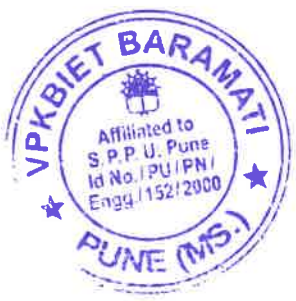
Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

S.Y. B. Tech Syllabus 2024-25 (As per NEP 2020)

ABOUT AI & DS DEPARTMENT

- Involvement of Experts from IITs, Govt. Colleges, Reputed Industries, Alumni and Students in development of curriculum.
- Automatic Bank Credit System (ABC)
- Choice of Electives
- Remedial Teaching
- Sponsorship for Publications and IPR
- Research Mentorship
- Industry Internship
- Provision of Credit Transfer Scheme (CTS)
- Peer Teaching Scheme
- Teacher Guardian Scheme (TGS)
- Proficiency Courses
- MOUs with Industries



INSTITUTE VISION AND MISSION

VISION

To achieve Academic Excellence through Persistent and Synergic Collaborations amongst all Stakeholders.

MISSION

1. To ensure holistic development of students as lifelong learners and problem solvers through value-based quality education.
2. To motivate faculty to attain the state-of-the-art knowledge and wisdom intheir domain and be a facilitator towards co creation of knowledge.
3. To frame and deploy conducive and empowering policies for multifaceted growth of students, faculty and staff to make them contributors towards excellence.
4. To partner with industry for mutually beneficial relations to generate employable and deployable workforce.
5. To fulfill the aspirations of alumni, parents, society, region and nation at large by generating technically competent and contributing manpower.

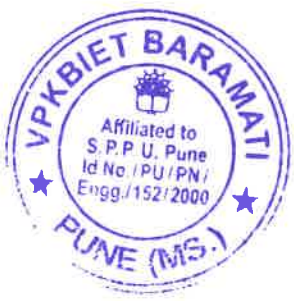
DEPARTMENT VISION AND MISSION

VISION

Imparting quality education to develop skillful, dynamic and creative workforce in the domain of Artificial Intelligence and Data Science

MISSION

1. To provide skill-based and state-of-the-art knowledge and induce problem solving skills to the graduates.
2. To associate with the industry and institutes of repute for experiences in the domain of Artificial Intelligence and Data Science.
3. To encourage the students for the solutions to the societal problems using the skills and knowledge of Artificial Intelligence & Data Science.
4. To undertake cross-disciplinary work for the experience based learning and collaborative research.



PROGRAMME EDUCATIONAL OBJECTIVES
(PEOS)

A graduate in AI&DS will be able to demonstrate:

- **PEO1:** To prepare globally competent graduates having strong fundamentals and domain knowledge to provide effective solutions for engineering problems.

- **PEO2**: To prepare the graduates to work as a committed professional with strong professional ethics and values, sense of responsibilities, understanding of legal, safety, health, societal, cultural and environmental issues.

- **PEO3**: To prepare committed and motivated graduates with research attitude, lifelong learning, investigative approach, and multidisciplinary thinking.

- **PEO4:** To prepare the graduates with strong managerial and communication skills to work effectively as individual as well as in teams.

PROGRAM SPECIFIC OUTCOMES (PSOS)

At the end of the programme students will be able to demonstrate:

- **PSO1:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities.

- **PSO2:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

- **PSO3:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledgeand research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the

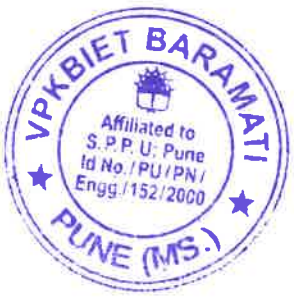
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



Syllabus: Second Year (SY B. Tech.) Artificial Intelligence and Data Science

(Pattern 2023) w.e.f. AY:2024-2025

SEMESTER-I

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
AI23201	Data Structure	3	2	-	20	20	70	20	20	-	150	3	1	-	4
AI23202	Discrete Mathematics	3	-	-	20	20	70	-	-	-	110	3	-	-	3
AI23203	Innovation Thinking in AI	3	2	-	20	20	70	20	20	-	150	3	1	-	4
AI23204	Network of Things	3	2	-	20	20	70	20	20	-	150	3	1	-	4
MD23051/52	Multidisciplinary minor	2	2	-	20	20	50	20	-	-	110	2	1	-	3
OE230XX	Open Electives	2	-	-	-	-	50	-	-	-	50	2	-	-	2
AI23205	Vocational and Skill Enhancement Course	-	4	-	-	-	-	40	20	-	60	-	2	-	2
Total		**16**	**12**	-	**100**	**100**	**380**	**120**	**80**	-	**780**	**16**	**6**	-	**22**

SEMESTER-II

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BS23207	Advanced Statistics and Numerical Methods	3	-	1	-	20	70	20	-	-	110	3	-	1	4
AI23211	Data Science	3	2	-	20	20	70	20	20	-	150	3	1	-	4
AI23212	Database Management System	3	2	-	20	20	70	20	20	-	150	3	1	-	4
AI23213	Operating System	3	2	-	20	20	70	20	20	-	150	3	1	-	4
AI23214	Software Project Management	3	-	-	20	20	70	-	-	-	110	3	-	-	3
MD23051/52	Multidisciplinary minor	2	2	-	20	20	50	20	-	-	110	2	1	-	3
Total		**17**	**8**	**1**	**100**	**120**	**400**	**100**	**60**	-	**780**	**17**	**4**	**1**	**22**

Dept. Academic Coordinator
Mr. P. N. Shendage

Head of Department
Dr. C. S. Kulkarni

Dean Academic
Dr. S. M. Bhosle

Principal
Dr. R. S. Bichkar

Bharati Vidyapeeth's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

K.B.S.I.E.T. BARAMATI
Affiliated to S.P.P.U. Pune
Id No. / PU / PN / Engg / 152 / 2000
PUNE (MS.)

BUCKET OF MULTIDISCIPLINARY MINOR COURSE

Multidisciplinary Minor Subjects	
Subject Code	**Subject Name**
AI23051	AI & Machine Learning
AI23052	Data Science
AI23053	Generative AI (Sem V+)
CO23051	Cloud Computing
CO23052	High Performance Computing (Sem V+)
CO23053	Computer Graphics & Gaming
IT23051	Cyber security
IT23052	Full Stack Development
ET23051	Embedded Systems
ET23052	Drone Technology
ET23053	Internet of Things
CE23051	Waste Management
CE23052	Green building & smart cities
ME23051	3-D Printing
ME23052	Robotics & Automation
EL23051	Solar Technology
EL23052	Industrial Automation
GS23051	Nanotechnology
GS23052	Linear Algebra and Statistics

BUCKET OF OPEN ELECTIVES

Open Elective Subjects	
Subject Code	**Subject Name**
OE23001	Digital Marketing
OE23002	Professional Leadership
OE23003	Organizational Behaviour
OE23004	Industrial Management
OE23005	Disaster Management
OE23006	Energy Economics & Management
OE23007	Operations Research
OE23008	Intellectual Property Rights
OE23009	Cyber Laws
OE23010	Bioinformatics
OE23011	Biotechnology
OE23012	International Relations
OE23013	Universal Human Values
OE23014	Education Technology
OE23015	Design Thinking
OE23016	Accounting & Finance
OE23017	Sustainability & Climate Change
OE23018	Agriculture Technology
OE23019	Architectural Technology

HONORS DEGREE (only for students having CGPA >= 7.5)
Honor: Computational Intelligence
Honor: Cloud Computing and Virtualization, Data Science
Honor: Data Science
Honor: Artificial Intelligence
Honor: Cyber security
Honor: VLSI Design Technology
Honor: Advanced Communication Systems
Honor: Advances in Construction Technology
Honor: Advanced Structural Engg.
Honor: Robotics and Automation
Honor: Refrigeration & Air-conditioning
Honor: Renewable Energy and E- mobility

DOUBLE MINOR DEGREE (only for students having CGPA >= 7.5)
Double Minor: Artificial Intelligence and Data Science
Double Minor: Cloud Computing and Virtualization
Double Minor: Full Stack Development
Double Minor: Embedded Systems and Real-Time OS
Double Minor: Municipal or Urban Engineering
Double Minor: Enterprise Resource Planning
Double Minor: Digital Mfg. and Robotics
Double Minor: Renewable Energy

SEMESTER I

Vidya Pratishthan's
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(Autonomous Institute)

AI23201- Data Structure

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks: 20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

Prerequisites: Programming and Problem Solving

Course Objectives:

- To develop logical ability to solve the problems in time efficient way
- To use appropriate data structures and algorithms while solving a problem
- To do the theoretical analysis of the problem to be solved
- To understand the advanced data structures while solving complex problems
- To understand the standard and abstract data representation methods

Course Outcomes (COs): The students will be able to:

CO1: Design an algorithm for searching and sorting algorithms and do the time and space analysis.
CO2: Apply basic data structures for solving a problem like expression evaluation.
CO3: Develop an algorithm for efficient operations with linear data structures.
CO4: Design and Develop algorithmic solutions with nonlinear data structures for time and space Efficiency.
CO5: Discriminate the usage of different nonlinear data structures for lowering the upper bound.
CO6: Apply nonlinear data structures to solve the computationally complex problems.

