Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. II (Data Science)

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2025-2026

Syllabus for Bachelor of Science (B.Sc.) Part – II Data Science

1. PREAMBLE:

In the era of digital transformation, data has emerged as a vital asset, driving innovation, shaping decisions, and unlocking solutions to complex global challenges. The Bachelor of Science in Data Science program is designed to cultivate a new generation of analytical thinkers and problem solvers equipped with the interdisciplinary knowledge of mathematics, statistics, computer science, and domain-specific expertise. This program aims to instil in students the skills necessary to extract meaningful insights from data, develop intelligent systems, and make data-driven decisions ethically and responsibly. It fosters curiosity, critical thinking, and a commitment to lifelong learning, preparing graduates to lead and innovate in academia, industry, government, and society. With a foundation rooted in rigor and relevance, the B.Sc. in Data Science aspires to empower students to become contributors to a data-informed world—capable of addressing emerging challenges with clarity, precision, and purpose.

2. General Objectives of the Course: -

1. To create graduates with sound knowledge of Data Science, who can contributetowards recent advances in technology?
2. To provide advanced and in-depth knowledge of data science and specialization in oneor two subjects of the new era of technology.
3. To prepare Graduates who will achieve peer-recognition, as an individual or ina team, through demonstration of good analytical, design, programming, and implementation skills.
4. To enable students, pursue a professional career in Data Science in related industry,business and research.
5. To impact industry knowledge and practical skills of current trends in IT field to thestudents.
6. To develop the ability among students to formulate, analyze and solve real life problemsfaced in Computer Science industry. To produce computer science professionals who can be directly employed or start his/her own work as
7. To Develop designing, analyzing and critical thinking skill among students.

3. PROGRAM OUTCOMES:

1. Possess a strong foundation of knowledge in their chosen field of study.

2. Develop a scientific mindset, becoming open-minded, critical, and curious, which will support their entry into research and innovation.

3. Be skilled in practical work, experiments, and the use of laboratory materials.

4. Be eligible to pursue higher studies in their field, both in India and abroad.

5. Qualify to appear for examinations for jobs in government organizations.
6. Meet the minimum eligibility requirements for various science-related job opportunities.
7. Be prepared to establish their own entrepreneurial ventures.
8. Enhance critical thinking, develop a scientific attitude, solve problems, improve practical skills, boost communication abilities, and strengthen social interactions.

4. PROGRAM SPECIFIC OUTCOME:

After completing the B.Sc. (Data Science) program, Students will:

1. Demonstrate strong grounding in mathematics, statistics, and computer science principles essential for data analysis and modeling.
2. Acquire, clean, process, and manage structured and unstructured data from diverse sources using appropriate tools and techniques
3. Apply statistical and machine learning models to derive insights, make predictions, and support data-driven decision-making.
4. Develop and implement algorithms using modern programming languages (such as Python, R, or SQL) to solve real-world data problems.
5. Effectively communicate data insights through visualization, storytelling, and presentation tailored to both technical and non-technical audiences.
6. Integrate data science methods with domain-specific knowledge to solve interdisciplinary problems in fields such as business, healthcare, finance, or the environment.
7. Understand and apply ethical principles, data privacy standards, and legal considerations in data handling and analysis.

1. TITLE: **Data Science**

2. YEAR OF IMPLEMENTATION: **2025-2026**

3. DURATION: **01 year**

4. PATTERN: **Semester examination**

5. MEDIUM OF INSTRUCTION: **English**

6. Structure of Course: As per NEP-2020 (2.0)

6. COURSE STRUCTURE

As per NEP-2020 (2.0)

Sem Level	**Courses**			**OE**	**VSC/ SEC**	**AEC/ VEC/ IKS**	**OJT/ FP/ CEP/ CC/RP**	**Total Credits**	**Degree/ Cum. Cr. MEME**
	Course I	**Course II**	**Course III**						
	Major	Minor	-						
Sem III (5.0)	Major V (2) Major VI (2) Major P III (2)	Minor V (2) Minor VI (2) Minor P III (2)	-	OE III (2)	VSC I (2) (P) (Major Specific) SEC I (2) (P)	AEC I (2) (P) (English) IKS II (2) (Major Specific)	-	22	UG Diploma: 88
Sem IV (5.0)	Major VII (2) Major VIII (2) Major P IV (2)	Minor VII (2) Minor VIII (2) Minor P IV (2)	-	OE IV (2)	VSC II (2) (P) (Major Specific) SEC II (2) (P)	AEC II (2) (P) (English) VEC II (2) (Environmental Studies)	-	22	Exit option: 4 Cr. NSQF/ Internship/ Skill Courses
Credits	12	12	-	04	08	08	-	44	

7. COURSE TITLES

B. Sc. (Data Science) Part-II

Semester: III					
Sr. No.	**Components**		**Course Code**	**Name of the Paper**	**Credits**
1	Major	Paper I	BDST 231	Python Programming	2
		Paper II	BDST 232	NOSQL Database	2
		Practical	BDSP 233	Lab Based on BDST 231 and BDST 232	2
2	Minor	Paper I	BDST 234	CPP Programming	2
		Paper II	BDST 235	Computer Networking	2
		Practical	BDSP 236	Lab Based on BDST 234 and BDST 235	2
3	Open Elective		BDSTOE 3	Open Elective III	2
4	VSC-I		BDSPVSC-I	Internet Data Security I	2
5	SEC-I		BDSP SEC-I	Data Analytics Skills for Data Science	2
6	AEC-I		BDSTAEC-I	English	2
7	IKS-II		BDSTIKS-II	Indian Knowledge System II	2
Total					**22**

Semester: IV					
Sr. No.	**Components**		**Course Code**	**Name of the Paper**	**Credits**
1	Major	Paper I	BDST 241	Python for Data Science & Analytics	2
		Paper II	BDST 242	Image Processing	2
		Practical	BDSP 243	Lab Based on BDST 241 and BDST 242	2
2	Minor	Paper I	BDST 244	Java Programming	2
		Paper II	BDST 245	Cyber Security	2
		Practical	BDSP 246	Lab Based on BDST 244 and BDST 245	2
3	Open Elective		BDSTOE 4	Open Elective IV	2
4	VSC-II		BDSPVSC-II	Internet Data Security II	2
5	SEC-II		BDSPSEC-II	Data Processing Skills for Data Scientist	2
6	AEC-II		BDSTAEC-II	English	2
7	VEC-II		BDSTVEC-II	Environmental studies	2
8	**22**				

8. Evaluation Structure 2025-26

B.Sc. II NEP 2.0

Semester III (5.0)

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	Mid -Semester	CCE-II			
Major	T	BDST 231	05	10	05	30	50	02
	T	BDST 232	05	10	05	30	50	02
	P	BDSP 233	--	--	--	50	50	02
Minor	T	BDST 234	05	10	05	30	50	02
	T	BDST 235	05	10	05	30	50	02
	P	BDSP 236	--	--	--	50	50	02
OE	T	BDST OE 3 (For IDS Courses)	05	--	05	15	25	01
	P	BDSPOE 3	--	--	--	25	25	01
OE	T	BDSTOE 3 (For Humanities)	05	10	05	30	50	02
VSC	P	BDSPVSC 1	--	--	--	50	50	02
SEC	P	BDSPSEC 1 Practical	--	--	--	25	25	02
AEC I	T	BDST AEC 1	05	10	05	30	50	02
IKS II	T	BDST IKS 2	05	10	05	30	50	02
Total							**550**	**22**

