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

Faculty of Science and Technology

Board of Studies

Information Technology

Syllabus

Second Year B. Tech. Information Technology

(2024 Pattern)
(w.e.f. AY: 2025-26)

Institute Vision and Mission

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

Mission
- To ensure holistic development of students as lifelong learners and problem solvers through value-based quality education.

- To motivate faculty to attain the state-of-the-art knowledge and wisdom in their domain and be a facilitator towards co-creation of knowledge.

- To frame and deploy conducive and empowering policies for multifaceted growth of students, faculty and staff to make them contributors towards excellence.

- To partner with industry for mutually beneficial relations to generate employable and deployable workforce.

- 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
To develop globally competent IT professionals through continuous learning.

Mission

- To provide graduates with the programming skills and domain knowledge.

- To collaborate with local, state, national, and international entities in education.

- To develop technically competent professionals with social values and ethics.

- To encourage faculty to acquire state-of-the art knowledge.

Program Educational Objectives	
PEO1	Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.
PEO2	Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.
PEO3	Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.
PEO4	Have commitment ethical practices, societal contributions through communities and life-long learning.
PEO5	Possess better communication, presentation, time management and team work skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

Program Outcomes		
PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate software or a software/hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide essay schematic solutions to complex engineering /Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solutions for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies /tools with the help of electives, profession along animations and extra-curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in the engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

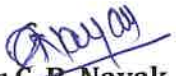| Program Specific Outcomes(PSO)	
PSO1	An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.
PSO2	An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.
PSO3	An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.
PSO4	Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.

SEMESTER-I

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	IT24201	Object Oriented Programming	3	2		10	30	60		30		130	3	1		4
PCC	IT24202	Data Structures & Algorithms	3	2		10	30	60		30		130	3	1		4
PCC	IT24203	Discrete Mathematics	3			10	30	60				100	3			3
MDM	MD24XXX	Multi-disciplinary minor	3	2		10	30	60	30			130	3	1		4
OE	OE24XXX	Open Elective	2			10		60				70	2			2
AEC	HS24201	Public Speaking and Aptitude	1	2		10			30		30	70	1	1		2
VSEC	IT24204	Python for Data Science	1	2		10			30	30		70	1	1		2
		Total	16	10	0	70	120	300	90	90	30	700	16	5	0	21

SEMESTER-II

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BSC	BS24203	Advanced Mathematics for IT Engineering	3			10	30	60				100	3			3
PCC	IT24211	Machine Learning	3	2		10	30	60		30		130	3	1		4
PCC	IT24212	Database Management System	3	2		10	30	60		30		130	3	1		4
PCC	IT24213	Logic Design and Computer Organization	3	2		10	30	60			30	130	3	1		4
MDM	MD240XX	Multi-disciplinary minor	2	2		10		60	30			100	2	1		3
VEC	HS24211	Environmental Studies	2			10		60				70	2			2
CEPFP	IT24214	Community Engineering. Project		4		10			30		30	70			2	2
		Total	16	12	0	70	120	360	60	60	60	730	16	6	0	22

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HoD – IT

Dr.C. B. Nayak
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Prof. S.M. Bhosle
Dean Academics

Prof. S.B. Lande
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ering & Tec   logy,
yanagari   41

Multidisciplinary Minor Courses

Course Code	Course Name	Course Code	Course Name
3 Credit MDM		**4 Credit MDM**	
AI24052	Data Science	GS24051	Nanotechnology
IT24051	Cyber security	ET24053	Internet of Things
IT24052	Full Stack Development	CE24051	Waste Management
EL24052	Industrial Automation	CO24052	High Performance Computing (Sem V+)
ET24051	Embedded Systems	CO24053	Computer Graphics & Gaming
EL24051	Solar Technology	ME24052	Robotics & Automation
GS24052	Linear Algebra and Statistics	AI24051	AI & Machine Learning
CO24053	Object Oriented Programming	CO24051	Cloud Computing
IT24054	Data Structure	ET24052	Drone Technology
ET24054	Microprocessor	ME24051	3-D Printing
		CE24052	Green building & smart cities

Open Elective Courses

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

SEMESTER-I

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	IT24201	Object Oriented Programming	3	2		10	30	60		30		130	3	1		4
PCC	IT24202	Data Structures & Algorithms	3	2		10	30	60		30		130	3	1		4
PCC	IT24203	Discrete Mathematics	3			10	30	60				100	3			3
MDM	MD24XXX	Multi-disciplinary minor	3	2		10	30	60	30			130	3	1		4
OE	OE24XXX	Open Elective	2			10		60				70	2			2
AEC	HS24201	Public Speaking and Aptitude	1	2		10			30		30	70	1	1		2
VSEC	IT24204	Python for Data Science	1	2		10			30	30		70	1	1		2
		Total	16	10	0	70	120	300	90	90	30	700	16	5	0	21

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Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

Object Oriented Programming

Course Code : IT24201	Course Credits: 04	Course type: PCC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	30	-

Prerequisite Course Mapping:
1. Workshop

Future Course Mapping:
1. Advanced Java Programming

Course Objective:
1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes: On completion of the course, learner will be able to
1. **Understand** the Object-Oriented Programming concepts.
2. **Identify** classes, objects, methods, and handle object creation.
3. **Understand** the initialization of objects, and destruction to model real-world problems.
4. **Develop** the Inheritance to achieve the reusability and polymorphism.
5. **Design** a solution using generic function and generic class.
6. **Apply** the concept of files for persistent data storage in real world application.

Syllabus		
UNIT No.	Syllabus	Hrs
I	**Introduction to Object Oriented Programming** Limitations of Procedural Programming, Introduction to OOP, Need of Object-Oriented Programming, Fundamentals of Object-Oriented Programming: Objects, Classes, Data Members, Methods, Messages, Data Encapsulation, Data Abstraction and Information Hiding, Inheritance, Polymorphism, Static and Dynamic Binding, Message Passing.	6
II	**Objects and Methods** Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class, Returning a Value, Adding a Method That Takes Parameters, Method Overloading, Array of Objects, Memory Allocation: 'new', Memory Recovery: 'delete', Static Data Members, Static Methods, Forward Declaration, Class as Abstract Data Types (ADTs), Classes as Objects.	6
III	**Constructors and Destructors** Constructors: Introduction, Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Dynamic Initialization of an Object, Constructor with Default Arguments, Symbolic Constants, Destructors and Finalize.	6
IV	**Inheritance and Polymorphism** Inheritance: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance , Constructors in derived Classes, Method Overriding, Abstract Classes and Interfaces. Polymorphism and Software Reuse: Introduction, Types of Polymorphism (Compile Time and Run Time Polymorphism), Mechanisms for Software Reuse, Efficiency and	7

		Polymorphism	
V		**Generic Programming and Threading** **Generics:** Generic Programming using generic function and class, Introduction to Language Specific Collection Interface: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class, Concurrent Programming, Basic Concepts of Concurrent Programming, Threads.	8
VI		**File handling** File Handling: Introduction, Concepts of Stream, Stream Classes, Byte Stream Classes, Character Stream, Classes, Using Stream, and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Character, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.	6
Total Teaching Hours			**39**

List of Practical Assignments:

1. Write a MyDate class which has attributes as day, month, and year. Create five objects of MyDate and display them.
2. Design a class 'Complex 'with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.
3. Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable. Employee class hasEmp_name, Emp_id, Address, Mail_id, and Mobile_noas members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and orderCopies(). Magazine Class has methods orderQty, Current issue, receiveissue().Write a program to find how many copies of the given books are ordered and display total sale of publication.
5. Implement a generic program using any collection class to count the number of elements in a collection that have a specific property such as even numbers, odd number, prime number and palindromes.
6. Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program that accepts dimensions of triangle/rectangle and display calculated area. Implement dynamic binding for given case study.
7. Write a Java program to create a producer-consumer scenario using the wait() and notify() methods for thread synchronization.
8. Implement a program for maintaining a database of student records using Files. Student has Student_id,name, Roll_no, Class, marks and address. Display the data for few students.
   1. Create Database
   2. Display Database
   3. Delete Records
   4. Update Record
   5. Search Record

Text Books:

1. 1.An Introduction to Object Oriented Programming (3rd Ed), by Timothy A. Budd, published by Addison-Wesley,2002
2. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.