Course Contents

Unit I: Introduction to Algorithms and Complexity Theory (08 Hours)

Searching: linear and binary search algorithm. Searching using key-value in a sequence of records. Insertion, bubble, selection sort algorithms. Sort algorithms on a sequence of records using specified keys. Comparative analysis of various searching and sorting algorithms. Time Complexity Analysis. Characteristics of an algorithm. Analyzing programs. Frequency count. Time and space complexity. Big 'O' Ω, Θ, notation. Best, average and worst cases. Recurrence relations, Solving recurrence relations with Master Method.

Unit II: Basic Data Structures (07 Hours)

Stacks and Queues: Stack and queue as ADT. Operations on stack and queue. Implementations using arrays and dynamic memory allocation. Application of stack for expression evaluation, expression conversion. Implementation of stack using queue and vice versa. Recursion and stacks. Problems like maze and knight's tour.

Unit III: Linked Data Structures (07 Hour)

Linked List- Singly Linked List(SLL), Stack as SLL, Queue as SLL, Doubly Linked List, Circular Singly Linked List, Finding a cycle in SLL, Operations on linked lists: insert, delete, traverse, search etc. Applications of linked list: Representation & manipulations of polynomials/sets using linked list concept.

Unit IV: Trees (08 Hour)

Basic terminology. Binary Tree: Properties of a Binary Tree, ADT Binary trees and its representations, concept of Non- Linear Data Structures, Difference between Linear and NonLinear data structure, Binary tree traversals (recursive and non-recursive) and various operations. Binary

Search Tree(BST): Properties, Insertion and deletion of nodes. Complexity Analysis of all operations, Threaded BST.

Unit V: Heaps (05 Hours)

Priority queues and Heap: Priority Queues. Max and Min Heap. Operations on heap, Heapsort. Applications of trees. AVL Trees: Introduction, Properties, Balance Factor, Operations like insert, rotate and delete, Red Black Trees: Properties, Operations like insert, delete and rotate.

Unit VI: Graphs (05 Hours)

Representation of graphs using adjacency matrix, adjacency list. Implementation of algorithms for traversals; implementing Kruskal's or Prim's or Single source shortest paths using Dijkstra's algorithm. Applications of graphs for problems like shortest path on a map.

Text Books:

1. "Fundamentals of Data Structures in C", E. Horowitz, S. Sahni, S. Anderson-freed, Second Edition, 2008, University Press, ISBN 978-81-7371-605-8
2. "Fundamentals of Data Structures in C++", Ellis Horowitz, S. Sahni, D. Mehta, 2nd Edition, 2008, University Press, ISBN-10: 8173716064
3. "An introduction to data structures with Applications", Jean-Paul Tremblay, Paul. G. Soresan, 2nd Edition, 1984, Tata Mc-Graw Hill International Editions, ISBN-0-07-462471- 7

Reference Books:

1. Peter Brass, "Advanced Data Structures", Cambridge University Press, ISBN: 978-1-10743982-5
2. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0.

E-Resources:

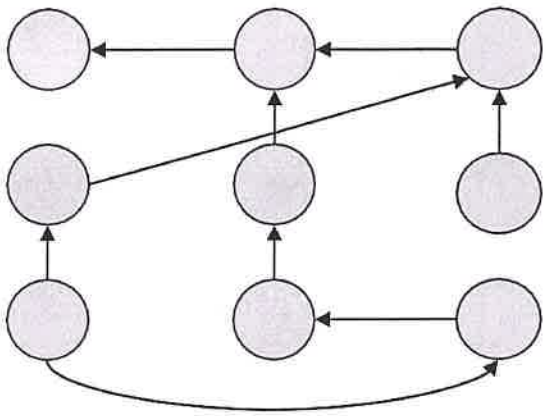
1. **https://nptel.ac.in/courses/106102064**
2. **https://archive.nptel.ac.in/courses/106/106/106106127/**
3. **https://onlinecourses.nptel.ac.in/noc22_cs26/preview**

List of Assignments

1. The mathematical expression, with operator precedence to be solved by computer, is given in infix form, convert it to the postfix form to make your computer understand the precedence and solve the expression.
2. Implement a knight tour of NxN size boards using stack as a data structure to keep track of the visited places.
3. A circular linked list, where the last node points to the first node, a mischievous guy disturbed the list and the last node points to the intermediate node. Write a program to find the intermediate node where last node points also correct the list and print
4. There are k sorted linked lists, each contains n elements, your task is to merge the linked list and return the single sorted linked list in O(nklogk) time
5. Write a program to construct a Binary Search Tree(BST) and find the post order predecessor of given key with a guarantee of preserving the worst case running time O(logn)
6. Write a non recursive version of finding the least common ancestor(LCA) of any two nodes in

the binary search tree and optimize your non recursive search by balancing the tree.

7. Write a program to convert any binary search tree to min heap as a complete binary tree, each node holding a higher than its parent, make a note of not exceeding the O(n) time.
8. The grid of 8x8 size, in which a mouse is located at 1x1 and needs to reach an 8x8 place, finds out the possible unique paths from its own location.
9. Priorities of the processes to be executed in computer are represented in following graph,



Construct the **max heap for** above represented graph and display the sequence of the executing the processes

10. Write a program **to prepare** a shortest path tour, in which it visits all the nodes only once except the starting node. You may represent a graph in terms of adjacency matrix storing non zero non negative values at $i \neq j$ if there exists a path.

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AI23202-Discrete Mathematics

Teaching Scheme:	Credits	Examination Scheme:
Theory: 3 Hours/Week	03	Activity: 20 Marks In-Sem: 20 Marks End-Sem Exam: 70 Marks

Prerequisites: Basic Mathematics

Course Objectives:

- To provide students with a solid foundation in the theory and principles of discrete mathematics, including logic, set theory, combinatorics, and graph theory.
- To equip students with the necessary tools and techniques for solving problems related to artificial intelligence and data science, such as algorithm design, complexity analysis, and probability theory.
- To develop students' critical thinking and problem-solving skills through the application of discrete mathematics to real-world problems in artificial intelligence and data science.
- To prepare students for advanced courses in artificial intelligence, machine learning, and data science by laying a strong mathematical foundation in discrete mathematics
- To enhance students' ability to communicate and collaborate effectively in interdisciplinary teams, by working on assignments that require the integration of discrete mathematics with concepts from artificial intelligence and data science.
- To cultivate an appreciation for the importance of discrete mathematics in the field of engineering and technology, and its role in shaping the future of artificial intelligence and data science.

Course Outcomes (COs): The students will be able to learn:

CO1: Formulate problems precisely (including real time situations), solve the problems, apply formal proof techniques, and explain the reasoning clearly.
CO2:.Design and analyze real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.
CO3: Specify, manipulate and apply equivalence relations; construct and use functions and apply these concepts to solve new problems.
CO4: Calculate numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics.
CO5: Model and solve computing problem using tree and graph and solve problems using appropriate algorithms.
CO6: Analyze the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures.