Semester IV

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	Mid - Semester	CCE-II			
Major	T	BDST 241	05	10	05	30	50	02
	T	BDST 242	05	10	05	30	50	02
	P	BDSP 243	--	--	--	50	50	02
Minor	T	BDST 244	05	10	05	30	50	02
	T	BDST 245	05	10	05	30	50	02
	P	BDSP 246	--	--	--	50	50	02
OE	T	BDSTOE 4 (For IDS Courses)	05	--	05	15	25	01
	P	BDSPOE 4	--	--	--	25	25	01
OE	T	BDSTOE 4 (For Humanities)	05	10	05	30	50	02
VSC	P	BDSPVSC 2	--	--	--	50	50	02
SEC	P	BDSPSEC 2 Practical	--	--	--	25	25	02
AEC II	T	BDSTAEC 2	05	10	05	30	50	02
VEC II	T	BDSTVEC 2	05	10	05	30	50	02
Total							550	22

DSC: Discipline Specific Course; DSE: Discipline Specific Elective VSC: Vocational Skill Course; OJT: On Job Training; FP: Field Project; CEP: Community Engagement Program, T: Theory; P: Practical

OTHER FEATURES:

A) LIBRARY:

Reference books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENT:

Computers,
LCD projector,
smart board

B.Sc. II

SEM -III

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type: Major V	**Marks:** 50
Credits: 2	**From:** A. Y. 2025-26

Name of the Course: BDST 231: **Python Programming**

Course objectives:

1. Understand python programming basics and paradigm.
2. Learn how to use python ide such as pycharm, jupyter and spyder.
3. Familiar about the basic constructs of python such as data, operations, conditions, loops, functions etc.
4. Use python for data science preprocessing data.

Course outcomes:

1. Manipulate and process dataset.
2. Perform data analysis to find hidden pattern form data sets.
3. Visualize dataset in term of different charts.
4. Determine the methods to create and develop python programs by utilizing the data structures like lists, dictionaries, tuples and sets.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Basics of Python** 1.1 Introduction to Python, Applications 1.2 Python IDE – PyCharm/ Jupyter /Spyder, 1.3 Comments, Basic Data types, variables and Identifiers, 1.4 Operators and expressions, Data type conversions, 1.5 Simple Input and output Command line Arguments & data input, 1.6 Input Operation, Keywords, Indentation.	8
Module -2:	**Module -2: Data Types** 2.1 List: Creating list, traversing list, List operations, List methods, List slicing,	8

	map and reduce. 2.2 Dictionaries: Creating dictionary, key and value, dictionary operations, dictionary methods. 2.3 Set: creating set, adding and removing element from set, union of set. 2.4 Tuple: Creating tuple, traversing tuple, tuple operation, tuple methods, conversion: list to tuple tuple to list. 2.5 Strings and their operations: - concatenation, appending, multiplication and slicing, strings formatting operator, built in string methods and functions, slice operation, in and not in operators, comparing strings, Iterating strings, the string module, Debugging.	
Module -3:	**Module -3: Decision Control Statements and Functions** 3.1 Decision Control Statements: Decision control statements 3.2 Conditional branching Statements: if, if-else, nested if statements. 3.3 Basic loop Structures/Iterative statements: while loop, for loop. Nested loops, looping with indices 3.4 Loop breaking statements: the break, continue, pass, else statement used with loops. 3.5 Function: Need for functions, definition, call, variable scope and lifetime, Function arguments, return statement. Defining functions, Type conversions, Recursive function 3.6 Advanced Functions: lambda, map, filter, reduce, documentation string	8
Module -4:	**Module -4: Modules and file Handling** 4.1 Modular programming: Introduction to modules and packages in Python, 4.2 Overview of standard library: NumPy, Pandas, Math, Matplotlib 4.3 Files handling: File path, Types of files, Opening and Closing files, 4.4 Reading and Writing files. 4.5 Directory Introduction and basic file operations.	6

Reference Books:-

1. Gowrishankar, S., and Veena A. "Introduction to Python Programming." Boca Raton: CRC Press, 2018.
2. Lutz, Mark. "Learning Python." Sebastopol: O'Reilly Media, 2013.
3. Matthes, Eric. "Python Crash Course: A Hands-On, Project-Based Introduction to Programming." San Francisco: No Starch Press, 2023.
4. McKinney, Wes. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython." Sebastopol: O'Reilly Media, 2017
5. Ramalho, Luciano. "Fluent Python: Clear, Concise, and Effective Programming." Sebastopol: O'Reilly Media, 2015.

6. Sweigart, Al. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners." San Francisco: No Starch Press, 2019.
7. Zelle, John M. "Python Programming: An Introduction to Computer Science." Franklin, Beedle & Associates, 2010.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : Major VI	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDST 232: **NoSQL Databases**

Course Objectives:

1. understanding the need for nosql databases.
2. learn the simplicity and speed advantages of key-value stores for basic data retrieval operations.
3. learn security features in nosql databases.
4. define demoralization in data modeling.

Course Outcomes:

1. define need for nosql databases.
2. define security features in nosql databases.
3. graph data model and its application in representing complex relationships.
4. ability to optimize queries to enhance database performance.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Introduction to NoSQL Databases** 1.1 Understanding the need for NoSQL databases, 1.2 Contrasting NoSQL databases with traditional relational databases, 1.3 Types of NoSQL Databases, Document- based databases (e.g., MongoDB, Couchbase), 1.4 Key-value stores (Redis, DynamoDB), 1.5 Column-family stores (Cassandra, HBase),Graph databases (Neo4j, Amazon Neptune)	8
Module -2:	**Module -2: Data Modeling Techniques** 2.1 Document modeling in document-based databases., 2.2 Key design considerations in key-value stores, 2.3 Column-family and wide-column store modeling techniques, 2.4 Graph modeling and its applications Schema-less design in NoSQL databases, 2.5 understanding data structures specific to each NoSQL type,	7

	2.6 Considering denormalization and its impact on data modeling	
Module -3:	**Module -3: Performance and Optimization** 3.1 Indexing strategies in NoSQL databases, 3.2 Query optimization and best practices, 3.3 Scaling strategies and sharding, 3.4 Document-Based Databases (MongoDB), Key-Value Stores (e.g., Redis, DynamoDB), Column-Family Stores (e.g., Cassandra, HBase)	7
Module -4:	**Module -4: Security and Backup Strategies** 4.1 Understanding security features in NoSQL databases 4.2 Authentication and Authorization 4.3 Encryption, Auditing and Logging, Firewalls and Network Security 4.4 Patch Management and Updates, Backup, recovery, 4.5 disaster management.	8

Reference Books: -

1. Deka, Ganesh Chandra. "NoSQL: Database for Storage and Retrieval of Data in Cloud." Boca Raton: Chapman and Hall/CRC, 2017.
2. Fowler, Adam. "NoSQL For Dummies." Hoboken: For Dummies, 2015.
3. Meier, Andreas, and Michael Kaufmann. "SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management." Wiesbaden: Springer Vieweg, 2019.
4. Patil, Manisha M. "NoSQL Databases." New Delhi: TechKnowledge Publications, 2023.
5. Sadalage, Pramod J., and Martin Fowler. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence." Boston: Addison-Wesley Professional, 2012.
6. Sullivan, Dan. "NoSQL for Mere Mortals." Indianapolis: Addison-Wesley Professional, 2015.
7. Tiwari, Shashank. "Professional NoSQL." Indianapolis: Wrox, 2011.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective • Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) • Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : Major	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSP 233 **Practical VII Based on BDST 231 & BDST 232**

Course Objectives:

1. Learn basics of python programming and paradigm.
2. Understand how to use python ide such as pycharm, jupyter and spyder.
3. Be familiar about the basic constructs of python such as data, operations, conditions, loops, functions etc.
4. Use python for data science preprocessing data.

