RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE
COURSE SEMESTER: III (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Discrete Mathematics and Graph Theory** Subject Code: **BTAI&ML-301T**

Load	Credits (TH+T)	College Assessment Marks	University Evaluation	Total Marks
[36 + 12] Hrs	3+1=4	30	70	100

Aim: Discrete mathematics is of direct importance to the fields of Computer Science and Information Technology. This branch of mathematics includes studying areas such as sophisticated forms of counting (combinatorics, etc), set theory, logic, relations, graph theory, and analysis of algorithms. This course is intended to provide students with an understanding of these areas and their use in the field of Information Technology.

Prerequisite(s): Require mathematical basic knowledge and should be familiar withsequences and series, limits, and integration and differentiation of univariate functions.

Course Objectives:

1	A primary objective is to provide a bridge for the student from lower-division mathematics courses to upper-division mathematics.
2	Obtain skills and logical perspectives in introductory (core) courses that prepare them for subsequent courses.
3	Develop proficiency with the techniques of mathematics and/or computer science, the ability to evaluate logical arguments, and the ability to apply mathematical methodologies to solving real world problems
4	A primary objective is to provide a bridge for the student from lower-division mathematics courses to upper-division mathematics.

Course Outcomes:
By the end of the course students shall be able to:

1	Apply graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction.
2	Gain an introduction into how mathematical models for engineering are designed, analyzed and implemented in industry and organizations.
3	Reason mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems; distinguish rigorous definitions and conclusions from merely plausible ones.
4	Analyze real world scenarios to recognize when Logic, sets, functions are appropriate, formulate problems about the scenarios, creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multiple approaches.
5	Apply knowledge of mathematics, physics and modern computing tools to scientific and engineering problems.
6	Apply their knowledge in life-long learning.

UNIT 1: Set Theory, Relations and Functions [7 Hours]

Sets: Review of propositions and logical operations, Principle of mathematical induction, Review of sets, Types and operations on sets.

Relations: Ordered pairs and n-tuples, Types of relations, Composite relation, Transitive closure of a relation, Partially ordered set, Hasse diagrams.

Functions: Definition, Composition of functions, Types of functions, Characteristics function and its properties.

UNIT 2: Fuzzy Set and Fuzzy Logic [7 Hours]

Fuzzy sets and systems, Crisp set, Operations and combinations on Fuzzy sets, Relation between Crisp set and Fuzzy set, Fuzzy relations, Overview of Fuzzy logic and classical logic.

UNIT 3: Group Theory and Ring Theory [7 Hours]

Binary operation, Algebraic structure, Groupoid, Semigroup, Monoid, Group, Subgroup, Normal subgroup (Only definitions and examples), Ring, Commutative ring, Ring with unity, Zero divisor, Integral domain, Field (Only definitions and simple examples).

UNIT 4: Graph Theory [8 Hours]

Basic concepts of graph theory, Digraphs, Basic definitions, Matrix representation of graphs, Subgraphs and quotient graphs, Isomorphic graphs, Paths and circuits, Reachability and connectedness, Node base, Euler's path & Hamilton's path, Tree, Binary tree, Undirected tree, Spanning tree, Weighted graphs (Only definitions and examples), Minimal spanning tree by Prim's algorithm & Kruskal's algorithm, Representation of algebraic expressions by Venn diagram and binary tree.

UNIT 5: Combinatorics [7 Hours]

Permutations and combinations, Pigeonhole principle with simple applications, Recurrence relations (Concept and definition only), Generating functions, Solution of recurrence relations using generating functions.

Text/ Reference Books

1. Discrete Mathematical Structures (PHI), B. Kolman, R. Busby, S. Ross.
2. Discrete Mathematical Structures with Applications to Computer Science (TMH), Tremblay and Manohar.
3. Fuzzy Sets Uncertainty and Information, George, J. Klir, Tina A. Folger.
4. Discrete Mathematics for Computer Scientists & Mathematicians, J. Mott, A. Kandel, T. Baker.
5. Discrete Mathematics, S. Lipschutz.

