



**Karmaveer Bhaurao Patil University,
Satara**

**Syllabus for
B. Sc. Honors Computer Science**

Under
Faculty of Science and Technology
(As per NEP 2020)

With effect from Academic Year 2026-2027

Syllabus for Bachelor of Science Honors, Computer Science

PREAMBLE:

In alignment with the NEP 2020 guidelines, the B.Sc. Honors, Computer Science programme is designed to provide students with advanced theoretical knowledge, practical skills, research aptitude, and industry-oriented competencies in emerging areas of Computer Science. The Honors in Computer Science program is an integrated academic degree offered under the Faculty of Science, aiming to build a strong foundation for advanced learning. This initiative represents a conscious effort to foster a knowledge-driven academic environment that keeps pace with evolving technological advancements.

A distinguishing feature of the Honors program is its focus on research, innovation, and experiential learning. Students are introduced to research methodology and its practical applications, enabling them to identify research problems, conduct literature reviews, apply scientific methods, and prepare technical reports. The curriculum also provides opportunities for On-the-Job Training (OJT), project-based learning, and laboratory-oriented practical courses that enhance technical proficiency and professional skills.

- 1. TITLE:** Computer Science
- 2. YEAR OF IMPLEMENTATION:** 2026-2027
- 3. DURATION:** 01 year
- 4. PATTERN:** Semester Examination
- 5. MEDIUM OF INSTRUCTION:** English
- 6. PRACTICAL BATCHES:** 20 students/batch
- 7. STRUCTURE OF COURSE: (As per NEP 2020)**

Sem (Level)	Courses			OE	VSC/ SEC	AEC/VEC/ IKS	OJT/FP/ CEP/CC/ RP	Total Credits
	Course I	Course II	RM					
	DSC Mandatory	DSE Elective						
SEM VII (6.0)	DSC XVII(4) DSC XVIII(4) DSC XIX(4) DSC (P) IX(2)	DSE XX(2) (Elect.) DSE (P) X(2)	RM I (2) RM (P) I (2)	-	-	-	-	22
SEM VIII (6.0)	DSC XXI(4) DSC XXII(4) DSC XXIII(4) DSC (P) XI(2)	DSE XXIV(2) (Elect.) DSE (P) XII(2)	-	-	-	-	OJT(4)	22
Credit	28	08	04					44

8. TITLE OF THE COURSE:

B. Sc. Honors (Computer Science) Semester-VII

Level	Semester	Course	Theory				Practical		
			Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of lectures per week	Credits
6.0	VII	DSC XVII	BCST 471	Design and Analysis of Algorithm	4	4	DSC (P) IX BCSP 477	4	2
		DSC XVIII	BCST 472	Principle of programming Languages	4	4			
		DSC XIX	BCST 473	Advanced Database Management Systems	4	4			
		DSE XX (Elect.)	BCST 474	Advanced Networking	2	2	DSE Elective X (P) BCSP 478	4	2
		DSE XX (Elect.)	BCST 475	Blockchain Technology					
		RM	BCSTRM 476	Research Methodology	2	2	BCSPRM 479	4	2

B. Sc. Honors (Computer Science) Semester-VIII

Level	Semester	Course	Theory				Practical		
			Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of lectures per week	Credits
6.0	VIII	DSC XXI	BCST 481	Natural Language Processing	4	4	DSC (P) XI BCSP 486	4	2
		DSC XXII	BCST 482	Cloud Computing	4	4			
		DSC XXIII	BCST 483	Digital Image Processing	4	4			
		DSE XXIV (Elect.)	BCST 484	Cyber Security and Laws	2	2	DSE Elect. (P) XII BCSP 487	4	2
		DSE XXIV (Elect.)	BCST 485	Mathematical and Statistical Foundations					
		OJT	-	On Job Training (OJT)	-	-	BCSPOJT 488	8	4

9. EVALUATION STRUCTURE:

B. Sc. Honors – Semester-VII

Vertical	Course Category	Course Code	Internal Evaluation (Best of Two CCE)			ESE	Total Marks	Credits
			CCE I	CCE II	CCE III			
DSC	T	BCST 471	20	20	20	60	100	04
	T	BCST 472	20	20	20	60	100	04
	T	BCST 473	20	20	20	60	100	04
	P	BCSP 477	20			30	50	02
DSE (1 Theory Papers Out of 2)	T	BCST 474	10	10	10	30	50	02
	T	BCST 475	10	10	10	30	50	02
	P	BCSP 478	20			30	50	02
RM	T	BCSTRM 476	10	10	10	30	50	02
	P	BCSPRM 479	20			30	50	02
Total							550	22

B. Sc. Honors - Semester -VIII

Vertical	Course Category	Course Code	Internal Evaluation (Best of Two CCE)			ESE	Total Marks	Credits
			CCE I	CCE II	CCE III			
DSC	T	BCST481	20	20	20	60	100	04
	T	BCST482	20	20	20	60	100	04
	T	BCST483	20	20	20	60	100	04
	P	BCSP 486	20			30	50	02
DSE (1 Theory Papers Out of 2)	T	BCST484	10	10	10	30	50	02
	T	BCST485	10	10	10	30	50	02
	P	BCSP 487	20			30	50	02
OJT	P	BCSPOJT 488	40			60	100	04
Total							550	22

DSC: Discipline Specific Course; DSE: Discipline Specific Elective RM: Research Methodology; OJT: On Job Training; RP: Research Project; T: Theory; P: Practical

➤ CONTINUOUS COMPREHENSIVE EVALUATION (CCE) STRUCTURE

- Internal evaluation of theory papers shall carry a weightage of 40%.
- Activity: For the internal evaluation of theory papers following activities will be adopted for CCE I & CCE II: class test/ open book test/ online course/ Industrial review/ Industrial visit/ e-learning video creation/ assignment/seminar/ case study/ fieldwork/ project.
- CCE III shall consist of multiple-choice questions.
- Each CCE will carry 10 marks for 2-credit theory papers and 20 marks for 4-credit theory papers, and the best two scores will be considered for final score.
- Internal evaluation of practical papers shall carry a weightage of 40%.
- For practical examinations, internal evaluation will be based on student performance, attendance, journal records, and viva voce.

10. 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:

1. Computer = 120 Computers.
2. LCD projector = 2
3. Smart board = 5
4. Software's: Turbo C7, Oracle, JDK, Ubuntu, StarUML, Adobe Photoshop, Visual Studio, Jupyter Notebook, Scala, Tableau, Hadoop.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VII

Type: DSC

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: Design & Analysis of Algorithms (BCST 471)

Course Objectives: Student should be able to,

- 1) understand the fundamental principles of algorithm design and analysis.
- 2) compare various algorithm design paradigms, including divide and conquer, dynamic programming, greedy algorithms, backtracking, and branch and bound.
- 3) learn the time and space complexity of algorithms using asymptotic notations.
- 4) study design and implement efficient algorithms for solving real-world computational problems.

Course Outcomes: Student will be able to,

- 1) apply mathematical, computational, and algorithmic concepts to design and analyze algorithms.
- 2) analyze the efficiency of algorithms using asymptotic notations and recurrence relations.
- 3) explain divide and conquer, greedy, and dynamic programming techniques to develop efficient solutions for computational problems.
- 4) design and implement backtracking and branch and bound algorithms to solve combinatorial optimization problems.

Module	Title and Contents	Hrs.
Module -1:	Introduction to Algorithms and Design Strategies 1.1 Fundamentals of algorithms, algorithm specification, performance analysis, cases in analysis, asymptotic notations, growth of functions, order of growth comparison. 1.2 Recurrence relation, role in recursive algorithms, algorithm correctness. 1.3 Overview of algorithm design techniques, divide and conquer, decrease and conquer transform and conquer, brute force, greedy method. 1.4 Applications and problem domains, sorting and searching algorithms string matching (basic idea), real-world relevance of algorithm design.	15
Module -2:	Optimization Techniques (DP, Backtracking & Branch and Bound) 2.1 Dynamic programming: principle and control abstraction, time analysis of dynamic programming. 2.2 Matrix chain multiplication, 0/1 knapsack problem, optimal binary search tree (OBST). 2.3 Backtracking: principle and control abstraction, 8-Queen problem, Graph coloring problem. 2.4 Branch and Bound: principle and control abstraction, travelling salesperson problem (TSP), basic time analysis of backtracking and branch and bound.	15
Module -3:	Advanced Algorithm Analysis and Design Techniques 3.1 Amortized analysis, aggregate analysis, accounting method. 3.2 Potential function method, binary counter analysis, stack operations analysis, time-space tradeoff. 3.3 Tractable and intractable problems, P, NP, NP-Complete basics (overview), randomized algorithms, approximation algorithms, greedy vs approximation approach (basic idea).	15

	3.4 Embedded algorithms, power-optimized scheduling in embedded systems, sorting algorithms for embedded systems, resource-constrained algorithm. design performance evaluation of algorithms.	
Module -4:	Multithreaded, Distributed and String-Matching Algorithms 4.1 Multithreaded Algorithms, introduction to multithreaded algorithms, performance measures, analysis of multithreaded algorithms, parallel loops. 4.2 Race conditions, multithreaded matrix multiplication, multithreaded merge sort. 4.3 Distributed algorithms, introduction to distributed algorithms. 4.4 Breadth first search (BFS), distributed minimum spanning Tree (MST). string matching algorithms, introduction to string matching, naive string matching algorithm, Rabin-Karp algorithm.	15

Reference Books: -

- 1) T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, 'Introduction to Algorithms', MIT Press, 2022.
- 2) P. H. Dave, H. B. Dave, 'Design and Analysis of Algorithms', Pearson Education, 2012.
- 3) R. Sedgewick, Kevin Wayne, 'Algorithms', Addison-Wesley, 2011.
- 4) E. Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 'Fundamentals of Computer Algorithms', Universities Press, 2008.
- 5) J. Kleinberg, É.Tardos, 'Algorithm Design', Pearson, 2005.

