

K. D. K. College of Engineering, Nagpur

**Scheme and Syllabus for
Bachelor of Technology (Computer Science & Engineering)**

**Submitted by
Board of Studies in Computer Science & Engineering**

Vision of the Institute

Transforming Society through excellence in Education, Innovation and Research.

Mission of the Institute

M1- To deliver quality, outcome-based education that provides strong technical knowledge and lifelong learning.

M2- To promote innovation and impactful research addressing real-world and societal challenges.

M3- To develop competent, ethical and socially responsible professionals through industry interaction and holistic development.

Vision of the Department

Empowering students with advanced computing knowledge, innovation and research solutions for societal transformation.

Mission of the Department

M1. To provide outcome-based education that strengthens fundamentals in core and emerging domains of Computer Science and Engineering

M2. To foster innovation, research, and development in emerging areas of computing to address real-world and societal challenges.

M3. To develop skilled, ethical and socially responsible computing professional through industry collaboration, teamwork and holistic development.

Program Educational Objectives (PEO)

PEO	STATEMENT
PEO1	Graduates will have field knowledge along with science, mathematics and engineering to solve complex problems and innovate computing solutions for societal needs
PEO2	Graduates will creatively design and deploy software and hardware in emerging computer-based systems for their professional careers, higher studies or research.
PEO3	Graduates will ethically lead as individuals or team members with leadership capabilities and professional responsibilities.

PROGRAMME OUTCOMES

POs	KEYWORDS	PROGRAM OUTCOMES
PO1	Engineering Knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
PO3	Design/Development of Solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
PO4	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
PO5	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
PO6	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
PO8	Individual and Collaborative Team work	Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO	STATEMENT
PSO1	Design, develop, and deploy integrated hardware-software systems using computer science principles considering societal needs.
PSO2	Develop professional skills in web-based systems, mobile apps, big data, machine learning, deep learning using modern tools to ensure sustainable outcomes.

Knowledge and Attitude Profile (WK)

- WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

KDK College of Engineering, Nagpur
B. Tech. V-Semester (Computer Science & Engineering)
SCHEME OF EXAMINATION from (2026-27)

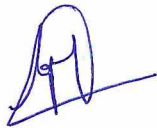
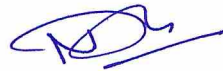
Sr. No.	Course Category	Course Code	Name of Course	BOS	Teaching Scheme (hrs.)			Total Credit	Examination Scheme					
					TH	TU	P		Theory				Practical	
									Exam Hrs.	MSE	CA	ESE	CA	ESE
1	PCC-VII	5BCS01T	Database Management System	CSE	3	-	-	3	3	30	20	50	-	-
2	PCC-VII	5BCS01P	Database Management System Lab	CSE	-	-	2	1	-	-	-	-	25	25
3	PCC-VIII	5BCS02T	Design & Analysis of Algorithm	CSE	3	-	-	3	3	30	20	50	-	-
4	PCC-VIII	5BCS02P	Design & Analysis of Algorithm Lab	CSE	-	-	2	1	-	-	-	-	25	25
5	PCC-IX	5BCS03T	Theory of Computation	CSE	2	-	-	2	2	15	10	25	-	-
6	PEC-I	5BCS04T	Refer Program Elective-I Basket	CSE	3	-	-	3	3	30	20	50	-	-
7	PEC-I	5BCS04P	Refer Program Elective-I Lab	CSE	-	-	2	1	-	-	-	-	25	25
8	MDM-III	5BCSMD03T	Refer MDM Basket	CSE	3	-	-	3	3	30	20	50	-	-
9	OE-III	5BOE03T	Refer Open Elective-III Basket	AS&H	3	-	-	3	3	30	20	50	-	-
Total					17	-	06	20	-	165	110	275	75	75
Total Marks (Theory & Practical)										550			150	
Total Marks (V Semester)										700				

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KDK College of Engineering, Nagpur
B. Tech. VI-Semester (Computer Science & Engineering)
SCHEME OF EXAMINATION from (2026-27)

Sr. No.	Course Category	Course Code	Name of Course	BOS	Teaching Scheme (hrs.)			Total Credit	Examination Scheme					
					Th	TU	P		Theory				Practical	
									Exam Hrs.	MSE	CA	ESE	CA	ESE
1	PCC-X	6BCS01T	Compiler Design	CSE	3	-	-	3	3	30	20	50	-	-
2	PCC-X	6BCS01P	Compiler Design Lab	CSE	-	-	2	1	-	-	-	-	25	25
3	PCC-XI	6BCS02T	Software Engineering & Project Management	CSE	2	-	-	2	2	15	10	25	-	-
4	PCC-XII	6BCS03T	Computer Networks	CSE	2	-	-	2	2	15	10	25	-	-
5	PEC-II	6BCS04T	Refer Program Elective-II Basket	CSE	3	-	-	3	3	30	20	50	-	-
6	PEC-II	6BCS04P	Refer Program Elective-II Lab	CSE	-	-	2	1	-	-	-	-	25	25
6	PEC-III	6BCS05T	Refer Program Elective-III Basket	CSE	3	-	-	3	3	30	20	50	-	-
7	MDM-IV	6BCSMD04T	Refer MDM Basket	CSE	3	-	-	3	3	30	20	50	-	-
8	VSEC-IV	6BCS06P	Professional Skills-II Lab & Mini Project	CSE	-	-	4	2	-	-	-	-	50	50
Total					16	-	08	20	-	150	100	250	100	100
Total Marks (Theory & Practical)									500			200		
Total Marks (VI Semester)									700					

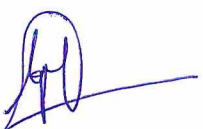
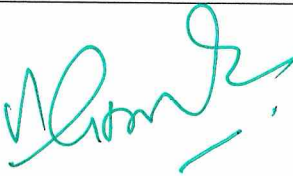




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KDK College of Engineering, Nagpur
B. Tech. (Computer Science & Engineering)
EXIT SCHEME

After Sixth Semester				BOS	Teaching Scheme (hrs.)			Total Credit	Examination Scheme					
Sr. No.	Course Category	Course Code	Name of Course											
					Theory	Tutorial	Practical		Theory				Practical	
									Exam Hrs.	CA	MSE	ESE	CA	ESE
1	Exit Course	CSEXT01P	Data Warehousing & Mining	CSE	-	-	2	1	-	-	-	-	25	25
2	Exit Course	CSEXT02P	Data Science	CSE	-	-	2	1	-	-	-	-	25	25
3	Exit Course	CSEXT03P	Capstone Project	CSE	-	-	12	6	-	-	-	-	-	200
			Total				16	8	-	-	-	-	50	250
							Total Marks			300				

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List of Multi-Disciplinary Minor Course (MDM) Basket-1

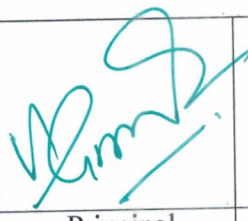
Sr. No.	Course Category	Subject Code	Semester	Title of the MDM Course	Credit
1	MDM 1	3BCSMD01T	III	Sampling & Statistical Modelling	3
2	MDM 2	4BCSMD02T	IV	Discrete Structures and Graph Theory	2
3	MDM 3	5BCSMD03T	V	Analog & Digital Communication	3
4	MDM 4	6BCSMD04T	VI	Embedded System with IoT	3
5	MDM 5	7BCSMD05T	VII	Wireless Communication System	3

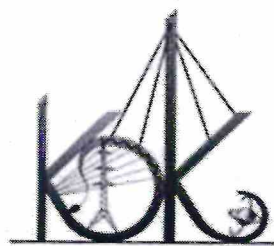
List of Multi-Disciplinary Minor Course (MDM) Basket-2

Sr. No.	Course category	Subject Code	Semester	Title of the MDM Course	Credit
1	MDM 1	3BCSMD01T	III	Sampling & Optimization Techniques	3
2	MDM 2	4BCSMD02T	IV	Foundation of Discrete Structure	2
3	MDM 3	5BCSMD03T	V	Programming with Arduino and Raspberry-Pi	3
4	MDM 4	6BCSMD04T	VI	Microprocessor & Microcontroller	3
5	MDM 5	7BCSMD05T	VII	Embedded System with IOT	3

List of Program Electives Basket

Sr. No.	Category	Course Code	Semester	Subject Name
1	PEC-I	5BCS04T-A	V	Artificial Intelligence
2		5BCS04T-B		Object Oriented Modelling Design
3	PEC-II	6BCS04T-A	VI	Machine Learning
4		6BCS04T-B		Cyber Security
5	PEC-III	6BCS05T-A	VI	Cluster & Cloud Computing
6		6BCS05T-B		Data Science

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K. D. K. College of Engineering, Nagpur

Syllabus – Fifth Semester

Bachelor of Technology (Computer Science & Engineering)

KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech Computer Science & Engineering

Semester: V	Subject Code: 5BCS01T	Name of Subject: Database Management System		
Total Hours Distribution per week				
Total Credit:3	Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To understand general idea of database management systems.
2	To develop skills to design databases using data modeling and design techniques.
3	To understand different normalization technique.
4	To demonstrate an understanding of career opportunities in subject areas of designing, storage techniques, data handling and managing techniques.
5	To develop skills to implement real life applications which involve database handling.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Interpret basic database concepts and data modeling techniques used in database design.
CO2	Study the concept of functional dependency and Perform the calculus with Design database by using different normalization technique.
CO3	Study query processing and Perform optimization on query processing.
CO4	Demonstrate the concept of transaction processing and different recovery technique used in RDBMS.
CO5	Study and Implement advanced databases which are used real time system.

Course Competencies	
1	Develop an understanding of the fundamental principles and applications of database systems for efficient data management.
2	Develop the ability to analyze, design, and optimize database systems using appropriate data modeling and normalization techniques.
3	Understand and apply methods for efficient data access, processing, and resource utilization in database systems.
4	Develop the ability to manage and maintain reliable database systems by ensuring data integrity, consistency, and recoverability.
5	Analyze and apply advanced database approaches to meet the requirements of modern computing environments.

