

Paper :< Subject>

Time: 2 Hours **Max. Marks: 40**

SECTION-A

Answer **all of the following questions:** **(2×5= 10)**

1.

2.

3.

4.

5.

SECTION-B

Answer **any Six** of the following: **(5×6= 30)**

6. From Unit-1
7. From Unit-1
8. From Unit-2
9. From Unit-2
10. From Unit-3
11. From Unit-3
12. From Unit-4
13. From Unit-4

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