Reference Books:
1. 1.Object-Oriented Programming and Java by Danny Poo (Author), Derek Kiong (Author), Swarnalatha Ashok (Author)Springer; 2nd ed. 2008 edition (12 October 2007), ISBN-10: 1846289629, ISBN-13: 978-1846289620,2007 .
2. Cay S Horstmann and Gary Cornell, Core Java Vol-1 and Vol-2, 9th Edition, Pearson Education India, ISBN-10: 9332518904 and 9332518890.
3. Eckel B., "Thinking in Java", 3rd Edition, Pearson Education, 2012.

Online Resources:

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OOP IT24201	CO1	1	1	-	-	2	-	-	-	1	-	-	1
	CO2	2	2	1	-	3	-	-	-	1	-	-	1
	CO3	2	2	2	-	3	-	-	-	2	-	-	1
	CO4	2	2	2	-	3	-	-	-	2	-	-	1
	CO5	3	3	3	-	2	-	-	-	2	-	-	1
	CO6	3	2	2	-	3	-	-	-	2	-	-	1

Data Structures and Algorithms								
Course Code : IT24202			**Course Credits: 04**			**Course type: PCC**		
Teaching Scheme			**Evaluation Scheme**					
TH	**PR**	**TUT**	**CAA**	**ISE**	**ESE**	**TW**	**PR**	**OR**
3	2	-	10	30	60	-	30	-

Prerequisite Course Mapping:
1. Fundamentals of Data Structures

Future Course Mapping:
1. Design and Analysis of Algorithm

Course Objectives:
1. To develop a logic for graphical modeling of the real life problems.
2. To suggest appropriate data structure and algorithm for graphical solutions of the problems.
3. To understand advanced data structures to solve complex problems in various domains.
4. To operate on the various structured data.
5. To build the logic to use appropriate data structure in logical and computational solutions.

Course Outcomes:
1. **Understand** the fundamental concepts of linked lists and their use in real world problem solving
2. **Utilize** non-linear data structures to address problems across different domains
3. **Apply** non-linear data structures for solving real time problems in various domains.
4. **Design** and **apply** the objectives and advantages of an effective hashing scheme for practical applications
5. **Develop** and **apply** algorithms for insertion, deletion, and search operations in B-Trees and B+ Trees
6. **Design** algorithms to address programming challenges, choose the right strategy for each application, and assess time and space complexity

UNIT No.	Syllabus	Teaching Hours
I	**Linked List:** Introduction to Static and Dynamic Memory Allocation, Linked List: Introduction, of Linked Lists, Linked List as ADT, Types of Linked List: Singly Linked Lists, Doubly Linked List, Circular Linked List, Primitive Operations on Linked List- Create, Traverse, Search, Insert, Delete, Sort, Concatenate. Implementation of stack and queue using Linked List, Generalized Linked List (GLL) concept, Representation of Polynomial using GLL.	7
II	**Tree:** basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals (recursive and non-recursive)- inorder, preorder, post order, depth first and breadth first, Operations on binary tree. ,binary Search Tree (BST), BST operations, Threaded binary search tree- concepts, threading, insertion and deletion of nodes in threaded binary search tree.	7
III	**Graph:** Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms, Dikjtra's Single source shortest path.	7
IV	**Hashing:** Hash Table- Concepts-hash table, hash function, basic operations,	6

	bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing, closed addressing and separate chaining.	
V	**Indexing and Multiway Trees:** Concept of AVL tree, LL, RR, RL and LR Rotations, Multiway search trees, B-Tree- insertion, deletion, B+Tree - insertion, deletion, use of B+ tree in Indexing. Heap implementation, Heap Sort, Heap as a Priority Queue	6
VI	**Introduction to Algorithm Analysis:** Complexity of algorithm: Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, finding complexity using step count method, Algorithmic Strategies: Introduction to algorithm design strategies- Divide and Conquer, Backtracking, Branch and Bound and Greedy strategy.	6

List of Practical Assignments:
1. Implement singly link list with following operations:
   a. Create, insert node at the front, middle and end, delete at the front, middle and end, reverse
2. Implement stack and queue using Linked List.
3. Implement binary tree and perform tree traversals non-recursively.
4. Implement binary search tree and perform following operations on it:
   a. create
   b. display
   c. insert
   d. height
   e. mirror image
   f. delete
   g. leaf nodes
5. Represent a given graph using adjacency matrix/ adjacency list to perform DFS and BFS.
6. Implementation of prims/kruskal's algorithm to find minimum spanning tree of a given graph.
7. Implementation of dijkstra's algorithm to find shortest path between two nodes.
8. Implementation of heap sort.
9. Implementation of hash table and handle collisions using linear probing.
10. Design a mini project using data structure concepts

Text Books:

1. Horowitz and Sahani, "Fundamentals of Data Structures in C++", University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926.

2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley Publication, ISBN: 978-1-118-29027-9

3. M Folk, B Zoellick, G. Riccardi, "File Structures‖, Pearson Education", ISBN:81-7758-37-5

4. Peter Brass, "Advanced Data Structures"‖, Cambridge University Press, ISBN: 978-1-107-43982-5

Reference Books:

1. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms"‖, Pearson Education, 1998, ISBN-0-201-43578-0.

2. Michael J Folk, "File Structures an Object Oriented Approach with C++‖", Pearson Education, ISBN: 81-7758-373-5.

3. Brassard and Bratley, "Fundamentals of Algorithmic", Prentice Hall India/Pearson Education, ISBN

4. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++"‖, Second Edition, University Press, ISBN:81-7371522 X.

	5. G A V Pai, "Data Structures and Algorithms"‖, McGraw-Hill Companies, ISBN - 9780070667266.

Online Resources:
1. https://nptel.ac.in/courses/106/102/106102064/
2. https://nptel.ac.in/courses/106/105/106105085
3. https:// nptel.ac.in/courses/106/106/106106127
4. https://www.ebookphp.com/advanced-data-structures-epub-pdf/
5. https://www.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epubpdf/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DSA IT24202	CO1	3	2	3	2	1	-	-	1	1	-	-	2
	CO2	3	2	3	2	1	-	-	1	1	-	-	2
	CO3	3	2	3	2	1	-	-	1	1	-	-	2
	CO4	3	2	2	2	1	-	-	1	1	-	-	2
	CO5	3	2	3	2	1	-	-	1	1	-	-	2
	CO6	3	2	2	2	1	-	-	1	1	-	-	2

Discrete Mathematics								
Course Code : IT24203			**Course Credits: 03**			**Course type: PCC**		
Teaching Scheme			**Evaluation Scheme**					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
03	-	-	10	30	60	-	-	-

Prerequisite Course Mapping:
   1. Mathematics

Future Course Mapping:
   1. Design and Analysis of Algorithms

Course Objectives:
   1. To gain sound knowledge, formulate and solve problems with sets and propositions.
   2. To understand and solve counting problems by applying elementary counting techniques to solve problems of discrete probability.
   3. To recognize types of relation, formulate and solve problems with relations and functions.
   4. To understand Graph terminologies and models to be applied in real life problems.
   5. To understand Tree terminologies and models to be applied in real life problem
   6. To understand the various types' algebraic structures and its applications.