Evaluation Pattern: 40:60

Total Marks: 100

Internal Continuous Evaluation (40 Marks):

- CCE - I : 20 Marks
 - CCE - II: 20 Marks
 - CCE - III: 20 Marks
- (Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (60 Marks):

1. Question No. 1 is compulsory.
 2. Attempt any four questions from question number 2 to 7.
- Question-1: 2 Marks $\times$ 6 = 12 Marks
 - Question-2: 6 Marks $\times$ 2 = 12 Marks
 - Question-3: 6 Marks $\times$ 2 = 12 Marks
 - Question-4: 6 Marks $\times$ 2 = 12 Marks
 - Question-5: 4 Marks $\times$ 3 = 12 Marks
 - Question-6: 4 Marks $\times$ 3 = 12 Marks
 - Question-7: 4 Marks $\times$ 3 = 12 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VII

Type: DSC

Marks: 100

Credits: 4

From: A. Y. 2026-27

**Name of the Course and Code: Principles of Programming Language
Learning (BCST 472)**

Course Objectives: Student should be able to,

- 1) understand the fundamental concepts and evolution of programming languages.
- 2) recognize the syntax, semantics, and structural features of programming languages.
- 3) examine data types, control structures, and the runtime behavior of programming languages.
- 4) identify object-oriented, concurrent, and other modern programming paradigms and concepts.

Course Outcomes: Student will be able to,

- 1) apply fundamental concepts and principles of programming languages, including syntax, control structures, and programming paradigms.
- 2) explain the implementation of common programming language features and underlying design concepts.
- 3) apply object-oriented programming principles to design and develop software solutions.
- 4) develop the ability to analyze and compare programming languages from a conceptual and practical perspective.

Module	Title and Contents	Hrs.
Module -1:	Introduction, Syntax and Semantics 1.1 Evolution of programming languages, need for studying programming languages. 1.2 Programming paradigms: Imperative paradigm, object-oriented paradigm, functional paradigm, logic programming paradigm. 1.3 Criteria for evaluating programming languages, language design principles, syntax and semantics of programming languages. 1.4 Formal methods for describing syntax: context-free grammars, backus-aur form (BNF) and EBNF, parse trees and derivations, ambiguity in grammars, introduction to lexical analysis and parsing techniques.	15
Module -2:	Data Types, Expressions, and Control Structures 2.1 Names, variables and binding concepts, scope and lifetime of variables, type systems: static and dynamic typing, type checking. 2.2 Primitive data types, structured data types: arrays, records, strings, union types, pointers and references. 2.3 Expressions and operators: arithmetic, logical, and relational operations, type conversion and type coercion, assignment statements. 2.4 Control structures: selection statements, iteration constructs, nested control structures.	15
Module -3:	Subprograms and Runtime Concepts 3.1 Subprogram design and implementation, Functions and Procedures. 3.2 Parameter passing mechanisms: call by value, call by reference, call by result and value-result. 3.3 Scope rules and referencing environments, activation records and runtime stack, recursive subprograms. 3.4 Overloading and generic subprograms, nested subprograms and blocks, static vs dynamic scope, memory management and garbage collection basics.	15

Module -4: Object Orientation, Concurrency, and Advanced Paradigms	4.1 Object-oriented programming concepts: classes and objects, encapsulation, inheritance, polymorphism, object-oriented design issues, exception handling mechanisms. 4.2 Concurrency concepts: processes and threads, synchronization mechanisms, semaphores and monitors. 4.3 Message passing and communication, Functional programming, concepts (theoretical basis). 4.4 Logic programming concepts and rule-based systems, multi-paradigm programming languages, comparison of programming, paradigms.	15
---	--	----

Reference Books: -

- 1) R. W. Sebesta, 'Concepts of Programming Languages', Pearson, 12th Edition, 2019.
- 2) E. Balagurusamy, 'Programming in ANSI C', McGraw Hill Education, 7th Edition, 2017.
- 3) M. L. Scott, 'Programming Language Pragmatics, Morgan Kaufmann', 4th Edition, 2016.
- 4) Y. P. Kanetkar, 'Understanding Pointers in C', BPB Publications, 2nd Edition, 2015.
- 5) K. C. Loudon and K. A. Lambert, 'Programming Languages: Principles and Practice', Cengage Learning, 3rd Edition, 2011.

Evaluation Pattern: 40:60

Total Marks: 100

Internal Continuous Evaluation (40 Marks):	End Semester Examination (60 Marks):
• CCE - I : 20 Marks • CCE - II: 20 Marks • CCE - III: 20 Marks (Best of 2 from CCE I, II & III Selected for final Score)	1. Question No. 1 is compulsory. 2. Attempt any four questions from question number 2 to 7. • Question-1: 2 Marks $\times$ 6 = 12 Marks • Question-2: 6 Marks $\times$ 2 = 12 Marks • Question-3: 6 Marks $\times$ 2 = 12 Marks • Question-4: 6 Marks $\times$ 2 = 12 Marks • Question-5: 4 Marks $\times$ 3 = 12 Marks • Question-6: 4 Marks $\times$ 3 = 12 Marks • Question-7: 4 Marks $\times$ 3 = 12 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences

(Computer Science)

Programme: B. Sc. Honors

Semester - VII

Type: DSC

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: Advanced Database Management System (BCST 473)

Course Objectives: Student should be able to,

1. understand the concepts and characteristics of different types of databases.
2. compare database query languages and the principles of active databases.
3. study indexing techniques and their role in improving database performance.
4. learn the ability to formulate and solve complex and recursive database queries.

Course Outcomes: Student will be able to,

1. explain the principles and importance of database security for protecting data and ensuring secure access.
2. demonstrate the fundamentals of query evaluation and heuristic query optimization techniques.
3. apply concurrency control and recovery mechanisms to ensure database consistency and reliability.
4. design and implement database systems by applying the fundamental concepts of Database Management Systems (DBMS).

Module	Title and Contents	Hrs.
Module -1:	Query Processing and Evaluation 1.1 Measures of query cost, selection operation, sort join operation, other operations, evaluation of expression. 1.2 Transformation of relational expressions, role of relational algebra. 1.3 Relational calculus in query optimization, estimating statistics of expression. 1.4 Choice of evaluation plans, views and query processing, query optimization.	15
Module -2:	Transaction Management and Recovery 2.1 Advanced feature of transactions, enhanced lock based and timestamp-based protocols. 2.2 Multiple granularity, multi-version schemes, deadlock handling. 2.3 Weak levels of consistency, concurrency in index structures, recovery and atomicity. 2.4 Recovery with concurrent transaction, buffer management, advanced recovery techniques, remote backup systems, use of sql in recovery, examples of e-transactions.	15
Module -3:	Database Security and Authorization 3.1 Levels of database security, access control. 3.2 Multilevel security, statistical database security. 3.3 Audit trails in the databases. 3.4 Examples of e-security.	15
Module -4:	Distributed Databases 4.1 Centralized versus non centralized databases, homogeneous and heterogeneous ddbms and their comparison. 4.2 Functions and architecture, distributed database design, query, processing in ddbms.	