Course Contents

Unit I: Set Theory and Logic (06 Hours)

Sets- Naïve Set Theory (Cartesian Set Theory), Axiomatic Set Theory, Set Operations, Cardinality of set, Principles of inclusion and exclusion. Types of Sets- Bounded and unbounded sets, Countable and uncountable sets, Finite and infinite sets, Countably infinite and uncountably infinite sets, Power set. Propositional Logic- logic, Propositional equivalences, Normal Forms, Application of propositional logic- Translating English sentences, Proof by mathematical induction.

Unit II: Relations and Functions (06 Hours)

Relations and their properties, n-array relations and their applications, representing relations, closures of relations, equivalence relations, Partial orderings, Partitions, Hasse Diagram, Lattices, Chains and Anti-chains, Transitive closure and Warshall's algorithm.

Functions- Subjective, Injective and Bijective functions, Identity function, Partial function, Invertible function, Constant function, Inverse functions and compositions of functions, The Pigeonhole Principle.

Unit III: Counting Principles (06 Hour)
The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and identities, Generalized Permutations and Combinations.

Unit IV: Graph Theory (06 Hour)
Graph Terminology, Types of Graph, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, The Handshaking lemma, Single Source Shortest Path- Dijkstra's Algorithm, Planar Graphs and Graph Coloring.

Unit V: Trees (06 Hours)
Introduction, Properties of Trees, Binary Search Tree, Tree Traversal, Decision Tree, Prefix Codes and Huffman Coding, cut sets, Spanning Trees and Minimum Spanning Trees, Kruskal's and Prim's Algorithm, The Max Flow-Min Cut Theorem (Transport Network).

Unit VI: Algebraic Structures (06 Hours)
The structure of Algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, Congruence relations, Rings, Integral Domains and Fields.

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics", TMH, ISBN 10:0-07-066913-9.
2. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8

Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978-0-07-288008-3
2. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.
3. Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.
4. Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd, ISBN:978-81-265-2758-8.
5. Sriram P.and Steven S., "Computational Discrete Mathematics", Cambridge University Press, ISBN 13: 978-0-521-73311-3.

E-Resources:

1. https://archive.nptel.ac.in/courses/106/106/106106183/
2. https://archive.nptel.ac.in/courses/106/105/106105192/
3. https://archive.nptel.ac.in/courses/106/103/106103205/

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AI23203- Innovation Thinking in AI

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity: 20 Marks** **ISE: 20 Marks** **ESE: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

Prerequisites: Programming and Problem solving

Course Objectives:

- To develop a foundational understanding of Innovation thinking in AI
- To recognize the opportunities and challenges in Innovation thinking.
- To outline, clarify, and generate ideas within the Innovation thinking process
- To provide an overview of prototyping techniques.
- To list the activities conducted during the Test and Reflect phase of Innovation thinking.
- To analyze Innovation Thinking case studies.

Course Outcomes (COs): The students will be able to learn:

CO1: Understand the necessity and attributes of Innovation thinking in AI.
CO2: Explore the potential and hurdles of Innovation thinking in AI
CO3: Acquire knowledge in the Innovation thinking process through diverse AI tool sets.
CO4: Grasp and understand the diverse techniques for prototyping.
CO5: List the activities conducted during the Testing and Reflection phase of the Innovation process.
CO6: Analyze disruptive innovations in Innovation thinking through case studies

Course Contents

Unit I: An Introduction to the Principles of Design Thinking (06 Hours)
Understanding the Fundamentals of Design Thinking, A Comprehensive View of the design Thinking, Key Characteristics of Design Thinking, Design Thinking-Attributes, The principles of AI for design thinking, Mapping AI For design thinking (Empathize, Define, Ideate, Prototype, Test), Comparing Design Thinking to the Scientific Method, Contrasting Problem-Focused and Solution-Focused Approaches, Analyzing Analysis and Synthesis, Divergent Thinking, Convergent thinking,

Unit II: Understanding Empathy: Core Principles and Tools for Practicing Empathy (6 Hours)
Empathize: Importance and Tools in Design Thinking, STEEP Analysis, Ask 5x Why, W+H" questions (who, what, where, when, why, how), AI-driven empathy mapping, Listening and Empathizing Techniques, Persona Development, and Customer Journey Mapping. Design Thinking for a User-Centered Approach to Machine learning.

Unit III: Design Thinking approach for generating Ideas (6 Hours)
Define the Problem, Challenges in idea generation, Preparing for Idea Generation, Brainstorming, AI powered Ideation, Ideate- Purpose, Methods & Tools, How might we?(HMV) SCAMPER, SCAMPER for Ideation, User Experience Journey.

Unit IV: Prototyping: Fundamental and Tools (6 Hours)
What is prototyping, Types of Prototyping, Storyboard prototype, Prototype Types and Test Techniques, Process of prototyping –MVP(minimal viable product), Rapid Prototyping Techniques, Tools for Prototyping AI: Wireframes, Storyboards, Building Low-Fidelity AI Prototypes.

Unit V: Evaluating Prototype Models (6 Hours)
Design Testing with Users, Exploring Visual Design. Feedback Capture Grid, Powerful questions in experience testing, Structured Usability Testing through Solution Interviews, A/B Testing, Design Testing with Users, choosing a Design Testing, Usability Testing, Reflect- I like, I wish, I wonder" framework, create a pitch, lean canvas lessons learned, Road map for implementation, CAP, 4s.,

Ethical Considerations in AI, Privacy and Security Concerns.

Unit VI : Real-world application of Design Thinking (6 Hours)
Design Thinking Netflix, Design Thinking Transformed Airbnb, IBM Design Thinking, Tesla Design Thinking, Redesigning the Customer Contact Centre at Toyota, Case Studies of AI Solutions Developed with Design Thinking.

Text Books:

1. Michael Lewrick, Patrick Link, Larry Leifer , "The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods", March 2020 edition, ISBN: 978-1-119- 62921-4, WILEY Publication.
2. Mr Lee Chong Hwa (Lead Facilitator), "The Design Thinking: Guidebook"

Reference Books:

1. Russ Unger, Carolyn Chandler, "A Project Guide to UX Design For user experience designers in the field or in the making (Voices That Matter)", 2nd Edition, ISBN 13: 978-0-321-81538-5
2. Karl T Ulrich, "Design – Creation of Artifacts in Society", 1st edition, ISBN 978-0-9836487-0- 3,University of Pennsylvania
3. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", ISBN- 9780061937743, Harper Collins, 2009.
4. Eli Woolery, "Design Thinking Handbook", In-Vision publisher.
5. Jeanne Liedtka, Andrew King, Kevin Bennett, "Solving Problems with Design Thinking: TenStories Of "What Works", Columbia Business School Publishing, E-ISBN 978-0-231-53605-9

E-Resources:

1. Design Thinking - A Primer online course video lectures by IIT Madras (freevideolectures.com)
2. Design Thinking Transformed Airbnb: https://review.firstround.com/how-design-thinking-transformed-airbnb-from-failing-startup-to-billion-dollar-business/
3. UberEATS: https://medium.com/uber-design/how-we-design-on-the-ubereats-team-ff7c41fffb76
4. IBM Design Thinking: A Framework To Help Teams Continuously Understand and Deliver: https://www.ibm.com/blogs/think/2016/01/ibm-design-thinking-a-framework-for-teams-to-continuously-understand-and-deliver/
5. Saving Product X:https://www.toptal.com/project-managers/digital/a-design-thinking-case-study
6. AI and Your Brain: An Ideation Dream Team: https://www.techwyse.com/blog/online-innovation/ai-and-your-brain-an-ideation-dream-team#
7. https://www.isjtrend.com/article_199162_733c843cbc57dcabcf4564aed643c9cd.pdf
8. https://www.sciencedirect.com/science/article/pii/S2405872619300887

MOOC:

1. **https://archive.nptel.ac.in/courses/110/106/110106124/**
2. **https://onlinecourses.swayam2.ac.in/imb23_mg65/preview**
3. **https://onlinecourses.swayam2.ac.in/aic23_ge17/preview**

List of Assignments

1. To practice user research techniques and develop user personas using making sense of steep analysis & strategic priorities template
2. To analyze research data and craft a clear problem statement.
3. To generate and evaluate creative solutions for the defined problem using such as mind mapping, SCAMPER, and Crazy 8s
4. To create low-fidelity prototypes of AI solutions using tools like Sketch, Figma etc.
5. To test prototypes with users and gather feedback using a capture grid.
6. To integrate AI technologies into the prototype using tools like TensorFlow or PyTorch etc.
7. To develop a comprehensive user-centered AI solution using Design Thinking process for any design challenge of your choice (Project).