Course Outcomes:
   1. Formulate and apply formal proof techniques and solve the problems with logical reasoning.
   2. Analyze and evaluate the combinatorial problems by using probability theory.
   3. Analyze types of relations and functions to provide solutions to computational problems.
   4. Apply the concepts of trees to devise mathematical models.
   5. Apply the concept of Graph Theory to solve the problems.
   6. Understand fundamental algebraic structures.

UNIT No.	Syllabus	Hrs
I	**Sets**: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Cartesian Product, Principle of Inclusion and Exclusion, Mathematical Induction. **Propositions**: Propositions, Logical Connectives, Conditional and Biconditional. Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Applications of propositional logic	7
II	**Combinatorics**: Rules of Sum and Product, Permutations,Combinations. **Discrete Probability**: Discrete Probability, Conditional Probability, Bayes Theorem, Applications of Combinatorics and Discrete Probability.	6
III	**Relations**: Properties of Binary Relations, Closure of Relations,Warshall's Algorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices. **Functions:** Functions, Composition of Functions, invertible Functions,Pigeonhole Principle.	7
IV	**Graphs:** Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite IV Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Dijkstra's Algorithm, Planar Graphs, Graph Coloring.	7
V	**Trees:** Tree Terminologies, Rooted Trees, Properties, Prefix Codes, Spanning Trees, Fundamental Cut Sets and Circuits, Max flow-Min Cut Theorem (Transport Network),	6

		Binary Trees and traversal, Binary Search Tree and Traversals.	
VI		**Algebraic Structures:** Introduction Semigroup, Monoid, Group, Abelian vi Group, Permutation Groups, Ring, Integral Domain, Field. Applications of Algebraic Structures.	6

List of Practical Assignments: NA

Text Books :
1. Kenneth H. Rosen. Discrete Mathematics and Its Applications, 7th Edition, McGraw Hill, 2012.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw- Hill.

Reference Books:
1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India.
2. Edgar G.Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education.
3. Tremblay J. S., "Discrete mathematical structures with application", 3rdEdition, Tata McGraw Hill.
4. Lipschutz Seymour, "Discrete mathematics", 4th Edition, Tata McGraw-Hill.
5. Johnsonbaugh Richard, "Discrete Mathematics", 7th edition, Pearson.
6. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover publication.

Online Resources:
1. NPTEL Course "Discrete Mathematics" By Prof, Sudarshan iyengar, Prof. Neeldhara IITRopar, IITGandhinagar.
2. https://onlinecourses,nptel.ac.in/noc20_cs37/unit?unit=41&1esson=42.

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DM IT24203	CO1	3	3	1	2	1	2		2		1		3
	CO2	3	3	2	2	2		2			1		3
	CO3	3	3	3	2	2	2	2		2	1		3
	CO4	3	3	2	3	2	2			1	1	2	3
	CO5	3	3	2	2	1	2	2			1		3
	CO6	3	3	2	2	1	2				1		3

	Public Speaking and Aptitude							
Course Code : HS24201			**Course Credits: 02**			**Course type: AEC**		
Teaching Scheme			**Evaluation Scheme**					
TH	**PR**	**TUT**	**CAA**	**ISE**	**ESE**	**TW**	**PR**	**OR**
1	2	-	10	-	-	30	-	30

Course Objectives:
1. To develop fluency in spoken English by improving vocabulary, pronunciation, intonation, and conversational skills for effective communication.
2. To enhance presentation skills by focusing on body language, voice modulation, strategic pauses, and empathetic communication for impactful public speaking.
3. To strengthen quantitative aptitude through problem-solving techniques in data interpretation, numerical computation, and statistics.
4. To develop logical and spatial reasoning skills for better analytical thinking and problem-solving in competitive exams.

Course Outcomes:
On the completion of the course, students will be able to -
1. Communicate effectively in various spoken interactions, including telephone conversations and discussions.
2. Deliver structured and engaging presentations with appropriate body language, voice modulation, and confident speech techniques.
3. Solve quantitative problems efficiently using data interpretation, numerical computation, and statistical analysis techniques.
4. Apply logical reasoning and spatial aptitude skills to analyze complex problems.

UNIT No.	Syllabus	Hrs
I	**Spoken English** Pre-Assessment, Vocabulary made easy, the Power of Words, Introduction to Word Accent, Introduction to Rhythm: Intonation, Rising Intonation, Falling Intonation, Introduction & Specific scenarios: Telephone Skills: Taking & Making Calls, Voice, Intonation, and Language, Conversations: The Role of Questions	4
II	**Impactful Presentations:** Body Language: Introduction, Mechanics and Style Voice Modulation: Voice Projection, replacing Fillers, and Emphasis Power of Pause: Pause to engage audience in Conversation, Combine Pause & Repetition Techniques, Demonstrate Confidence & Control, establish Presence Empathy: Essential Human Quality, Practice Heartful Communication, Impact of Communication, How to deliver memorable speech.	4
III	**General Aptitude for all Competitive Exams** **Quantitative Aptitude** Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2- and 3-dimensional plots, maps, and tables Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series Mensuration and geometry Elementary statistics and probability. **Analytical Aptitude** Logic: deduction and induction, Analogy, Numerical relations and reasoning. **Spatial Aptitude** Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping paper folding, cutting, and patterns in 2 and 3 dimensions.	6

List of Practical Assignments for reference :

Session 1: Vocabulary & Word Accent Mastery
- o Pre-Assessment: Conduct a quick spoken test to evaluate pronunciation and fluency.
- o Vocabulary exercises using flashcards & interactive word-building games.

Session 2: Intonation & Rhythm in Speech
- o Introduction to rising and falling intonation with examples.
- o Roleplay exercises for practicing intonation in different scenarios (expressing surprise, asking questions, etc.).
- o Rhythm practice: Reading passages with proper pauses and stress patterns.

Session 3: Telephone Skills & Professional Conversations
- o Practicing making and taking calls with simulated dialogues.
- o Focus on voice modulation, clarity, and polite expressions.

Session 4: Body Language & Stage Presence
- o Mirror exercises to improve facial expressions and gestures.
- o Practicing posture, movement, and eye contact while speaking.

Session 5: Voice Modulation & Power of Pause
- o Exercises on voice projection and eliminating fillers.
- o Practicing pauses strategically to enhance speech impact.
- o Repetition and emphasis techniques using speech excerpts.

Session 6: Empathy & Heartfelt Communication
- o Interactive storytelling to practice emotional connection.
- o Exercises on active listening and empathetic responses.
- o Speech practice: delivering a short talk with an emotional appeal.

Session 7: Quantitative Aptitude – Data Interpretation & Computation
- o Solving numerical problems based on bar graphs, pie charts, and tables.
- o Quick estimation exercises using ratios, percentages, and logarithms.
- o Group challenges on permutations and combinations.

Session 8: Analytical Aptitude – Logical & Numerical Reasoning
- o Deduction and induction puzzles.
- o Solving analogy-based reasoning questions.
- o Speed tests for numerical relations and reasoning.

Session 09: Spatial Aptitude – Shape & Pattern Recognition
- o Hands-on paper folding and cutting exercises.
- o Visualization tasks for rotation, scaling, and mirroring of shapes.
- o Solving pattern-based problems in 2D and 3D space.