	4.3 Distributed concurrency management, deadlock management. 4.4 Distributed commit protocols: 2 PC and 3 PC.	
Reference Books: - 1) A. Silberschatz, H. F. Korth, and S. Sudarshan, 'Database System Concepts', New York: McGraw-Hill Education, 2019. 2) E. Ramez, and S. B. Navathe, 'Fundamentals of Database Systems', Boston: Pearson Education, 2016. 3) T. Connolly and C. Begg, 'Database Systems: A Practical Approach to Design, Implementation, and Management', Harlow: Pearson Education, 2015. 4) P. J. Sadalage., and M. Fowler, 'NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence', Boston: Addison-Wesley, 2012. 5) J. D. Ullman, Garcia-Molina Hector and J. Widom, 'Database Systems: The Complete Book', Upper Saddle River, NJ: Prentice Hall, 2008.		
Evaluation Pattern: 40:60		
Total Marks: 100		
Internal Continuous Evaluation (40 Marks): • CCE - I : 20 Marks • CCE - II: 20 Marks • CCE - III: 20 Marks (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination (60 Marks): 1. Question No. 1 is compulsory. 2. Attempt any four questions from question number 2 to 7. • Question-1: 2 Marks $\times$ 6 = 12 Marks • Question-2: 6 Marks $\times$ 2 = 12 Marks • Question-3: 6 Marks $\times$ 2 = 12 Marks • Question-4: 6 Marks $\times$ 2 = 12 Marks • Question-5: 4 Marks $\times$ 3 = 12 Marks • Question-6: 4 Marks $\times$ 3 = 12 Marks • Question-7: 4 Marks $\times$ 3 = 12 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VII

Type: DSE

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Advanced Networking (BCST 474)

Course Objectives: Student should be able to,

1. describe the working principles and features of transport layer protocols such as UDP, TCP, and SCTP.
2. understand the architecture of the Internet, IP addressing schemes, subnetting, and network layer protocols.
3. learn common network security threats, attacks, and vulnerabilities, and understand the fundamentals of cryptography.
4. develop the ability to analyze networking concepts and apply appropriate techniques for secure and efficient communication in distributed environments.

Course Outcomes: Student will be able to,

1. identify network security threats and apply basic cryptographic techniques for secure communication.
2. apply networking principles, addressing schemes, and communication protocols to design and configure computer networks.
3. demonstrate the use of appropriate networking tools and techniques for network configuration, monitoring, and troubleshooting.
4. analyze network architectures, routing algorithms, and transport mechanisms to identify and resolve common networking problems.

Module	Title and Contents	Hrs.
Module -1:	Internet Architecture and Network Layer 1.1 Structure of internet, intranet, role of internet service provider (ISP) and internet, corporation for assigned names and numbers (ICANN). 1.2 IPv4-header format, IPv6 -header format. 1.3 Subnet, subnet addressing and address masking, super netting. 1.4 Address mapping- address resolution protocol (ARP) mapping logical to physical addresses, working and message format, reverse address resolution protocol (RARP) mapping physical to logical addresses working and message format.	8
Module -2:	Transport Layer Protocols 2.1 User datagram protocol-user datagram, UDP services, UDP applications. 2.2 Transmission control protocol- TCP services, TCP features. 2.3 State transition diagram, flow control, error control, TCP congestion, SCTP services. 2.4 Features, flow control, error control.	8

Module -3:	Network Attacks & Cryptographic Techniques 3.1 Basic security concepts, history of network security, data security vs. network security. 3.2 Computer and network attacks, introduction to vulnerabilities, threats and attacks. 3.3 Layers of attacks, spoofing, sniffing, malware: viruses, worms, trojan horses, ciphers. 3.4 Cryptography cryptographic systems, types of cryptography: symmetric key and asymmetric key cryptography, encryption and decryption techniques.	7
Module -4:	Distributed Databases 4.1 Wireless network communication- 3G, 4G, 5G SDN (software defined network)- architecture, working, applications. 4.2 Network functions virtualization (NFV)-architecture, benefits, applications edge computing and edge networking-definition, components, challenges, applications. 4.3 Multimedia wireless networks – streaming audio and video, voice over internet protocol (VoIP), protocols – real time transport protocol (RTP), real-time streaming protocol (RTSP).	7
Reference Books: - 1) W. Stallings, ‘Data and Computer Communications’, Harlow: Pearson Education, 2021. 2) J. F. Kurose and K. W. Ross, ‘Computer Networking: A Top-Down Approach’, Harlow: Pearson Education, 2021. 3) L. L. Peterson, and B. S. Davie, ‘Computer Networks: A Systems Approach’, Burlington, MA: Morgan Kaufmann Publishers, 2019. 4) B. A. Forouzan, ‘Data Communications and Networking’, New York: McGraw-Hill Education, 2017. 5) A. S. Tanenbaum, and D. J. Wetherall, ‘Computer Networks’, Harlow: Pearson Education, 2011.		
Evaluation Pattern: 40:60		
Total Marks: 50		
Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks • CCE - II: 10 Marks • CCE - III: 10 Marks (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination (60 Marks): 1. Question No. 1 is compulsory. 2. Attempt any four questions from question number 2 to 7. • Question-1: 2 Marks × 6 = 12 Marks • Question-2: 6 Marks × 2 = 12 Marks • Question-3: 6 Marks × 2 = 12 Marks • Question-4: 6 Marks × 2 = 12 Marks • Question-5: 4 Marks × 3 = 12 Marks • Question-6: 4 Marks × 3 = 12 Marks • Question-7: 4 Marks × 3 = 12 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VII

Type: DSE

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code : Blockchain Technology (BCST 475)

Course Objectives: Student should be able to,

1. understand the history, types, and applications of blockchain technology.
2. acquire knowledge of cryptographic techniques and blockchain consensus algorithms.
3. learn to develop and deploy blockchain applications using Web3j.
4. study and implement blockchain-based applications to address real-world problems.

Course Outcomes: Student will be able to,

1. explain the history, types, and applications of blockchain technology.
2. demonstrate an understanding of cryptographic techniques and blockchain consensus algorithms.
3. apply and implement an Initial Coin Offering (ICO) on the Ethereum blockchain.
4. develop and deploy blockchain-based projects using Web3j.

Module	Title and Contents	Hrs.
Module -1:	Introduction to Blockchain 1.1 Distributed DBMS – limitations of distributed DBMS. 1.2 Introduction to block chain – history, definition. 1.3 Distributed ledger, blockchain categories – public, private, consortium, blockchain network and nodes. 1.4 Peer-to-peer network, mining mechanism, generic elements of blockchain, features of blockchain, and types of blockchain.	8
Module -2:	Blockchain Architecture 2.1 Operation of bitcoin blockchain, blockchain architecture – block, hash, distributor P2P, structure of blockchain. 2.2 Consensus mechanism: proof of work (PoW), proof of stake (PoS). 2.3 Byzantine fault tolerance (BFT). 2.4 Proof of authority (PoA) and proof of elapsed time (PoET).	8
Module -3:	Blockchain-Based Futures System 3.1 Project presentation- futures smart contract, blockchain oracles- Web3j. 3.2 Setting up the Web3J- installing web3j, wallet creation, java client. 3.3 The wrapper generator: initializing web3j. 3.4 Setting up ethereum accounts- deploying the contract.	7
Module -4:	Blockchains in Business and Creating ICO 4.1 Public versus private and permissioned versus permission less blockchains- privacy and anonymity. 4.2 Ethereum- why are privacy and anonymity important? 4.3 Ethereum enterprise alliance- blockchain as-a-service initial coin offering (ICO): Project setup for ICO. 4.4 Implementation- token contracts- token sale contracts, contract security and testing the code.	7

Reference Books: -

- 1) A. Narayanan, J. Bonneau, E. Felten, A. Miller, and S. Goldfeder, 'Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction', Princeton: Princeton University Press, 2026.
- 2) A. M. Antonopoulos, 'Mastering Bitcoin: Unlocking Digital Cryptocurrencies' Sebastopol, CA: O'Reilly Media Inc., 2025.
- 3) B. Bellaj, R. Horrocks, Xun (Brian) Wu,' Blockchain by Example: A Developer's Guide to Creating Decentralized Applications Using Bitcoin, Ethereum, and Hyperledger' Birmingham: Packt Publishing, 2018.
- 4) T. Josh, 'Blockchain: The Blockchain for Beginners, Guide to Blockchain Technology and Blockchain Programming', CreateSpace Independent Publishing Platform, 2017.
- 5) M. Swan, 'Blockchain: Blueprint for a New Economy', Sebastopol, CA: O'Reilly Media, 2015.

Evaluation Pattern: 40:60**Total Marks: 50****Internal Continuous Evaluation (20 Marks):**

- CCE - I : 10 Marks
 - CCE - II: 10 Marks
 - CCE - III: 10 Marks
- (Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (30 Marks):

- 1. Question No. 1 is compulsory.**
 - 2. Attempt any two questions from question number 2 to 4.**
- Question-1: 2 Marks $\times$ 5 = 10 Marks
 - Question-2: 5 Marks $\times$ 2 = 10 Marks
 - Question-3: 5 Marks $\times$ 2 = 10 Marks
 - Question-4: 5 Marks $\times$ 2 = 10 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences (Computer Science)

Programme: B. Sc. Honors

Semester - VII

Type: RM

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Research Methodology (BCSTRM 476)

Course Objectives: Student should be able to,

1. understand the fundamental concepts, principles, and processes involved in conducting systematic and scientific research.
2. study appropriate research methods, techniques, and tools for identifying research problems, reviewing literature, and collecting relevant data.
3. analyze research data using suitable qualitative and quantitative methods and interpret the findings to draw meaningful conclusions.
4. evaluate research outcomes and demonstrate the ability to prepare research proposals, reports, and scholarly publications while adhering to ethical research practices.