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(Autonomous Institute)

AI23204: Network of Things

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks: 20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

Prerequisites: Programming and Problem Solving

Course Objectives:

- To understand the basic digital electronics and microprocessors.
- To understand the definition and significance of the Internet of Things.
- To gain a comprehensive understanding of various sensors, actuators and the fundamentals of IoT system development using Arduino and Raspberry Pi.
- To introduce the basic fundamentals of big data, data analytics and cloud computing.
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Outcomes (COs): The students will be able to:

CO1: Have a thorough understanding of the structure, function and characteristics of computer systems and understand the structure of various number systems and its application in digital design.
CO2: Explain the concept of internet of things and identify the technologies that make up the internet of things.
CO3: Identify and describe different types of sensors, actuators and also develop the IoT applications using Arduino and RaspberryPi.
CO4:Analyze trade-offs in interconnected wireless embedded device networks. Select Appropriate protocols for IoT Solutions.
CO5: Explain the basics concept of Bigdata ,data analytics and cloud computing and its use in IoT
CO6: Identify the application of IoT in automation of commercial and real world examples

Course Contents

Unit I: Fundamentals of Computer Organization & Digital Electronics (07 Hours)

Basic organization of computers & computer Function, classification micro, mini, mainframe and super computer, system bus, I-Cycle, interrupt and class of interrupts, number systems, number conversion, 1's & 2's complement, introduction of microprocessor & microcontroller.

Unit II: Introduction of Internet of Things (06 Hours)

Introduction, definitions & characteristics of IoT, IoT architectures, Challenges, physical & logical design of IoT, Enabling Technologies in IoT, IoT decision framework, Asset management, IoT connectivity and management, Applications of IoT.

Unit III: IoT Physical Devices and Endpoints(06 Hours)

Definition, types of sensors, types of actuators, examples and working, building IoT with Arduino: Arduino–Interfaces-Arduino IDE–Programming. RaspberryPi: Introduction, about the RaspberryPi board: hardware layout, operating systems, and configuration. Programming RaspberryPi with Python.

Unit IV: IoT Systems, Network and Protocols(06 Hours)

Study of RFID, Types of RFID, Wireless networks; wireless Sensor Networking (WSN); cellular Machine-to Machine (M2M) application networks; computer connected to internet; network devices; Device configuration and management; exchange information in real time without human intervention; IoT Protocols, IoT Security & IoT Communication.

Unit V: Data Handling& Analytics: (06 Hours)

Introduction of bigdata, 3V's, Types of data, characteristics of big data, data handling technologies, Flow of data, data acquisition, data storage, introduction to hadoop. Introduction to data Analytics, types of data analytics, Introduction to cloud computing: definition, characteristics, deployment model. Interfacing of NODEMCU with cloud database.

Unit VI: IOT Applications (06 Hours)

IoT Verticals; IoT Hosted Services; IoT Application development, IoT Software providers; Review of various IoT application domains including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communication and wearable computing devices.

Text Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515. 2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things: Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0

Reference Books:

1. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
2. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345 3.
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN: 978-1- 118-43063-7

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

List of Assignments

1. Study of Raspberry-Pi/ Beagle board/ Arduino and other microcontroller
2. Write a program using Arduino to control LED (One or more ON/OFF). Or Blinking
3. Create a program that illuminates the green LED if the counter is less than 100, illuminates the yellow LED if the counter is between 101 and 200 and illuminates the red LED if the counter is greater than 200
4. Create a program so that when the user enters 'b' the blue light blinks, 'g' the green light is illuminated 'y' the yellow light is illuminated and 'r' the red light is illuminated
5. Write a program that asks the user for a number and outputs the number squared that is entered.
6. Write a program to control the color of the LED by turning 3 different potentiometers. One will be read for the value of Red, one for the value of Green, and one for the value of Blue.
7. Understanding the connectivity of Raspberry-Pi /Beagle board circuit / Arduino with IR sensor. Write an application to detect obstacle and notify user using LEDs
8. Write an application to detect gas leakage and notify user using LEDs/buzzer
9. Write an application to detect soil moisture and notify user using LEDs/buzzer
10. Write a program using piezo element and use it to play a tune after someone knocks

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AI23205- Tools for Data Science

Teaching Scheme: Practical: 4 Hour/Week	**Credits** 02	**Examination Scheme:** Term Work: 40 Marks Practical: 20 Marks

Prerequisites: Basic python programming

Course Objectives:

- To understand the tools for Data Science
- To understand working of datasets in Data Science
- To study and understand the Jupyter notebook environment
- To study Github repository

Course Outcomes (COs): The students will be able to learn:

CO1: Demonstrate the basic knowledge of data science process.
CO2: Setup the software environment for python and apply various techniques to work with data.
CO3: Manipulate and visualize the data using tools like pandas and matplotlib
CO4: Develop simple data science applications

Course Contents

Unit I: Overview of Data Science Tools (04 Hours)

Data Science – Overview, Categories of Data Science Tools, Open Source Tools for Data Science, Commercial Tools for Data Science, Cloud Based Tools for Data Science, Languages of Data Science: Introduction to Python, Introduction to R Language, Introduction to SQL, Other Languages for Data Science.

Unit II: Packages, APIs, Datasets and Models (04 Hours)

Libraries for Data Science, Application Programming Interfaces (APIs), Data Sets - Powering Data Science, Sharing Enterprise Data - Data Asset exchange, Machine Learning Models – Learning from Models to Make Predictions, Github: Introduction, repositories.

Unit III: Jupyter Notebooks and JupyterLab (04 Hour)

Introduction to Jupyter Notebooks, Getting Started with Jupyter, Jupyter Kernels, Jupyter Architecture, Additional Anaconda Jupyter Environments, Additional Cloud Based Jupyter Environments. Introduction to Watson Studio: Jupyter Notebooks in Watson Studio, Linking GitHub to Watson Studio.

Unit IV: Data Analytics Tools (02 Hour)

Basic visualization using matplotlib/seaborn in python: histogram, barplot, scatter plot, pie plot,etc. Microsoft Excel, Power BI, Tableau, RapidMiner, KNIME.

Text Books:

1. J. Janssens, Data science at the command line, First edition. Sebastopol, CA: O'Reilly, 2014..
2. J. Grus, Data Science from Scratch: First Principles with Python, 1 edition. Sebastopol, CA: O'Reilly Media, 2015,
3. N. Zumel and J. Mount, Practical data science with R. Shelter Island, NY: Manning Publications Co, 2014.

Reference Books:

1. L. Pierson and J. Porway, Data science, 2nd edition. Hoboken, NJ: John Wiley and Sons, Inc, 2017.
2. C. O'Neil and R. Schutt, Doing Data Science: Straight Talk from the Frontline, 1 edition. Beijing ; Sebastopol: O'Reilly Media, 2013.
3. J. VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, First edition. Shroff/O'Reilly, 2016.
4. S. R. Das, Data Science: Theories, Models, Algorithms, and Analytics.

https://srdas.github.io/MLBook/.

E-Resources:

1. https://www.coursera.org/learn/open-source-tools-for-data-science
2. https://skills.github.com/
3. https://docs.github.com/en/get-started/start-your-journey/hello-world

List of Assignments

1. Convert a python dictionary into a dataframe
   1. Accept a dictionary from user 2.Convert into dataframe 3.Display dataframe

2. Perform the following operations using Python on any open source dataset (e.g., data.csv)
   1. Import all the required Python Libraries.
   2. Locate open source data from the web (e.g., https://www.kaggle.com). Provide a clear description of the data and its source (i.e., URL of the web site).
   3. Load the Dataset into pandas dataframe
   4. Display dataframe

3. Introduction to **Github:**
   1. Get started **using** GitHub (Register / Login etc..)
   2. Communicate **using** Markdown : Organize ideas and collaborate using Markdown, a lightweight **language** for text formatting.
   3. GitHub Pages **: Create** a site or blog from your GitHub repositories with GitHub Pages.