Session 10 : Mock test from online test series of companies like TCS, Infosys employability tests like CoCubes, AMCAT etc.
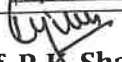
Text Books :
1. "A Course in Phonetics and Spoken English" – T. Balasubramanian
2. "Effective Technical Communication" – M. Ashraf Rizvi
3. "Quantitative Aptitude for Competitive Examinations" – R.S. Aggarwal
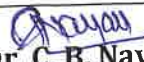
Reference Books:
1. "High School English Grammar & Composition" – Wren & Martin
2. "How to Speak, How to Listen" – Mortimer J. Adler
3. "Logical and Analytical Reasoning" – A.K. Gupta

Online Resources:
1. Mastering Speaking and Presentations: A case Based Approach by Prof. Seema Singh, IIT,Kharagpur
   https://onlinecourses.nptel.ac.in/noc25_hs96/preview

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BOS Chairman – HSSM	Dean Autonomy	Dean Academics	Principal

Python for Data Science								
Course Code : IT24204			Course Credits: 02			Course type: VSEC		
Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
1	2	-	10	-	-	30	30	-

Prerequisite Course Mapping:
Basic knowledge of basic data science algorithms.

Future Course Mapping:
Machine Learning, Deep Learning, Data Science and Big Data Analytics

Course Objectives:
1. To learn and implement python programs for data science.
2. To learn data visualization using python libraries.
3. To understand the basic concepts of machine learning

Course Outcomes:
On the completion of the course, students will be able to -
1. To underrated python program development environment and python basics
2. Understand python programming constructs
3. Analyze data using python numpy library
4. Analyze data using pandas library functions
5. Visualize data using python matplotlib library libraries
6. Apply machine learning for predictive analysis

UNIT No.	Syllabus	Hrs
I	**Basics of Python Programming:** Introduction to python for Data science, Features of python, variables and Data types, Input operations, Keywords, Indentation, Operators and expressions, Python List, Tuples and Dictionary.	3
II	**Decision Control Statements** Selection/Conditional Branching statements: if, if-else, nested-if Basic loop statements: While loop, for loop, break, continue, pass Functions: Need for functions, Function definition, function call, return statement, variable scope and lifetime	3
III	**Data Analysis with NumPy** Introduction Numpy: Numpy data types, Array, attributes of ndarray, basic operations on array, indexing, slicing, reshaping of array, mathematical and statistical methods: mean, sum, np, analysing data across arrays: where()	3
IV	**Data Analysis with pandas:** Series, Dataframe, indexing, operations between Dataframe and series, sorting, common mathematical and statistical methods: min,,max, mean, std, csum, Reading files (cvs, excel, json , database), creating subsets, merge subsets	3
V	**Data visualization** Introduction to data visualization, types of data visualization, Introduction to matplotlib, plot, Figures and subplots, labels and legend, Scatter plot, Line plot, Bar plot, Histogram, Box plot	3
VI	**Introduction to Machine Learning** What is machine learning, Machine learning types, Dataset: Training, Test, Validation set, Case study : Regression, Classification	3

List of Practical Assignments:

1) Python Installation and setup development:
   - i.   Install python using pip install
   - ii. Install Anaconda navigator, conda for python libraries and creating virtual environment
   - iii. Google colab, Jupyter notebook for python program development

2) Create a List of elements and perform following operations:

   - i.   Create a list
   - ii. Accessing elements of list ,
   - iii. change elements of a list,
   - iv. deleting list

3) Accept N numbers from the user and find the minimum, maximum number in the list, Sum and average of numbers.

4) Write a program to accept marks obtained by a student in five courses and compute his/her result grade using following criteria:

Aggregate Marks	Grade
<40	Fail
>=40 and <60	Pass
>=60 and <75	First Division
>=75	Distinction

5) To accept a number from the user and print the number in a reverse order. For example: Input: 123,

   Output : 321

6) To create a array using and perform following operations:
   1. Create a array using list
   2. Create a rank 2 (2D) array
   3. Retrieve elements from the array. (Use array slicing operator)
   4. Reverse order of elements in arrays
   5. Create a 3 by 3 array and reshape it into 1 by 9 array
   6. Perform element wise addition/ subtraction /multiplication /sum /
   7. Find square of every element in array
   8. Select element in array based on conditions

7) Perform the following operations using Python on the data set. Use Facebook metrics dataset

   1. Create data subsets
   2. Merge Data
   3. Sort Data
   4. Transposing Data
   5. Shape and reshape

8) Perform data visualization using matplotlib library on Facebook metrics dataset, Air Quality dataset.

9) Predict the salary of an employee based on his experience using linear regression.

Text Books :
   1. Python Programming using Problem Solving approach, Reema Thareja, Oxford University press
   2. Python Data Science Essentials , Alberto Boschetti, Luca Massaron, Third edition , Packet
   3. Foundational python for Data Science, Kennedy R. Behrman, Addison-Wesley

Reference Books:
1. Python Data Science Handbook, Jake VanderPlas, O'relly, First edition, ISBN- 978-1-491-91205-8
2. Python for Data Analysis, Wes McKinney, 1 edition, O'relly, ISBN: 978-1-449-31979-3
3. Mastering python for data science, Samir Madhavan
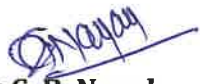
Online Resources:
1. https://archive.nptel.ac.in/courses/106/106/106106212/
2. https://onlinecourses.nptel.ac.in/noc22_cs32/preview
3. https://www.coursera.org/learn/python-for-applied-data-science-ai

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PDS IT24204	CO1	3	1	1		2							1
	CO2	1	2		2	2	1						1
	CO3	3	2	2	2	2	1						1
	CO4	2	2		2	3	2						1
	CO5	1	2		2	3							1
	CO6	3	2	3	2	2	2						1

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BSC	BS24203	Advanced Mathematics for IT Engineering	3			10	30	60				100	3			3
PCC	IT24211	Machine Learning	3	2		10	30	60		30		130	3	1		4
PCC	IT24212	Database Management System	3	2		10	30	60		30		130	3	1		4
PCC	IT24213	Logic Design and Computer Organization	3	2		10	30	60			30	130	3	1		4
MDM	MD240XX	Multi-disciplinary minor	2	2		10		60	30			100	2	1		3
VEC	HS24211	Environmental Studies	2			10		60				70	2			2
CEPFP	IT24214	Community Engineering. Project		4		10			30		30	70		2		2
		Total	16	12	0	70	120	360	60	60	60	730	16	6	0	22

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Advanced Mathematics for IT Engineering

Course Code : BS24203			Course Credits: 04			Course type: BSC		
Teaching Scheme			**Evaluation Scheme**					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	-	-	10	30	60	-	-	-

Prerequisite Course Mapping: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification & Representation of data.

Future Course Mapping:
1. Machine Learning
2. Deep Neural Network

Course Objectives:

To provide the students with concepts and techniques in Linear differential equations, Fourier transform, Statistical methods, and Probability theory. The aim is to equip them with the techniques to understand advanced-level mathematics and its applications that would be useful in their discipline and enhance their thinking power.