Course Outcomes: Student will be able to,

1. demonstrate ethical practices in research, including academic integrity, proper citation, plagiarism avoidance, and responsible handling of research data.
2. apply appropriate research methods, techniques, and tools to formulate research problems, objectives, hypotheses, and research designs.
3. develop the ability to prepare research proposals, reports, and scholarly publications using appropriate academic and technical standards.
4. analyze relevant literature and research data using suitable qualitative and quantitative methods to derive meaningful findings.

Module	Title and Contents	Hrs.
Module -1:	Fundamental Principles of Research Methodology 1.1 Research methods vs. methodology i) Introduction ii) Types: Library research, field research, laboratory research. 1.2 Defining a research problem i) Concept ii) Selecting the research problem iii) Techniques involved in defining problem iv) Conclusion of the problem. 1.3 Research Design i) Need for research design ii) Concept in research design iii) Types of research design. 1.4 Developing a research plan i) Need ii) Essential characteristics of research plan.	8
Module -2:	Conceptual Frameworks in Research Methodology 2.1 Reporting practical and project work structure of report title, authors and their institution, abstract, keywords, abbreviations. 2.2 IMRAD technique a) Introduction b) Material and methods c) Result discussion and conclusion d) Acknowledgements. 2.3 Preparing a grant proposal for research project 2.4 Manuscript submission to research journals i) Statement of proposal ii) Ethical considerations iii) Publishing editorial issues iv) Preparation and submission.	8

Module -3:	Descriptive Statistics 3.1 Importance of statistics in computer science. 3.2 Samples and population. 3.3 Types of data, random sampling methods and sampling errors, scales and variables, accuracy and precision. 3.4 Measures of central tendency i) Mean (arithmetic, geometric, harmonic), median, percentile and mode ii) Measures of dispersion – mean deviation, standard deviation and variance iii) Measures of a) Skewness, b) Kurtosis.	7
Module -4:	Hypothesis Testing 4.1 Introduction to hypothesis testing i) Null hypothesis ii) Alternate hypothesis. 4.2 Statistical tools - significance level, type I and type II errors, p-value, one tailed and two tailed tests. 4.3 Distribution of sample means, standard error and confidence interval, Degrees of freedom iii) Equality of two population means, proportions: t-tests and z-test. 4.4 Chi square test - test for goodness of fit, independence and homogeneity iv) F test and ANOVA.	7

Reference Books: -

- 1) R. Kumar, 'Research Methodology: A Step-by-Step Guide for Beginners. 5th ed. London:', SAGE Publications, 2019.
- 2) M. Saunders, P. Lewis and A. Thornhill, 'Research Methods for Business Students. 8th ed. Harlow', Pearson, 2019.
- 3) J. W. Creswell, and J. D. Creswell, 'Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed. Thousand Oaks, CA', SAGE Publications, 2018.
- 4) D. R. Cooper, and P. S. Schindler, 'Business Research Methods 12th ed. New York', McGraw-Hill Education, 2014.
- 5) C. R. Kothari and G. Garg, 'Research Methodology: Methods and Techniques. 3rd ed. New Delhi', New Age International Publishers, 2014.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks • CCE - II: 10 Marks • CCE - III: 10 Marks (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): 1. Question No. 1 is compulsory. 2. Attempt any two questions from question number 2 to 4. • Question-1: 2 Marks $\times$ 5 = 10 Marks • Question-2: 5 Marks $\times$ 2 = 10 Marks • Question-3: 5 Marks $\times$ 2 = 10 Marks • Question-4: 5 Marks $\times$ 2 = 10 Marks
---	---



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences (Computer Science)

Programme: B. Sc. Honors

Semester - VII

Type: DSC P-IX

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Practical I based on BCST 471 and BCST 472
(BCSP 477)

Practical Batch: 20 Student/Batch

Course Objectives: Student should be able to,

1. understand the fundamental principles of algorithm design, analysis, and complexity to develop efficient computational solutions.
2. describe the fundamental concepts, principles, paradigms, and language design features of programming languages.
3. apply appropriate algorithm design paradigms and techniques to solve complex computational problems efficiently.
4. analyze and evaluate different programming language constructs and paradigms to select appropriate languages and techniques for solving computational problems.

Course Outcomes: Student will be able to,

1. understand the fundamental concepts and principles of algorithm design and analysis.
2. apply appropriate algorithmic techniques and design paradigms to solve computational problems.
3. analyze programming language features, syntax, semantics, and implementation techniques.
4. evaluate different programming languages and paradigms based on their suitability for solving specific computational problems.

Sr. No.	Content	Hrs.
1.	Implement fibonacci using dynamic programming and compare with recursion.	60
2.	Solve matrix chain multiplication using dynamic programming.	
3.	Implement 0/1 knapsack problem using dynamic programming.	
4.	Construct optimal binary search tree (OBST) using dynamic programming.	
5.	Solve the 8-Queen problem using backtracking.	
6.	Implement graph coloring problem using backtracking.	
7.	Solve travelling salesperson problem using branch and bound.	
8.	Perform amortized analysis of stack operations using different methods.	
9.	Implementation and analysis of sorting algorithms.	
10.	Implementation of divide and conquer strategy.	
11.	Write a program to demonstrate global and local variables, scope, and variable lifetime using functions.	

12.	Perform operations on different data types and demonstrate implicit and explicit type conversion.
13.	Create and manipulate structured data (records, arrays, strings) and perform basic operations on them.
14.	Develop a program using expressions, selection statements, loops, and nested control structures.
15.	Write functions to perform tasks and demonstrate parameter passing using suitable examples.
16.	Implement recursive solutions (factorial/fibonacci) and compare them with iterative methods.
17.	Create a program using classes to demonstrate encapsulation, inheritance, polymorphism, and exception handling.
18.	Study of data types and variables in different programming languages.
19.	Implementation of control structures.
20.	Study of functions and recursion.

Reference Books: -

- 1) D. Jungnickel, 'Graphs, Networks and Algorithms', Springer, 2022.
- 2) S. Skiena, 'The Algorithm Manual', Springer, 2020.
- 3) T. Cormen, C. Leiserson, & R. Rivest, 'Introduction to Algorithms', MIT Press, 2009.
- 4) J. D. Ullman, Garcia-Molina Hector and J. Widom, 'Database Systems: The Complete Book', Upper Saddle River, NJ: Prentice Hall, 2008.
- 5) E. Horowitz, S. Sahni & T. R. Sangu, 'Computer algorithms', SiliconPr Publication, 2007.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):

- Journal : 10 Marks
- Students Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences
(Computer Science)

Programme: B. Sc. Honors

Semester - VII

Type: DSE P-X

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Practical II Based on BCST 473 and
BCST 474 (BCSP 478)

Practical Batch: 20 Student/Batch

Course Objectives: Student should be able to,

1. understand advanced database concepts, architectures, transaction management, query processing, distributed databases, and modern database technologies.
2. study network performance, protocols, architectures, and security mechanisms to identify and resolve complex networking challenges.
3. know advanced networking technologies and solutions based on performance, scalability, reliability, and security requirements.
4. design and analyze advanced database techniques for designing, managing, securing, and optimizing efficient and scalable database systems.

Course Outcomes: Student will be able to,

1. utilize advanced database concepts, architectures, data models, and database management techniques.
2. identify advanced networking technologies, including wireless networks, software-defined networking, cloud networking, and network virtualization, for developing secure and efficient network solutions.
3. analyze network performance, traffic management, security mechanisms, and communication issues to identify and resolve complex networking problems.
4. evaluate advanced SQL, transaction management, indexing, query optimization, and database design techniques to develop efficient database solutions.

Sr. No.	Content (Any 15)	Hrs.
1.	Implement DDL and DML.	60
2.	Use of single row and aggregate functions.	
3.	Implement joins and sub queries.	
4.	Write anonymous blocks and control structures.	
5.	Programs on cursors.	
6.	Programs on functions and procedures.	
7.	programs on exception handling and triggers.	
8.	programs on DBA concepts.	

9.	Normalization of database.	
10.	Implement transaction management in a database and study ACID properties.	
11.	Set up IP addresses and subnet masks on given network devices.	
12.	Identify and resolve network issues using network diagnostic tools like ping, tracert, show, debug commands.	
13.	Configure basic routing protocols using any relevant software/virtual lab.	
14.	Study of data security features.	
15.	Understand OSI and TCP/IP models using simulation tools like cisco packet tracer or gns3.	
16.	Simulation of network topology using cisco packet tracer.	
17.	Study of IP addressing and subnetting.	
18.	Create and simulate different network topologies.	
19.	Simulate fragmentation of IP packets and observe behaviour in Wireshark.	
20.	Case study : software defined networking (SDN) in a data centre.	