Course Outcomes:

1. Manipulate and process dataset.
2. Perform data analysis to find hidden pattern form data sets.
3. Visualize dataset in term of different charts.
4. Determine the methods to create and develop python programs by utilizing the data structures like lists, dictionaries, tuples and sets.

Practical's	Title and Contents	Hrs
Practical-:	1. Write a Python program to explore various data types including numeric types, Boolean types and compound types. 2. Write a Python program to perform Input and Output Operations. 3. Write a Python program to demonstrate looping in python and use of break statement and continue statement. 4. Write a Python program to demonstrate the use of Built-in Functions. 5. Write a Python Program to implement Lambda Functions. 6. Python Program to create list, apply various functions to it.	60

7. Write a Python Program to implement tuples for storing data. Verify the immutability property on tuples.
8. Write a Python Program to implement Dictionary and operations on dictionaries.
9. Write a Python Program to create sets and various operations on it.
10. Apply indexing and slicing operations to access elements of array.
11. Use the MongoDB shell or a GUI tool to create a new database.
12. Within your database, create collections to organize your data.
13. Insert sample documents into your collections.
14. Practice querying documents using 'find' with various conditions.
15. Update documents using 'updateOne' and 'updateMany'.
16. Delete documents using 'deleteOne' and 'deleteMany'.
17. Create indexes on fields to improve query performance.
18. Use the aggregation framework for complex data manipulations.
19. Perform a backup of your database and restore it to ensure data recovery
20. Store location-based data using Geo JSON.

Reference Books:-

1. Gowrishankar, S., and Veena A. "Introduction to Python Programming." Boca Raton: CRC Press, 2018.
2. Lutz, Mark. "Learning Python." Sebastopol: O'Reilly Media, 2013.
3. Matthes, Eric. "Python Crash Course: A Hands-On, Project-Based Introduction to Programming." San Francisco: No Starch Press, 2023.
4. McKinney, Wes. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython." Sebastopol: O'Reilly Media, 2017
5. Patil, Manisha M. "NoSQL Databases." New Delhi: TechKnowledge Publications, 2023.
6. Sadalage, Pramod J., and Martin Fowler. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence." Boston: Addison-Wesley Professional, 2012.
7. Sullivan, Dan. "NoSQL for Mere Mortals." Indianapolis: Addison-Wesley Professional, 2015.

Evaluation Pattern:

Total Marks: 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions based on BDST 231) • Question -2 Attempt any one question (20 M) (write Two questions of 10 marks out of three questions based on BDST 232)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : Minor	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDST 234: **CPP Programming**

Course objectives:

1. Provide object-oriented programming insight using C++.
2. Use the object-oriented paradigm in program design.
3. Explore & understand the principles of object-oriented programming.
4. Lay a foundation for advanced programming.

Course Outcomes:

1. Analyze the strengths of object-oriented programming.
2. Design and apply oop principles for effective programming.
3. Percept the utility and applicability of oop.
4. Apply object-oriented concepts for advanced programming.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Classes and Objects** 1.1 C++ programming Basics, Data Types, 1.2 Structures, Enumerations, control structures, 1.3 Arrays and Strings, Class, Object, 1.4 class and data abstraction, class scope and accessing class members, 1.5 Separating interface from implementation, controlling access to members.	8
Module -2:	**Module -2: Functions and Operator Overloading** 2.1 Function, function prototype, 2.2 Constructors and destructors, 2.3 Copy Constructor, Objects and Memory requirements, 2.4 Static Class members, data abstraction and information hiding, 2.5 inline function, concept of overloading, 2.6 Operator overloading, Overloading Unary and Binary Operators.	8
Module -3:	**Module -3: Polymorphism and Inheritance**	

	3.1 Data Conversion, Type casting (implicit and explicit), 3.2 Keywords explicit and mutable. Inheritance- Base Class and derived Class, 3.3 protected members, relationship between base Class and derived Class, 3.4 Overriding Member Functions, 3.5 Class Hierarchies Polymorphism concept, relationship among objects in inheritance hierarchy, 3.6 Abstract classes	7
Module -4:	**Module -4 : Exception Handling & Templates** 4.1 Exception Handling, Fundamentals, 4.2 exception specifications, user defined exceptions, processing unexpected exceptions, 4.3 constructor, destructor and exception handling, exception and inheritance, Templates, 4.4 Function template, overloading Function templates, 4.5 class template, Nontype parameters, 4.6 export keywords.	7

Reference Books:-

1. Alexandrescu, Andrei. Modern C++ Design: Generic Programming and Design Patterns Applied. Boston: Addison-Wesley, 2001.
2. Cogswell, Jeffrey M. C++ All-in-One For Dummies. Hoboken: For Dummies, 2015.
3. Lippman, Stanley B., Josée Lajoie, and Barbara E. Moo. C++ Primer. Boston: Addison-Wesley, 2012.
4. Meyers, Scott. Effective Modern C++: 42 Specific Ways to Improve Your Use of C++11 and C++14. Sebastopol: O'Reilly Media, 2014.
5. Prata, Stephen. C++ Primer Plus. Indianapolis: Sams Publishing, 2011.
6. Schildt, Herbert. C++: The Complete Reference. New York: McGraw-Hill Education, 2003.
7. Stroustrup, Bjarne. A Tour of C++. Boston: Addison-Wesley, 2013.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective • Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) • Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : Minor	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDST 235: **Computer Networking**

Course objectives:

1. Understand fundamental networking concepts, protocols, and standards.
2. Exploring various layers of the osi model and tcp/ip suite.
3. Exploring application layer protocols and their functions.
4. Importance of network security, protocols.