CO-PO Articulating Matrix

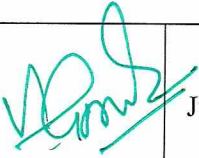
Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	-	1	1	-	1	2	3	3
CO2	3	3	3	2	-	1	1	1	-	1	2	3	3
CO3	3	3	3	2	-	1	1	1	-	1	2	3	3
CO4	3	3	3	3	-	1	1	1	-	1	2	3	3
CO5	3	3	3	3	-	1	1	1	-	1	3	3	3

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Introduction to database systems			
Approaches to building a database, Three-schema architecture of a database, Challenges in building a DBMS, DBMS Architecture- Various components of a DBMS, Types of data models.	9	-	1
UNIT 2: Relational Data Model			
Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys, Relational algebra operators, Tuple relation calculus, Domain relational calculus. Physical and logical hierarchy: Concept of index, B-trees, bitmap index. Concepts of Functional dependency, Normalization (1NF, 2NF, 3NF, BCNF, etc.). SQL Queries	9	-	2
UNIT 3: Query Processing and Optimization			
Query Processing and Optimization process, measures of query cost estimation in query optimization, pipelining and Materialization, Structure of query evaluation plans.	9	-	3
UNIT 4: Transactions			
Transaction concepts, properties of transactions, Serializability of transactions, Two-Phase Commit protocol. Recovery and Atomicity. Log based recovery, concurrent executions of transactions, Locking mechanism, deadlock, two-phase locking protocol	9	-	4

UNIT 5: Recovery System and advanced databases			
Failure classification, recovery and atomicity, log based recovery, checkpoints, buffer management, Introduction to SQLite, Mongo DB and NOSQL databases.	9	-	5

Text Books:
1. Database System Concepts by Avi Silberschatz, Henry F. Korth, S. Sudarshan, Tata McGraw Hill, Fifth Edition. 2. Fundamentals of Database Systems - Elmasiri and Navathe, Addison Wesley, 2000. 3. An introduction to Database Systems, CJ Date, A. Kannan, S. Swamynathan-Eight Edition.
Reference Books:
4. Database Management Systems - by Raghu Ramakrishnan and Johannes Gehrke, Tata McGraw Hill Publication, Third Edition. 5. Introduction to Database Management Systems by Kahate, Pearson Education.

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Faculty of Science and Technology
B. Tech Computer Science & Engineering

B: Tech Computer Science & Engineering			
Semester: V	Subject Code: 5BCS01P	Name of Subject: Database Management System Lab	
Total Hours Distribution per week			
Total Credit:1	Lecture(L): --	Tutorial(T):--	Practical(P):--2 Hrs
Examination Scheme			
Continuous Assessment		End Semester Examination	Total Marks
25 Marks		25 Marks	50 Marks

Course Objectives	
1	To develop skills in designing databases using data modeling and database design techniques.
2	To implement real-world applications involving efficient database management and handling
3	To provide hands-on experience in developing database applications using PL/SQL programming techniques and to understand advanced databases.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Design Entity Relationship (ER) diagrams for database applications using appropriate modeling techniques.
CO2	Implement SQL queries for data definition, data manipulation, data retrieval operations and joins, views, and indexing techniques.
CO3	Demonstrate the use of PL/SQL procedures, functions, triggers, and cursors for database programming and implement Mongo DB and NOSQL databases.

Course Competencies	
1	Develop the ability to analyze data requirements and create conceptual data models for database applications
2	Develop practical skills in implementing SQL queries for data definition, data manipulation, and data retrieval operations.
3	Develop database programming skills using PL/SQL procedures, functions, triggers, and cursors and implement advanced databases

CO-PO Articulating Matrix

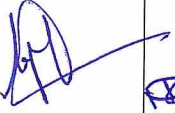
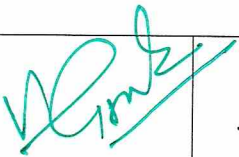
Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	1	2	3	2	1	3	3	3
CO2	3	3	3	3	3	1	2	3	2	1	3	3	3
CO3	3	3	3	3	3	1	2	3	2	1	3	3	3

A minimum of 10 practical to be performed

List of Practical		Mapped with CO Number
1	Introduction to DBMS	CO1
2	To Draw ER diagram for College Management System and Hotel Management System	CO1
3	To Perform DDL, DML Commands in SQL.	CO2
4	To Perform aggregate functions in SQL.	CO2
5	To Perform Join and Set Operation in SQL.	CO2
6	To Perform Various Arithmetical, Relational & Logical Operators in SQL.	CO2
7	To perform a) various Clauses in SQL and b) Like operator in SQL	CO2
8	To implement integrity constraints in SQL.	CO2
9	To create View and Materialized view in SQL.	CO2
10	To Create a User and Grant Permissions	CO3
11	To create index in SQL	CO3
12	To create functions and procedures using PL/SQL.	CO3
13	To implement triggers in PL/SQL.	CO3
14	To Install MongoDB and MongoDB Compass	CO3
15	To perform CRUD operations in MongoDB	CO3

Reference Books:

1. Database Management Systems - by Raghu Ramakrishnan and Johannes Gehrke, Tata McGraw Hill Publication, Third Edition.
2. Introduction to Database Management Systems by Kahate, Pearson Education.

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. Computer Science & Engineering

Semester: V	Subject Code: 5BCS02T	Name of Subject: Design and Analysis of Algorithm		
Total Hours Distribution per week				
Total Credit: 3		Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To introduce students the general idea of analysis and design of algorithm.
2	Apply important algorithmic design paradigms and methods of analysis.
3	To enable students to formulate and solve complex optimization problems using dynamic programming techniques.
4	To introduce systematic problem-solving techniques using backtracking and branch and bound approaches.
5	To provide conceptual understanding of computational complexity theory, including problem classification into P, NP, NP-complete, and NP-hard.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Classify basic concepts of algorithm in analysis and Design of algorithms and Examine Recurrence relations, solutions of recurrence of searching sorting Methods
CO2	Apply Greedy methods used for analysis and Design of Algorithm.
CO3	Analyze Dynamic Programming concepts in designing algorithm.
CO4	Describe Branch & Bound concepts in designing algorithm.
CO5	Evaluate advanced techniques and tools available for algorithm analysis and development.

Course Competencies	
1	Analyze algorithm efficiency
2	Design algorithms using Divide and Conquer and Greedy strategies
3	Apply Dynamic Programming techniques to develop optimal solutions
4	Develop solutions using Backtracking and Branch and Bound methods
5	Classify computational problems into P, NP, NP-Hard, and NP-Complete categories

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	1	--	1	--	1	2	3	2
CO2	3	3	3	2	3	1	--	1	--	1	2	2	1
CO3	3	3	3	2	3	1	--	1	--	1	2	2	1
CO4	3	3	3	2	3	1	--	1	--	1	2	2	1
CO5	3	3	2	3	3	1	--	1	--	1	2	1	1

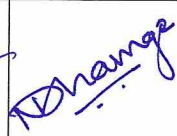
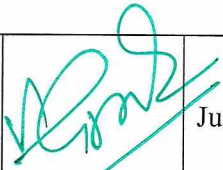
SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Introduction of Algorithms			
Analysis of algorithms, Recurrence relation, Master Theorem, Characteristic Equation, and Disjoint set Operation. Divide and Conquer: Bitonic Sorting, Min Max Problem, AND OR Graphs,	9	-	1
UNIT 2: Greedy Strategy			
Introduction, Optimal merge pattern, Huffman coding, Minimum spanning trees, Fractional Knapsack problem, job sequencing with deadlines single source shortest path algorithms: Dijkstra's Algorithm.	9	-	2
UNIT 3: Dynamic Programming			
Introduction, 0/1 Knapsack, Multistage graph, Floyd-warshall algorithms, optimal binary search trees, Matrix chain Multiplication, Travelling sales man Problem, Longest common subsequence.	9	-	3
UNIT 4: Backtracking			
Backtracking: General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Branch and Bound, Connected Components and bi-connected components, Articulation Point.	9	-	4

UNIT 5: P NP Class			
P, NP-completeness & NP hard problems. Basic Concept of non-deterministic algorithms. NP hard and NP complete classes, Decision and Optimization Problem, Polynomial reduction	9	-	5

Text Books:
1. Computer Algorithms, Horowitz, Sahani, Rajsekharan, 2nd Edition, Silicon Press
2. Introduction to Algorithm, Thomas H. Cormen, 3rd Edition, 2009, MIT press
3. The Design and Analysis of Computer Algorithms”, Pearson education by Alfred V. The Design and Analysis of Computer Algorithms”, Pearson education by Alfred V. Aho, John E. Hopcraft, Jeffrey D. Ullman.
4. Fundamentals of Algorithms”, Prentice Hall by Brassard, Bratley
5. “Design and Analysis of Algorithms”, Pearson Education, II nd Edition, Parag Dave, Himanshu Dave
6. Fundamentals of Algorithm, Dr. S.R.Sathe, Laxmi Publication

Reference Books:
1. Algorithms, S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani, 1st Edition, 2006
2. Computer Algorithms: Introduction to Design and analysis, 3rd Edition, By Sara Baase and A.V. Gelder Pearson Education.

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B. Tech Computer Science & Engineering

Semester: V	Subject Code: 5BCS02P	Name of Subject: Design and Analysis of Algorithm Lab	
Total Hours Distribution per week			
Total Credit:1	Lecture(L): --	Tutorial(T):--	Practical(P):--2 Hrs
Examination Scheme			
Continuous Assessment	End Semester Examination		Total Marks
25 Marks	25 Marks		50 Marks

Course Objectives	
1	To implement and analyze fundamental algorithms using design techniques such as divide and conquer, greedy methods.
2	To develop practical programming skills for solving computational problems such as dynamic programming.
3	To strengthen understanding of algorithmic concepts by designing solutions for optimization, and backtracking approaches.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Design and develop solutions using Divide and Conquer and Greedy strategies.
CO2	Evaluate and implement problem solutions using Dynamic Programming techniques.
CO3	Design and implement algorithms using Backtracking to solve computational problems.

Course Competencies	
1	Implement and analyze algorithms using C/C++ programs and evaluate their time and space complexity for different problem sizes.
2	Develop practical skills in implementing Divide and Conquer, Greedy Method, and Dynamic Programming.
3	Solve combinatorial and optimization problems efficiently.

A minimum 10 practical to be performed

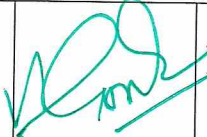
Sr. No.	List of Practical	CO
01	Write a program to implement Heap sort	CO1
02	Write a program to implement a) Merge Sort b) Quick Sort	CO1
03	Write a program to implement Min Max Method.	CO1
04	Write a program to implement Binary Search using Divide and Conquer method.	CO1
05	Write a program to implement Knapsack problem using Greedy method.	CO1
06	Write a program to implement Huffman Code	CO2
07	Write a program to implement Floyd-warshal algorithm.	CO2
08	Write a program to implement Travelling sales man Problem	CO2
09	Write a program to implement 0/1 Knapsack Problem	CO2
10	Write a program to implement Longest Common Subsequence	CO2
11	Write a program to implement Multistage Graph	CO2
12	Write a program to implement N-Queen problem	CO3
13	Write a program to implement Longest Common Subsequence.	CO3
14	Write a program to implement Sum of Subsets	CO3
15	Write a program to implement Graph Coloring Technique	CO3

Reference Book

1. Introduction to Algorithm, Thomas H. Cormen, 3rd Edition, 2009, MIT press
2. The Design and Analysis of Computer Algorithms”, Pearson education by Alfred V. The Design and Analysis of Computer Algorithms”, Pearson education by Alfred V. Aho, John E. Hopcraft, Jeffrey D. Ullman.