Reference Books: -

- 1) W. Stallings, 'Data and Computer Communications', Harlow: Pearson Education, 2021.
- 2) J. F. Kurose, and W. R. Keith, 'Computer Networking: A Top-Down Approach', Harlow: Pearson Education, 2021.
- 3) A. Silberschatz, H. F. Korth, and S. Sudarshan, 'Database System Concepts', New York: McGraw-Hill Education, 2019.
- 4) R. Elmasri and S. B. Navathe. 'Fundamentals of Database Systems'. Boston: Pearson Education, 2016.
- 5) T. Connolly and C. Begg. 'Database Systems: A Practical Approach to Design, Implementation, and Management', Harlow: Pearson Education, 2015.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):	Practical Exam Paper (30 Marks):
• Journal : 10 Marks • Students Performance: 05 Marks • Viva: 05 Marks	ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VII

Type: DSE P-X

Marks: 50

Credits: 2

From: A. Y. 2026-27

**Name of the Course and Code: Practical II based on BCST 473 and
BCST 475 (BCSP 478)**

Practical Batch: 20 Student/Batch

Course Objectives: Student should be able to,

1. understand modern front-end development concepts and practices.
2. develop knowledge of component-based architecture and its applications in web development.
3. study and build interactive user interfaces to enhance user experience.
4. acquire knowledge of Ether mining concepts and related blockchain processes.

Course Outcomes: Student will be able to,

1. explain the fundamental concepts and principles of queries.
2. organize events and user interactions to develop responsive applications.
3. integrate APIs and handle asynchronous operations effectively in application development.
4. execute subqueries for efficient data retrieval and processing.

Sr. No.	Content (Any 15)	Hrs.
1.	Implement DDL and DML.	60
2.	Use of single row and aggregate functions.	
3.	Implement joins and sub queries.	
4.	Write anonymous blocks and control structures.	
5.	Programs on cursors.	
6.	Programs on functions and procedures.	
7.	Programs on exception handling and triggers.	
8.	Programs on DBA concepts.	
9.	Normalization of database.	
10.	Implement transaction management in a database and study ACID properties.	
11.	Create a simple client class in python that generates private and public keys using the built-in RSA algorithm, and test it.	
12.	Write a Python program for a transaction class that can send and receive money, and test it.	
13.	Create multiple transactions in python and display them.	
14.	Write a python program to create a blockchain, add a genesis block, and run it.	

15.	Install and set up Go ethereum and the mist browser, then develop and test a sample application.	
16.	Write solidity programs to demonstrate variables, operators, loops, decision-making, strings, arrays, enums, structs, mappings, conversions, ether units and special variables.	
17.	Write solidity programs to demonstrate withdrawal patterns and restricted access.	
18.	Implement and demonstrate the use of libraries, assembly, events, and error handling in solidity.	
19.	Write a program to demonstrate ether mining.	
20.	Install and configure Go ethereum and the mist browser again, then develop and test another sample.	

Reference Books: -

- 1) A. Silberschatz, H. F. Korth and S. Sudarshan, 'Database System Concepts', New York: McGraw-Hill Education, 2019.
- 2) B. Bellaj, R. Horrocks and Xun (Brian) Wu, 'Blockchain by Example: A Developer's Guide to Creating Decentralized Applications Using Bitcoin', Ethereum, and Hyperledger. Birmingham: Packt Publishing, 2018.
- 3) J. Thompson, 'Blockchain: The Blockchain for Beginners, Guide to Blockchain Technology and Blockchain Programming', CreateSpace Independent Publishing Platform, 2017.
- 4) R. Elmasri and S. B. Navathe, 'Fundamentals of Database Systems', Boston: Pearson Education, 2016.
- 5) J. D. Ullman, Garcia-Molina Hector and J. Widom, 'Database Systems: The Complete Book' Upper Saddle River, NJ: Prentice Hall, 2008.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):

- Journal : 10 Marks
- Students Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VII

Type: RM Practical

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Practical III based on BCSTRM 476 (BCSPRM 479)

Practical Batch: 20 Student/Batch

Course Objectives: Student should be able to,

1. understand research problems, formulate clear objectives, and develop testable hypotheses.
2. apply the fundamental concepts of research methodology and the research process in the field of Computer Science.
3. analyze various research designs, data collection methods, and statistical analysis techniques.
4. develop the ability to prepare structured research reports while adhering to ethical standards in research and publication.

Course Outcomes: Student will be able to,

1. define research problems with appropriate objectives, scope, and research goals.
2. classify comprehensive literature reviews, analyze existing studies, and identify research gaps.
3. design experiments, select suitable research methodologies, and analyze data effectively using appropriate tools and techniques.
4. prepare technical research reports, ensure proper citation of sources, and present research findings ethically and professionally.

Sr. No.	Content	Hrs.
1.	Implement Data Visualization Using Tables, Charts, and Graphs	60
2.	Implement Data Collection, Organization and Descriptive Statistical Analysis.	
3.	Demonstrate the Application of Measures of Central Tendency and Dispersion	
4.	Implement Correlation and Regression Analysis on Research Data	
5.	Demonstrate Hypothesis Testing Using t-Test and Chi-Square Test	
6.	Implement Analysis of Variance (ANOVA) for Research Data	
7.	Demonstrate the Interpretation and Presentation of Statistical Results	
8.	Study and Implement Mendeley for Reference Management	
9.	Study and Implement LaTeX for Research Paper Preparation	
10.	Research Project Problem: Literature searching, Review writing, Presentation (equivalent to 5 practicals)	

Reference Books: -

- 1) R. Kumar, 'Research Methodology: A Step-by-Step Guide for Beginners. 5th ed. London:',

SAGE Publications, 2019.

- 2) M. Saunders, Philip Lewis, and Adrian Thornhill, 'Research Methods for Business Students. 8th ed. Harlow', Pearson, 2019.
- 3) J. W. Creswell and J. D. Creswell, 'Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed. Thousand Oaks, CA', SAGE Publications, 2018.
- 4) D. R. Cooper and P. S. Schindler, 'Business Research Methods. 12th ed. New York: McGraw-Hill Education', 2014.
- 5) C. R. Kothari, and G. Garg, 'Research Methodology: Methods and Techniques. 3rd ed. New Delhi', New Age International Publishers, 2014.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):

- Journal : 10 Marks
- Students Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences (Computer Science)

Programme: B.Sc. Honors

Semester - VIII

Type: DSC

Marks: 100

Credits: 4

From: A.Y. 2026-27

Name of the Course and Code: Natural Language Processing (BCST 481)

Course Objectives: Student should be able to,

1. understand the fundamental concepts and principles of Natural Language Processing (NLP).
2. learn the basic concepts of speech processing, including speech analysis and modeling techniques.
3. distinguish Context-Free Grammar (CFG) and Probabilistic Context-Free Grammar (PCFG) concepts in NLP.
4. analyze the role of sentence semantics and pragmatics in natural language understanding.

Course Outcomes: Student will be able to,

1. apply first-order logic, semantic representations, thematic roles, word-sense relations, and semantic attachments for natural language understanding.
2. Analyze linguistic and computational problems involving ambiguity, spelling errors and part-of-speech tagging.
3. design and develop NLP solutions for tasks such as text classification, sentiment analysis, machine translation, information extraction, and question answering.
4. develop skills for learning and applying emerging NLP technologies.

Module	Title and Contents	Hrs.
Module -1:	Introduction 1.1 Origins and challenges of NLP, language modeling, grammar based language model. 1.2 Statistical language model, regular expressions, finite state automata: English morphology, transducers for lexicon and rules. 1.3 Tokenization, detecting and correcting spelling errors, minimum edit distance.	15
Module -2:	Word Level Analysis 2.1 Unsmoothed n-grams, evaluating n-grams. 2.2 Smoothing, interpolation and backoff : word classes, part-of-speech tagging. 2.3 Rule- based stochastic and transformation-based tagging. 2.4 Issues in part of speech tagging – hidden markov and maximum entropy models.	15
Module -3:	Syntactic Analysis 3.1 Context free grammars, grammar rules for English, tree banks. Normal forms for grammar – dependency grammar – syntactic parsing, ambiguity. 3.2 Dynamic programming parsing – shallow parsing – probabilistic cfg, probabilistic CYK(Cocke-Younger-Kasami), probabilistic lexicalized CFGS – feature structures, unification of feature structures.	15
Module -4:	Semantics And Pragmatics 4.1 Requirements for representation, first-order logic, description logics: syntax-driven semantic analysis. 4.2 Semantic attachments: word senses, relations between senses, thematic roles. 4.3 Sectional restrictions: word sense disambiguation (wsd), wsd using supervised,	15

	dictionary & thesaurus. Bootstrapping methods – word similarity using thesaurus and distributional methods.	
Reference Books:- 1) T. Zwingmann, ‘Build Your LLM and Fine-Tune It for Real Tasks’, Manning Publications, 2026. 2) L. Hobson and M. Dyshel. ‘Natural Language Processing in Action, 2nd edition, Manning Publications, 2025. 3) C. A. Iglesias and Jinyi Zhang. ‘Recent Applications of Machine Learning in Natural Language Processing (NLP)’, MDPI, 2025. 4) A. Freed, Cari Jacobs and Eniko Rozsa, ‘Effective Conversational AI’, Manning Publications, 2025. 5) A . Narayanan, and S. Kapoor. ‘AI Snake Oil: What Artificial Intelligence Can Do, What It Can’t, and How to Tell the Difference’, Princeton University Press, 2024.		
Evaluation Pattern: 40:60		
Total Marks: 100		
Internal Continuous Evaluation (40 Marks): • CCE - I : 20 Marks • CCE - II: 20 Marks • CCE - III: 20 Marks (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination (60 Marks): 1. Question No. 1 is compulsory. 2. Attempt any four questions from question number 2 to 7. • Question-1: 2 Marks $\times$ 6 = 12 Marks • Question-2: 6 Marks $\times$ 2 = 12 Marks • Question-3: 6 Marks $\times$ 2 = 12 Marks • Question-4: 6 Marks $\times$ 2 = 12 Marks • Question-5: 4 Marks $\times$ 3 = 12 Marks • Question-6: 4 Marks $\times$ 3 = 12 Marks • Question-7: 4 Marks $\times$ 3 = 12 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VIII