Course Outcomes:
1. Solve higher-order linear differential equations using appropriate techniques useful for modeling in their field.
2. Understand the concepts of Fourier transform.
3. Understand and apply the various concepts of statistical methods of correlation, and regression and Apply them in their field.
4. Apply the concepts of appropriate Probability and Probability distribution for data analysis and predictions in multiple data sets.
5. Solve Algebraic, Transcendental equations and System of linear equations using numerical techniques.
6. Compute Interpolating polynomials, numerical differentiation, and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

UNIT No.	Syllabus	Teaching Hours
I	**Unit I: Linear Differential Equations (LDE) and Applications** Introduction, Solution of LDE, General method, short-cut method, Method of variation of parameters, Cauchy's, Legendre's DE, Simultaneous DE.	7
II	**Unit II: Fourier and Z Transform** Fourier Transform: General Fourier transform, Fourier Sine and Cosine transform, and inverse transforms. Z - Transform: Theorems and Properties of Z-transform, and Inverse Z-transform. Applications of Z-transforms to solve difference-equations.	7
III	**Unit III Statistics** Statistics: Measures of dispersion, Moments, Skewness and Kurtosis, Correlation and Regression analysis. Curve fitting: Fitting of straight lines and related curves.	7
IV	**Unit IV: Probability and Probability Distributions** Theorems on probability, Random variables, Probability Mass function, Probability Density function, Mathematical Expectation. Binomial, Poisson, and Normal distribution and applications.	7
V	**Unit V: Numerical methods for Algebraic equations and System of**	7

		Equations	
		Numerical Solution of Algebraic and Transcendental Equations: Bisection, Secant, Regula-Falsi, Newton–Raphson and Successive Approximation Methods. Numerical Solutions of System of linear equations: Gauss elimination, LU Decomposition, Cholesky, Jacobi and Gauss-Seidel Methods.	
VI		**Unit VI: Numerical methods for calculus** Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formula, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4th order.	7

Textbooks:
1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
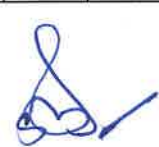
Reference Books:
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley India
2. M. D. Greenberg, "Advanced Engineering Mathematics", 2nd e Pearson Education
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7ed, Cengage Learning
4. S. L. Ross, "Differential Equations", 3e, Wiley India
5. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5e, Elsevier Academic Press
6. M. K. Jain, S. R. K. Iyengar, and R. K. Jain, "Numerical Methods for Scientific and Engineering Computation", 5e, (New Age International Publication).
7. Draper, N. R. and Smith, H. "Applied Regression analysis", (1998) (John Wiley) Third Edition.
8. S.P. Gupta, Sultan Chand and Sons, "Statistical Methods", New Delhi, 2009.

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AMIT BS24203	CO1	3	2	2	1	2	-	-	-	-	1	-	1
	CO2	3	2	2	1	2	-	-	-	-	1	-	1
	CO3	3	3	3	2	2	1	1	-	-	1	-	1
	CO4	3	3	3	2	2	1	1	-	-	1	-	1
	CO5	3	3	2	2	2	1	-	-	-	1	-	1
	CO6	3	3	2	2	2	1	-	-	-	1	-	1

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Vidya Pratishthan's
Kamalnayan Bajaj Institute of
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Vidyanagar, Baramati - 413133

Machine Learning								
Course Code : IT24211			**Course Credits: 04**			**Course type: PCC**		
Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
03	02	-	10	30	60	-	30	-

Prerequisite Course Mapping:
1. Basics of Statistics
2. Linear Algebra
3. Calculus
4. Probability

Future Course Mapping:
Deep Learning

Course Objectives:
1. To Understand the basic concepts of machine learning and apply them for the various problems
2. To learn various machine learning types and apply for different machine learning tasks
3. To learn to evaluate machine learning model
4. To understand model hyper parameters, optimize the machine learning model and generalize it.

Course Outcomes:
1. **CO1: Understand** the basic concepts of machine learning and apply them for the various problems
2. **CO2: Design** classification models and their relevant applications, Analyse classification models performance.
3. **CO3: Apply** regression techniques to solve real world problem and **evaluate** regression model performance
4. **CO4: Apply** the tree-based and probabilistic machine learning algorithms
5. **CO5: Apply unsupervised** learning algorithms for real world problems.
6. **CO6: Understand** the fundamental concepts of Artificial Neural Network

UNIT No.	Syllabus	Teaching Hours
I	**Introduction:** Definition, Machine learning applications, Learning Tasks-Descriptive and Predictive Tasks, Types of Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning. Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Dataset Preparation: Training , Testing Dataset, Dataset Validation Techniques – Hold-out, k-fold Cross validation, Leave-One-Out Cross-Validation (LOOCV).	7
II	**Classification:** **Binary Classification:** Linear Classification model, Performance Evaluation-Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure **Multi-class Classification:** Model, Performance Evaluation Metrics – Per-class Precision and Per-Class Recall, weighted average precision and recall -with example, Handling more than two classes, Multiclass Classification techniques -One vs One, One vs Rest **Linear Models:** Introduction, Linear Support Vector Machines (SVM) –	7

	Introduction, Soft Margin SVM, Introduction to various SVM Kernels to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid. **Logistic Regression** – Model, Cost Function.	
III	**Regression** Introduction, Univariate Regression, multivariate regression, Regression model representation, Least-Square Method, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Linear Regression optimization with Gradient Descent. Estimating the values of the regression coefficients Introduction to Polynomial Regression: Generalization- Overfitting Vs. Underfitting, Bias Vs. Variance.	7
IV	**Tree based and probabilistic models** Tree Based Model: Decision Tree – Concepts and Terminologies, Impurity Measures -Gini Index, Information gain, Entropy, Tree Pruning -ID3/C4.5, Advantages and Limitations Probabilistic Models: Naïve Bayes Classifier	6
V	**Distance and Rule based models** Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), K-Nearest Neighbour for Classification and Regression, Clustering: K-means clustering Algorithm-with example, Hierarchical Clustering, Divisive Dendrogram for hierarchical clustering, Association Rule Mining: Introduction, Rule learning for subgroup discovery, Apriori Algorithm, Performance Measures -- Support, Confidence, Lift.	6
VI	**Introduction to Artificial Neural Network** Biological Neuron, Introduction to ANN, McCulloch Pitts Neuron, backpropogation, perceptron, activation functions, Introduction to deep learning, Convolution neural network.	6

List of Practical Assignments:
1. Data preparation: Data preparation: Download heart dataset from kaggle.(https://www.kaggle.com/zhaoyingzhu/heartcsv) and perform operation on given dataset as : Find Shape,size, dimension of the dataset, Find Missing Values, Find data type of each column, Find Mean age of patients, Create subsets of the dataset, split dataset into training (75%)and test set (25%), visualize data.
2. Assignment on Classification technique : Implement binary/Multiclass classification using Support vector classifier using suitable dataset and Evaluate model.
3. Assignment on Regression technique: Apply Linear regression using suitable library function. Assess the performance of regression models using MSE, MAE and R-square metrics. Visualize regression model
4. Download graduate admission prediction dataset from kaggle.(https://www.kaggle.com/mohansacharya/graduate-admissions) . Apply Data transformation, Data-preprocessing techniques, prepare data. Build a machine learning model classifier using Decision tree to predict whether a student will get admission or not. Evaluate model.
5. Assignment on clustering: Download mall-customer dataset from kaggle. https://www.kaggle.com/shwetabh123/mall-customers). Apply clustering algorithms (based on the spending score) to find thee group of customers. Evaluate model
6. Assignment on Association Rule Learning: Download Market Basket Optimization dataset from link (https://www.kaggle.com/hemanthkumar05/market-basket-optimization) . This dataset comprises the list of transactions of a retail company over the period of one week. It contains a total of 7501 transaction records where each record consists of the list of items sold in one transaction. Using this record of transactions and items in each transaction, find the association rules between items.

7.	Mini project: Develop a mini project in a group of 3-4 students for a machine learning task

Text Books :
1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press, 2004
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Tom M. Mitchell, "Machine Learning", McGraw-Hill, 2010

Reference Books:
1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.