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	1	2	3	2	1	3	3	2
CO2	3	3	3	2	3	1	2	3	2	1	3	3	2
CO3	3	3	2	2	3	1	2	3	2	1	3	3	2

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. Computer Science & Engineering

Semester: V	Subject Code: 5BCS03T	Name of Subject: Theory of Computation		
Total Hours Distribution per week				
Total Credit:2	Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
15 Marks	20 Marks	25 Marks	50 Marks	2 Hours

Course Objectives	
1	To understand the fundamental concepts of Finite Automata, and to learn how to design, analyze, and minimize automata models.
2	To understand the concepts of Regular Expressions and their relationship with Finite Automata
3	To understand the relationship between formal languages, grammars, and automata.
4	To understand the concepts and working of Pushdown Automata and Turing Machines

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	To design and implement DFA and NFA for given problems, convert between different automata forms, minimize DFA, and apply Moore and Mealy machines for real-world applications.
CO2	To construct and simplify regular expressions
CO3	Design context-free grammars and pushdown automata and understand their equivalence in recognizing context-free languages.
CO4	Apply the concepts of Turing Machines and their role in defining computability for problem solving.

Course Competencies	
1	Apply mathematical models of computation.
2	Design and convert computational models.
3	Analyze language classes and their properties.
4	Develop Turing Machine solutions and understand computability.

CO-PO Articulating Matrix

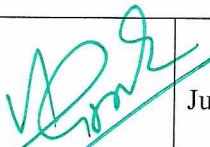
Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	-	-	2	2	2
CO2	3	3	2	1	1	-	-	-	-	-	2	2	2
CO3	3	3	3	2	1	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	2	2	2

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: FINITE AUTOMATA (FA)			
Strings, Alphabet, Language, Operations, Finite state machine, definitions, Finite automation model, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA. Conversion of NFA into DFA, Minimization of FSM, Equivalence between two FSM's., Finite automata with output (Moore and Mealy machines) and Inter conversion.	8	-	1
UNIT 2: REGULAR EXPRESSIONS (RE)			
REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions-Interconversion, Pumping lemma. Closure properties of regular sets (proofs not required), Regular grammars, Right linear and left linear grammars, Equivalence between regular linear grammar and F.A. inter conversion between RE and RG.	7	-	2
UNIT 3: CONTEXT-FREE GRAMMAR			
CONTEXT-FREE GRAMMAR (CFG): LMD, RMD, Derivation Trees, Ambiguity in CFGs , Chomsky Normal Form, Greibach Normal Form, Push Down Automata, Definition, Model, acceptance of CFL, Equivalence of CFL and PDA , Inter conversion	8	-	3

UNIT 4: Turing Machine			
Turing Machine, Definition, Model, Design of TM, Universal Turing Machine Computable functions, Recursive enumerable language, , Types of TM's, Properties of recursive & non-recursive enumerable languages, Universal Turing Machine, Post-correspondence problem, Ackermann's Function Introduction to recursive function theory.	7	-	4

Text Books:
1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, 3 rd edition, Pearson Education. 2. Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-808458-7. 3. Theory of Computation - O.G. Kakde ,University Science Press
Reference Books:
1. An Introduction to Formal Languages and Automata – by Peter Linz, Jones & Bartlett Learning. 2. Automata Theory and Formal Languages , PHI Learning.

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Semester: V	Subject Code: 5BCS04T-A	Name of Subject: Artificial Intelligence		
Total Hours Distribution per week				
Total Credit:3	Lecture(L): 3 Hrs	Tutorial(T):--		
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	Introduce students to the fundamental concepts and history of Artificial Intelligence.
2	Explore various problem-solving techniques and search algorithms used in AI.
3	Familiarize students with knowledge representation methods and reasoning techniques.
4	Develop an understanding of handling uncertainty and probability in AI systems.
5	Understand machine learning concepts, expert systems and basic natural language processing concepts.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Define Artificial Intelligence and explain its historical development and current applications. Formulate problems using state space representation
CO2	Apply appropriate search techniques to solve search problem. Implement and compare uninformed and informed search algorithms for problem-solving
CO3	Utilize various knowledge representation techniques such as predicate logic, semantic nets, script and frames.
CO4	Apply probabilistic reasoning and Bayesian networks to handle uncertainty in AI systems.
CO5	Classify various learning Techniques and architecture of expert system.

Course Competencies	
1	Understand AI fundamentals and problem representation methods
2	Apply search and optimization techniques for problem solving
3	Represent and infer knowledge using logical and structured methods
4	Handle uncertain knowledge and design intelligent agents
5	Understand AI learning models and expert system concepts

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	1	-	-	-	1	2	2	1
CO2	3	3	3	3	1	2	-	-	-	1	2	3	2
CO3	3	3	3	3	1	2	-	-	-	1	2	2	2
CO4	3	3	3	2	-	2	-	-	-	1	2	2	3
CO5	3	2	2	1	1	2	1	-	-	1	2	2	3

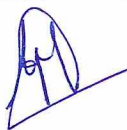
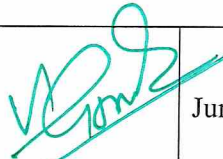
SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Introduction to AI			
Introduction: What is AI? History & Applications, Artificial intelligence as representation & Search, Production system, Control strategy, Basics of problem solving: problem representation paradigms, defining problem as a state space representation, Characteristics.	9	-	1
UNIT 2: Search Techniques			
Search Techniques: Uninformed Search techniques(BFS, DFS, Uniform cost Search), Informed Heuristic Based Search, Hill-climbing. Best-First Search, Problem Reduction, and Constraint Satisfaction.	9	-	2
UNIT 3: Knowledge representation			
Knowledge representation: Knowledge representation Issues, First order logic, Inference in first order logic Predicate Logic, Structured Knowledge Representation: Unification, Backward Chaining. Forward Chaining, Resolution, Semantic Nets, Frames, and Scripts.	9	-	3
UNIT 4: Uncertain knowledge & Intelligent Agents			
Uncertainty: Handling uncertain knowledge, rational decisions, basics of probability, axioms of probability, Baye's Rule and conditional independence, Bayesian networks, Exact and Approximate inference in Bayesian Networks. Intelligent Agents: Introduction to Intelligent Agents, Rational Agents, their structure, reflex, model-based, goal-based, and utility-based agents.	9	-	4

UNIT 5: Knowledge and learning			
Learning: What is learning? Knowledge and learning. Learning in Problem Solving. Learning from example, Statistical Learning methods, Unsupervised learning, Supervise learning, Reinforcement Learning. Learning probabilistic models Expert Systems: Fundamental blocks, Knowledge Engineering. Knowledge Acquisition. Knowledge-Based Systems, Basic understanding of Natural language Processing.	9	-	5

Text Books:
1. E.Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008.
2. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition

Reference Books:
1. Introduction to Artificial Intelligence – Charniak (Pearson Education)
2. Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers

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Semester: V	Subject Code: 5BCS04T-B	Name of Subject: Object Oriented Modeling Design		
Total Hours Distribution per week				
Total Credit:3	Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours
Course Objectives				
1	To explain the basic concepts of object-oriented modeling and the conceptual model of UML.			
2	To develop the ability to model system structure using UML diagrams such as Class, Object, and Collaboration diagrams.			
3	To apply behavioral UML diagrams like Use Case, Activity, State Machine, and Sequence diagrams to represent systems behavior.			
4	To illustrate architectural modeling using Component and Deployment diagrams and explain the Unified Process.			
5	To describe the architecture-centric development process and analyze system architecture through a case study.			

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Classify the fundamental concepts of object-oriented modeling and the conceptual framework of UML.
CO2	Develop UML structural models using Class, Object, and Collaboration diagrams to represent system structure.
CO3	Apply behavioral modeling techniques using UML diagrams such as Use Case, Activity, State Machine, and Sequence diagrams.
CO4	Illustrate software architecture using Component and Deployment diagrams and describe the Unified Process.
CO5	Analyze the architecture-centric development process and apply architectural concepts through a case study.

Course Competencies	
1	Develop an understanding of object-oriented modeling principles and standard modeling techniques for software system design
2	Develop the ability to model and represent the structural aspects of software systems using appropriate design methodologies
3	Develop competency in analyzing and modeling the behavioral aspects of software systems for effective design and development
4	Develop the ability to model software architecture and apply systematic software development processes for effective system design
5	Analyze software system requirements and apply architectural principles to support system design and implementation

CO-PO Articulating Matrix

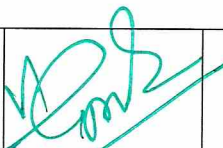
Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	1	-	-	1	2	2	2
CO2	3	2	3	2	-	-	1	-	-	1	3	3	3
CO3	3	2	3	2	-	-	1	-	-	1	3	3	3
CO4	3	2	3	2	-	-	1	-	-	1	3	3	3
CO5	3	2	3	3	-	-	1	-	-	1	3	3	3

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Introduction to Object Orientation Modeling			
Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, importance of modeling, principles of modeling, object oriented modeling, Aggregation and association, Generalization, Introduction to UML, conceptual model of the UML, Architecture.	9	-	1
UNIT 2: Basic Structural Modeling:			
Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Terms, concepts, depicting asynchronous messages with/without priority, callback mechanism, and broadcast messages.	9	-	2
UNIT 3: Basic Behavioural Modeling:			
Use cases, Use case Diagrams, Activity Diagrams, State Machine, Process and thread, Event and signals, Time diagram, interaction diagram, Dataflow diagram, Package diagram, sequence diagram, E-R diagram.	9	-	3
UNIT 4: Architectural Modeling			
Component, Deployment, Component diagrams and Deployment diagrams. The Unified process: use case driven, architecture centric, iterative, and incremental. Use case driven process: why use case, capturing use cases, analysis, design, and implementation to realize the use cases, testing the use cases.	9	-	4

UNIT 5: Architecture-centric process			
Architecture-centric process: architecture in brief, why we need architecture, use cases and architecture, the steps to architecture, an architecture description Case Study: The Unified Library application.	9	-	5

Text Books:
1. The Unified Modeling Language User Guide by Grady Booch, James Rumbaugh, Ivar Jacobson 2nd Edition, Pearson Education.
2. UML 2 Toolkit by Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado WILEY-Dreamtech India Pvt. Ltd.
3. The Unified Software Development Process by Ivar Jacobson, Grady Booch, James Rumbaugh, Pearson Education
Reference Books:
1. Fundamentals of Object Oriented Design in UML by Meilir Page-Jones Pearson Education.
2. Modeling Software Systems Using UML2 by Pascal Roques WILEY-Dreamtech India Pvt. Ltd
3. Practical Object-Oriented Design with UML by Mark Priestley TATA McGrawHill

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Semester: V	Subject Code: 5BCS04P-A	Name of Subject: Artificial Intelligence Lab		
Total Hours Distribution per week				
Total Credit:1	Lecture(L): --	Tutorial(T):--	Practical(P):--2 Hrs	
Examination Scheme				
Continuous Assessment		End Semester Examination		Total Marks
25 Marks		25 Marks		50 Marks

Course Objectives	
1	To understand AI problem-solving techniques and search algorithms
2	To understand and apply knowledge representation methods and probabilistic reasoning.
3	To apply intelligent agent concept and explore machine learning and expert system fundamentals.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Apply and Implement state space representation, production systems, uninformed and informed search algorithms to solve AI problems.
CO2	Use knowledge representation techniques. Analyze and handle uncertainty using probability theory and Bayesian networks.
CO3	Develop basic learning models and intelligent agents for decision-making systems.