Type: DSC

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: Cloud Computing (BCST 482)

Course Objectives: Student should be able to,

1. understand the principles, concepts, and paradigms of cloud computing.
2. interpret the role and significance of virtualization technologies in cloud environments.
3. analyze cloud security challenges and implement suitable security solutions.
4. study and understand cloud infrastructure using appropriate platforms and technologies.

Course Outcomes: Student will be able to,

1. utilize the fundamental principles and concepts of distributed computing.
2. explain the importance of virtualization in distributed computing and its role in enabling cloud computing.
3. analyze the performance and efficiency of cloud computing environments.
4. evaluate distributed computing environments developed using lower-level services and technologies.

Module	Title and Contents	Hrs.
Module -1:	Introduction to Cloud Computing 1.1 Overview, evolution of cloud computing, types of cloud, desired features of a cloud. 1.2 Benefits and disadvantages of cloud computing, cloud infrastructure management, infrastructure as a service providers. 1.3 Platform as a service providers, multitenant technology, cloud enabling technology: broadband networks and internet architecture. 1.4 Data center technology, infrastructure as a service, platform as a service, software as a service, cloud deployment models.	15
Module -2:	Cloud Models & Services 2.1 Cloud models – benefits of cloud models, public, private, hybrid, and community clouds. 2.2 Types of clouds services: SaaS, PaaS, IaaS, DaaS, MaaS, CaaS. Service Providers: google app engine, microsoft azure. 2.3 Amazon EC2, IBM, Sales Force. 2.4 Introduction to mapreduce, GFS, HDFS, hadoop framework.	15
Module -3:	Essentials & Collaborating with Cloud 3.1 Hardware and infrastructure – clients, security, network, services; accessing cloud – platforms, web applications. 3.2 Web APIs, web browsers; cloud storage – overview, cloud storage providers. 3.3 Application, client, infrastructure, service, centralizing email communications. 3.4 Collaborating on calendars, schedules & task management, event management, project management and contact management.	15

Module -4:	Virtualization and Security for Cloud 4.1 Introduction to virtualization technologies, load balancing and virtualization. 4.2 Understanding hyper visors, virtual machines provisioning and manageability virtual machine. 4.3 Migration services, provisioning in the cloud context virtualization of CPU. 4.4 Memory, I/O devices, virtual clusters and resource management, overview cloud security challenges and risks – software-as-a-service security.	15
Reference Books:- 1) R. Buyya, Christian Vecchiola, S. T. Selvi, ‘Mastering Cloud Computing: Foundations and Applications Programming’, McGraw Hill, 2023. 2) G. C. Fox, Kai Hwang, J. G Dongarra, ‘Distributed and Cloud Computing, From Parallel Processing to the Internet of Things’, Morgan Kaufmann Publishers, 2022. 3) A. Bahga and V. Madiseti, ‘Cloud Computing: A Hands-On Approach. Hyderabad’, Universities Press, 2014. 4) T. Erl, R. Puttini and Z. Mahmoud, ‘Cloud Computing: Concepts, Technology & Architecture’, Upper Saddle River, NJ”, Pearson, 2013. 5) R. Buyya, J. Bromberg and A. M. Goscinski, ‘Cloud Computing: Principles and Paradigms’, Hoboken, NJ: Wiley, 2011.		
Evaluation Pattern: 40:60		
Total Marks: 100		
Internal Continuous Evaluation (40 Marks): • CCE - I: 20 Marks • CCE - II: 20 Marks • CCE - III: 20 Marks (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): 1. Question No. 1 is compulsory. 2. Attempt any four questions from question number 2 to 7. • Question-1: 2 Marks $\times$ 6 = 12 Marks • Question-2: 6 Marks $\times$ 2 = 12 Marks • Question-3: 6 Marks $\times$ 2 = 12 Marks • Question-4: 6 Marks $\times$ 2 = 12 Marks • Question-5: 4 Marks $\times$ 3 = 12 Marks • Question-6: 4 Marks $\times$ 3 = 12 Marks • Question-7: 4 Marks $\times$ 3 = 12 Marks	



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VIII

Type: DSC

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: Digital Image Processing (BCST 483)

Course Objectives: Student should be able to,

1. understand the fundamental concepts and principles of digital image processing.
2. identify current trends and applications in the field of digital image processing.
3. describe various basic image processing operations and techniques.
4. know image analysis algorithms and their applications.

Course Outcomes: Student will be able to,

1. apply image processing algorithms to solve practical problems, including object recognition and analysis.
2. analyze image segmentation methods and morphological operations for image enhancement and analysis.
3. evaluate the fundamental concepts and techniques of digital image processing.
4. develop and implement algorithms for digital image processing applications.

Module	Title and Contents	Hrs.
Module -1:	Fundamentals of Image Processing 1.1 Steps in image processing, human visual system, Sampling & quantization, representing digital images. 1.2 Spatial & gray-level resolution, image file formats, basic relationships between pixels, distance measures. 1.3 Basic operations on images: image addition, subtraction, logical operations, scaling, translation, rotation. 1.4 Image histogram, color fundamentals & models – RGB, HSV, YIQ.	15
Module -2:	Image Enhancement, Restoration and Compression 2.1 Spatial domain enhancement: point operations-log transformation, power-law transformation, piecewise linear transformations, histogram equalization. 2.2 Filtering operations- image smoothing, image sharpening. frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. 2.3 Homomorphic filtering. restoration: noise models, restoration using inverse filtering and wiener filtering. types of redundancy, fidelity criteria, lossless compression – run length coding. 2.4 Huffman coding, bit-plane coding, arithmetic coding. Introduction to DCT, wavelet transform. lossy compression – DCT based compression, Wavelet based compression. image and video compression standards – JPEG, MPEG.	15
Module -3:	Image Segmentation and Morphological Operations 3.1 Image segmentation: point detections, line detection, edge detection first order derivative – prewitt and sobel. second order derivative – LoG, DoG, Canny. 3.2 Edge linking, hough transform, thresholding – global, adaptive. otsu's method. region growing, region splitting and merging.	15

	3.3 Morphological operations: dilation, erosion, opening, closing, 3.4 Hit-or miss transform, boundary detection, thinning, thickening, skeleton.	
Module -4:	Object Recognition and Applications 4.1 Feature extraction, patterns and pattern classes, representation of pattern classes. 4.2 Types of classification algorithms, minimum distance classifier, correlation based classifier, bayes classifier. 4.3 Applications: biometric authentication, character recognition, 4.4 Content based image retrieval, remote sensing, medical, application of image processing.	15

Reference Books:-

- 1) J. Z. Mahmoud, 'Digital Image Processing: Advanced Technologies and Applications' MDPI, 2024.
- 2) K. C. Santosh, 'Recent Trends in Image Processing and Pattern Recognition (RTIP2R 2023)', Springer, 2024.
- 3) E. R. Dougherty, 'Digital Image Processing Methods', United States: CRC Press, 2020.
- 4) R. C. Gonzalez, and R. E. Woods, 'Digital Image Processing. 4th ed. Boston', Pearson, 2017.
- 5) Jähne Bernd., 'Digital Image Processing. 4th ed. Berlin', Springer, 2013.

Evaluation Pattern: 40:60

Total Marks: 100

Internal Continuous Evaluation (40 Marks):

- CCE - I : 20 Marks
 - CCE - II: 20 Marks
 - CCE - III: 20 Marks
- (Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (60 Marks):

1. Question No. 1 is compulsory.
 2. Attempt any four questions from question number 2 to 7.
- Question-1: 2 Marks $\times$ 6 = 12 Marks
 - Question-2: 6 Marks $\times$ 2 = 12 Marks
 - Question-3: 6 Marks $\times$ 2 = 12 Marks
 - Question-4: 6 Marks $\times$ 2 = 12 Marks
 - Question-5: 4 Marks $\times$ 3 = 12 Marks
 - Question-6: 4 Marks $\times$ 3 = 12 Marks
 - Question-7: 4 Marks $\times$ 3 = 12 Marks



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VIII

Type: DSE

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Cyber Security and Laws (BCST 484)

Course Objectives: Student should be able to,

1. understand the fundamental and advanced concepts of cybersecurity, including security threats and defense mechanisms.
2. analyze cyber laws, digital rights and ethical issues in cyberspace with reference to frameworks such as the Information Technology Act, 2000.
3. build practical experience with security tools, vulnerability assessment techniques and intrusion detection systems.
4. study cryptographic techniques, secure communication methods and data protection strategies.