Online Resources:
1. Introduction to Machine Learning: https://nptel.ac.in/courses/106/106/106106139/
2. Machine Learning: https://nptel.ac.in/courses/106/106/106106202/
3. Machine Learning for Science and Engineering applications: https://nptel.ac.in/courses/106/106/106106198/
4. Introduction to Machine Learning: https://nptel.ac.in/courses/106/105/106105152/
5. Deep Learning (Part-I): https://nptel.ac.in/courses/106/106/106106184/
6. Deep Learning: https://onlinecourses.nptel.ac.in/noc19_cs54/preview
7. Naive Bayes from Scratch: https://courses.analyticsvidhya.com/courses/naive-bayes
8. Getting Started with Neural Networks: https://courses.analyticsvidhya.com/courses/getting-startedwith-neural-networks
9. Sk-learn library: https://scikit-learn.org/stable/
10. Pandas library: https://pandas.pydata.org/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ML IT24211	CO1	2			1	2				1	1	1	1
	CO2	3	2	2	1	2				1	1	1	1
	CO3	3	2	2	1	3				2	1	1	1
	CO4	3	2	1	1	2				1	1	1	1
	CO5	3	2	3	2	3				1	1	1	2
	CO6	2			2								1

Database Management System								
Course Code : IT24212			Course Credits: 04			Course type: PCC		
Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	30	-

Prerequisite Course Mapping:
1. Discrete Mathematics
2. Fundamentals of data structure and algorithm

Future Course Mapping:
1. Advanced Database Management System
2. Data Science

Course Objectives:
1. To understand the fundamental concepts of database management systems
2. To absorb different PL-SQL concepts
3. To understand systematic database design approaches
4. To acquire the skills to handle data
5. To learn and understand various Database Architectures and its use for application development
6. To learn advances in DBMS

Course Outcomes:
1. Understand the basic concepts of DBMS and Design ER Model
2. Implement database queries using database languages
3. Apply concepts of RDBMS and Normalize the database design using normal forms.
4. Apply transaction management concepts for problem solving.
5. Understand and Apply the concepts of NOSQL
6. Understand the advanced DBMS

Unit No.	Syllabus	Hrs
I	**Introduction to DBMS and ER Model** Data,Type of Data,Database,Types of Databases,Applications and Purpose of Database Systems,Data Abstraction,Data Independence,View of data,Database Languages, Database System Structure, Data Models. **ERModel:** Entity,Types of Entities, Attributes, Types of attributes,Relationship,Constraints ,keys,ER Diagram,EER Diagram,Converting ER and EER Diagram to tables.	7
II	**Introduction to SQL and PL/SQL** **SQL:**Characteristics and Advantages,SQL Data Types and Literals, DDL, DML, DCL, TCL,SQL Operators,Tables:Creation,Updation,Deletion,SQL DML Queries:SELECT Query and clauses,Index and Sequence in SQL,Views:Creating,Dropping,Set operation. **PL/SQL:**Stored Procedures and Functions,Cursors,Triggers	7
III	**Introduction to Relational Database Design** Relational Model:Basic concepts,Attributes,Domains,CODD'S Rules.Relational Integrity:Domain,Relational Integrities,Enterprise constraints,Database Design:Features of good relational design,Normalization,Atomic Domains and 1NF,2NF,3NF and BCNF,Decomposition using functional dependencies.	7

IV	**Database Transaction Management** Introduction to database transaction,transaction states,ACID Properties, Serial Schedule,Serializability:Conflict and View, Cascaded Abort,recoverable and non recoverable schedules .Concurrency Control:Lock based.Timestamp based deadlock handling.Recovery Methods:Shadow Paging,Log based recovery,Checkpoints	6
V	**NOSQL Databases** Introduction to distributed database system,advantages,disadvantages,CAP Theorem,Types of Data:Structured,Semistructured and Unstructured Data.NOSQL Database:Introduction,need ,features,Types of NOSQL Databases:key value store,wide column store,document store,graph,BASE Properties,Comparative study of NOSQL and RDBMS,MongoDB:CRUD Operations	6
VI	**Advances in Databases** Emerging Databases:Active and deductive databases,semantic databases,Complex data types:semi structured data Nested DataTypes:JSON,XML Spatial Data:Geographic data,geometric data,Big data introduction ,HBase	6

List of Practical Assignments:
1. Design ER Diagram for any project.
2. Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc.
3. Write at least 10 SQL queries on the suitable database application using SQL DMLStatements.Note:Instructor will design the queries which demonstrate the use of concepts like Insert,Select, Update, Delete with operators, functions, and set operator etc.
4. Write at least10 SQL queries for suitable database applications using SQL DML statements. Note: Instructor will design the queries which demonstrate the use of concepts like all types of Join ,Sub-Query and View
5. Write stored procedure,functions
6. Cursors:(All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL code to implement all types of cursor and display empno, name and salary of 5 highest paid employees using cursor. Employee(empno,ename,join_date,designation,salary)
7. Database Trigger (All Types: Row level and Statement level triggers, Before and AfterTriggers).1.Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in the Library_Audit table. Note: Instructor will Frame the problem statement for writing PL/SQL block for all types of Triggers in line with above statement.
8. Implement CURD Operations using MongoDB
9. Mini Project: To identify any real life application and create database for it using all DBMS concepts like.keys,tables,procedure and triggers

Text Books :
1. Database System Concepts by Silberschatz A., Korth H., Sudarshan S. , 6th edition
2. Data Mining :Concepts and Techniques ,Jiawei Han, Micheline Kamber, Jian Pei

Reference Books:
1. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
2. S.K.Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
3. Joy A. Kreibich, "Using SQLite", O'REILLY, ISBN: 13:978-93-5110-934-1
4. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications ISBN: 9788176569644, 9788176569644
5. Reema Thareja, Data warehousing, Oxford University Press. ISBN 0195699610

Online Resources:
1. NPTEL Course-https://onlinecourses.nptel.ac.in/noc25_cs18/preview

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DBMS IT24212	CO1	2	3	1		1				2			1
	CO2	2	2	2	2					3		1	2
	CO3	1	3	3	2					2		1	1
	CO4	1	2	2		2	1		1	2		1	2
	CO5	2	2	2						1			1
	CO6	2	1	2		2							

Logic Design and Computer Organization								
Course Code : IT24213			Course Credits: 04			Course type: PCC		
Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	-	30

Prerequisite Course Mapping:
1. Basics of electronics engineering.

Future Course Mapping:
1. Microprocessor and Microcontroller.

Course Objectives:
1. To make undergraduates aware of logic design and different levels of abstraction of computer systems from a hardware perspective.
2. To make undergraduates aware of combinational and sequential circuits.
3. To make undergraduates understand the functions, characteristics of various components of Computer in particular processor & memory.

Course Outcomes:
On completion of the course, students will be able to–
1. Perform basic binary arithmetic & simplify logic expressions.
2. Grasp the operations of logic ICs and implement combinational logic functions using ICs.
3. Comprehend the operations of basic memory cell types and implement sequential logic functions using ICs.
4. Elucidate the functions & organization of various blocks of CPU.
5. Understand CPU instruction characteristics, enhancement features of CPU.
6. Describe an assortment of memory types (with their characteristics) used in computer systems and basic principle of interfacing input, output devices.