Course Competency	
1	Problem modeling, Algorithm design and implementation
2	Logical reasoning, Logical reasoning and inference.
3	Intelligent system design

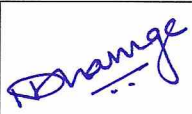
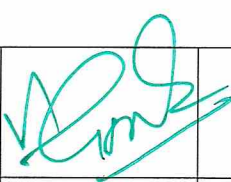
CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	2	1	1	1	0	2	2	3	2
CO2	3	3	3	2	3	1	1	1	0	2	2	3	3
CO3	3	3	3	2	2	1	1	1	1	2	2	3	2

A minimum of 10 practical should be performed

Sr. No	List of Practical	CO Mapped
01	Represent a following problem as a state space. Water Jug Problem Missionaries and Cannibals 8-Puzzle	CO1
02	Implement a rule-based production system.	CO1
03	Represent a graph as a search problem and find minimum-cost path DFS and BFS.	CO1
04	Implement Hill Climbing algorithm.	CO1
05	Implement concept of Constraint Satisfaction Problem (CSP) for solving N-Queen Problem and Map Colouring	CO1
06	Represent (knowledge) facts in First Order Predicate Logic.	CO2
07	Implement Forward Chaining algorithm.	CO2, CO3
08	Implement Backward Chaining algorithm.	CO2, CO3
09	Implement Unification Algorithm	CO2, CO3
10	Prove theorem using Resolution.	CO2, CO3
11	Represent knowledge using Semantic Nets.	CO2
12	Calculate posterior probability using Bayes Rule.	CO2, CO3
13	Build a simple Bayesian Network.	CO2, CO3
14	Simulate different AI agents.	CO2, CO3

Reference Book	
1.	Introduction to Artificial Intelligence – Charniak (Pearson Education)
2.	Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers

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Semester: V	Subject Code: 5BCS04P-B	Name of Subject: Object Oriented Modeling Design Lab
Total Hours Distribution per week		
Total Credit:1	Lecture(L): --	Tutorial(T):-- Practical(P):--
Examination Scheme		
Continuous Assessment	End Semester Examination	Total Marks
25 Marks	25 Marks	50 Marks

Course Objectives	
1	To explain the basic concepts of object-oriented modeling and the conceptual model of UML.
2	To develop the ability to model system structure using UML diagrams such as Class, Object, and Collaboration diagrams.
3	To develop skills to illustrate architectural modeling using Component and Deployment diagrams and explain the Unified Process.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Develop the fundamental concepts of object-oriented modeling and the conceptual framework of UML.
CO2	Develop UML structural models using Class, Object, and Collaboration diagrams to represent system structure.
CO3	Apply behavioral modeling techniques using UML diagrams such as Use Case, Activity, State Machine, and Sequence diagrams.

Course Competency	
1	Develop skills of object-oriented modeling principles and standard modeling techniques for software system design
2	Develop the ability to model and represent the structural aspects of software systems using appropriate design methodologies
3	Analyze software system requirements and apply architectural principles to support system design and implementation

CO-PO Articulating Matrix

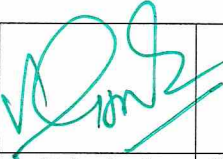
Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	1	2	3	2	1	3	3	3
CO2	3	3	3	3	3	1	2	3	2	1	3	3	3
CO3	3	3	3	3	3	1	2	3	2	1	3	3	3

A minimum of 10 practical to be performed

List of Practical		CO Mapped
1	Write a program to implement polymorphism	CO1
2	Write a program to apply abstraction, encapsulation, modularity, hierarchy, and reusability while designing an object model	CO1
3	To create UML class diagram demonstrating one-to-one, one-to-many, and many-to-many associations	CO1
4	To construct object diagrams representing object instances and their relationships at a specific point in time.	CO2
5	To design class diagrams for real-world applications such as Library Management System, Banking System, or Hospital Management System.	CO2
6	To Create collaboration diagrams illustrating message numbering, object interactions, and communication links.	CO2
7	To create UML Use Case Diagrams for applications such as Library Management System, ATM System, Hospital Management System, or Online Shopping System.	CO3
8	To Design State Machine Diagrams to represent the lifecycle and state transitions of objects such as ATM, Traffic Light, or Online Order	CO3
9	To Create Sequence Diagrams illustrating object interactions, message flow, activation bars, synchronous/asynchronous messages, and object lifelines.	CO3
10	Design E-R Diagrams for database applications by identifying entities, attributes, relationships, keys, and cardinality	CO3
11	To create Deployment Diagrams showing software components deployed on servers, clients, databases, and network devices.	CO3
12	To Perform object-oriented analysis based on identified use cases and prepare analysis models	CO3
13	To analyze why architecture is required in software systems (scalability, maintainability, performance, security, and reusability)	CO3
14	To Prepare an Architecture Description Document (ADD) for a sample system including diagrams, components, and design decisions.	CO3
15	Case Study: Unified Library Application – System Modeling Develop complete UML models: Use Case Diagram, Class Diagram, Sequence Diagram, Component Diagram, Deployment Diagram	CO3

Reference Books:

1. Fundamentals of Object Oriented Design in UML by Meilir Page-Jones Pearson Education.
2. Modeling Software Systems Using UML2 by Pascal Roques WILEY-Dreamtech India Pvt. Ltd
3. Practical Object-Oriented Design with UML by Mark Priestley TATA McGrawHill

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Semester: V	Subject Code: 5BCS04P-C	Name of Subject: Professional Skill-I Lab
Total Hours Distribution per week		
Total Credit:1	Lecture(L): --	Tutorial(T):-- Practical(P):--
Examination Scheme		
Continuous Assessment	End Semester Examination	Total Marks
25 Marks	25 Marks	50 Marks

Course Objectives	
1	To understand the Advance concepts of Python Programming.
2	To understand the Advance concepts of Data Structure and algorithms.
3	To understand the Advance concepts of Full stack development.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Develop proficiency in advance python programming and effective data manipulation strategies.
CO2	Exhibit expertise in advance data structures and algorithms and optimization of complex problems.
CO3	Design and maintain modern, scalable, secure and production ready full-stack web applications.

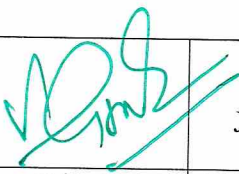
Course Competency	
1	Develop skills using advance python programming to solve complex problems.
2	To design optimize solutions for solving computational Problems and improving the efficiency of software applications.
3	Developing and testing user friendly full stack solutions using modern development tools.

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	3	2	3	1	1	3	3	3
CO2	3	3	3	3	3	3	2	3	1	1	3	3	3
CO3	3	3	3	3	3	3	2	3	1	1	3	3	3

A minimum of 10 practical should be performed

Name of Topic		CO
1	Study and implementation of Advanced Data Structures in Python.	CO1
2	Write Python programs to demonstrate Object-Oriented Programming concepts (Classes, Objects, Inheritance, Polymorphism, and Encapsulation).	CO1
3	To perform File Handling operations and automate file management using the OS module.	CO1
4	Write a program to implement Exception Handling and fetch data from a JSON-based REST API using Python JSON APIs.	CO1
5	Develop Python programs using Libraries in Python & perform basic Web Scraping.	CO1
6	To implement Arrays, Strings, Linked Lists, Stacks, and Queues with various operations.	CO2
7	To implement Tree and Graph data structures along with DFS and BFS traversal techniques.	CO2
8	To implement Sorting and Searching algorithms.	CO2
9	Analyze the Time and Space Complexity of different algorithms using practical implementations.	CO2
10	Write a program on Recursion and Backtracking.	CO2
11	Design responsive web pages using HTML, CSS, and JavaScript.	CO3
12	Write a program on React basics & Component Architecture.	CO3
13	Develop a web application using Django/Flask framework.	CO3
14	To implement a database integration with the backend application.	CO3
15	To implement Create, Read, Update, and Delete (CRUD) operations in a full-stack web application.	CO3

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Semester: V	Subject Code: 5BCSMD03T	Name of Subject: Analog and Digital Communication		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours
Course Objectives				
1	Understand the basic principles of analog and digital communication, including signals, modulation techniques, and sampling.			
2	Understand the concept of continuous and discrete time signal and sampling			
3	Learn the Basics of Different Analog and Digital Modulation Techniques			
4	Apply fundamental concepts of digital communication such as PCM, DM, and error handling to analyze simple communication systems.			
5	Apply various Modulation Techniques to Design different types of Filter and Signaling modules for Practical Applications			
Course Outcomes				
After completion of syllabus, the student will be able to				
CO1	Understand the advantages and basic concepts of digital communication			
CO2	Explain the sampling theorem and its importance in signal processing			
CO3	Describe pulse modulation techniques such as PAM, PWM, and PPM.			
CO4	Explain the working principle of Pulse Code Modulation (PCM).			
CO5	Understand the concept and operation of Delta Modulation (DM).			

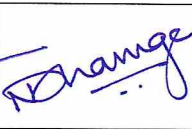
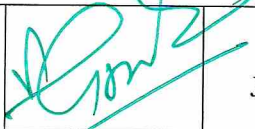
Course Competencies:	
1	Explain the basic working of analog and digital communication systems.
2	Identify and compare different modulation techniques used in communication
3	Apply sampling theorem and pulse modulation methods in simple problems.
4	Analyze basic digital communication techniques like PCM and DM.
5	Recognize errors and basic methods used for reliable data transmission.

CO-PO Articulating Matrix

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	-	2	2	2
CO2	3	2	-	-	-	2	-	-	-	-	2	2	2
CO3	3	2	-	-	-	2	-	-	-	-	2	2	2
CO4	3	2	-	-	-	2	-	-	-	-	2	2	2
CO5	3	2	-	-	-	2	-	-	-	-	2	2	2

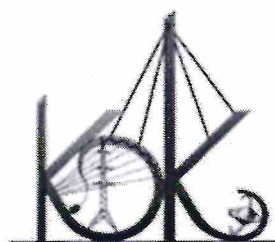
Syllabus

Details of Topic	Hours	Mapped with CO
Unit 1: Introduction to Communication Systems	9	CO1
Elements of a communication system ,Types: Analog vs Digital communication, Types of communication (wired & wireless), Frequency spectrum and bandwidth, Basic concepts of noise and interference.		
Unit 2: Analog Communication	9	CO2
What is modulation, Amplitude Modulation (AM),Frequency Modulation (FM) , Phase Modulation (PM) basics, Demodulation techniques (AM & FM),Comparison of AM, FM, and PM.		
Unit 3: Noise in Communication Systems	9	CO3
Types of noise: internal & external, Thermal noise and its effects, Signal-to-noise ratio (SNR), Noise in AM and FM systems. Methods to improve SNR.		
Unit 4: Digital Communication Basics	9	CO4
Advantages of digital communication. Sampling theorem, Pulse modulation techniques, PAM, PWM, PPM, Pulse Code Modulation (PCM), Delta Modulation (DM).		
Unit 5: Digital Modulation Techniques	9	CO5
ASK (Amplitude Shift Keying), FSK (Frequency Shift Keying), PSK (Phase Shift Keying), QPSK basics, Bit rate vs baud rate, Bandwidth requirements.		
Text Books 1. Communication Systems by Simon Haykin 2. Modern Digital and Analog Communication Systems by B.P. Lathi. 3. Electronic Communication Systems by George Kennedy and Bernard Davis.		
References Books 1. 1. Digital Communications: Fundamentals and Applications by Bernard Sklar 2. 2. Analog and Digital Communications by Hwei P. Hsu.		