Course Outcomes:

1. Be various protocols and the basic structure of ip address and concept of sub netting with numerical.
2. Various protocols like tcp.
3. Understand various network layer and application layer.
4. Like the network security.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Basics of Networks:** 1.1 Introduction to networks, Internet, 1.2 protocols and standards 1.3 Introduction to OSI model with layers, 1.4 TCP/IP suite with layers, 1.5 comparison between TCP/IP and OSI, 1.6 Addressing.	8
Module -2:	**Module -2: Physical Layer and Data link layer** 2.1 Physical Layer: digital transmission, multiplexing, transmission media, circuit switched networks, 2.2 Datagram networks, virtual circuit networks, switch and Telephone network. 2.3 Data link layer: Introduction, Block coding, cyclic codes, checksum, 2.4 framing, flow and error control, Noiseless channels, noisy channels, HDLC, 2.5 point to point protocols**.**	8

Module -3:	**Module -3: Network Layer** 3.1 Network Layer: Logical addressing, 3.2 Internetworking, tunneling, address mapping, 3.3 ICMP, IGMP, forwarding, 3.4 uni-cast routing protocols, 3.5 multicast routing protocols.	8
Module -4:	**Module -4 : Application Layer:** 4.1 Application Layer: Domain name space, 4.2 DNS in internet, electronic mail, 4.3 FTP, WWW, HTTP, SNMP, 4.4 Multi-media, network security	6

Reference Books:-

1. Comer, Douglas E. Computer Networks and Internets. Upper Saddle River: Pearson, 2014.
2. Forouzan, Behrouz A. Data Communications and Networking. New York: McGraw-Hill, 2013.
3. Kurose, James F., and Keith W. Ross. Computer Networking: A Top-Down Approach. Boston: Pearson, 2017.
4. Peterson, Larry L., and Bruce S. Davie. Computer Networks: A Systems Approach. San Francisco: Morgan Kaufmann, 2011.
5. Tanenbaum, Andrew S., and David J. Wetherall. Computer Networks. Upper Saddle River: Pearson, 2011.
6. Worley, Rick C. Computer Networking Bible: [3 in 1] The Complete Crash Course to Effectively Design, Implement and Manage Networks. Independently published, 2023.
7. Worley, Rick C. Computer Networking Bible: [3 in 1] Implement and Manage Networks. Independently published, 2024.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective • Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) • Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : Minor	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSP 236: **Practical VIII Based on BDST 234 & BDST 235**

Course Objectives:

1. Provide object-oriented programming insight using C++.
2. Use the object-oriented paradigm in program design.
3. Explore & understand the principles of object-oriented programming.
4. Exploring various layers of the OSI model and TCP/IP suite.

Course Outcomes:

1. Analyze the strengths of object-oriented programming
2. Apply object-oriented concepts for advanced programming.
3. Understand the basic concepts of data communication including the key aspects of networking and their interrelationship.
4. Be various protocols and the basic structure of IP address and concept of sub netting with numerical.

Practical's	Title and Contents	Hrs
Practical :	1. Demonstrate different data types and constants in C++. 2. structure and enumeration. 3. control structures. 4. Demonstrate arrays and basic string operations. 5. Create a simple class with member functions and objects. 6. Hands-on experience with the use of a copy constructor. 7. Demonstrate inheritance between base and derived classes. 8. Use exception handling to catch runtime errors.	60

9. Create a function template for generic programming.
10. Demonstrating binary operator overloading.
11. Demonstration of Routers.
12. Case study of Modem.
13. Case study of Hub.
14. Demonstration of Switches.
15. Case study Of Cables.
16. Case study of WWW.
17. Use of various Commands and utilities.
18. Case study Virtual Static Routing.
19. Case study of HDLC.
20. Case study of IGMP.

Reference Books:-

1. Alexandrescu, Andrei. Modern C++ Design: Generic Programming and Design Patterns Applied. Boston: Addison-Wesley, 2001.
2. Cogswell, Jeffrey M. C++ All-in-One For Dummies. Hoboken: For Dummies, 2015.
3. Lippman, Stanley B., Josée Lajoie, and Barbara E. Moo. C++ Primer. Boston: Addison-Wesley, 2012.
4. Meyers, Scott. Effective Modern C++: 42 Specific Ways to Improve Your Use of C++11 and C++14. Sebastopol: O'Reilly Media, 2014.
5. Peterson, Larry L., and Bruce S. Davie. Computer Networks: A Systems Approach. San Francisco: Morgan Kaufmann, 2011.
6. Tanenbaum, Andrew S., and David J. Wetherall. Computer Networks. Upper Saddle River: Pearson, 2011.
7. Worley, Rick C. Computer Networking Bible: [3 in 1] The Complete Crash Course to Effectively Design, Implement and Manage Networks. Independently published, 2023.

Evaluation Pattern:

Total Marks: 100 / 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions based on BDST 234) • Question -2 Attempt any one question (20 M) (write Two questions of 10 marks out of three questions based on BDST 235)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : VSC	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSP 237 **Internet Data Security I**

Course Objectives:

1. Understand fundamental concepts of data security, cyber security, and security threats.
2. Analyze industry case studies on cybercrime, network security, and firewalls.
3. Implement authentication techniques, security mechanisms, and risk management strategies.
4. Explore ai, ml, and blockchain applications in enhancing cyber security.

Course Outcomes:

1. Analyze the strengths of object-oriented programming
2. Apply object-oriented concepts for advanced programming.
3. Understand the basic concepts of data communication including the key aspects of networking and their interrelationship.
4. Be various protocols and the basic structure of ip address and concept of sub netting with numerical.

Practical's	Title and Contents	Hrs
Practical-:	1. Demonstration of Data Security. 2. Case study on Industry Perspective application of data security. 3. Demonstration of Cyber Security. 4. Case study on Cyber Crime. 5. Demonstration on Security Threats. 6. Implementation of 2-Step Verification. 7. Demonstration on OSI Security Architecture. 8. Implementation on Security Attacks. 9. Case study on Firewalls Security. 10. Demonstration Of Security Mechanism. 11. Case study on Web Security. 12. Demonstration on Authentication. 13. Case study on Network Security. 14. Demonstration on Authentication. 15. Case study on Web Application Security.	60

16. Demonstration on Risk Management.
17. Case study on AI Cyber Security.
18. Case study on ML Cyber Security.
19. Demonstration on DL Cyber Security.
20. Case study on Block chain and its Implications

Reference Books:-

1. Andress, Jason. The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice. Waltham: Syngress, 2014.
2. Cheswick, William R., and Steven M. Bellovin. Firewalls and Internet Security: Repelling the Wily Hacker. Reading: Addison-Wesley, 1994.
3. Du, Wenliang. Internet Security: A Hands-on Approach. Syracuse: Self-published, 2019.
4. Elahi, Ata, and Alex Cushman. Computer Networks: Data Communications, Internet and Security. Cham: Springer, 2023.
5. Lenhard, Thomas H. Data Security: Technical and Organizational Protection Measures against Data Loss and Data Leakage. Wiesbaden: Springer Vieweg, 2021.
6. Oorschot, Paul C. van. Computer Security and the Internet: Tools and Jewels from Malware to Bitcoin. Cham: Springer, 2021.
7. Whitman, Michael E., and Herbert J. Mattord. Management of Information Security. Boston: Cengage Learning, 2017.

Evaluation Pattern:

Total Marks: 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions) • Question -2 Attempt any one question (20 M) (write Two questions of 10 marks out of three questions)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : SEC (Practical)	**Marks:** 50
Credits: 2	**From:** A. Y. 2025-26

Name of the Course: BDSP SEC I: Data Analytic Skills for Data Scientist

Course Objectives:

1. Study about data collection.
2. Understand the role of data in creation of effect in industry.
3. Study the ethical consideration about data.
4. Understand the sustainable development goals for an organization.

Course Outcomes:

1. Ability to clean and preprocess raw data effectively.
2. Understanding data distributions and patterns.
3. Creating meaningful features for predictive modeling.
4. Understand the concept and significance of data processing in the data science lifecycle.