Unit	Syllabus	Hrs
I	**Introduction To Digital Electronics** Digital Logic Families: Digital IC characteristics, TTL: Standard TTL characteristics, Operation of TTL NAND gate, CMOS: Standard CMOS characteristics, operation of CMOS NAND gate, Comparison of TTL & CMOS. Signed binary number representation and arithmetic: Sign Magnitude, 1's complement & 2's complement representation, unsigned binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2's complement ,Codes: Binary, BCD, Octal, Hexadecimal, Excess-3, Gray code & their conversions Logic minimization: representation of logic functions: logic statement, truth table, SOP form, POS form; Simplification of logical functions using K-Maps up to 4 variables.	7
II	**Combinational Logic Design** Design using SSI chips: Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, N-bit Binary adder, Introduction to MSI chips: Multiplexer (IC 74153), Demultiplexer (IC 74138), Decoder (74238) Encoder (IC 74147), Binary adder (IC 7483) design using MSI chips: BCD adder using IC 7483, Implementation of logic functions using IC 74153 & 74138.	6
III	**Sequential Logic Design** Introduction to sequential circuits: Difference between combinational circuits and sequential circuits; Memory element-latch.Flip- Flops: Logic diagram, truth table &	7

	excitation table of SR, JK, D, T flip flops; Conversion from one FF to another, Study of flip flops with regard to asynchronous and synchronous, Preset & Clear, Master Slave configuration, Study of 7474, 7476 flip flop ICs, Application of flip-flops, Counters-asynchronous, synchronous and modulo n counters, study of 7490 modulus n counter ICs & their applications to implement mod counters; Registers- shift register types (SISO, SIPO, PISO & PIPO)& applications.	
IV	**Computer Organization & Processor** Computer organization & computer architecture, organization, functions & types of computer units- CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer), IO(types & functions) & system bus(Address, data & control , Typical control lines, Multiple-Bus Hierarchies); Von Neumann & Harvard architecture; Instruction cycle Processor: Single bus organization of CPU, ALU(ALU signals, functions & types), Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR)& control unit (control signals & typical organization of hard wired & microprogrammed CU), Micro Operations (fetch, indirect, execute, interrupt) and control signals for these micro operations.	6
V	**Processor Instructions and Processor Enhancements** Instruction : elements of machine instruction, instruction representation (Opcode & mnemonics, Assembly language elements), Instruction Format & 0-1-2-3 address formats, Types of operands Addressing modes, Instruction types based on operations (functions & examples of each), key characteristics of RISC & CISC, Interrupt: its purpose, types, classes & interrupt handling (ISR , multiple interrupts), exceptions, instruction pipelining (operation & speed up), Multiprocessor systems: Taxonomy of Parallel Processor Architectures, two types of MIMD clusters & SMP (organization & benefits) & multicore processor (various Alternatives & advantages 0f multicores), typical features of multi core intel core i7.	7
VI	**Memory & Input / Output Systems** Memory Systems: Characteristics of memory systems, Memory hierarchy, signals to connect memory to processor, memory read & write cycle, characteristics of semiconductor memory: SRAM, DRAM & ROM, Cache memory – Principle of Locality, Organization, Mapping functions, Write policies, Replacement policies, Multi Level Caches, Cache coherence, Input / Output Systems: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA).	6

List of Practical Assignments:

1. Design and implement 4-bit BCD to Excess-3 code convertor.
2. Design and implement 1 digit BCD adder using IC7483.
3. Design and implement following using multiplexer IC 74153 (a) full adder (b) Any three variable function(cascade method).
4. Design and implement a full subtractor using decoder IC 74138.
5. Design and implement 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip flop IC 7476.
6. Design and implement 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip flop IC 7476.
7. Design and implement Modulo 'N' counter using IC7490. (N= 100 max).
8. Design & simulate single bit ALU with four functions (AND, OR, XOR, ADD).

Text Books :

1. "Modern Digital Electronics", R.P. Jain, Tata McGraw-Hill, Third Edition.
2. "Computer organization and architecture, designing for performance" by William Stallings, Prentice Hall, Eighth edition.

Reference Books:

1. "Digital Design", M Morris Mano, Prentice Hall, Third Edition.

2. "Computer organization" , Hamacher and Zaky, Fifth Edition.
3. "Computer Organization and Design: The Hardware Software Interface" D. Patterson, J. Hennessy, Fourth Edition, Morgan Kaufmann.
4. " Microprocessors and interfacing-programming and hardware" Douglas V. Hall and SSSP Rao, McGraw-Hill ,Third Edition.

Online Resources:
NPTEL Course :
1. https://archive.nptel.ac.in/courses/106/105/106105185/#
2. https://archive.nptel.ac.in/courses/106/105/106105163/
Virtual Lab:
simulator Link http://vlabs.iitkgp.ac.in/coa/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
LDCO IT24213	CO1	3	3	3	-	3	2	-	-	1	-		1
	CO2	3	3	3	-	3	2	-	-	1	-		1
	CO3	3	3	3	-	3	2	-	-	1	-		1
	CO4	3	-	-	-	2	-	2	-	1	-	-	1
	CO5	3	-	-	-	2		2	-	1	-	-	1
	CO6	3	-	-	-	2		2	-	1	-	-	1

Environmental Studies

Course Code : HS24211	Course Credits: 02	Course type: HSSM

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
2	-	-	10	-	60	-	-	-

Course Objectives:
1. Understand the fundamental concepts of environmental science and its relevance to engineering.
2. Analyze the environmental impact of various engineering industries.
3. Learn about sustainable engineering practices, pollution control, and waste management.
4. Study environmental laws in India and global initiatives for environmental conservation.
5. Explore corrective measures and preventive technologies for mitigating environmental damage.

Course Outcomes:
CO 1: Gain an understanding of environmental issues related to engineering industries.
CO 2: Analyze the impact of engineering industries on the environment
CO 3: Learn sustainable engineering solutions for mitigating environmental damage.
CO 4: Be aware of Indian and global initiatives for environmental protection
CO 5: Develop a sense of responsibility towards environmental conservation in their professional field.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction to Environmental Studies** Importance of Environmental Studies, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Ecosystems and Biodiversity: Types, Importance, and Conservation, Sustainable Development Goals (SDGs) and Role of Engineers in Sustainability, Renewable and Non-Renewable Resources, Water Resources: Overuse, Pollution, and Engineering Solutions, Energy Resources: Fossil Fuels, Nuclear Power, and Renewable Energy Alternatives, Land Resources: Soil Degradation, Deforestation, and Urbanization	6
II	**Impact of Engineering Industries on Environment** Manufacturing & Automobile Industry: Air pollution, Carbon emissions, Waste disposal, Chemical & Pharmaceutical Industry: Water and soil contamination, Hazardous waste, Construction & Infrastructure: Land degradation, Dust pollution, Waste generation, Electronics & IT Industry: E-waste, Energy consumption, Semiconductor waste, Power Generation (Thermal, Hydropower, Nuclear): Pollution, Waste heat, Radiation hazards, Causes and Effects of Climate Change, Global Warming and Greenhouse Effect.	7
III	**Engineering Solutions for Environmental Mitigation and Sustainable Practices** Carbon Capture and Storage (CCS), Green Chemistry & Eco-friendly Materials, Sustainable Design & Life Cycle Assessment (LCA), Energy-efficient Technologies & Smart Grids, Case Studies on Successful Pollution Reduction. Waste Management Strategies: Solid Waste and Biomedical Waste Management, E-Waste: Sources, Impact, and Recycling, Hazardous Waste Handling and Treatment, Circular Economy and Zero-Waste Technologies. Sustainable Engineering Practices: Renewable Energy Technologies (Solar, Wind, Biomass, Hydropower) Green Buildings and Sustainable Architecture, Electric Vehicles and Smart Transportation Systems, Sustainable Agriculture and Water Conservation Technologies	7
IV	**Environmental Initiatives in India and Worldwide** National Initiatives: Swachh Bharat Abhiyan, Namami Gange, National Green Tribunal (NGT), Corporate Social Responsibility (CSR) & Environmental Compliance,	6

| | Environmental Activism and the Role of NGOs, Environmental Laws and Policies in India, The Environmental Protection Act, 1986, Role of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB), International Environmental Agreements (Kyoto Protocol, Paris Agreement, COP Summits), Global Initiatives: UNEP, IPCC, World Bank Environmental Policies | |

List of Activities for reference:

Unit 1: Introduction to Environmental Studies

1. **Ecosystem Study Report** – Visit a local park, water body, or forested area and document its ecosystem components (flora, fauna, food chains).
2. **Sustainability Case Study** – Choose one of the *Sustainable Development Goals (SDGs)* and prepare a report on its implementation in India.
3. **Renewable vs. Non-Renewable Resources** – Prepare a comparative chart listing sources, usage, and sustainability factors.
4. **Water Conservation Survey** – Conduct a survey in your neighborhood or campus to assess water consumption and suggest conservation strategies.