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COURSE SEMESTER: III (C.B.C.S.)
BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Operating Systems** Subject Code: **BTAI&ML-302T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12] Hrs	**3+1=4**	**30**	**70**	**100**

Aim: To understand the basic principles and the working of Computer systems.

Prerequisite(s): Basic knowledge of microprocessors, data structures and any programming language.

Course Objectives:

1	To understand the services provided by and the design of an operating system.
2	To understand the structure and organization of the file system.
3	To understand what a process is and how processes are synchronized and scheduled.
4	To understand different approaches to memory management.

Course Outcomes:

At the end of this course students are able to:

CO1	Disassemble and reassemble a working computer
CO2	Handle and repair components in a safe manor for both the student and the component
CO3	Evaluate a nonworking computer system and suggest repairs or upgrades
CO4	Identify hardware in a computer system
CO5	Establish a local computer network
CO6	Load and configure a working Windows Operating System

SYLLABUS

UNIT I: **[08 Hours]**

Introduction: Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, File systems: File concept, Access methods

UNIT II: **[07 Hours]**

Disk space management and space allocation strategies, directory structures, disk arm scheduling strategies.
CPU Scheduling: Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms

UNIT III: **[07 Hours]**

Memory management: Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging , page faults and instruction restart , page replacement algorithms, Locality, Thrashing, Garbage Collection.

UNIT IV **[07 Hours]**

Process cooperation and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, classical inter process communication problems.

UNIT V **[07 Hours]**

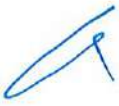
Deadlocks & Protection: Deadlock definition, Prevention, Avoidance, Detection and recovery, Goals of Protection, access matrix, implementation, Security problem.

Text books:

6. Operating System concepts – Silberchatz& Galvin, Addison Wesley, 6th Edn.
7. Modern Operating Systems – Tanenbaum, Pearson Edn. 2ndedn
8. Operating Systems – A.Godbole: TMH Pubilcations

Reference books:*Operating System –Milan Milenkovik*

1. Operating Systems, 3rd Edition by Gary Nutt, Pearson Education



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COURSE SEMESTER: III (C.B.C.S.)
BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Computer Organization and Architecture** Subject Code: **BTAI&ML-303T**

Load Th	Credits Th	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	3	30	70	100

Aim: To understand the basic principles and the working of Computer systems.

Prerequisite(s): Student should have basic knowledge of computers and mathematics.

Course Objectives:

1	How Computer Systems work & the basic principles
2	Ability to perform computer mathematical operations on arithmetic and floating point numbers.
3	To impart the knowledge on micro programming
4	How I/O devices are accessed and its principles.

Course Outcomes:

At the end of this course students are able to:

CO1	Understand the basic components of a computer, and the execution of complete instruction and design of control unit.
CO2	Perform mathematical operations on arithmetic and floating point numbers similar to the manner computer does.
CO3	Impart the knowledge on micro programming
CO4	Understand the concept of input/output and their organization.
CO5	Conceptualize the concepts of pipelining techniques and memory management.

SYLLABUS

Unit I: Functional blocks of a computer **[07 Hours]**

CPU, memory, input-output subsystems, control unit, Instruction set architecture of a CPU – registers, instruction execution cycle, addressing modes.

Unit II: Data representation **[07 Hours]**

Fixed and floating point representations, Computer arithmetic – integer addition and subtraction, carry look- ahead adder, multiplication – shift-and add, Booth multiplier, Division restoring and non-restoring techniques.

Unit III: CPU control unit design **[07 Hours]**

Hardwired and micro-programmed design approaches.