Practical's	Title and Contents	Hrs
Practical-:	1. Installation of Jupyter Notebook 2. Importing and Exploring CSV Files using Pandas 3. Reading Excel, JSON, and Text Data Files 4. Collecting Data from APIs using Python 5. Importing Data from Databases (MySQL/SQLite) 6. Exploring Data using Pandas Functions 7. Handling Missing Data in Datasets 8. Detecting and Removing Duplicates 9. Handling Outliers using Statistical Methods 10. Converting and Formatting Data Types 11. To Find Mean, Median, Mode on data set.	30

12. To Find Variance, Std, Range functions on data set.
13. To find the Quartiles, Skewness and kurtosis on data set.
14. Performing above practical's on Sales dataset.
15. Performing above practical's on Agriculture dataset.
16. Performing above practical's on Hospital dataset.
17. Performing above practical's on Manufacturing dataset.
18. Performing above practical's on Tourism dataset.
19. Performing above practical's on Data Scientist Salary dataset.
20. Performing above practical's on Laptop price dataset.

Reference Books:-

1. Dawson, Russell. Fundamentals of Data Analytics: Learn Essential Skills, Embrace the Future, and Catapult Your Career in the Data-Driven World. Independently published, 2023.
2. Fawcett, Tom, and Foster Provost. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking. Sebastopol: O'Reilly Media, 2013.
3. Granville, Vincent. Developing Analytic Talent: Becoming a Data Scientist. Indianapolis: Wiley, 2014.
4. Haider, Murtaza. Getting Started with Data Science: Making Sense of Data with Analytics. Upper Saddle River: IBM Press, 2015.
5. Maheshwari, Anil. Data Analytics Made Accessible. North Charleston: CreateSpace Independent Publishing Platform, 2014.
6. McKinney, Wes. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. Sebastopol: O'Reilly Media, 2017.
7. Schwabish, Jonathan. Better Data Visualizations: A Guide for Scholars, Researchers, and Wonks. New York: Columbia University Press, 2021.

Evaluation Pattern:

Total Marks: 100 / 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three Questions) • Question -2 Attempt any one question (20 M) (write Two questions of 10 marks out of three questions)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type: IKS	**Marks:** 50
Credits: 2	**From:** A. Y. 2025-26

Name of the Course: BDST IKS II: Ethics in Data Science

Course objectives:

1. Introduce students to the fundamental concepts, theories, and principles of ethics in the context of data science.
2. Develop awareness of ethical challenges in data collection, processing, and analysis, and their impact on society.
3. Familiarize students with privacy regulations, data governance frameworks, and legal compliance requirements in India and globally.
4. Equip students with the ability to identify, evaluate, and mitigate algorithmic bias and ensure accountability in AI systems.

Course outcomes:

1. Summarize the ethical codes of conduct for computing professionals (ACM, IEEE).
2. Discuss workplace ethical challenges, including whistleblowing and conflicts of interest.
3. Critically assess emerging issues such as deep fakes, misinformation, and the environmental impact of AI systems.
4. Propose strategies for responsible innovation, incorporating human oversight in AI systems.

Module	Title and Contents	Hrs
Module -1:	Module -1: Foundations of Ethics in Data Science 1.1 Introduction to ethics: meaning, scope, importance 1.2 Ethical theories: Utilitarianism, Deontology, Virtue Ethics 1.3 Data science & society: bias, fairness, transparency	8

Module -2:	Module -2: Privacy, Consent, and Data Governance 2.1 Data privacy: confidentiality, anonymity, informed consent 2.2 Legal frameworks: Indian IT Act, Digital Personal Data Protection Act, GDPR basics 2.3 Data ownership & governance models	8
Module -3:	Module -3: Algorithmic Bias, Accountability, and Responsible AI 3.1 Sources & impact of bias in datasets and algorithms 3.2 Algorithmic accountability & transparency (Explainable AI) 3.3 Responsible innovation & human-in-the-loop systems	8
Module -4:	Module -4: Professional Conduct, Emerging Issues 4.1 Codes of conduct: ACM, IEEE guidelines 4.2 Workplace ethics, whistleblowing, conflict of interest 4.3 Emerging issues: deepfakes, misinformation, environmental impact of AI	6

Reference Books:-

1. O'Neil, Cathy – Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy – Crown, 2016.
2. Johnson, Deborah G., and Reuben R. McDaniel – Ethical Issues in Engineering – Prentice Hall, 1998 (Chapters on ethical theories).
3. Quinn, Michael J. – Ethics for the Information Age – Pearson, 2020.
4. Bynum, Terrell Ward, and Simon Rogerson – Computer Ethics and Professional Responsibility – Blackwell, 2004.
5. Solove, Daniel J. – Understanding Privacy – Harvard University Press, 2008.
6. Greenleaf, Graham – Asian Data Privacy Laws: Trade and Human Rights Perspectives – Oxford University Press, 2014 (Indian IT Act & global perspectives).
7. Kuner, Christopher – Transborder Data Flows and Data Privacy Law – Oxford University Press, 2013.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) Note: Conversion of 50 marks of ESE evaluation to 30 Marks

B.Sc. II

SEM -IV

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - IV
Type : Major	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDST 241: Python for Data Science & Analytics

Course objectives:

1. Familiarize students with foundational data processing libraries such as numpy and pandas for efficient data handling.
2. Be equip students with advanced data visualization techniques using matplotlib and seaborn.
3. Introduce students to statistical libraries for performing hypothesis testing, probability analysis, and time series modeling.
4. Provide hands-on experience with machine learning preprocessing techniques, including feature engineering and dimensionality reduction.

Course Outcomes:

1. Demonstrate proficiency in creating, manipulating, and processing data using numpy and pandas.
2. Effectively visualize data using various plotting techniques in matplotlib and seaborn.
3. Apply statistical methods for data analysis, including hypothesis testing and anova.
4. Implement data preprocessing techniques to clean, transform, and optimize datasets for machine learning.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Foundational libraries :** 1.1 NumPy arrays: Creating arrays, accessing arrays index, basic arrays operations, maths operation on arrays 1.2 Pandas: basic operations on pandas data frame 1.3 Pandas Series- basic operation on series, creating series from array, data input-output, 1.4 data manipulation (filtering, sorting, slicing), data cleaning and transformation.	7

Module -2:	**Module -2: Advance visualization libraries in python** 2.1 Matplotlib: pyplot, plotting, markers, line, labels, grid, subplot, scatter, bars, histograms, pie plot 2.2 Customizing Seaborn Plots : Changing Figure Aesthetic, Removal of Spines, Changing the figure Size, Scaling the plots, Setting the Style Temporarily 2.3 Color Palette : Diverging Color Palette, Sequential Color Palette, Setting the default Color Palette 2.4 Creating Different Types of Plots :Relational Plots, Categorical Plots, Distribution Plots, Regression Plots.	7
Module -3:	**Module -3: Statistical Libraries** 3.1 Installing and importing StatsModels, 3.2 descriptive statistics, 3.3 probabilities, 3.4 hypothesis testing, Time Series Analysis, ANOVA.	8
Module -4:	**Module -4 : Machine learning libraries** 4.1 Scikit-learn for Data preprocessing: Managing missing values, Managing Outliers, 4.2 Feature Engineering, Dimensionality Reduction 4.3 Scikit-learn for model building: Regression analysis, 4.4 Classification and Clustering,	8