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K. D. K. College of Engineering, Nagpur

Syllabus – Sixth Semester

Bachelor of Technology (Computer Science & Engineering)

KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. Computer Science & Engineering

Semester: VI	Subject Code: 6BCS01T	Name of Subject: Compiler Design		
Total Hours Distribution per week				
Total Credit:3	Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

1	Define the different phases of the Compiler and utilities of Automata
2	Understand the concept of syntax and semantic Analysis.
3	Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.
4	Understand the Architecture of computer and its use in designing a compiler.
5	Understand advanced code optimization techniques, register allocation, code generation, and error handling across different phases of compiler design

Course Outcomes

After completion of syllabus, students would be able to

CO1	Interpret the compiler concepts along with the compiler phases and construction tools.
CO2	Apply the parsing techniques for syntax analysis.
CO3	Analyze semantic structures using attribute grammars, SDT, STM .
CO4	Implement the concept of Code Optimizations.
CO5	Design efficient target code generation schemes through various techniques.

Course Competencies

1	Understand compiler fundamentals
2	Design and implement syntax analysis techniques
3	Apply semantic analysis and symbol table management
4	Generate and optimize intermediate code
5	Develop target code generation strategies

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	1	--	--	--	--	--	--	2	1	1
CO2	3	3	3	2	--	--	--	--	--	--	2	1	1
CO3	3	3	3	2	--	--	--	--	--	--	2	1	1
CO4	3	3	3	2	--	--	--	--	--	--	2	1	1
CO5	3	1	1	1	--	--	--	--	--	--	2	1	1

SYLLABUS

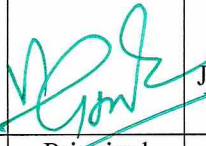
Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Introduction to Compiler			
Introduction: Concepts of Compiler, Interpreter, Assembler, Phases of a Compiler , Compiler construction tools(LEX and YACC) , Bootstrapping and cross compilers , Error handling in compiler , Top Down Parsing, FIRST () and FOLLOW(), LL(1) parser.	9	-	1
UNIT 2: Syntax Analysis			
Parsers, Shift-Reduce Parser, Top-down parser, Predictive Parsers, Bottom up parsing technique, LR parsing algorithm, Design of SLR, CLR, LALR, parsers.	9	-	2
UNIT 3: Semantic Analysis & Symbol Table			
Semantic Analysis: Attribute Grammar, syntax directed definition, evaluation, and flow of attribute in a syntax tree, Syntax Directed Translation (SDT) . Symbol Table: Basic Structure, symbol table attributes and managements, Runtime Environment: Procedure activation, parameter passing, value return ,memory allocation	9	-	3
UNIT 4: Intermediate Code Generation			
Translation of different language features, different types of intermediate forms, code improvement (optimization),control flow, Basic blocks and flow graphs, data dependence etc, local optimization, global optimization, peep hole optimization etc.	9	-	4
UNIT 5: Code improvement			
Register allocation and target code generation types of Errors, Lexical phase Errors, Syntactic phase Errors, DAG representation of basic blocks, Global data flow analysis, Dominators, Loop invariant computations, Loop unrolling, Loop jamming, simple code generator.	9	-	5

Text Books:

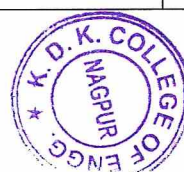
- 1.Compilers: Principles, Techniques and Tools, V. Aho,R. Sethi, J.Ullman
2. Lex and Yaac, Levine R. John, Tony Mason and Doug Brown.

Reference Books:

- 3.Compiler Design , Karthi M, Rajkumar Y, Sudha Rani S

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B.Tech Computer Science & Engineering

Semester: VI	Subject Code: 6BCS01P	Name of Subject: Compiler Design Lab
Total Hours Distribution per week		
Total Credit:1	Lecture(L): --	Tutorial(T):-- Practical(P):--2 Hrs
Examination Scheme		
Continuous Assessment	End Semester Examination	Total Marks
25 Marks	25 Marks	50 Marks

Course Objectives	
1	To gain hands-on experience in designing and implementing lexical analyzers and parsers using tools like LEX/FLEX and YACC
2	To implement and verify parsing techniques such as LL(1), shift-reduce, and LR parsing methods
3	To design and implement intermediate representations such as three-address code, DAG, and basic block structures.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Design and implement lexical analyzer and parser using tools such as Lex and Yacc.
CO2	Generate intermediate code and understand basic code optimization techniques.
CO3	Apply compiler design concepts for developing language processing applications.

Course Competency	
1	Develop lexical analysis programs to perform token recognition, pattern matching,
2	Design and implement parsers for syntax checking and grammar validation using top-down and bottom-up parsing techniques with Lex and Yacc.
3	Implementing basic code generation and code optimization techniques

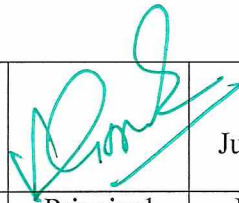
CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	2	-	3	-	-	2	1	1
CO2	3	3	2	2	3	1	-	3	-	-	2	1	1
CO3	3	3	2	2	3	1	-	3	-	-	2	1	1

A minimum of 10 practical should be performed

Sr. No.	List of Practical	CO Mapped
01	Write a lex program to recognize keywords, identifiers and numbers.	CO1
02	Write a lex program to count number of letters, words, special characters, number, space and line in a given input file	CO1
03	Implement a Lex Program to detect and remove comments from a C program.	CO1
04	Write a C program for parser generation using YACC.	CO1
05	Write a C program for elimination of left recursion in a given grammar.	CO1
06	Write a C program to remove left factoring in a given grammar.	CO1
07	Write a C program to implement recursive descent parser for top-down parsing.	CO2
08	Write a C program to implement Shift-Reduce parser using bottom-up parsing.	CO2
09	Write a C program to implement intermediate code generation for simple expression.	CO2
10	Write a C program for implementation of three-address code.	CO2
11	Write a C program for implementing simple code optimization technique.	CO2
12	Develop a Symbol Table Management Program to perform insertion, deletion, searching, and updating of identifiers.	CO3
13	Implement Intermediate Code Optimization Techniques such as constant folding, constant propagation, and common sub-expression elimination.	CO3
14	Implement Peephole Optimization to improve the generated target code.	CO3
15	Develop a Simple Code Generator to generate target machine code with register allocation for arithmetic expressions.	CO3

Reference Book
1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, <i>Compilers: Principles, Techniques, and Tools</i> (2nd Edition), Pearson Education, 2007
2. D. M. Dhamdhare, <i>Compiler Construction: Principles and Practice</i> , Macmillan India Ltd., 2008

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. Computer Science & Engineering

Semester: VI	Subject Code: 6BCS02T	Name of Subject: Software Engineering and Project Management		
Total Hours Distribution per week				
Total Credit:2	Lecture(L): 2 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
15 Marks	10 Marks	25 Marks	50 Marks	2 Hours

Course Objectives	
1	To understand general idea of software engineering
2	To develop skills to design various software process models
3	To provide knowledge of requirement engineering principles and techniques used in software analysis and design
4	To develop skills required for software testing and various risk strategies

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Acquire knowledge of software engineering methods, practices, process models and application
CO2	Classify measures metrics and indicators and learn various modeling approach
CO3	Analyze and extract requirements for the product and translate these into a documented design using different modelling techniques
CO4	Learn software testing methods and types and to know software risk and principles of quality management also reengineering and reverse engineering.

Course Competency	
1	Develop an understanding of software engineering principles, methodologies, and processes for effective software development and maintenance.
2	Develop the ability to analyze, evaluate, and apply software measurement and modeling techniques for effective software engineering practices.
3	Apply requirement analysis and modeling techniques to design effective software solutions.
4	Understand and apply software testing, quality assurance, reengineering, and reverse engineering principles in software development and maintenance.

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	1	1	-	1	2	3	3	3
CO2	3	2	2	2	1	1	1	-	-	2	3	3	3
CO3	3	2	2	2	1	1	1	-	-	2	3	3	3
CO4	3	2	2	3	1	1	1	-	-	2	3	3	3

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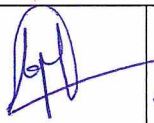
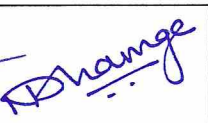
Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Introduction to Software Engineering			
Basics: Introduction to Software Engineering, Software Engineering-A Layered technology, Software Process Models-The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Agile Process Models.	7	-	1
UNIT 2: System Modeling and Approaches			
Measures, Metrics and Indicators. System Engineering-Hierarchy, Business Process Engineering System Modeling-Analysis Modeling Approaches, Data Modeling, and Scenario based Modeling, Flow Oriented Modeling, Class Based Modeling, and Behavioral Model.	8	-	2
UNIT 3: Design Engineering Concepts			
Design Engineering Concepts, Design Model, Architectural Design, Cohesion, Coupling, User Interface Analysis and Design, Cohesion, Coupling.	7	-	3
UNIT 4: Software Testing and Risk			
Unit Testing, Integration Testing, Validation Testing, System Testing, Black Box Testing, White Box Testing, Software Risk, Software Quality Assurance, Software Reengineering and Reverse Engineering	8	-	4

Text Books:

1. Software Engineering-A Practitioner's Approach(Sixth Edition) by Roger Pressman (TMH)
2. Software Engineering (Ninth Edition)-Ian Sommerville (Pearson).

Reference Books:

1. Schaum's Outline of Theory and Problems of Software Engineering by David Gustafson (TMH).
2. Software Engineering (Third Edition) by K.K Aggarwal and Yogesh Singh (New Age Publishers).
3. Software Engineering, Theory and Practice (4th Edition) Pfleeger, Atlee (Pearson).