Memory system design: semiconductor memory technologies, memory organization

Unit IV Peripheral devices and their characteristics **[08 Hours]**

Input-output subsystems, I/O device

interface, I/O transfers – program controlled, interrupt driven and DMA, software interrupts and exceptions I/O device interfaces – USB,

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Unit V: **[07 Hours]**

Parallel Processors and Pipelining

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Text books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education

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COURSE SEMESTER: III (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **DATA STRUCTURES** Subject Code: **BTAI&ML-304T**

Load	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12] Hrs	**3+1=4**	30	70	100

Aim: To introduce and practice the implementation of various data structures used for indexing, searching, and sorting operations and also introduce basic mathematical techniques for algorithm analysis and design.

Prerequisite(s): Computer Programming Language knowledge

Course Objectives:

1	Students will construct and analysis various data structures and abstract data types including lists, stacks, queues, trees, and graphs.
2	Students will implement various sorting, searching, and hashing algorithms.
3	Students will build a substantial, complex data structure.

Course Outcomes:

At the end of this course Student are able to:

CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.
CO2	Describe common applications for stacks, queues [ABET (a, b, c)]
CO3	Understand basic applications for Linked List
CO4	Demonstrate different methods for traversing trees
CO5	Solve problem involving graphs, trees and heaps

SYLLABUS:

Unit I: **[7 Hours]**

Introduction: Basic Terminologies, Data Structure,Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

Unit II: **[7 Hours]**

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Unit III: **[7 Hours]**

Linked Lists: Singly linked lists: Representation in memory (Static & Dynamic), Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Unit IV: **[8 Hours]**

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis, Binary Heaps

Unit V: **[7 Hours]**

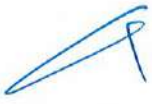
Graphs: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis: Breadth and depth first searches, connected component, spanning trees, shortest path–single source & all pairs , topological sort, Hamiltonian path.

Text books:

1. Data Structures with C, Seymour Lipschutz, Schaums Outlines, Tata McGraw Hill Education.
2. Data Structures using C and C++ by Y. Langsam, Pearson Education.
3. Data Structures using C by Tanenbaum, Pearson Education

Reference books:

1. Data Structures and program design in C by Robert Kruse, Bruce Leung & Clovis Tondo.
2. Data Structures: A Pseudocode Approach with C by Richard F. Gilberg and Behrou Forouzan.
3. Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni,Computer Science Press.
4. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.



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FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE
COURSE SEMESTER: III (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Data Structures Lab** Subject Code: **BTAI&ML-304P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	1	25	25	50

Aim: To introduce and practice the implementation of various data structures used for indexing, searching, and sorting operations and also introduce basic mathematical techniques for algorithm analysis and design.

Prerequisite(s): Computer Programming Language knowledge

Course Objectives:

1	To understand basic techniques and strategies of algorithms
2	To strengthen the ability to identify and apply the suitable data structure for the given real world problem
3	To analyze advanced data structure

Course Outcomes:

At the end of this course Student are able to:

CO1	Understand the ADT, hash tables and dictionaries to design algorithms
CO2	Choose most appropriate data structure and apply algorithms
CO3	Apply and analyze non linear data structure to solve real world complex problems
CO4	Apply and analyze algorithm design techniques
CO5	Analyze the efficiency of most appropriate data structure
CO6	Design and implement different algorithms

Programming Language/Tools to be used C++, JAVA, Python

Practical List: (Programs Based on following topics)

1. Array Implementation of List ADTs
2. Linked List Implementation of List ADTs
3. Array Implementation of Stack ADTs
4. Linked List Implementation of Stack ADTs
5. Array Implementation of Queue ADTs
6. Linked List Implementation of Queue ADTs
7. Applications of List : Polynomial Manipulation

8. Applications of Stack: Infix To Postfix Expression
9. Implementation of Binary trees And operations of Binary trees
10. Implementation of Binary Search Trees
11. Implementation of AVL Trees
12. Implementation of Heaps Using Priority Queues
13. Depth First Search
14. Breadth First Search
15. Applications of Graphs
16. Linear Search
17. Binary Search
18. Bubble Sort
19. Insertion Sort
20. Hashing With Separate Chaining
21. Hashing With Open Addressing