4. Pull, Merge, workflow tasks:
   1. Review pull **requests** : Collaborate and work together on GitHub.
   2. Resolve **merge conflicts** : Learn why conflicts happen and how to resolve them.
   3. Release-**based workflow** : Practice a release-based workflow and explore branching strategies.

5. Automate **workflows with** GitHub Actions :
   1. Hello GitHub **Actions : Create** a GitHub Action and use it in a workflow.
   2. Test with **Actions : Create** workflows that enable you to use Continuous Integration (CI) for your projects.
   3. Publish packages **: Use** GitHub Actions to publish your project to a Docker image.

6. Basic data visualization I:
   1. Download the **Iris** flower dataset or any other dataset into a DataFrame
   2. Create a histogram for each feature in the dataset to illustrate the feature distributions

7. Basic data **visualization II:** Download the Iris flower dataset or any other dataset into a DataFrame
   1. Visualize **data by using** pie chart
   2. Visualize **data by using** bar plot

8. Data Analytics **tools I:** Learn basic environment of analytics tools like Tableau/Power BI

9. Data Analytics tools II :
   1. Import a dataset in Tableau/Power BI
   2. Create a simple dashboard that shows visualization and analysis.

SEMESTER II

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BS23207- Advanced statistics and Numerical Method

Teaching Scheme: **Theory: 3 Hours/Week** **Tutorial: 1 Hour/Week**	**Credits** **04**	**Examination Scheme:** **In-Semester: 20 Marks** **End-Semester: 70 Marks** **Term Work: 20 Marks**

Prerequisites:
Basics of Statistics, Data Types, Measures of Central Tendency, Probability Theory. Conditional Probability, Bayes Theorem, Basics of Numerical Methods.

Course Objectives:

- To make the students familiarize with concepts and techniques in Statistics and Probability Theory.
- The aim is to equip them with the techniques to understand advanced levels of mathematics, statistics and their applications that would enhance thinking and logical power, useful in their disciplines.

Course Outcomes (COs): The students will be able to learn:

CO1: Understand the concepts of dispersion, skewness and kurtosis, and use them to analyze a given data.
CO2: Understand and apply the theory of correlation and regression analysis for data predictions.
CO3: Classify various discrete probability distributions and apply them to analyze a particular data set.
CO4: Develop basic concepts of continuous probability distributions and use them in their field.
CO5: Learn the concepts of various sampling tests, the null and the alternative hypotheses useful for analyzing the population(s) under study.
CO6: Compute Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

Course Contents

Unit I: Measures of Dispersion, Moments, Skewness and Kurtosis (07 Hours)

Measures of Dispersion: Dispersion, Characteristics for an Ideal Measure of Dispersion, Range, Coefficient of Range, Quartile Deviation, Coefficient of Quartile Deviation, Mean Deviation about Mean, Variance, Standard Deviation and Coefficient of Variation.
Moments: Moments about an arbitrary value, Raw moments, Central Moments, Skewness and Kurtosis.

Unit II: Correlation and Regression (07 Hours)

Bivariate Data, Scatter Diagram, and Association between two variables, Correlation, Karl Pearson's coefficient of correlation, Regression: Regression lines, properties, Curve fitting: fitting of straight line, parabola and related curves.

Unit III: Probability and Discrete Probability Distributions (07 Hours)

Probability, Theorems on Probability, Random variables, Discrete Random variable: Probability mass function, Mathematical Expectation, Discrete Probability distributions: Binomial, Poisson, Poisson approximation to Binomial distribution.

Unit IV: Continuous Probability Distributions (07 Hours)

Continuous Random variable: Probability density function, properties, Mathematical Expectation, Continuous Probability distributions: Uniform distribution, Exponential distribution, Gaussian/Normal distribution, Chi-square distribution.

Unit V: Inferential Statistics: Tests For Hypothesis (07 Hours)

Statistical Hypothesis: Simple and Composite, Test of a Statistical Hypothesis, Critical Region, Two

Types of Errors, Level of Significance, Power of the Test, Large Sample Tests: Test for Mean of a single Population, Test for the Equality of Means of two Populations, Chi-square test for Goodness of fit.

Unit VI: Numerical Methods (07 Hours)

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formula, Numerical Differentiation.

Numerical Integration: Trapezoidal and Simpson's rules.

Solution of Ordinary differential equations: Runge-Kutta 4th order method.

Reference Books:

1. Glen Cowan, "Statistical Data Analysis", University Of Siegen, Clarendon Press, Oxford, 1998, ISBN: 0198501552.
2. Ken Black, "Applied Business Statistics", Wiley, 7th Edition, ISBN: 9788126537075
3. Fundamentals of Mathematical Statistics by S. C. Gupta and V. K. Kapoor (Sultan Chand & Sons)
4. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5e, Elsevier Academic Press.
5. M. K. Jain, S. R. K. Iyengar And R. K. Jain1, "Numerical Methods for Scientific and Engineering Computation", 5e,New Age International Publication.

E-Books:

1. NIST/SEMATECH e-Handbook of Statistical Methods
2. Elements of Statistical Learning: data mining, inference, and prediction. 2nd Edition. (su.domains)

Term Work:

I. Tutorials for the subject shall be engaged in minimum three batches (batch size of 22 students) per division.

II. Term work shall consist of six assignments on each Unit-1 to Unit-6 and is based on performance and continuous internal assessment.

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AI23211- Data Science

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks:20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

Prerequisites: Discrete Mathematics

Course Objectives:

- To understand the need of Data Science.
- To understand computational statistics in Data Science
- To study and understand data analytics through machine learning algorithms
- To be conversant with time series analytics
- To learn model evaluation techniques
- To empower students with visualization tools and techniques used in data science

Course Outcomes (COs): The students will be able to:

CO1: Apply data pre-processing techniques
CO2: Apply statistics for Data Analytics
CO3: Implement Data Analytics using basic machine learning algorithms
CO4: Implement basic time series analysis techniques
CO5: Analyze and Apply evaluation techniques for the model
CO6: Implement data visualization using visualization tools in Python programming

Course Contents

Unit I: Introduction to Data Science (06 Hours)

Basics and need of Data Science, Applications of Data Science, Relationship between Data Science and Information Science, Business intelligence versus Data Science, Data: Data Types, Data Collection. Data Wrangling, Need of Data wrangling, Methods: Data Cleaning, Data Integration, Data Reduction, Data Transformation, and Data Discretization.

Unit II: Statistical Inference (06 Hours)

Need of statistics in Data Science, Measures of Central Tendency: Mean, Median, Mode, Mid-range. Measures of Dispersion: Range, Variance, Mean Deviation, Standard Deviation. Bayes theorem, Basics and need of hypothesis and hypothesis testing, Pearson Correlation, Sample Hypothesis testing, Chi-Square Tests, t-test.

Unit III: Predictive Data Analytics with Python (06 Hour)

Data Analytic Lifecycle, Analytics Types: Predictive, Descriptive and Prescriptive. Supervised, Unsupervised learning. Regression: Linear Regression, Logistic Regression. Classification: Naïve Bayes, Decision Trees, SVM. Introduction to Scikit-learn, Installations, Dataset, mat plotlib, filling missing values, Regression and Classification using Scikit-learn.

Unit IV: Forecasting and Time series Analysis (06 Hour)

Time Series Analysis vs Forecasting, Time Series Analysis-components, data types, stationarity and non-stationarity, Moving Average Methodology, Time series analysis using data science and machine learning, Auto-Regressive model: understanding ARMA and ARIMA.

Unit V: Model Evaluation and Selection (06 Hours)

Metrics for Evaluating Classifier Performance, Holdout Method, cross validation and Random Sub sampling, Parameter Tuning and Optimization, Result Interpretation, Metrics, Confusion matrix, sensitivity, specificity, precision, recall, F-measure, AUC-ROC Curves, Elbow plot.

Unit VI: Data Visualization (06 Hours)

Introduction to Data Visualization, Types of data visualization, Data Visualization Techniques, Tools used in Data Visualization, Challenges to Big data visualization, Visualizing Big Data, Analytical techniques used in Big data visualization, Data Visualization using Python: Line plot, Scatter plot, Histogram, Density plot, Box- plot, Bar plot, Pie chart, Heatmap, etc..