Reference Books:-

1. Deitel, Paul J., and Harvey Deitel. "Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and The Cloud." Boston: Pearson, 2019.
2. Grus, Joel. "Data Science from Scratch: First Principles with Python." Sebastopol: O'Reilly Media, 2019.
3. McKinney, Wes. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter." Sebastopol: O'Reilly Media, 2022.
4. Molin, Stefanie. "Hands-On Data Analysis with Pandas: A Python Data Science Handbook for Data Collection, Wrangling, Analysis, and Visualization." Birmingham: Packt Publishing, 2021.
5. Thareja, Reema. "Data Science and Machine Learning Using Python." New Delhi: Oxford University Press, 2022.
6. VanderPlas, Jake. "Python Data Science Handbook: Essential Tools for Working with Data." Sebastopol: O'Reilly Media, 2016.
7. Vasiliev, Yuli. "Python for Data Science: A Hands-On Introduction." San Francisco: No Starch Press, 2022.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks)

• Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - IV
Type : Major	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDST 242: Image Processing

Course objectives:

1. Introduce the fundamental concepts of image processing, including the representation and components of digital images.
2. Provide a deep understanding of digital image representation, sampling, and quantization.
3. Implement methods for image restoration, including noise reduction and filtering techniques.
4. Real-world applications of image processing in fields such as computer vision, medical imaging, and object recognition

Course outcomes:

1. Demonstrate a clear understanding of the fundamental principles of image processing, including digital image representation and the components of an image processing system.
2. Perform basic pixel operations, arithmetic operations, and spatial filtering techniques for manipulating and enhancing images.
3. Utilize spatial and frequency domain techniques for image enhancement and noise reduction.
4. Explore the role of image processing in diverse fields such as medical imaging, remote sensing, computer vision, and entertainment.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Fundamentals of Image Processing:** 1.1 Introduction of Image Processing, 1.2 Digital Image Representation, Components of Image Processing System, pixel operations, 1.3 Arithmetic Operations, 1.4 Application of Image Processing.	8

Module -2:	**Module -2: Digital Image Fundamentals and Image Enhancement** 2.1 Image sampling and quantization, 2.3 Color models (RGB, CMYK, HSV, etc.), 2.3 Basic relationships between pixels (neighbors, connectivity), 2.4 Spatial domain techniques: contrast stretching, histogram equalization, 2.5 Filtering in the spatial domain: smoothing and sharpening filters	8
Module -3:	**Module -3: Image Restoration and Image Compression** 3.1 Image Restoration, Noise reduction using spatial and frequency domain filters, 3.2 Inverse filtering, Wiener filtering, 3.3 Fundamentals of image compression, 3.4 Lossy compression techniques: JPEG, MPEG.	8
Module -4:	**Module -4 : Image Segmentation** 4.1 Thresholding methods, Edge detection (Sobel, Prewitt, Canny), 4.2 Region-based segmentation, Contours, 4.3 shape descriptors, Texture analysis, 4.4 Face detection and recognition, Object detection	6

Reference Books:-

1. Bovik, Alan C., ed. Handbook of Image and Video Processing. 2nd ed. San Diego: Academic Press, 2005.
2. Gonzalez, Rafael C., and Richard E. Woods. Digital Image Processing. 4th ed. Boston: Pearson, 2018.

   Jain, Anil K. Fundamentals of Digital Image Processing. Englewood Cliffs: Prentice Hall, 1989. This classic text offers an in-depth exploration of the theoretical foundations of image processing.
3. Jayaraman, S., S. Esakkirajan, and T. Veerakumar. Digital Image Processing. New Delhi: Tata McGraw-Hill Education, 2011.

   An accessible guide that combines theory with practical examples, often used in academic settings.
4. Petrou, Maria, and Costas Petrou. Image Processing: The Fundamentals. 2nd ed. Chichester: Wiley, 2010.
5. Pratt, William K. Digital Image Processing. 2nd ed. New York: Wiley-Interscience, 1991.
6. Sridhar, S. Digital Image Processing. 2nd ed. New Delhi: Oxford University Press, 2016.

Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation (20Marks): • CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective • Note: Conversion of 40 marks of internal evaluation to 20 Marks	**End Semester Examination (30 Marks):** • Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) • Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - IV
Type : Major	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSP 243 Practical IX Based on BDST 241 & BDST 242

Course Objectives:

1. The systematic way of solving problem.
2. Standard and abstract data representation methods.
3. Various data searching and sorting methods with pros and cons.
4. Real-world applications of image processing in fields such as computer vision, medical imaging, and object recognition.

Course Outcomes:

1. Discriminate the usage of various structures in approaching the problem solution.
2. Design the algorithms to solve the programming problems.
3. Demonstrate a clear understanding of the fundamental principles of image processing, including digital image representation and the components of an image processing system.
4. Perform basic pixel operations, arithmetic operations, and spatial filtering techniques for manipulating and enhancing images.

Practical's	Title and Contents	Hrs
Practical-:	1. Write a Python program to search for an element in a list using linear search. 2. Write a program to implement binary search on a sorted list. 3. Implement binary search using recursion in Python. 4. Solve the problem of searching in a rotated sorted array. 5. Implement bubble sort to arrange elements in ascending order. 6. Write a Python program to implement selection sort.	60

7. Use the divide-and-conquer approach to implement merge sort.
8. Implement in-order, pre-order, and post-order traversal of a binary tree.
9. Write a program to calculate the height of a binary tree.
10. Create a BST and implement insertion, deletion, and search operations.
11. Reading and Displaying Images
12. Image Resizing and Cropping
13. Image Rotation and Translation
14. Drawing Shapes and Text on Images
15. Blurring and Smoothing
16. Image Conversion: Grayscale and Binary
17. Increase or decrease the brightness of an image.
18. Detect edges in an image using methods like Canny edge detection.
19. Perform operations like dilation, erosion, opening, and closing.
20. Detect and highlight a specific colour in an image.

Reference Books:-

1. Deitel, Paul J., and Harvey Deitel. "Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and The Cloud." Boston: Pearson, 2019.
2. Grus, Joel. "Data Science from Scratch: First Principles with Python." Sebastopol: O'Reilly Media, 2019.
3. McKinney, Wes. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter." Sebastopol: O'Reilly Media, 2022.
4. Molin, Stefanie. "Hands-On Data Analysis with Pandas: A Python Data Science Handbook for Data Collection, Wrangling, Analysis, and Visualization." Birmingham: Packt Publishing, 2021.
5. Jayaraman, S., S. Esakkirajan, and T. Veerakumar. Digital Image Processing. New Delhi: 2011.
6. Petrou, Maria, and Costas Petrou. Image Processing: The Fundamentals. 2nd ed. Chichester: Wiley, 2010.
7. Pratt, William K. Digital Image Processing. 2nd ed. New York: Wiley-Interscience, 1991.

Evaluation Pattern:

Total Marks: 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions based on BDST 241) • Question -2 Attempt any one question (20 M) • (write Two questions of 10 marks out of three questions based on BDST 242)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - IV
Type : Minor	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDST 244: Java Programming

Course objectives:

1. Learn basic concepts of java language.
2. Study the concepts of classes and objects.
3. Study the concepts of inheritance, packages, and interfaces.
4. Understand exception handling and multithreading.