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FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE
COURSE SEMESTER: III (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Digital Circuits And Fundamentals Of Microprocessor** Subject Code: **BTAI&ML-305T**

Load	Credits Th	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	3	30	70	100

Prerequisites:

1. Differences between Analog and Digital Circuits.
2. Advantages of Digital Circuts over Analog Circuits.
3. Transistor concepts
4. Basics of all electronics components

Course Objectives

1. To acquaint students with various basic digital gates used in digital system and develop logical circuits using Boolean gates, construction of various logic circuits using basic gates.
2. To lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor.

Course Outcomes (CO's)

On completion of the course, student will be able to:

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design and evaluate combinational circuits.
3. Design and evaluate sequential circuits.
4. Understand the architecture of microprocessor for the basic operations
5. To understand architecture and features of 8086 Microprocessors.

SYLLABUS:

Unit I: (8 hours)

Boolean Algebra, Types of Number Systems, Types of Codes and Forms of Expression: Analog Vs. Digital Systems, Boolean Algebra, D' Morgan's Laws. Types of Number System: Decimal, Binary, Octal, He x, Type of Codes: Reflected (Gray), Self Complementary (Excess-3), BCD and ASCII codes, Conve rsion of Codes, Gates and their truth tables.

Forms of Expression: Sum of products and Product of Sums, Standard Sum of products and Product of Sums, Minterms and Maxterms, Karnaugh map: simplification of functions using K- map (up to 4 variables) and their implementation using logic gates.

Unit II: Combinational Circuits: (8 hours)

Decoders, Encoders. Priority Encoder, Multiplexers, Demultiplexers, Code converters. Implementation of Functions using Decoder. Arithmetic Circuits: Adder (Half and Full),

Subtractor (Half and Full). BCD adder / Subtrac tor, Concept of ALU.

Unit III: Types Flip Flops & Sequential Circuits: (7 hours)

SR, JK, Ma ster Slave JK, D and T. Race around Condit ion (Racing) and Toggling. Charac teristics Table and Excitation Table, Conversion of FlipFlop.

Sequential Circuits: Counters, Modulus of Counter, Types- Synchronous Counter and Asynchronous (Ripple) counter.

Unit IV: Architecture & Programming of 8085: (7 hours)

8085 microprocessor architecture, addressing modes, instruction sets,

Programming in 8085.

Unit V: Introduction to 8086: (6 hours)

Features, Architecture and addressing modes of 8086

Text Books:

1. Modern digital Electronics- R. P. Jain, McGraw Hill.
2. Digital Integrated Electronics- Herbert Taub, McGraw Hill.
3. Digital Logic and Computer Design- Morris Mano (PHI).
4. Digital Integrated Electronics- Herbert Taub, McGraw Hill.
5. Digital Electronics Logic and System – James Bingnell and Robert Donovan, Cengage Learning
6. Digital Circuits & Systems by K.R.Venugopal & K. Shaila
7. 8 bit Microprocessor by Ramesh Gaonkar.
8. 8 bit microprocessor & controller by V. J. Vibhute, Techmak Publication.

9. Microprocessor and interfacing : Douglas Hall

10. Advanced Microprocessors And Peripherals A.K.Ray ,K.M.Bhuchandi

11. 8085 Microprocessor & its Applications by A. Nagoor Kani, Mc Graw Hill.

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NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.)

DEGREE COURSE SEMESTER: III (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Digital Circuits and Fundamentals of Microprocessor Lab Subject Code: BTAI&ML-305P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	1	25	25	50

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NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.)

DEGREE COURSE SEMESTER: III (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Professional Skills I (Core Python) Subject Code: **BTAI&ML-306P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	**1**	25	25	50

Aim: To achieve programming skills using Python coding.