Text Books:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC Education services, Wiley publication, 2012, ISBN0-07-120413-X.
2. Jaiwei Han, Micheline Kamber, and Jian Pie, "Data Mining: Concepts and Techniques", Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
3. Thomas Nield, "Essential Math for Data Science", O'Reilly Media Inc., October 2022, ISBN: 9781098102869

Reference Books:

1. EMC Education Services, "Data Science and Big Data Analytics - Discovering, analyzing, visualizing and Presenting Data" 1st Edition Phil Hanna, JSP : Complete Reference, TATA McGraw-Hill Company
2. DT Editorial Services, "Big Data, Black Book", DT Editorial Services, ISBN: 9789351197577, 2016 Edition.
3. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, (2020), ISBN: 978-1-108-47244-9
4. Wes McKinney, "Python for Data Analysis", O'Reilly media, ISBN: 978-1-449-31979-3
5. Trent Haunk, "Scikit-learn Cookbook", Packt Publishing, ISBN: 9781787286382

E-Resources:

1. **https://archive.nptel.ac.in/courses/106/106/106106179/**
2. **https://archive.nptel.ac.in/courses/106/106/106106212/**
3. **https://archive.nptel.ac.in/courses/106/105/106105174/**
4. **https://www.analyticsvidhya.com/blog/2021/10/a-comprehensive-guide-to-time-series-analysis/**

List of Assignments

1. Data Wrangling, I Perform the following operations using Python on any open source dataset
   1. Import all the required Python Libraries.
   2. Locate open source data from the web (e.g., https://www.kaggle.com). Provide a clear description of the data and its source (i.e., URL of the web site).
   3. Load the Dataset into pandas dataframe.

4. Data Preprocessing: check for missing values in the data using pandas isnull(), describe() function to get some initial statistics. Provide variable descriptions. Types of variables etc. Check the dimensions of the data frame.
5. Data Formatting and Data Normalization: Summarize the types of variables by checking the data types (i.e., character, numeric, integer, factor, and logical) of the variables in the data set. If variables are not in the correct data type, apply proper type conversions.
6. Turn categorical variables into quantitative variables in Python.

2. Data Wrangling II Create an "Academic performance" dataset of students and perform the following operations using Python.

1. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.
2. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them.
3. Apply data transformations on at least one of the variables. T

3. Descriptive Statistics - Measures of Central Tendency and variability Perform the following operations on any open source dataset (e.g., data.csv)

1. Provide summary statistics (mean, median, minimum, maximum, standard deviation) for a dataset (age, income etc.) with numeric variables grouped by one of the qualitative (categorical) variable. For example, if your categorical variable is age groups and quantitative variable is income, then provide summary statistics of income grouped by the age groups. Create a list that contains a numeric value for each response to the categorical variable.
2. Compute some basic statistical details like percentile, mean, standard deviation etc. of the species of 'Iris-setosa', 'Iris-versicolor' and 'Iris-versicolor' of iris.csv dataset.

4. Data Analytics I

1. Create a Linear Regression Model using Python to predict home prices using Boston Housing Dataset (https://www.kaggle.com/c/boston-housing).

5. Data Analytics II

1. Implement logistic regression using Python to perform classification on Social_Network_Ads.csv dataset.
2. Compute confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset

6. Data Analytics III

1. Implement Simple Naïve Bayes classification algorithm using Python on iris.csv dataset.
2. Compute confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.

7. Moving Average Methodology implementation.

8. Implementation of Auto-Regressive Model

9. Implement ARIMA in python.

10. Data Visualization I
    1. Use the inbuilt dataset 'titanic'. The dataset contains 891 rows and contains information about the passengers who boarded the unfortunate Titanic ship. Use the Seaborn library to see if we can find any patterns in the data.
    2. Write a code to check how the price of the ticket (column name: 'fare') for each passenger is distributed by plotting a histogram
    3. Plot a box plot for distribution of age with respect to each gender along with the information about whether they survived or not. (Column names: 'sex' and 'age')
    4. Write observations on the inference from the above statistics.

Mini Projects – PYTHON/R (Any ONE Mini Project)

1. Use the following dataset and classify tweets into positive and negative tweets. https://www.kaggle.com/ruchi798/data-science-tweets
2. Develop a movie recommendation model using the scikit-learn library in python. Refer dataset https://github.com/rashida048/Some-NLP-Projects/blob/master/movie_dataset.csv
3. Use the following covid_vaccine_statewise.csv dataset and perform following analytics on the given dataset https://www.kaggle.com/sudalairajkumar/covid19-inindia?select=covid_vaccine_statewise.csv
    a) Describe the dataset
    b) Number of person's state wise vaccinated for first dose in India
    c) Number of person's state wise vaccinated for second dose in India
    d) Number of Males vaccinated
    e) e) Number of females vaccinated

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AI23212- Database Management System

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks: 20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

Prerequisites: Discrete Mathematics , Data Structures and Algorithms

Course Objectives:

- To understand the fundamental concepts of database systems.
- To learn Database query language.
- To understand the basic issues of transaction processing and concurrency control.
- To learn unstructured data management.

Course Outcomes (COs): The students will be able to learn:

CO1: Visualize and build your database foundation with the ER model.
CO2: Transform raw data into meaningful insights with query languages.
CO3: Apply proven techniques to ensure data integrity and prevent anomalies.
CO4: Implement mechanisms to manage data changes seamlessly in real-time scenarios.
CO5: Use NoSQL databases for processing unstructured data
CO6: Understand databases connectivity

Course Contents

Unit I: Introduction to Database Management Systems and ER Model (06 Hours)

Introduction: Data, Types of Data, Database, Types of Database, Purpose of Database Systems, Database-System Applications, View of Data, Data Independence, Database System Structure. **ER Model**: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity-Relationship Model, Design Issues, Extended E-R Features, Converting ER and EER diagram into tables.

Unit II: SQL and PL/SQL (06 Hours)

Introduction to SQL: Database Languages ,Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Updating, **SQL DML Queries:** SELECT Query and clauses, Index and Sequence in SQL, **Views:** Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, SQL Functions, Nested Queries, **PL/SQL**: Stored Procedures & Functions, Cursors, Triggers, Assertions, Roles and Privileges

Unit III: Normalizations (06 Hours)

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. **Database Design:** Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF and 4NF.

Unit IV: Transaction Management (06 Hour)

Introduction to Database Transaction, Transaction states, ACID properties, Concept of Schedule, Serial Schedule. **Serializability:** Conflict and View, Cascaded Aborts, Recoverable and Nonrecoverable Schedules. **Concurrency Control:** Lock-based, Time-stamp based Deadlock handling. Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints. **Log-Based Recovery:** Deferred Database Modifications and Immediate Database Modifications.

Unit V: NoSQL Databases (06 Hours)

Introduction to Distributed Database System- Advantages, disadvantages, CAP Theorem. **NoSQL Database**: Introduction, need, Features, Types of NoSQL Database, BASE Properties, **MongoDB (with syntax and usage)**: CRUD Operations, Indexing, Aggregation.

Unit VI: Database Connectivity (06 Hours)

Introduction: Database connectivity, Drivers, Steps of Database Connectivity, Database Connectivity with MySQL, DriverManager class, Connection interface, PreparedStatement interface, ResultSet interface, ResultSetMetaData Interface, DatabaseMetaData interface, Batch Processing.

Text Books:

1.Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9.

2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.

3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.

4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13:978-0321826626.

Reference Books:

1.Ramez Elmasri , Shamkant B. Navathe "FUNDAMENTALS OF Database Systems SEVENTH EDITION" ISBN-13: 978-0-13-397077-7, 2017.