Unit 2: Impact of Engineering Industries on Environment

1. **Industrial Impact Assessment** – Select an engineering industry (automobile, chemical, IT, etc.) and analyze its environmental impact.
2. **Carbon Footprint Calculation** – Calculate the carbon footprint of your daily activities (electricity, transportation, food, etc.) and suggest ways to reduce it.
3. **Climate Change Awareness Video** – Create a short video (2–3 min) explaining global warming and its impact.
4. **Case Study on Pollution Control Failures** – Research a real-world incident of industrial pollution (e.g., Bhopal Gas Tragedy, Minamata Disease) and analyze the causes and consequences.

Unit 3: Engineering Solutions for Environmental Mitigation and Sustainable Practices

1. **Waste Management Audit** – Conduct a waste audit in your college or home, classify the waste generated, and propose a waste management plan.
2. **E-Waste Collection Drive** – Organize a drive to collect and safely dispose of e-waste in your locality. Submit a report on the amount collected and its disposal method.
3. **Renewable Energy Model** – Create a working or conceptual model of a solar panel, wind turbine, or biomass plant.
4. **Green Building Analysis** – Identify a green building in your city (or college) and analyze its energy-efficient features.

Unit 4: Environmental Initiatives in India and Worldwide

1. **Report on National Environmental Policies** – Summarize key environmental laws in India and their effectiveness.
2. **International Climate Agreements Presentation** – Prepare a presentation on major agreements like the Paris Agreement, Kyoto Protocol, and their impact on India.
3. **NGO/CSR Initiative Study** – Research an NGO or corporate social responsibility (CSR) initiative focused on environmental protection and prepare a report.
4. **Swachh Bharat Implementation Review** – Visit a local area, document cleanliness conditions, and suggest improvements under *Swachh Bharat Abhiyan*.

Evaluation Criteria (10 Marks Total)

- Depth of Research & Analysis (3 Marks)
- Presentation & Clarity (3 Marks)
- Creativity & Practical Application (2 Marks)
- Timely Submission (2 Mark)

Text Books :
1. **Benny Joseph,** *Environmental Studies*, McGraw Hill Education, 3rd Edition, 2021.
2. **Anubha Kaushik & C.P. Kaushik,** *Environmental Studies*, New Age International Publishers, 5th Edition, 2022.
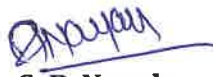
Reference Books:
1. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2021.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Press, 3rd Edition, 2021.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria & Sons, 2nd Edition, 2020.

Additional Reports & Resources:
- Government of India - Ministry of Environment, Forest & Climate Change (MoEFCC) Reports (Website)
- United Nations Environment Programme (UNEP) Reports (Website)
- IPCC Climate Change Reports (Website)
- Central Pollution Control Board (CPCB) Reports (Website)

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Community Engineering. Project								
Course Code : IT24214			**Course Credits:02**			**Course type: CEP**		
Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
-	4	-	10	-	-	30	-	30

Prerequisite Course Mapping:
1. JAVA, Python
2. Database Management system, Web Technology.

Future Course Mapping:
Project

Course Objectives:
1. To learn the various processes involved in project development.
2. To provide Community service to enable the students to acquire life skills and knowledge.
3. To provide a service to society through education.
4. To engage students with the community and to develop civic and social responsibility skills among. students, so that students become more aware of what their community needs.

Course Outcomes:
CO1: Identify and choose real life problems through field trips, awareness camps, surveys.
CO2: Solve problems through collaboration.
CO3: Apply engineering knowledge to formulate the problem statement.
CO4: Develop and design prototype/software/app.
CO5: Tackle technical challenges for solving real world problems with team efforts.
CO6: Evaluate the solution based on the criteria specified.

Introductory information:
   The project can be application oriented and/or will be based on some real life problems in the society. The student will take a project which will involve the problem identification, analysis, design of a system in the area of the identified domain. The outcome of such projects is evaluated on the basis of economical, societal, environmental, demographic feasibility and implementation. The project will be preferably by a group of 3-4 students who will jointly work and implement the project.

Guidelines to Faculty and Students:
1. The Head of the department / Project coordinator shall constitute a review committee
2. There shall be two reviews.
3. Project committee should finalize the scope of the project/field work.
4. Project will be reviewed by the project review committee. For sponsored projects, an employee of the sponsoring organization may be one of the members of the review committee.
5. Every student of the project group shall make a presentation on the progress made by them before the committee during each review.
6. The record of the remarks/suggestions of the review committee (project diary) should be properly maintained and should be made available at the time of examination
7. Project report must be checked for plagiarism
8. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner.

Group Structure:

Group structure should enable students to work in mentor–monitored groups. The students plan, manage and complete a project activity.

1. There should be a team of 3 to 4 students who will work cohesively.
2. A guide should be assigned to individual groups who will help them with the learning and development process.

Selection of Project/Problem:

1. The project scope/topic can be from any social problems, but selection related to IT technical aspects is desirable.
2. Project/problem requiring solutions through conceptual model development and use of software tools should be preferred.
3. Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving / implementation of project/problem.
4. Problems may require in depth study of social / Domain problems.
5. Hands-on activities, organizational and field visits, interacting with research institutes and expert consultation should be included in the approach to make students aware of the latest technologies.

Project report contains:

1. Certificate
2. Certificate sponsoring organization (If any)
3. Acknowledgement
4. Abstract
5. List of Abbreviations (As applicable)
6. List of Figures (As applicable)
7. List of Graphs (As applicable)
8. List of Tables (As applicable)
9. Introduction
10. Need/Importance
    a. Forms of community service
    b. Ways to participate in community
11. Literature Survey
12. Problem Statement and Objective
13. Proposed System
    a. Algorithm
    b. Design details
14. System Architecture
15. Project Plan / Activities planned
16. System Implementation-code documentation
17. Test Cases
18. GUI/Working modules
19. Activities conducted
20. Experimental Results in suitable format
21. Conclusion and Future work
22. References

Appendices
a) Plagiarism Report of Paper and Project report
b) Tools used / Hardware Components specifications (If any)

Evaluation Criteria:

Following criteria and weightage is suggested for evaluation of Project Term Work.

1. Originality of Problem Statement: 10% (03 Marks)
2. Depth of Understanding the Problem Statement: 10% (03 Marks)
3. Literature Survey/ Field work with identified gaps: 10% (04 Marks)
4. Design and Analysis of Algorithm / Model / Architecture / System: 40% (12 Marks)
5. Presentation Skill: 10% (03 Marks)
1. Report preparation : 10% (05 Marks)

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CEP IT24214	CO1	1	3	3	2	1	3	1	1	3	2	1	1
	CO2		3	3	1	1	2	1	1	3	2	2	1
	CO3	2	1		1		1		1	2	1	2	1
	CO4	3	2	3	1	2	2	1	1	3	2	2	2
	CO5	1	2	2	1	3	1	1	2	2	1	2	1
	CO6	2	2		1	2			1	1	1	1	1

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