Course Outcomes: Student will be able to,

1. analyze cyber threats, vulnerabilities and risk factors associated with systems and networks.
2. apply cryptographic algorithms and key management techniques to ensure secure data transmission and communication.
3. interpret cyber laws, privacy rights and regulatory frameworks, including the Digital Personal Data Protection Act, 2023.
4. implement security solutions using tools and techniques such as firewalls, Intrusion Detection/Prevention Systems (IDS/IPS) and penetration testing methodologies.

Module	Title and Contents	Hrs.
Module -1:	Cyber Security Fundamentals & Threat Landscape 1.1 Basics, CIA triad, internet governance, role of ICANN. 1.2 Cybercrime, cyber warfare, APTs, cyber kill chain. 1.3 Software flaws, weak authentication, risk assessment (ISO/NIST). 1.4 Security standards, compliance, national policies.	8
Module -2:	Web, Network and System Security 2.1 HTTP/HTTPS, session security, OWASP Top 10 2.2 MFA, biometrics, RBAC, identity management 2.3 Firewalls, IDS/IPS, network monitoring 2.4 OS security, virtualization, cloud & container security	8
Module -3:	Cyber Law, Cryptography & Digital Rights 3.1 Cyber law and legal frameworks, Information Technology Act 2000, cyber Jurisprudence. 3.2 Cryptography fundamentals and algorithms, symmetric encryption(AES,DES), asymmetric encryption(RSA), hashing algorithms(SHA family). 3.3 Concepts of plain text and cipher text. Key exchange techniques (Diffie-Hellman), Public key infrastructure (PKI), digital signatures and certificates. 3.4 Data protection, privacy & digital rights, digital personal data protection act 2023.	7

Module -4:	Cybercrime, Defense Techniques and Emerging Trends 4.1 Types of crimes, investigation, evidence handling. 4.2 Security tools and defense mechanisms: cryptography, firewalls, SIE penetration testing. 4.3 Incident handling, disaster recovery. 4.4 BCP.emerging trends in cyber security, quantum cryptography.	7
Reference Books:- 1) J. Pelton , I. B. Singh, ‘Digital Defense: A Cybersecurity Primer’, Copernicus, 2025. 2) B. Craig, ‘Cyberlaw: The Law of the Internet and Information Technology’, Lexis Nexis publishing, 2024. 3) J. Andress, S. Winterfeld, ‘Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners2nd Edition’, Syngress publishing, 2023 4) K. J. Migga, ‘Guide to Computer Network Security. 4th ed. Cham’, Springer, 2020. 5) J. Katz and Y. Lindell, ‘Introduction to Modern Cryptography. 2nd ed. Boca Raton, FL’, CRC Press, 2014.		
Evaluation Pattern: 40:60		
Total Marks: 50		
Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks • CCE - II: 10 Marks • CCE - III: 10 Marks (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): 1. Question No. 1 is compulsory. 2. Attempt any two questions from question number 2 to 4. • Question-1: 2 Marks × 5 = 10 Marks • Question-2: 5 Marks × 2 = 10 Marks • Question-3: 5 Marks × 2 = 10 Marks • Question-4: 5 Marks × 2 = 10 Marks	



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences
(Computer Science)

Programme: B. Sc. Honors

Semester - VIII

Type: DSE

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Mathematical and Statistical Foundation
(BCST 485)

Course Objectives: Student should be able to,

1. understand the concepts of vector spaces and develop proficiency in the algebra of linear transformations.
2. explore the relationship between linear transformations and matrices, and understand eigenvalues, eigenvectors, and their real-world applications.
3. apply hypothesis testing and statistical inference techniques, including ANOVA, p-values, and comparative analysis of datasets for informed decision-making.
4. describe a strong foundation in statistical modeling techniques, including correlation, regression, probability distributions, and simulation methods for effective data analysis.

Course outcomes: Student will be able to,

1. explain the concepts of basis and dimension in vector spaces and their applications in linear algebra.
2. determine eigenvalues, eigenfunctions, and characteristic polynomials of matrices.
3. apply statistical models, probability distributions, and regression techniques to analyze real-world data and generate meaningful insights using tools such as Python.
4. implement hypothesis testing and interpret statistical results to draw informed conclusions and compare datasets effectively.

Module	Title and Contents	Hrs.
Module -1:	Vector Spaces 1.1 Vector space, subspace, sum of subspaces, direct sum, quotient space. 1.2 Homomorphism or linear transformation, kernel and range of homomorphism. 1.3 Fundamental theorem of homomorphism, isomorphism theorems, linear span, finite dimensional vector space. 1.4 Linear dependence and independence, basis, dimension of vector space and Subspaces.	8
Module -2:	Linear Transformations 2.1 Linear transformation, rank and nullity of a linear transformation, sylvester's law, algebra of linear transformations, sum and scalar multiple of linear transformations. 2.2 The vector space of homomorphism, product (composition) of linear transformations, linear operator. 2.3 Linear functional, invertible and nonsingular linear transformation, eigen space, characteristic. 2.4 Polynomial of a matrix and remarks on it, similar matrices, characteristic polynomial of a linear operator, examples on eigenvalues and eigenvectors.	8

Module -3:	Statistical Modelling and Distributions 3.1 Overview of linear correlation and correlation, application and numerical examples on linear correlation and correlation. 3.2 Introduction to residual error, mean square error, rmse, multilinear correlation, regression, logistic regression, simulation using monte carlo method, overview of discrete and continuous probability distributions, binomial distribution, poisson. 3.3 Distribution geometric distribution, exponential distribution, normal distributions, numeric examples and random no. generation using python	7
Module -4:	Hypothesis Tests and Statistical Tests 4.1 Typical analysis procedures, hypothesis concept, errors. 4.2 p Value and sample size, confusion matrix, ANOVA, test on. 4.3 Sample mean, comparison of two groups. 4.4 Comparison of multiple groups, categorical data analysis.	7
Reference Books:- 1) P. Sahana, ‘Advanced Statistical Methods’, Springer Nature Singapore, 2024. 2) S. M. Ross, ‘Introduction to Probability and Statistics for Engineers and Scientists. 6th ed. Cambridge, MA’, Academic Press, 2020. 3) D. C. Montgomery, and G. C. Runger, ‘Applied Statistics and Probability for Engineers. 7th ed. Hoboken, NJ’, Wiley, 2018. 4) S. Gilbert, ‘Introduction to Linear Algebra. 5th ed. Wellesley, MA’, Wellesley-Cambridge Press, 2016. 5) Shi Ning-Zhong, and Jian Tao, ‘Statistical Hypothesis Testing: Theory and Methods’, Singapore: World Scientific, 2008.		
Evaluation Pattern: 40:60		
Total Marks: 50		
Internal Continuous Evaluation (20 Marks): - CCE - I : 10 Marks - CCE - II: 10 Marks - CCE - III: 10 Marks (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): 1. Question No. 1 is compulsory. 2. Attempt any two questions from question number 2 to 4. - Question-1: 2 Marks $\times$ 5 = 10 Marks - Question-2: 5 Marks $\times$ 2 = 10 Marks - Question-3: 5 Marks $\times$ 2 = 10 Marks - Question-4: 5 Marks $\times$ 2 = 10 Marks	



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences (Computer Science)

Programme: B. Sc. Honors

Semester - VIII

Type: DSC P-XI

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code : Practical III based on BCST 481 and BCST 482
(BCSP 486)

Practical Batch: 10 Student/Batch

Course Objectives: Student should be able to,

1. understand virtualization, containerization, and cloud service models, including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
2. know the text preprocessing techniques, including tokenization, stemming and lemmatization for effective natural language processing applications.
3. learn skills in building and evaluating models for tasks such as sentiment analysis and text classification.
4. build hands-on expertise in cloud storage, networking, and security mechanisms for cloud-based environments.

Course Outcomes: Student will be able to,

1. implement Natural Language Processing (NLP) algorithms for tasks such as text classification, tagging, and parsing.
2. develop and evaluate NLP models using deep learning frameworks such as TensorFlow and PyTorch.
3. deploy and manage applications on cloud computing platforms.
4. configure virtual machines, storage services, and networking components in cloud environments.