2.R.P. Mahapatra, Database Management Systems,, Khanna Book Publishing 2016

E-Resources:

1. **https://archive.nptel.ac.in/courses/106/105/106105175/**

List of Assignments

1. Draw ER diagrams for different schemas & Convert them into tables (Assume any suitable schema). Display constraints.
2. SQL Queries: Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc.
3. SQL Queries: Write at least 10 SQL queries on the suitable database application using SQL DML statements.
4. SQL Queries – All types of Join, Sub-Query and View: Write at least10 SQL queries for suitable database application using SQL DML statements.
5. Unnamed PL/SQLcode block: Use of Control structure and Exception handling is mandatory
6. Write a PL/SQL block of code using parameterized Cursor that will merge the data available in the newly created table N_Roll_Call with the data available in the table O_Roll_Call. If the data in the first table already exists in the second table then that data should be skipped.
7. Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc.).
8. MongoDB – Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable example using MongoDB.
9. Exporting and Importing data: Design and develop SQL DML statements to demonstrate exporting/Importing tables to external files of different file formats ex. CSV, XLSX, TXT, etc.
10. Database Connectivity: Write a program to implement MySQL/Oracle database connectivity with any front end language to implement Database navigation operations (add, delete, edit etc.)

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AI23213: Operating System

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks:20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

Prerequisites: Programming and Problem Solving

Course Objectives:

- To understand functions of operating system
- To learn and understand process, resource and memory management.
- To learn and understand file and I/O management.

Course Outcomes (COs): The students will be able to:

CO1: Enlist functions of OS and types of system calls
CO2: Apply process scheduling algorithms to solve a given problem
CO3: Illustrate deadlock prevention, avoidance and recovery\
CO4: Explain memory management technique
CO5: Illustrate I/O and file management policies
CO6: Describe Linux process management

Course Contents

Unit No. I Fundamental Concepts of Operating system

Operating system functions and characteristics, historical evolution of operating systems, issues in operating system design, User's view of the OS, Types of OS: Batch, time sharing, multiprogramming, distributed, network and real-time systems, Operating-System Services, Types of System Calls, System Programs. .

Unit No. II Process Management

Process concept, Process Control Block(PCB), Process Operations, Process Scheduling: Types of process schedulers, Types of scheduling: Preemptive, Non preemptive. Scheduling algorithms: FCFS, SJF, RR, Priority, Inter process Communication (IPC). Threads: multithreaded model, implicit threads, threading issues

Unit No. III Synchronization and Deadlock

Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors).Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication: Pipes, shared memory system. Deadlock: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

Unit IV : Memory Management

Memory management: Background, Types of memory Logical Versus Physical Address space, Swapping Contiguous Allocation, Virtual Memory: Background, Demand paging, Page replacement,

Page replacement algorithms, Allocation of frames, Thrashing (Only concept)

Unit V : I/O and File System

I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Disk Scheduling, Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN **File Management:** File concept , File support, Access methods ,Allocation methods ,Directory systems ,File protection ,Free space management

Unit VI : Linux

Overview Of Linux - Linux Goals, Interfaces to Linux, The Shell, Linux Utility Programs, Kernel structure, Processes in Linux – Process management system calls in Linux, Implementation of process and threads in Linux, Process scheduling Linux, Booting

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY, ISBN978-1-118-06333-0, 9th Edition

2. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition

3. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition

4. Unix Shell Programming – Yashwant Kanetkar, BPB publications.

Reference Books:

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526

2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278

3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978-0-471-68723-8

4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project

E-Resources: https://archive.nptel.ac.in/courses/106/105/106105214/

List of Assignments

1. Write a series of BASH shell commands for common system administration tasks, including file management, process control, disk usage monitoring, and system information retrieval.
2. Implement a program using fork(), exec(), and wait() system calls to create a child process, execute a new program in the child, and synchronize the parent process to wait for the child to complete.
3. Implement preemptive (Round Robin) and non-preemptive (FCFS, SJF, Priority) CPU scheduling algorithms, calculating and displaying waiting time, turnaround time, and CPU utilization for each.
4. Implement a simulation of virtual memory using demand paging, and apply page replacement algorithms such as FIFO (First-In-First-Out),LRU (Least Recently Used) and optimal to handle page faults and minimize them.
5. Implement various disk scheduling algorithms, including FIFO (First-Come-First-Serve), SSTF (Shortest Seek Time First), SCAN, and C-SCAN, and evaluate their performance based on average seek time.
6. Build a basic file system that supports file creation, reading, writing, and deletion using low-level system calls such as open(), read(), write(), and close().

7. Implement the Banker's algorithm to avoid deadlock by analysing resource allocation and safely granting resource requests.
8. Write a program using semaphores to implement the Readers-Writers problem, ensuring mutual exclusion while allowing multiple readers and one writer to access a shared resource concurrently.
9. Write a program that creates child processes, executes commands in the child processes, and handles synchronization using wait mechanisms.
10. Write a C program to dynamically adjust the priority of a process using the nice() system call and observe the impact on scheduling.

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AI23214 - Software Project Management

Teaching Scheme:	Credits	Examination Scheme:
Theory: - 3 Hours/Week	03	Activity Marks: 20 Marks In Sem: 20 Marks End Sem: 70 Marks

Prerequisites: Basic of Software engineering

Course Objectives:

- To understand the basic Principal of Software Engineering
- To Acquiring knowledge of techniques for capturing, specifying, visualizing, and analyzing software requirements.
- To implement design and testing principles in software project development.
- To become acquainted with project management framework and tools

Course Outcomes (COs): The students will be able to learn:

- **CO1:** Understand and apply the principles of software reuse, reengineering, and retooling to enhance software development efficiency and quality.
- **CO2:** Understand the structure and components of a Software Requirements Specification (SRS) document.
- **CO3:** Utilize various tools and techniques for accurate cost estimation and analysis in project management contexts.
- **CO4:** Apply programming language principles and test developed application based on testing methodology.
- **CO5:** Understand the significance of project quality management.
- **CO6:** Analyze emerging trends in software engineering.

Course Contents

Unit I: Software Engineering and Project Management Basics (06 Hours)

Introduction of Software Engineering: Defining Software, Three "R"-Reuse, Reengineering and Retooling, Software Engineering – importance – emergence - Phases of software development – Feasibility study, Requirement Analysis, Design, Implementation, Testing, and Maintenance phases Software Life Cycle Models - Classical waterfall, Iterative, prototyping, Spiral, and Agile - Compare Life cycle models

Unit II: Requirements Specification and Design: (06 Hours)

Structure of an SRS document, Data Flow Diagrams - Role of Software Architecture and Architecture Views - Planning for a Software Project, Software Design - Software design concepts - Function Oriented Design and its Complexity Metrics - Object Oriented Design and its Complexity Metrics - Detailed Design. SRS Case study.

Unit III: Project Planning:(06 Hour)

Project initiation, planning scope management ,creating the breakdown structure, effort estimation and scheduling ,importance of project schedule, estimating activity resource,esitimating activity duration, Developing schedule using Gantt chart, Critical path method, PERT with example, planning cost management ,estimating cost, cost estimation tools and technique.

Unit IV: Software Development and Testing (06 Hour)

Software Coding - Programming principles and coding guidelines - method of incrementally developing code - managing the evolving code Testing - Unit testing and Code Inspection - Testing

concepts and testing process - Design of Test case and Test plan - Black-box testing - White box testing

Unit V: Project Management(06 Hour)

Tools for project management, Agile: Scrum. The Importance of Project Quality Management: Planning Quality Management, Performing Quality Assurance, Controlling Quality, Tools and Techniques for Quality Control (statistical control, six sigma) The Importance of Project Risk Management, Planning Risk Management, Common Sources of Risk in IT Projects.

Unit VI: Emerging Trends in Software Engineering and Project Management (07 Hour)

Software configuration management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools). global software development challenges Project Management trends: CRM, ERP: Basic concepts, Advantages and limitations, SAP,

Text Books:

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Mcgraw-Hill, ISBN: 0073375977, Seventh or Eighth Edition..
2. Joseph Phillips, IT Project Management –On Track From Start to Finish, Tata Mc Graw-Hill, ISBN13: 978-0-07106727-0, ISBN-10: 0- 07-106727-2.

Reference Books:

1. Pankaj Jalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115
2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946.
3. Managing Information Technology Project, 6edition, by Kathy Schwalbe, Cengage Learning publication.
4. Software Engineering Project Management by Richard H. Thayer Wiley India Publication.