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KDK College of Engineering, Nagpur
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B. Tech. Computer Science & Engineering

Semester: VI	Subject Code: 6BCS03T	Name of Subject: Computer Networks		
Total Hours Distribution per week				
Total Credit:2	Lecture(L): 2 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
15 Marks	10 Marks	25 Marks	50 Marks	2 Hours

Course Objectives	
1	To Interpret the fundamental of Computer Network.
2	To study the OSI Reference Model and communication Media.
3	To study the packet transmission & traffic management in Computer Network.
4	To Gain core knowledge of IP Addressing and Routing Protocols.

Course Outcomes	
After completing the course, students will be able to	
CO1	Interpret the functions of Computer Network.
CO2	Demonstrate the functions of each layer in OSI model along with error handling methods.
CO3	Apply different transmission protocol with traffic management algorithms.
CO4	Classify the routing protocols and analyze how to map IP addresses.

Course Competencies	
1	Understanding the functions of computer network & role of transmission media in Computer Network.
2	Ability to identify authentic user and error detecting techniques.
3	Competence in utilizing packet transmission methods to minimize congestion control.
4	Apply Routing method to deliver packet to the end destination user with proper IP addressing methods.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	1	-	1	1	-	-	-	3	2	2
CO 2	3	2	1	1	-	1	1	-	-	-	3	3	2
CO 3	3	2	2	1	-	2	1	-	-	-	3	3	2
CO 4	3	2	2	1	-	2	1	-	-	-	3	3	2

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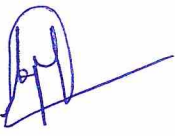
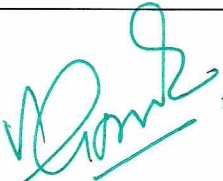
Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Data Communication over Physical Layer			
Components of computer network (HUB, SWITCH, ROUTER), Classification of Networks: - Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks: IEEE 802.11 and WiMAX, Network Topologies, Transmission media: Guided Media, Coaxial cable, Twisted Pair Cable, Fiber optic cable and Unguided Media- Radio waves.	8	-	1
UNIT 2: Data Link Layer			
Transmission Modes: Serial and Parallel transmission. Security: User Authentication, Security Protocols in Internet, Firewalls, OSI Reference Model, Protocol Hierarchy and Manchester Encoding. Types of errors, Error Detection and Correction Method, Hamming Code, CRC Code framing Techniques (Character and bit stuffing).	7	-	2
UNIT 3: Network Layer & Transport Layer			
Protocols: Simplex Stop and wait, Go back-N ARQ, Selective repeat ARQ, Sliding Window Protocol, Multiple Access Protocol: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Duties of transport layer, Process-to-process delivery, Data Traffic, Congestion control Category: Leaky bucket algorithm, Token bucket algorithm.	8	-	3
UNIT 4: IP Addressing and Routing Protocols			
Physical and Logical Addressing, Classful Addressing in IPV4 Addresses, IP addressing Methods with sub-netting and super-netting. Routing Protocols and Algorithms, Static and Dynamic Routing Algorithms: Distance Vector (Bellman ford Routing Algorithm), Shortest Path Routing (Dijkstra's algorithms), ARP, ICMP. DNS, SMTP, SNMP.	7	-	4

Text Books:

1. B. A. Forouzan – “Data Communications and Networking (3rd Ed.)” – TMH
2. A. S. Tanenbaum – “Computer Networks (4th Ed.)” – Pearson Education/PHI
3. W. Stallings – “Data and Computer Communications (8th Ed.)” – PHI/ Pearson Education

Reference Books:

1. Kurose and Rose – “Computer Networking -A top down approach featuring the internet” – Pearson Education.

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KDK College of Engineering, Nagpur
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Semester VI	Subject Code: 6BCS04T-A	Name of Subject: Machine Learning		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs./week		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To introduce the fundamental concepts of Machine Learning, its types, workflow, data preprocessing techniques, and real-world applications.
2	To develop an understanding of supervised learning techniques for regression problems and their performance evaluation using appropriate metrics.
3	To enable students to apply supervised learning classification algorithms and evaluate classification models using standard performance metrics.
4	To familiarize students with unsupervised learning methods, clustering algorithms, clustering evaluation techniques, and the basics of reinforcement learning.
5	To provide knowledge of advanced machine learning techniques such as ensemble learning and explore their applications in image recognition, speech recognition, recommendation systems, spam filtering, and fraud detection.

Course Outcomes	
After completing the course, students will be able to	
CO1	Apply basics of Machine Learning Techniques for solving real world problems
CO2	Analyze different types of Regression Techniques.
CO3	Implement various classification techniques.
CO4	Illustrate unsupervised and Reinforcement machine learning techniques.
CO5	Examine modern trends, ensemble learning methods, and practical applications of Machine Learning in various domains.

Course Competencies:	
1	Demonstrate an understanding of the fundamental concepts, types, workflow, data preprocessing techniques, and applications of Machine Learning.
2	Apply supervised learning regression algorithms and evaluate their performance using appropriate regression metrics such as MSE, MAE, and R ² score.
3	Develop and evaluate classification models using supervised learning algorithms including Logistic Regression, KNN, Naïve Bayes, Decision Trees, Support Vector Machines, and Random Forests.
4	Implement unsupervised learning techniques such as K-Means, Hierarchical Clustering, DBSCAN, and anomaly detection, and explain the basic concepts of Reinforcement Learning.
5	Analyze and utilize ensemble learning techniques and identify suitable Machine Learning applications in image recognition, speech recognition, recommendation systems, spam filtering, malware detection, virtual assistants, and fraud detection

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	1	1	-	1	3	2	2
CO2	3	3	2	1	2	1	1	1	-	1	3	3	2
CO3	3	3	3	2	3	2	1	1	-	1	3	3	3
CO4	3	3	3	2	3	2	1	2	-	1	3	3	3
CO5	3	3	3	2	3	2	1	2	-	1	3	3	3

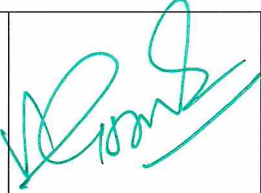
SYLLABUS

Details of Topic	Hours	Mapped with CO
UNIT I: Introduction to Machine Learning: Machine learning and its types (Supervised, unsupervised reinforcement), overview of the machine learning workflow and common data preprocessing techniques, well-posed learning problems, Applications of Machine learning, issues in machine learning. Types of data: Numerical and categorical data, data issues and remediation.	09	CO1
UNIT II: Supervised Learning: Regression: Introduction to regression, Types of regression: Multiple linear regression, Polynomial regression model, Evaluation metrics for regression models: Mean Squared error (MSE), R- squared, Mean Absolute error (MAE). Data pre-processing: Dimensionally reduction, feature subset selection,	09	CO2
UNIT III: Supervised Learning: Classification: Introduction to Classification, Logistic regression, K-nearest neighbor (KNN), Naive Bayes Decision trees, Support vector machine, Random forests, Evaluation metrics for Classification models: Accuracy , Precision, Recall, F1 Score, ROC Curves.	09	CO3
UNIT IV: Unsupervised Learning: Clustering and Reinforcement Learning: Introduction to Clustering & its type, K-means clustering, anomaly detection algorithm, Hierarchical clustering, DBSCAN, Evaluation for Clustering: Silhouette Score, Cohesion and Separation Metrics. Introduction to Reinforcement Learning: Agent, Environment, State, Action and Reward.	09	CO4

UNIT V: Trends and applications in Machine learning:		
Ensemble learning, Bagging, randomization, Boosting, Applications of Machine learning: Image recognition, speech recognition, Prediction recommendation: email spam and malware filtering, virtual personal assistant, online fraud detection.	09	CO5

Text Books	
1	Machine Learning by Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das
2	Introduction to Machine Learning by Dr. Nilesh Shelke, Dr. Narendra. V Choudhary, Dr. Gopal Sakarkar, Das Ganu Publications, ISBN-978-93-84336-
3	Machine Learning by Tom Mitchell, Mc Graw Publications

Reference Books:	
1	Python Machine Learning by Dr. Randal S. Olson

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Semester VI	Subject Code: 6BCS04P-A	Name of Subject: Machine Learning Lab		
Total Hours Distribution per week				
Total Credit: 1	Lecture (L): -		Tutorial (T) : -	Practical (P): 2 Hrs./week
Examination Scheme				
Continuous Assessment		End Sem. Examination	Total Marks	
25 Marks		25 Marks	50 Marks	

Course Objective	
1	To develop and implement regression, classification, clustering, and neural network techniques.
2	To analyze and evaluate machine learning models using appropriate performance measures.
3	To apply machine learning techniques for solving real-world data analysis and prediction problems.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	Implement regression techniques for prediction problems and apply classification algorithms for solving supervised learning problems.
CO2	Implement clustering techniques for unsupervised learning and data analysis.
CO3	Apply neural networks and deep learning models for intelligent decision-making applications.

Course Competencies:	
1	Prepare and preprocess datasets by handling missing values, encoding categorical variables, normalizing data, and selecting relevant features for machine learning tasks
2	Develop and evaluate regression models using Machine Learning techniques and assess their performance using metrics such as MSE, MAE, and R ² score.
3	Implement and compare classification algorithms such as Logistic Regression, K-Nearest Neighbors (KNN), Naïve Bayes, Decision Trees, Support Vector Machines (SVM), and Random Forests using standard evaluation metrics.

CO-PO Articulating Matrix:

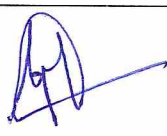
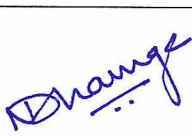
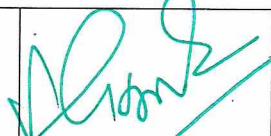
CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3	2	2	3	2	1	2	1	2	3	3	3
CO 2	3	3	3	3	3	2	1	2	1	2	3	3	3
CO 3	3	3	3	2	3	2	1	2	2	2	3	3	3

A Minimum 10 Practical to be performed

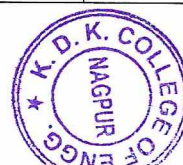
SN	List of Practical	CO Mapped
1	To Study of Python libraries for Machine Learning (NumPy, Pandas, Matplotlib, Scikit-learn)	CO1
2	Data preprocessing: Handling missing values, encoding categorical data, feature scaling, and train-test split.	CO1
3	Implementation of Simple Linear Regression for prediction.	CO1
4	Implementation of Multiple Linear Regression for prediction.	CO1
5	Implementation of Logistic Regression for binary classification.	CO1
6	Implementation of K-Nearest Neighbors (KNN) classifier.	CO1
7	Implementation of Decision Tree Classification	CO1
8	Implementation of Naïve Bayes classifier	CO1
9	Performance evaluation of classification models using Accuracy, Precision, Recall, F1-Score, Confusion Matrix, and ROC-AUC	CO1
10	Implementation of K-Means Clustering for unsupervised learning	CO2
11	Implementation of Hierarchical Clustering and dendrogram analysis.	CO2
12	Cluster evaluation using Silhouette Score and visualization.	CO2
13	Implementation of Artificial Neural Network (ANN) using TensorFlow/Keras.	CO3
14	Implementation of a Deep Learning model (MLP) for image or tabular data classification.	CO3
15	Mini Project: Develop a Machine Learning solution for a real-world prediction or classification problem.	CO1,CO2,CO3

Suggested References:

- 1.Introduction to Machine Learning, Second Edition, Ethem Alpaydm, The MIT Press
- 2.Applied Machine Learning, M. Gopal, Mc Graw Hill
- 3.Andreas C. Müller and Sarah Guido Introduction to Machine Learning with Python, A Guide for Data Scientists ORIELLY

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KDK College of Engineering, Nagpur
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Semester: VI	Subject Code: 6BCS04T-B	Name of Subject: Cyber Security		
Total Hours Distribution per week				
Total Credit:3	Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	Introduce the fundamentals of Cybercrime and its legal perspectives with respect to India.
2	Acquaint the student with various types of attacks and Cyber offenses.
3	Make the student aware of crimes related to wireless devices.
4	Familiarize the student with tools and other possible vulnerabilities that assist in performing crimes and of the consequences of Cybercrimes.
5	Design solutions and system components that meet specified needs while considering public health, safety, and culture.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Classify the types of Cybercrimes happening all around.
CO2	Understand anti forensics and fraud techniques.
CO3	Identify and analyze various cyberattack methods and their impact on information systems
CO4	Demonstrate the contribution of key loggers, password crackers, viruses and worms towards enabling the possibilities of Cybercrime.
CO5	Assess the seriousness of the security problems faced by the organizations.