Prerequisite(s): Nil

Course Objectives:

1	To understand fundamentals of writing Python scripts
2	Learn core Python scripting elements such as variables and flow control structures.
3	Write Python functions to facilitate code reuse

Course Outcomes:

At the end of this course Student are able to:

CO1	To understand the environment of Python Programming
CO2	To apply the operation on conditions using simple programs
CO3	To analyze the different platform on the same conditions of program structures
CO4	To recognize built-in and User-defined module
CO5	To understand the use of inheritance
CO6	To apply handling of user defined exception

Programming Language/Tools to be used
Installing Anaconda 3
Jupyter Notebook
In addition similar platform Colab

Instructions

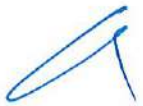
- Install and configure python IDE
- Basic operator's: Arithmetic, logical, Bitwise, Membership, Identity operators, python operator precedence, Control Flow, Conditional statement (if, if ...else, nested if), Looping in python (while, for, nested loops)

- Global variable & local variable. Modules: Writing modules, importing modules, importing objects from modules, python built-in modules (e.g. Numeric & mathematical module, functional programming module) namespace & scoping.
- Python package: Introduction, writing python package, using standard (e.g. math, scipy, numpy, matplotlib, pandas etc.) & User defined package.

Method overloading, Data hiding.
File Handling and Exception handling.

List of Programs:

1. Python and Pycharm Installation
2. Programs on basic control structures & loops.
3. Programs on operators & I/O operations.
4. Programs on Python Script
5. Programs on Lists.
6. Programs on Strings.
7. Programs on recursion & parameter passing techniques.
8. Programs on Tuples.
9. Programs using Python Dictionary
10. Programs on file Handling.
11. Programs on searching & sorting Techniques.
12. Programs on Exception handling concepts.
13. Programs on Testing.
14. Programs on NumPy and
15. Programs on Data Manipulation Using Pandas



RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: III(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Universal Human Values **Subject Code: BTAI&ML-307T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
24 Hrs	**2**	15	35	50

Aim: To inculcate sensitivity among students towards themselves and their surrounding including family, society and nature.

Prerequisite(s): Nil

Course Objectives:

1	Development of a holistic perspective based on self-exploration, about themselves (human being), family, society and nature/existence.
2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3	Strengthening human relationship.
4	Development of commitment and courage to act.

Course Outcomes:

At the end of this course Student are able to:

CO1	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
CO2	Students would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3	They would become sensitive to their commitment towards human relationship
CO4	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

SYLLABUS

Unit 1

[6 Hours]

Value education, definition, need for value education. The content and the process of value education, basic guidelines for value education, self-exploration as a means of value education, happiness and prosperity as part of value education.

Unit 2

[6 Hours]

Harmony of self with body, coexistence of self and body, understanding the needs of self and the needs of body, understanding the activities in the self and the activities in the body.

Unit 3

[6 Hours]

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships), Understanding meaning of Trust; Difference between intention and competence, Understanding harmony in society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Unit 4

[6 Hours]

Basics for ethical human conduct, defects in ethical human conduct, human rights violations and social disparities, value based life.

Text Book:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria,ExcelBooks, NewDelhi,2010

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Indian Ethos and Modern Management: Amalgam of the best of the ideas from the East and the West, B.L. Bajpai, New Royal Book Bo., Lucknow, 2004
4. Human society in ethics and politics, Bertrand Russel, Routledge Publications, 2009

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SEMESTER: III(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Environmental Science **Subject Code: BTAI&ML-308T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
24 Hrs	-		-	

Course Objectives:

1	Identify different types of air pollutions as well as explain their causes, detrimental effects on environment and effective control measures.
2	Recognize various sources of water pollutants and interpret their causes and design its effective control measure.
3	Illustrate various types of pollutants and waste management.
4	Analyze various social issues related to environment and challenges in implementation of environmental laws.