Course outcomes:

1. Implement object Oriented concepts using java.
2. Develop object Oriented software application.
3. Develop multithreading applications.
4. Handle exceptions while executing programs.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Basic of Java Programming:** 1.1 Introduction to Java, Java Virtual Machine (JVM), 1.2 JDK tool Structure of java program, 1.3 compilation and execution of java program, Java keywords, 1.4 Data types. Java variables- declaration and assigning values to variables scope of variables, 1.5 Type casting- Implicit and Explicit casting, 1.6 Operators of java, Control structures of java –1-Branching statements- If, if …. else, 1.7 if …else if and switch statement, 2- Iterative statements- for loop, 1.8 do… while, while loop, for each loop, 3- jumping statements-break and continue statement.	8
Module -2:	**Module -2: Introducing classes and objects** 2.1 Introduction: Classes, Objects and methods, 2.2 Defining a class, field declaration, method declaration, Accessing class members, 2.3 access specifies in java, Static variables and methods, 2.4 Method overloading, Constructor- types of constructors, 2.5 constructor overloading, Use of this keyword, Array, types of Array, 2.6 array of object Collection-Iterator interface, List interface,	7

	2.7 Array List class, Linked List class, Vector class and Stack class.	
Module -3:	**Module -3: Inheritance, packages and interfaces** 3.1 Introduction: Classes, Objects and methods, 3.2 Defining a class, field declaration, method declaration, Accessing class members, 3.3 access specifies in java, Static variables and methods, 3.4 Method overloading, Constructor- types of constructors, 3.5 constructor overloading, Use of this keyword, Array, types of Array, 3.6 array of object Collection-Iterator interface, List interface, 3.7 Array List class, Linked List class, Vector class and Stack class.	7
Module -4:	**Module -4 : Exception Handling** 4.1 Concept of exception, difference between error and exception, 4.2 Types of exceptions-checked and unchecked, 4.3 Exception handling using try and catch block, Multiple catch block, 4.4 finally block, throws keyword, 4.5 User defined exception, 4.6 Concept of multithreading in java,	8

Reference Books:-

1. Bloch, Joshua. Effective Java. 3rd ed. Boston: Addison-Wesley, 2018.
2. Burd, Barry. Java: A Beginner's Guide. 8th ed. New York: McGraw-Hill Education, 2018.
3. Goetz, Brian, with Tim Peierls, Joshua Bloch, Joseph Bowbeer, David Holmes, and Doug Lea. Java Concurrency in Practice. Boston: Addison-Wesley, 2006.
4. Horstmann, Cay S. Core Java Volume I—Fundamentals. 11th ed. Upper Saddle River: Prentice Hall, 2018.
5. Karumanchi, Narasimha. Data Structures and Algorithms Made Easy in Java. 2nd ed. Hyderabad: CareerMonk Publications, 2011.
6. Schildt, Herbert. Java: The Complete Reference. 13th ed. New York: McGraw-Hill Education, 2023.
7. Sierra, Kathy, and Bert Bates. Head First Java. 2nd ed. Sebastopol: O'Reilly Media, 2005.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective • Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) • Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - IV
Type : Minor	**Marks:** 50
Credits : 2	**From: A. Y. 2025-26**

Name of the Course: BDST 245: Cyber Security

Course objectives:

1. Basics of computer, network and information security.
2. Study operating system security and malwares.
3. Acquaint with security issues in internet protocols.
4. Analyze the system for vulnerabilities.

Course outcomes:

1. Use cryptographic techniques in secure application development.
2. Apply methods for authentication, access control, intrusion detection and prevention.
3. Apply the scientific method for security assessment.
4. Illustrate computer forensics knowledge.

Module	Title and Contents	Hrs
Module -1:	**Module -1: Basic concepts of Cyber Security:** 1.1 Introduction, Elements of Information Security, 1.2 Security Policy, Techniques, Steps, Categories, 1.3 Operational Model of Network Security, 1.4 Basic Terminologies in Network Security. Threats and Vulnerability, 1.5 Difference between Security and Privacy.	8
Module -2:	**Module -2: Data Encryption Techniques and Standards** 2.1 Introduction, Encryption Methods: Symmetric, Asymmetric, 2.2 Cryptography, Substitution Ciphers. Transposition Ciphers, 2.3 Stenography applications and limitations, 2.4 Block Ciphers and methods of operations, Feistal Cipher, 2.5 Data Encryption Standard (DES), Triple DES, Weak Keys in DES Algorithms, 2.6 Advance Encryption Standard (AES).	8

Module -3:	**Module -3: Public Key and Management** 3.1 Public Key Cryptography, RSA Algorithm: Working, 3.2 Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, 3.3 Elliptic Curve: Arithmetic, Cryptography, Security, Authentication methods, 3.4 Message Digest, Kerberos, X.509 Authentication service. 3.5 Digital Signatures: Implementation, Algorithms, Standards (DSS), 3.6 Authentication Protocol	8
Module -4:	**Module -4 : Firewall and Intrusion** 4.1 Computer Intrusions. Firewall Introduction, 4.2 Characteristics and types, Benefits and limitations. 4.3 Firewall architecture, Trusted Systems, Access Control. Intrusion detection, 4.4 IDS: Need, Methods, Types of IDS, 4.5 Password Management, Limitations and Challenges.	6

Reference Books:-

1. Kaplan, Fred. Dark Territory: The Secret History of Cyber War. New York: Simon & Schuster, 2016.
2. Kosseff, Jeff. Cybersecurity Law. Hoboken: Wiley, 2017.
3. Nichols, Lester. Cybersecurity Architect's Handbook: An End-to-End Guide to Implementing , Birmingham: Packt Publishing, 2023
4. Ozkaya, Erdal. Cybersecurity: The Beginner's Guide. Birmingham: Packt Publishing, 2019.
5. Steinberg, Joseph. Cybersecurity For Dummies. Hoboken: Wiley, 2019.
6. Walker, Shawn. Cybersecurity Bible: The Complete Guide to Detect, Prevent and Manage Cyber Threats. Independently published, 2024.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20Marks):	**End Semester Examination (30 Marks):**
• CCE – I: 10 Marks: Objective • CCE – II: 10 Marks: Objective • Mid Semester Exam: 20 Marks: Subjective • Note: Conversion of 40 marks of internal evaluation to 20 Marks	• Question -1: Solve the following questions (Five question of 2 Marks) • Question -2: Attempt any two questions (Three question of 10 Marks) Question -3: Attempt any two questions (Five question of 5 Marks) • Note: Conversion of 50 marks of ESE evaluation to 30 Marks

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - IV
Type : Minor	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSP246 Practical X Based on BDST 244 & BDST 245

Course Objectives:

1. Learn basic concepts of java language.
2. Study the concepts of classes and objects.
3. Study the concepts of inheritance, packages, and interfaces.
4. Understand exception handling and multithreading.

Course Outcomes:

1. Implement object-oriented concepts using java.
2. Develop object-oriented software application.
3. Use cryptographic techniques in secure application development.
4. Apply methods for authentication, access control, intrusion detection and prevention.