Course Competency	
1	Develop the ability to identify, analyze, and classify various cyber threats and cybercrimes affecting individuals, organizations, and society.
2	Develop the ability to analyze cybercrime techniques, tools, and practices to support effective cyber security and cybercrime prevention.
3	Develop the ability to identify, analyze, and assess cyber threats and attack methods to enhance the security of information systems.
4	Understand and evaluate the techniques used by cybercriminals and their impact on digital environments.
5	Develop the ability to identify, assess, and evaluate security risks and vulnerabilities affecting organizational information systems.

CO-PO Articulating Matrix

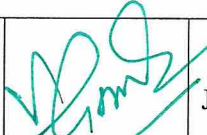
Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	1	1	1	-	-	-	2	2	2
CO2	3	3	2	2	2	1	1	-	-	-	2	2	2
CO3	3	3	2	2	1	1	1	-	-	-	2	2	2
CO4	3	2	2	2	1	1	1	-	-	-	2	2	2
CO5	3	3	2	2	1	1	2	-	-	-	2	2	2

Syllabus

Details of Topic:	Allotment of Hours		Mapped with CO Number
Unit I			
Security Concepts: Authentication, Authorization, Non-repudiation, Confidentiality, Integrity, availability. Cyber Crimes and Criminals: Definition of cyber-crime, types of cyber-crimes and types of cyber-criminals.	9	-	1
Unit II			
Anti-forensics: Use of proxies, use of tunneling techniques. Fraud techniques: Phishing and malicious mobile code, Rogue antivirus, Click fraud. Threat Infrastructure: Botnets, Fast Flux and advanced fast flux.	9	-	2
Unit III			
Techniques to gain foothold: Shell code, Buffer overflows, SQL Injection, Race Conditions, DoS Conditions, Brute force and dictionary attacks. Misdirection, Reconnaissance, and Disruption. Methods: Cross-Site Scripting (XSS), Social Engineering, WarXing, DNS Amplification Attacks	9	-	3
Unit IV			
Overview of IT Act 2000, Amendments and Limitations of IT Act, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offenses, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.	9	-	4

Unit V			
Introduction, Computer Intrusions. Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control. Intrusion detection, IDS: Need, Methods, Types of IDS, Password Management, Limitations and Challenges.	9	-	5

Text Books:
1. Nina Godbole and Sunil Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1/e, Wiley INDIA, 2011. 2. James Graham, Richard Howard and Ryan Otson: Cyber Security Essentials, 1/e, CRC Press, 2011. 3. Chwan-Hwa(John) Wu, J. David Irwin: Introduction to Cyber Security, 1/e, CRC Press T&F Group, 2. 4. Krishna Kumar, Cyber Laws: Intellectual property & E Commerce Security, 1/e, Dominant Publishers & Distributors
Reference Books:
1. Nina Godbole and Sunil Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1/e, Wiley INDIA, 2011. 2. James Graham, Richard Howard and Ryan Otson: Cyber Security Essentials, 1/e, CRC Press, 2011. 3. Chwan-Hwa(John) Wu, J. David Irwin: Introduction to Cyber Security, 1/e, CRC Press T&F Group, 2.

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B. Tech. Computer Science & Engineering			
Semester: VI	Subject Code: 6BCS04P-B	Name of Subject: Cyber Security Lab	
Total Hours Distribution per week			
Total Credit:1	Lecture(L):	Tutorial(T):--	Practical(P):-- 2 Hrs
Examination Scheme			
Continuous Assessment		End Semester Examination	Total Marks
25 Marks		25 Marks	50 Marks

	Course Objectives
1	To provide hands-on experience in implementing basic encryption and decryption algorithms
2	To provide practical experience in implementing AES for secure data confidentiality.
3	To understand SQL injection attacks and implement appropriate prevention techniques.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Implement substitution cipher, encryption, decryption algorithms in cyber security
CO2	Implement Advanced Encryption Standard (AES) for file/text encryption.
CO3	Demonstrate SQL Injection attack and prevention

Course Competency	
1	Apply substitution cipher techniques and fundamental cryptographic concepts for secure communication.
2	Implement the Advanced Encryption Standard (AES) algorithm for secure file and text encryption.
3	Demonstrate SQL Injection attacks and implement prevention mechanisms for secure database applications.

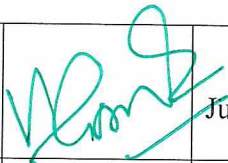
CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	2	-	3	2	2
CO2	3	3	3	3	3	2	2	2	2	-	3	2	2
CO3	3	3	3	3	3	2	2	2	2	-	3	2	2

A Minimum of 10 practical should be performed

List of Practical		CO Mapped
1	To implement encrypt and decrypt plaintext using the Caesar Cipher algorithm	CO1
2	To develop a program to perform encryption and decryption using a substitution key	CO1
3	To perform encryption and decryption using a keyword-based polyalphabetic cipher	CO1
4	To demonstrate secure tunneling concepts (e.g., SSH/VPN) and understand how tunneling works in network communication.	CO2
5	To configure and analyze web traffic through a proxy server in a lab environment	CO2
6	To identify the characteristics, behavior, and warning signs of fake antivirus applications.	CO2
7	To examine sample network traffic or logs to identify botnet-related communication patterns.	CO2
8	To examine how attacks affect service availability and evaluate incident response and mitigation strategies.	CO3
9	To identify race conditions in sample applications and learn synchronization techniques to prevent them.	CO3
10	To demonstrate the creation, storage, and verification of electronic records and study their legal validity under the IT Act.	CO3
11	To analyze the role, responsibilities, licensing, and functioning of Certifying Authorities in issuing Digital Signature Certificates.	CO3
12	To configure firewall rules to allow and deny network traffic in a laboratory environment.	CO3
13	To create and test inbound and outbound firewall rules for different network services	CO3
14	To configure user authentication, authorization, file permissions, and role-based access control (RBAC).	CO3
15	To install and configure an IDS in a virtual lab and monitor network events and alerts	CO3

Reference Books:	
1.	Nina Godbole and Sunil Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1/e, Wiley INDIA, 2011.
2.	James Graham, Richard Howard and Ryan Otson: Cyber Security Essentials, 1/e, CRC Press, 2011.
3.	Chwan-Hwa(John) Wu, J. David Irwin: Introduction to Cyber Security, 1/e, CRC Press T&F Group, 2.

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B. Tech. Computer Science & Engineering				
Semester: VI	Subject Code: 6BCS05T-A	Name of Subject: Cluster and Cloud Computing		
Total Hours Distribution per week				
Total Credit:3	Lecture(L): 3 Hrs	Tutorial(T):--	Practical(P):--	
Examination Scheme				
Mid Semester Examination	Continuous Assessment	End Semester Examination	Total Marks	Exam Duration
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To study fundamental concepts of cloud computing
2	To understand the implementation of Virtualization in Cloud Computing
3	To learn the application and security on cloud computing
4	To understand security in cloud
5	To enable learners to understand and implement advanced cloud computing concepts and architectures

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Classify the different Cloud Computing environment.
CO2	Analyze virtualization technology and install virtualization software.
CO3	Demonstrate data storage technique on Cloud, based on Cloud application.
CO4	Apply security in cloud applications.
CO5	Demonstrate advance techniques in Cloud Computing..

Course Competency	
1	Analyze cloud computing architectures, deployment models, and service offerings for diverse applications.
2	Develop the ability to deploy and manage virtualized environments using industry-standard virtualization platforms.
3	Develop competency in implementing security measures for cloud computing environments and applications.
4	Develop the ability to identify cloud security risks and implement appropriate mitigation strategies.
5	Develop the ability to utilize advanced cloud computing concepts and services for modern computing applications.

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	-	1	3	2	2
CO2	3	3	3	2	1	1	-	-	-	1	3	3	3
CO3	3	3	3	2	1	1	-	-	-	1	3	3	3
CO4	3	3	2	2	1	1	1	-	-	1	3	3	3
CO5	3	3	3	2	1	1	1	-	-	1	3	3	3

SYLLABUS

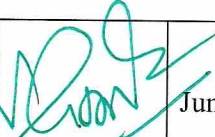
Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T	
Unit I			
Introduction: Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage, Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models	9	-	1
Unit II			
Introduction to Virtualizations: Definition of Virtualization, Types of Virtualizations, Virtualization Architecture and Software, Pitfalls of Virtualization, Virtualization and Cloud Security	9	-	2
Unit III			
Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing, Cloud Characteristics. Distributed Data Storage	9	-	3
Unit IV			
Risks in Cloud Computing: Risk Management, Types of Risks in Cloud Computing. Data Security in Cloud: Security Issues, Challenges, advantages, Disadvantages, Cloud Digital persona and Data security, Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud	9	-	4
Unit V			
Future Trends in Cloud Computing, Mobile Cloud, Automatic Cloud Computing: Comet Cloud. Jungle Computing, Distributed Cloud Computing Vs Edge Computing, Containers, Docker, and Kubernetes, Introduction to DevOps, IOT	9	-	5

Text Books:

- 1.A.Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson, ISBN: 978-81-317-7651-3
- 2.Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN-13:978-1-25-902995-0
- 3.Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Pearson Education

Reference Books:

- 1.Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach" McGraw Hill Tim Mather,
- 2.Subra K, Shahid L., "Cloud Security and Privacy", Oreilly, ISBN-13 978-81-8404-815-5.
- 3.Dr. Kris Jamsa, "Cloud Computing: SaaS, Paas, laas Virtualization and more", Wiley Publications, ISBN: 978-0-470-97389-9

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Semester : VI	Subject Code: 6BCS05T-B	Name of Subject: Data Science		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs/week		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To acquire skills in data preparatory and preprocessing steps
2	To learn the tools and packages in Python for data science
3	To acquire knowledge in data interpretation and visualization techniques
4	To learn regression and its application in data science
5	To understand the concept of decision trees and map reduce in data science.
Course Outcomes	
After completing the course, students will be able to	
CO1	Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings and effectively present results using data science tools
CO2	Apply principles of Data Science to the analysis of business problems
CO3	Apply ethical practices in everyday business activities and make well -reasoned ethical business and data management decisions.
CO4	Demonstrate knowledge of statistical data analysis techniques utilized in business decision making
CO5	Apply advanced data analysis for proper decision making.