Learning Objective Learning Outcomes:

1. Student will be able to learn the natural sources available.
2. Students will also learn about ecosystem, biodiversity, pollution.
3. Student will also learn the effect on environment on social aspects and Human population.
4. The student on completion of course will understood the Ecosystem
5. Environmental issues related with social and human population.
6. Biodiversity and its conversion

UNIT-1 Air pollution and its control techniques: **[6 Hours]**

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle.

Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs).
Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

UNIT-2 Water pollution and its control techniques: **[6 Hours]**

Major sources of water pollution: Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplastics

Techniques to control water pollution: Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal and its utility.
Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills

UNIT-3 Other Environmental Pollution& Waste Management: **[6 Hours]**

Soil pollution: Soil around us, Soil water characteristics, soil pollution.

Causes, effects & control : noise pollution, nuclear & radiation hazards, marine pollution (Oil spills & Ocean Acidification)
Solid waste management: Composting, vermiculture, landfills, hazardous waste treatment, bioremediation technologies, conventional techniques (land farming, constructed wetlands), and phytoremediation.
Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

Unit-4 Social Issues and the Environmental Laws: **[6 Hours]**

Concept of Sustainable development
Water conservation, rain water harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns. Environmental Laws (brief idea only)
Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act

Issues involved in enforcement of environmental legislation.

Different government initiatives (brief idea only)- National ambient air quality standard 2009, Swachh Bharat Abhiyan, National afforestation program and Act- 2016, National River conservation plan and National Ganga River basin authority, Formation of National Green Tribunal

Activity

1. Field Trip & Report Writing
2. Case-study & Report Writing

Books suggested:

1. Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut

3. P Aarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth-Heinemann
4. D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd.
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6. Indian Environmental Law: Key Concepts and Principles edited by Shibani Ghosh, Publisher, Orient BlackSwan, 2019. ISBN, 9352875796.
7. P. Thangavel & Sridevi, Environemental Sustainability: Role of Green technologies, Springer publications

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Introduction to Artificial Intelligence — Subject Code: BTAI&ML-402T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**03**	**30**	**70**	**100**

Aim: To understand the basic principles and concepts of ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING.

Prerequisite(s): Student should have basic knowledge of computers and mathematics.

Course Objectives:

1	To create appreciation and understanding the achievements of AI and the theory underlying those achievements
2	To create an understanding of the basic issues of knowledge representation

Course Outcomes:

At the end of this course students are able to:

CO1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	To create an understanding of the basic issues of knowledge representation
CO4	Formulate and solve problems with uncertain information using Bayesian approaches.
CO5	Attain the capability to represent various real life problem domains using logic based techniques and

SYLLABUS

UNIT-I **[6 Hours]**

Introduction: What is AI? History & Applications, Artificial intelligence as representation & Search, Production system, Basics of problem solving: problem representation paradigms, defining problem as a state space representation, Characteristics.

UNIT-II **[7 Hours]**

Search Techniques: Uninformed Search techniques, Informed Heuristic Based Search, Generate and test, Hill-climbing, Best-First Search, Problem Reduction, and Constraint Satisfaction.

UNIT-III **[8 Hours]**

Knowledge representation: Knowledge representation Issues: First order logic, Predicate Logic, Structured Knowledge Representation: Backward Chaining, Backward Chaining, Resolution,Semantic Nets, Frames, and Scripts, Ontology.

UNIT-IV **[8 Hours]**

Uncertainty: Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, Baye's Rule and conditional independence, Bayesian networks, Exact and Approximate inference in Bayesian Networks, Fuzzy Logic.

Intelligent Agents: Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

UNIT-V **[7 Hours]**

Learning: What is learning?, Knowledge and learning, Learning in Problem Solving, Learning from example, learning probabilistic models

Expert Systems: Fundamental blocks, Knowledge Engineering, Knowledge Acquisition, Knowledge Based Systems, Basic understanding of Natural language

Text Books:

1. E.Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008.
2. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
3. Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers
4. Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3rd Edition

Reference Books:

1. Introduction to Artificial Intelligence – Charniak (Pearson Education)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Theory of Computation** Subject Code: **BTAI&ML-404T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12] Hrs	**3+1=4**	**30**	**70**	**100**

Aim: It deals with how efficiently problems can be solved on a model of computation using an algorithm.