Practical's	Title and Contents	Hrs
Practical-:	1. Installation of Java 2. Performing Operator in Java 3. Implementation of Conditional Statement 4. Implementation of looping statements 5. Program on class, objects, 6. Program on field and method. 7. Implementation of Method Overriding 8. Program on Array 9. Program on Collection 10. Program on Inheritance 11. Case study on Cyber Attacks. 12. Case study on Network Security.	60

13. Case study on Symmetric encryption algorithm.
14. Case study on Asymmetric Symmetric encryption algorithm.
15. Case study on Intrusion detection.
16. Case study on Cryptography.
17. Case study on public encryption algorithm.
18. Case study on Authentication Protocol.
19. Case study on Digital Signature
20. Case Study on Dimond Problem

Reference Books:-

1. Bloch, Joshua. Effective Java. 3rd ed. Boston: Addison-Wesley, 2018.
2. Burd, Barry. Java: A Beginner's Guide. 8th ed. New York: McGraw-Hill Education, 2018.
3. Goetz, Brian, with Tim Peierls, Joshua Bloch, Joseph Bowbeer, David Holmes, and Doug Lea. Java Concurrency in Practice. Boston: Addison-Wesley, 2006.
4. Horstmann, Cay S. Core Java Volume I—Fundamentals. 11th ed. Upper Saddle River: Prentice Hall, 2018.
5. Nichols, Lester. Cybersecurity Architect's Handbook: An End-to-End Guide to Implementing and Maintaining Robust Security Architecture. Birmingham: Packt Publishing, 2023
6. Ozkaya, Erdal. Cybersecurity: The Beginner's Guide. Birmingham: Packt Publishing, 2019.
7. Steinberg, Joseph. Cybersecurity For Dummies. Hoboken: Wiley, 2019.

Evaluation Pattern:

Total Marks: 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions based on BDST 243) • Question -2 Attempt any one question (20 M) (write Two questions of 10 marks out of three questions based on BDST 244)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : VSC	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSP VSC II: Internet Data Security II

Course Objectives:

1. Understand fundamental concepts of data security, cyber security, and security threats.
2. Analyze industry case studies on cybercrime, network security, and firewalls.
3. Implement authentication techniques, security mechanisms, and risk management strategies.
4. Explore ai, ml, and blockchain applications in enhancing cyber security.

Course Outcomes:

1. Gain a strong foundation in cyber security principles, threats, and security mechanisms.
2. Apply security concepts to solve real-world cyber threats and vulnerabilities.
3. Develop hands-on skills in implementing authentication, encryption, and security protocols.
4. Understand the role of ai, ml, and blockchain in modern cyber security frameworks.

Practical's	Title and Contents	Hrs
Practical-:	1.Demonstration on Cryptography 2.Case study on Digital signature 3.Case study on Encryption techniques 5.Case study on Internet of Things 6.Case study on Internet security Mechanisms 7.Case study on Cloud security 8.Case study on Cloud computing Case study on Operating system security 10.Case study on Software security 11.Case study on Security software development lifecycle 12.Case study on Cyber law using data science 13.Case study on Cryptographic protocols in SSL	60

	14.Case study on Iot security architecture 15.Case study on Cloud computing architecture 16.Case study on Access control mechanisms DAC 17.Case study on Static code analysis 18.Case study on Dynamic code analysis 19.Case study on Cyber laws 20.Case study on Regulations and Privacy issues in cyber laws.	

Reference Books:-

1. Andress, Jason. The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice. Waltham: Syngress, 2014.
2. Cheswick, William R., and Steven M. Bellovin. Firewalls and Internet Security: Repelling the Wily Hacker. Reading: Addison-Wesley, 1994.
3. Du, Wenliang. Internet Security: A Hands-on Approach. Syracuse: Self-published, 2019.
4. Elahi, Ata, and Alex Cushman. Computer Networks: Data Communications, Internet and Security. Cham: Springer, 2023.
5. Lenhard, Thomas H. Data Security: Technical and Organizational Protection Measures against Data Loss and Data Leakage. Wiesbaden: Springer Vieweg, 2021.
6. Oorschot, Paul C. van. Computer Security and the Internet: Tools and Jewels from Malware to Bitcoin. Cham: Springer, 2021.
7. Whitman, Michael E., and Herbert J. Mattord. Management of Information Security. Boston: Cengage Learning, 2017.

Evaluation Pattern:

Total Marks: 100 / 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions) • Question -2 Attempt any one question (20 M) • (write Two questions of 10 marks out of three questions)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computer Science

Programme: B.Sc.	**Semester** - III
Type : SEC	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BDSPSEC II: Data Processing Skills for Data Scientist (Practical)

Course Objectives:

1. Study about data collection.
2. Understand the role of data in creation of effect in industry.
3. Study the ethical consideration about data.
4. Understand the sustainable development goals for an organization.

Course Outcomes:

1. Ability to clean and preprocess raw data effectively.
2. Be data distributions and patterns.
3. Creating meaningful features for predictive modeling.
4. Concept and significance of data processing in the data science lifecycle.

Practical's	Title and Contents	Hrs
Practical-:	1. Plot a Histogram graph on the data set. 2. Plot a Bar chart graph on the data set. 3. Plot a Scatter plot graph on the data set. 4. Plot a Box plot graph on the data set. 5. Plot a Count plot and Heatmap graph on the data set. 6. Plot a Pair plot graph on the data set. 7. Plot a Pie chart graph on the data set. 8. Plotting Multiple Graphs in One Figure (Subplots) 9. Data pre-processing and Standardization. 10. Min-Max Normalization.	15

	11. Max normalization absolute Scaling. 12. Z-Score Standardization using Pandas 13. Data pre-processing and Standardization. 14. Training the Model Evolution by Accuracy score. 15. Building a Simple Linear Regression Model 16. Implementing Logistic Regression for Classification 17. Model Accuracy, Precision, Recall, and F1-Score Evaluation 18. Data Analysis on Sales Dataset 19. Data Analysis on Student Performance Dataset 20. Mini Data Analysis Project (Complete Pipeline)	

Reference Books:-

1. Dawson, Russell. Fundamentals of Data Analytics: Learn Essential Skills, Embrace the Future, and Catapult Your Career in the Data-Driven World. Independently published, 2023.
2. Fregly, Chris, and Antje Barth. Data Science on AWS: Implementing End-to-End, Continuous AI and Machine Learning Pipelines. Sebastopol: O'Reilly Media, 2021.
3. Goldmeier, Jordan. Data Smart: Using Data Science to Transform Information into Insight. Indianapolis: Wiley, 2013.
4. McKinney, Wes. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter. 2nd ed. Sebastopol: O'Reilly Media, 2017.
5. Nield, Thomas. Essential Math for Data Science: Take Control of Your Data with Fundamental Linear Algebra, Probability, and Statistics. Sebastopol: O'Reilly Media, 2022.
6. Reis, Joe, and Matt Housley. Fundamentals of Data Engineering: Plan and Build Robust Data Systems. Sebastopol: O'Reilly Media, 2022.
7. VanderPlas, Jake. Python Data Science Handbook: Essential Tools for Working with Data. Sebastopol: O'Reilly Media, 2016.

Evaluation Pattern:

Total Marks: 50

Journal and Students Performance Viva (10 M)	**Practical Exam Paper (40 M):**
• Journal: 5 marks • Student's Performance: 5marks	• Question -1 Attempt any two question (20 M) (write Two questions of 10 marks out of three questions based on BDST 231)

	• Question -2 Attempt any one question (20 M) (write Two questions of 10 marks out of three questions based on BDST 232)