E-Resources:

1. https://swayam.gov.in/nd1_noc19_cs69/preview
2. https://swayam.gov.in/nd2_cec20_cs07/preview
3. **https://www.atlassian.com/agile/scrum**

Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name:-Data Structure **Course Code AI23201**

Year: - SY **Branch: - AI&DS** **Semester: - III**

The course Data structures (AI23201) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
AI23201- Data Structure		
Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks: 20 Marks** **In Sem: 20 Marks** End Sem: 70 Marks **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance (likely in the second week of October 2024).

Students who fail to attend this activity but have a genuine reason will be accommodated with a rescheduled quiz, which will also be announced through email, noticeboard, or the department website well in advance, using a different set of questions from the specified categories.

Mr. D. M. Padulkar

Course Coordinator

Dr. C. S. Kulkarni

Head of Department

Head
Department of Artificial Intelligence & Data Science,
VPKBIET, Baramati 413 133

Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name: - Discrete Mathematics **Course Code: AI23202**

Year: - SY **Branch: - AI&DS** **Semester: - III**

The course Discrete Mathematics (AI23202) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
AI23202-Discrete Mathematics		
Teaching Scheme: Theory: 3 Hours/Week	Credits 03	Examination Scheme: Activity: 20 Marks In-Sem: 20 Marks End-Sem Exam: 70 Marks

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance (likely in the second week of October 2024).

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Mrs. K. S. Gaikwad

Course Coordinator

Dr. C. S. Kulkarni

Head of Department

Head
Department of Artificial Intelligence
& Data Science,
VPKBIET, Baramati 413 133

Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name:- ITAI **Course Code AI23203**

Year:- SY **Branch: AI&DS** **Semester:- III**

The course Innovation Thinking in AI (AI23203) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

AI23203- Innovation Thinking in Artificial Intelligence		
Teaching Scheme: Theory: 3 Hours/Week Practical: 2 Hour/Week	Credits 03	Examination Scheme: Activity:20 Marks ISE: 20 Marks ESE: 70 Marks Term Work: 20 Marks Practical: 20 Marks

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance (likely in the second week of October 2024).

Students who fail to attend this activity but have a genuine reason will be accommodated with a rescheduled quiz, which will also be announced through email, noticeboard, or the department website well in advance, using a different set of questions from the specified categories.

Mr. P. G. Ghorpade

Course Coordinator

Dr. C. S. Kulkarni

Head of Department

Head
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VPKBIET, Baramati 413 133

Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name: - Network of Things **Course Code:AI23204**

Year: - SY **Branch: - AIDS** **Semester: - III**

The course **Network of Things** (AI23204) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
AI23204: Network of Things		
Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits 04**	Examination Scheme: Activity Marks: 20 Marks **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **Mini Project**. The evaluation rubrics with marks for Mini Project are as follows: Project Idea and Innovation (4 Marks), Technical Implementation (8Marks), Demonstration and Functionality (4Marks) and Documentation and Presentation (4Marks) from the Evaluate and Create categories of Bloom's Taxonomy). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance (likely in the second week of October 2024).

Students who fail to attend this activity but have a genuine reason will be accommodated with a separate presentation for the same topic, which will also be announced through email, noticeboard, or the department website well in advance.

Mr. P. N. Shendage

Course Coordinator

Dr. C. S. Kulkarni

Head of Department

Head
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VPKBIET, Baramati 413 133

Vidya Pratishthan's

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Department of Artificial Intelligence and Data Science

Plan for Activity (10 Marks)

Course Name: - Introduction to Computational Intelligence **Course Code: AI23281**

Year: - SY **Branch: - AI&DS** **Semester: - III**

The course Introduction to Computational Intelligence(AI23281) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
AI23281- Introduction to Computational Intelligence		
Teaching Scheme: **Theory: 2 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **03**	**Examination Scheme:** **Activity: 10 Marks** **ISE: 20 Marks** **ESE: 50 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance (likely in the second week of October 2024).

Students who fail to attend this activity but have a genuine reason will be accommodated with a rescheduled quiz, which will also be announced through email, noticeboard, or the department website well in advance, using a different set of questions from the specified categories.

Mr. D. M. Padulkar

Course Coordinator

Dr. C. S. Kulkarni

Head of Department

Head
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Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (10 Marks)

Course Name: - Artificial Intelligence and Data Science **Course Code: AI23261**

Year: - SY **Branch: - AI&DS** **Semester: - III**

The course Artificial Intelligence and Data Science (AI23281) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
DM23001- Artificial Intelligence and Data Science		
Teaching Scheme: **Theory: - 2 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **03**	**Examination Scheme:** **Activity: - 10 Marks** **In-Sem:- 20 Marks** **End-Sem:- 50 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance (likely in the second week of October 2024).

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Dr. C. S. Kulkarni

Course Coordinator

Dr. C. S. Kulkarni

Head of Department

Head
Department of Artificial Intelligence
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Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name: - Data Science

Course Code: AI23211

Year: - SY

Semester: - IV

Branch: - AI&DS

The course Data Science (AI23211) at the second-year level, Semester IV of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's **Kamalnayan Bajaj Institute of Engineering and Technology, Baramati** **(Autonomous Institute)**		
AI23211- Data Science		
Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks:20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a Mini Project. The evaluation rubrics with marks for Mini Project are as follows: Project Idea (4 Marks), Technical Implementation (8 Marks), Demonstration and Functionality (4 Marks) and Documentation and Presentation (4 Marks). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance.

Students who fail to attend this activity but have a genuine reason will be accommodated with a separate presentation for the same topic, which will also be announced through email, noticeboard, or the department website well in advance.

Course Coordinator

Dr. C. S. Kulkarni

HoD

VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune
Id No.:PU/PN/Engg/152/2000
PUNE (MS.)

Vidya Pratishthan's

Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name: - Database Management System

Course Code: AI23212

Year: - SY **Branch: - AI&DS**

Semester: - IV

The course **Database Management System** at the second-year level, Semester IV of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
AI23212- Database Management System		
Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks: 20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance.Students who fail to attend this activity but have a genuine reason will be accommodated with a rescheduled quiz, which will also be announced through email, noticeboard, or the department website well in advance, using a different set of questions from the specified categories.

Course Coordinator

VPKBIET BARAMATI Affiliated to S.P.P.U. Pune Id No./PU/PN/Engg./152/2000 PUNE (MS.)

Dr. C. S. Kulkarni

HoD

Vidya Pratishthan's

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Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name:-Operating System **Course Code AI23213**

Year:- SY **Branch:- AI&DS** **Semester:- IV**

The course Data structures (AI23201) at the second-year level, Semester III of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)		
AI23213: Operating System		
Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **Activity Marks:20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks** **Term Work: 20 Marks** **Practical: 20 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance.

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Course Coordinator

Dr. C. S. Kulkarni

HoD

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Vidya Pratishthan's

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Department of Artificial Intelligence and Data Science

Plan for Activity (20 Marks)

Course Name:- SPM **Course Code AI23214**

Year:- SY **Branch:AI&DS** **Semester:- IV**

The course Software Project Management (AI23214) at the second-year level, Semester IV of the Artificial Intelligence and Data Science program, includes the following evaluation scheme:

AI23214 - Software Project Management		
Teaching Scheme: **Theory: - 3 Hours/Week**	**Credits** **03**	**Examination Scheme:** **Activity Marks: 20 Marks** **In Sem: 20 Marks** **End Sem: 70 Marks**

The evaluation under the "**Activity**" component, worth 20 marks, will consist of a **quiz** featuring Multiple Choice Questions from various categories. The distribution of questions will be as follows: 20% difficult questions (from the Evaluate and Create categories of Bloom's Taxonomy), 40% medium questions (from the Apply and Analyze categories), and 40% easy questions (from the Remember and Understand categories). The schedule for this activity will be communicated via email, noticeboard, or the department website well in advance

Students who fail to attend this activity but have a genuine reason will be accommodated with a rescheduled quiz, which will also be announced through email, noticeboard, or the department website well in advance, using a different set of questions from the specified categories.

Course Coordinator

HoD Dr. C. S. Kulkarni

VPKBIET BARAMATI PUNE (MS.) Affiliated to S.P.P.U. Pune Id No.: PU/PN/Engg/152/2000