Course Competencies	
1	Apply statistical and mathematical techniques to analyze structured and unstructured data.
2	Use programming languages such as Python and R for data analysis, visualization, and model development.
3	Perform data cleaning, pre-processing, transformation, and feature engineering on real-world datasets.
4	Design and implement machine learning models for classification, regression, clustering, and prediction tasks.
5	Analyse large datasets using data mining and big data technologies.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	1	-	1	-	-	-	1	3	2	2
CO 2	3	3	2	2	-	1	-	-	-	1	3	2	3
CO 3	3	3	2	2	-	1	2	-	-	1	3	2	3
CO 4	3	3	2	2	-	1	-	-	-	1	3	2	3
CO 5	3	3	2	2	-	1	1	-	-	1	3	2	3

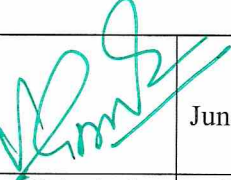
SYLLABUS

Details of Topic	Hours	Mapped with CO
UNIT I: Introduction to data science & exploratory data analysis		
Need for data science benefits, application and uses facets of data, Elements of Structured data, Rectangular data, Estimates of location, variability, Exploring Binary and Categorical Data, Correlation, Exploring two or more variables.	9	CO1
UNIT 2: Python for data handling and data visualization		
Basics of Numpy arrays aggregations computations on arrays comparisons masks boolean logic fancy indexing structured arrays Data manipulation with Pandas data indexing and selection operating on data missing data hierarchical indexing combining datasets – aggregation and grouping – pivot tables. Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statsmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh.	9	CO2
UNIT 3: Data & sampling distributions		
Random Sampling and sample Bias, Selection Bias, Sampling Distribution of a Statistic, Bootstrap, Confidence Intervals, Different types of Distributions. Statistical Experiments And Significance Testing: A/B testing, Hypothesis Tests, Resampling, Statistical Significance p-Values, Degree of freedom, ANOVA, Multi-Arm Bandit Algorithm.	9	CO3
UNIT 4: Regression and Prediction		
Simple Linear Regression, Prediction Using Regression, Factors Variables in Regression, Regression diagnostics, Polynomial and Spline Regression, Logistic Regression. Classification: Naïve Byes, Discriminant Analysis, Strategies for imbalanced data	9	CO4

UNIT 5: ADVANCED DATA ANALYSIS		
Decision Trees: What Is a Decision Tree? Entropy, The Entropy of a Partition, Creating a Decision Tree, Random Forests Neural Networks: Perceptron, Feed-Forward Neural Networks, Backpropagation, Example: Defeating a CAPTCHA MapReduce: Why MapReduce? Examples like word count and matrix multiplication	9	CO5

Text Books	
1	Data Science from Scratch : Joel Grus, O'Reilly Media Inc., ISBN: 9781491901427
2	David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.

Reference Books:	
1	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016
2	"Practical Data Science", Andreas François Vermeulen APress

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Semester: VI	Subject Code: 6BCSMD04T	Name of Subject: Embedded System with IoT		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

1	To introduce the concepts, architecture, and applications of embedded systems and their role in modern electronic products
2	To provide knowledge of embedded system design methodologies, quality attributes, and hardware-software co-design principles.
3	To develop programming skills for 8-bit microcontrollers and interfacing techniques using ports, timers, serial communication, and interrupts
4	To familiarize students with IoT concepts, Arduino platform, and embedded programming for connected devices
5	To enable students to design and implement IoT-based solutions using communication protocols and technologies for real-world applications

Course Outcomes

After completion of syllabus, the student will be able to

CO1	Classify the architecture and operation of embedded systems, microcontrollers, and IoT devices.
CO2	Design and develop embedded applications using sensors, actuators, and interfacing techniques.
CO3	Demonstrate a strong understanding of embedded core concepts and develop problem-solving skills in related areas.
CO4	Implement IoT-based communication systems using wireless protocols
CO5	Develop secure, efficient, and scalable embedded and IoT projects for industrial and societal application.

Course Competencies:

1	Ability to understand and analyze embedded system architecture and IoT frameworks.
2	Ability to interface sensors, actuators, and peripheral devices with microcontrollers.
3	Ability to develop embedded programs using C/Python for real-time applications.
4	Ability to implement IoT communication protocols and cloud connectivity solutions.
5	Ability to troubleshoot, test, and optimize embedded and IoT systems.

CO PO Articulating Matrix

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	1	2	-	-	-	1	2	2	2
CO2	3	3	2	1	1	2	-	-	-	1	2	2	2
CO3	3	3	3	1	2	2	-	-	-	2	2	2	3
CO4	3	3	3	3	2	2	-	-	-	2	2	2	3
CO5	3	3	3	3	2	2	1	-	-	3	3	2	3

Syllabus

Details of Topic	Hours	Mapped with CO
Unit 1: Introduction to Embedded System:	9	CO1
What is an Embedded Systems? Embedded systems Vs General computing systems, History of Embedded Systems, Classification of Embedded systems, Major Application Areas of Embedded Systems. Purpose of Embedded Systems, The Typical Embedded System, Microprocessor Vs Microcontroller, Differences between RISC and CISC, Harvard V/s VonNeumann Processor/Controller Architecture, Big-endian V/s Little-endian processors, Memory (ROM and RAM types).		
Unit 2: Embedded System Design Concepts:	9	CO2
Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design		
Unit 3: 8-Bit Embedded Processor	9	CO3
8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.		
Unit 4: IoT And Arduino Programming	9	CO4
Introduction to the Concept of IoT Devices , IoT Devices Versus Computers , IoT Configurations, Basic Components ,Introduction to Arduino ,Types of Arduino– Arduino Toolchain, Arduino Programming Structure,		

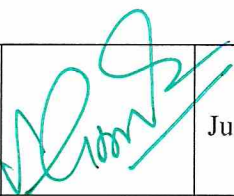
Unit 5: IoT Communication And Applications		
IoT Communication Models and APIs ,IoT Communication Protocols ,Bluetooth, WiFi , ZigBee,GPS , GSM modules,IoT Applications in Real world Scenario(Case study)	9	CO5

Text Books

- 1 Raj Kamal, Embedded Systems: SoC, IoT, AI and Real-Time Systems, 4th Edition, McGraw Hill Education, 2020..
- 2 Shriram K. Vasudevan, RMD Sundaram, Abhishek S. Nagarajan, Internet of Things, 3rd Edition, Wiley India, 2024..
- 3 A.P. Godse and D.A. Godse, Embedded Systems and IoT Design, 1st Edition, Technical Publications, 2023
- 4 Dr. G. Vimala Kumari et al., Embedded Systems and IoT: A Theoretical Approach, 1st Edition, GCS Publishers, 2022.

References Books

1. Edward Ashford Lee and Sanjit Arunkumar Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach, 2nd Edition, MIT Press, 2016.
2. Peter Marwedel, **Embedded System Design**, 3rd Edition, Springer, 2021.

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Semester: V	Subject Code: 5BCS04P-C	Name of Subject: Professional Skill-II Lab and Mini Project	
Total Hours Distribution per week			
Total Credit:2	Lecture(L): --	Tutorial(T):--	Practical(P):--
Examination Scheme			
Continuous Assessment		End Semester Examination	Total Marks
50 Marks		50 Marks	100 Marks

Course Objectives	
1	To understand the practical skills required to design, build, and deploy full-stack web applications using the MERN stack.
2	To understand the practical skills required to deploy, manage, and scale cloud-native applications using Kubernetes and modern container orchestration technologies.
3	To understand and gain knowledge, practical skills required to automate network operations and build network applications using Python.

Course Outcomes	
After completion of syllabus, students would be able to	
CO1	Develop and integrate RESTful APIs with front-end applications and perform database operations in a MERN-based application.
CO2	Apply Kubernetes concepts to configure, deploy, and monitor scalable cloud-native applications.
CO3	Develop Mini Project based on Python programs for network automation, socket programming, and network application development.

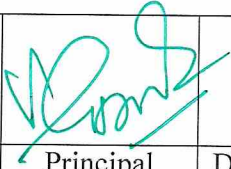
Course Competency	
1	Develop and integrate full-stack web applications using the MERN stack with efficient database management.
2	Develop, deploy, manage, and monitor cloud-native applications using Kubernetes and container orchestration tools.
3	Develop mini project Python-based solutions for network programming, automation, and network application management.

CO-PO Articulating Matrix

Program Outcome & Program Specific Outcome													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	3	2	3	1	1	3	3	3
CO2	3	3	3	3	3	3	2	3	1	1	3	3	3
CO3	3	3	3	3	3	3	2	3	1	1	3	3	3

A minimum of 10 practical should be performed

Name of Topic		CO Mapped
1	Installation and configuration of MongoDB. Create databases, collections, and perform basic document operations.	CO1
2	Design and implement MongoDB schemas using embedded and referenced documents.	CO1
3	Develop a web server using Node.js and implement basic server-side functionality.	CO1
4	Develop RESTful APIs using Node.js and Express.js for resource management.	CO1
5	Implement CRUD (Create, Read, Update, Delete) operations using MongoDB	CO1
6	Install Kubernetes and deploy a containerized application using Pods, Deployments, and Services.	CO2
7	Configure Kubernetes applications using ConfigMaps and Secrets.	CO2
8	Demonstrate scaling, auto-healing, rolling updates, and rollback features in Kubernetes. Scaling & auto-healing, Rollbacks & Versioning	CO2
9	Configure Kubernetes networking, Services, Ingress, and Role-Based Access Control (RBAC).	CO2
10	Deploy a Kubernetes application on a cloud platform and demonstrate cloud integration.	CO2
11	Study the TCP/IP and OSI networking models using network analysis tools.	CO3
12	To implement socket programming using TCP and UDP protocols. Socket	CO3
13	To implement program for HTTP/HTTPS request handling and REST API communication.	CO3
14	Automate remote server management using SSH and the Paramiko library. Network automation(SSH-Paramiko)	CO3
15	To demonstrate basic cyber security concepts including authentication, encryption, hashing, and secure communication.	CO3
16	Develop a mini project based on recent technologies.	CO3

			June 2026	1.00	Applicable for AY 2026-27 onwards
Chairman, BoS	Dean(Acad.)	Principal	Date of release	Version	

Principal
K. D. K. College of Engg.
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