Sr. No.	Content	Hrs.
1.	Write a python NLTK program to remove stop words from a given text.	60
2.	Write a python NLTK program to split the text sentence/paragraph into a list of words.	
3.	Write a python NLTK program to tokenize sentences in languages other than English.	
4.	Write a python NLTK program to create a list of words from a given string.	
5.	Write a python NLTK program to list down all the corpus names.	
6.	Write a python NLTK program to get a list of common stop words in various languages in Python.	
7.	Write a python NLTK program to find the definition and examples of a given word using WordNet.	
8.	Write a python NLTK program to find the sets of synonyms and antonyms of a given word.	
9.	Write a python NLTK program to get the overview of the tagset, details of a specific tag in the tagset and details on several related tagsets, using regular expression.	
10.	Write a python NLTK program to find the number of male and female names in the names corpus. Print the first 10 male and female names.	
11.	Working and implementation of software as a service.	

12.	Working and implementation of platform as a services.
13.	Creation of virtual machine on cloud.
14.	Cloud storage and file upload.
15.	Practical implementation of storage as a service.
16.	Working of google drive to make spreadsheet and notes.
17.	Execute the step to demonstrate and implementation of cloud on single sign on.
18.	Installing and developing application using google app engine.
19.	Deployment of web application on cloud.
20.	Implementation of load balancing.

Reference Books:-

- 1) C. Dierbach, 'Introduction to Computer Science Using Python: A Computational Problem-Solving Focus', John Wiley & Sons, 2023.
- 2) J. V. Eijck, C. Unger, 'Computational Semantics with Functional Programming', Cambridge University Press, 2022.
- 3) M. Greg, 'An Introduction to Functional Programming Through Lambda Calculus', Dover Publications Inc., 2021.
- 4) K. C. Loudon, 'Programming Languages: Principles and Practice', Course Technology Inc., 2021.
- 5) R. L. Halterman, 'Learning to program with python', Southern Adventist University, 2021.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):

- Journal : 10 Marks
- Students Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VIII

Type: DSE P-XII

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Practical IV based on BCST 483 and BCST 484 (BCSP 487)

Practical Batch: 10 Student/Batch

Course Objectives: Student should be able to,

1. describe the fundamental and advanced concepts of cybersecurity, including security threats and defense mechanisms.
2. understand the fundamentals of digital images, including image acquisition, sampling, quantization, and image representation in spatial and frequency domains.
3. study image enhancement techniques such as contrast adjustment, filtering, and other image processing methods.
4. develop knowledge of cryptographic techniques, secure communication methods, and data protection strategies.

Course Outcomes: Student will be able to,

1. understand and implement various feature extraction techniques for image and data analysis applications.
2. identify and analyze cyber threats, vulnerabilities, and risk factors associated with systems and networks.
3. apply cryptographic algorithms and key management techniques to ensure secure data communication and protection.
4. design and develop object recognition systems for real-world applications.

Sr. No.	Content (Any 15)	Hrs.
1.	W.A.P to read and display an image.	60
2.	W.A.P to read an image & display its matrix information.	
3.	W.A.P to perform image addition.	
4.	W.A.P to perform image subtraction.	
5.	W.A.P to perform image multiplication.	
6.	W.A.P to perform image division.	
7.	W.A.P to implement 2DFT convolution property.	
8.	W.A.P to implement 2DFT rotational property.	
9.	Image enhancement using histogram equalization.	
10.	Edge detection using sobel operator.	

11.	Enhancement through point operation.
12.	Study of basic cyber security concepts.
13.	Vulnerability assessment of a website
14.	Implementation of symmetric encryption.
15.	Implementation of asymmetric encryption (RSA)
16.	Hashing techniques (SHA)
17.	Key exchange using diffie-hellman
18.	Network packet analysis
19.	Implementation of password strength checker.
20.	Implementation of caesar cipher encryption and decryption.

Reference Books:-

- 1) S. Sridhar, 'Digital Image Processing', Oxford University Press, 2026.
- 2) J. Andress, Steve Winterfeld, 'Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners 2nd Edition', Syngress publishing, 2023.
- 3) R. C. Gonzalez and R. E. Woods, 'Digital Image Processing', Third Edition, - Pearson Education, 2008.
- 4) R. C. Gonzalez, R. E. Woods, and L. E. Steven, 'Digital Image Processing Using MATLAB', Second Edition, - Tata McGraw Hill Publication, 2020.
- 5) N. Godbole, and S. Belapure, 'Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives', Wiley India Pvt Ltd, 2011.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):

- Journal : 10 Marks
- Students Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

Board of Studies in Computational Sciences (Computer Science)

Programme: B. Sc. Honors

Semester - VIII

Type: DSE P-XII

Marks: 50

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Practical IV based on BCST 483 and BCST 485 (BCSP 487)

Practical Batch: 10 Student/Batch

Course Objectives: Student will be able to,

1. understand the fundamentals of digital image processing, including image acquisition, sampling, quantization, and representation in spatial and frequency domains.
2. apply image enhancement techniques, including contrast adjustment, filtering, and other image processing operations.
3. describe and apply fundamental mathematical and statistical concepts, principles, and techniques relevant to Computer Science and data analysis.
4. analyze mathematical models and statistical methods to interpret data, solve computational problems, and support informed decision-making.

Course Outcomes: Student should be able to,

1. understand and implement feature extraction techniques for effective image and data analysis.
2. analyze data using suitable statistical methods and interpret results to derive meaningful conclusions.
3. evaluate mathematical models and statistical outcomes to support problem-solving, research, and data-driven decision-making.
4. design and develop object recognition systems for various real-world applications.

Sr. No.	Content (Any 15)	Hrs.
1.	W.A.P to read and display an image.	60
2.	W.A.P to read an image & display its matrix information.	
3.	W.A.P to perform image addition.	
4.	W.A.P to perform image subtraction.	
5.	W.A.P to perform image multiplication.	
6.	W.A.P to perform image division.	
7.	W.A.P to implement 2DFT convolution property.	
8.	W.A.P to implement 2DFT rotational property.	
9.	Image enhancement using histogram equalization.	
10.	Edge detection using sobel operator.	
11.	Implement correlation.	
12.	Spearman's rank correlation coefficient.	
13.	Linear regression.	
14.	Multiple correlation.	

15.	Application of binomial distribution.
16.	Application poisson distribution.
17.	Application of normal distribution.
18.	Application of exponential distribution.
19.	Large sample test for means.
20.	Large sample test for proportions.

Reference Books:-

- 1) S. Gilbert, 'Introduction to Linear Algebra. 5th ed. Wellesley, MA', Wellesley-Cambridge Press, 2016.
- 2) S. Sridhar, 'Digital Image Processing', Oxford University Press, 2026.
- 3) J. Andress, S. Winterfeld, 'Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners 2nd Edition', Syngress publishing, 2023.
- 4) S. M. Ross, 'Introduction to Probability and Statistics for Engineers and Scientists. 6th ed. Cambridge, MA', Academic Press, 2020.
- 5) D. C. Montgomery and G. C. Runger, 'Applied Statistics and Probability for Engineers. 7th ed. Hoboken, NJ', Wiley, 2018.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Evaluation (20 Marks):

- Journal : 10 Marks
- Students Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

ESE = 30 Marks.



Karmaveer Bhaurao Patil University, Satara

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

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science Satara

**Board of Studies in Computational Sciences
(Computer Science)**

Programme: B. Sc. Honors

Semester - VIII

Type: OJT

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: On Job Training (BCSPOJT 488)

Course Objectives: Student should be able to,

1. understand professional ethics, workplace practices, and industry standards.
2. apply computer science knowledge and skills to solve industry-related problems and tasks.
3. learn technical, communication, collaboration, and teamwork skills required for professional success.
4. gain practical experience by working in a real-world professional environment.

Course outcomes: Student will be able to,

1. apply theoretical concepts of computer science to solve practical and industry-oriented problems.
2. utilize relevant software tools and technologies effectively for professional applications.
3. collaborate efficiently within a team and demonstrate professional communication skills.
4. illustrate and present a comprehensive report highlighting training experiences, skills acquired, and learning outcomes.

Module	Title and Content	Hrs.
	On job Training provides practical exposure to real-world application of physics in industries, laboratories and research organizations. Students gain hand-on experience with instruments, experimental techniques, data analysis and workplace practicals. It helps students connect theoretical concepts learning in the classroom with practical application. OJT develops technical skills, problem-solving abilities, professional ethics and confidence for higher education and employment. Internship Guidelines for Students 1) Documentation: Annexures – I to IX (compulsory). 2) Safety: Students must follow ethical, safety, and confidentiality rules by company/organization and institutional norms during the OJT. 3) Complete allotted tasks, maintain a daily logbook. 4) Attendance: Minimum 75% required. 5) Discipline: Respectful and ethical behavior during On-the-job training is mandatory. 6) Prepare and submit project report and presentation.	120
Evaluation Pattern: 40:60		
Total Marks: 100		
Internal Evaluation (40 Marks): • Appendix VII: Supervisor Evaluation Of Intern 20 Marks • Attendance Diary/Logbook 20 Marks		End Semester Examination (60 Marks): • Viva Voce / Presentation 20 Marks • Depth of knowledge and skills acquired 20 Marks • Report 20 Marks