Prerequisite(s): Students entering this course should have a strong background in Discrete Mathematics, and basics of Data Structures and Algorithms.

Course Objectives:

1	To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2	To illustrate finite state machines to solve problems in computing
3	To explain the hierarchy of problems arising in the computer sciences.
4	To familiarize Regular grammars, context frees grammar.

Course Outcomes:

At the end of this course Student are able to:

CO1	To know key notions of computation, such as algorithm, computability, decidability, reducibility, and complexity, through problem solving.
CO2	To function effectively as a member of a team in order to accomplish a common goal.
CO3	To function effectively as a member of a team in order to accomplish a common goal.
CO4	To apply design and development principles in the construction of software systems of varying complexity.
CO5	To define more powerful computing models.
CO6	To solve various problems of applying normal form techniques.

SYLLABUS

UNIT I: **[7 Hours]**

Strings, Alphabet, Language operations, Finite state machine definitions, Finite automation model, Acceptance of strings and language, Non deterministic finite automation, Deterministic finite automation, Equivalence between NFA and DFA, Conversion of NFA into DFA, Moore and Mealy machines

UNIT II: **[8 Hours]**

Regular sets, Regular expressions, Identity rules, Manipulation rules, Manipulation of regular expressions, Pumping lemma, Closure properties of regular sets(proofs not required), Chomsky hierarchy of languages, Regular grammars, Right linear and left linear grammars, Equivalence between regular linear programming and FA.

UNIT III: **[7 Hours]**

Context free grammar, Derivation trees, Chomsky normal form, Greibach normal form, Push down automata, Definition, Model acceptance of CFL, Equivalence of CFL and PDA, Inter conversion, Closure properties of CFL(Proofs omitted),Pumping Lemma of CFL .

UNIT IV: **[7 Hours]**

Turing Machine: Definition, Model of TM, Design of TM, Universal Turing Machine, Computable function, Recursive enumerable language, Types of TM"s (proofs not required), Linear bounded automata and Context sensitive language.

UNIT V: **[7 Hours]**

Decidability and Undecidability of problems, Properties of recursive & recursively enumerable languages, Halting problems, Post correspondence problem, Ackerman function, and Church"s hypothesis, Recursive and Primitive Functions, Bounded Minimization, Unbounded Minimization.

Text books:

1. Introduction to Automata Theory, Languages and Computation by J. E. Hopcraft,R. Motwani, J. D Ullman, second Edition, Pearson Education, Aisa
2. An Introduction to Formal Languages and Automata by Peter Linz
3. Introduction to Langauges and the theory of Automata by John Martin, Third Edition (TMH)

Reference books:

1. Theory of Computer Science, Automata, Languages and Computation by K. L. P. Mishra and N. Chandrasekaran, Third Edition, PHI Learning.
2. Elements of Theory of Computation by Lewis H.P and Papadimition C.H

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Mathematical Foundation for AI & ML **Subject Code: BTAI&ML-401T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs(Theory)	3	30	70	100

Aim: To understand the basic mathematical concepts of data science.

Prerequisite(s): -

Course Objectives:

1. To develop the understanding of theory of probability and its applicability in data science
2. To derive inference by using concepts of sampling theory and testing of hypothesis.
3. To formulate mathematical models of real world problems.

Course Outcomes : Students will be able to

1. Apply the concepts of probability. Understand the random variables and probability functions.
2. Analyze the data of real world problems using special probability distributions and Mathematical expectations.
3. understand concepts of sampling theory and estimation which is used in the field of data science.
4. Learn the techniques of testing hypothesis and apply it to test the significance of various data samples.
5. Apply the concept of Regression analysis to mathematical model generated by various data samples.

SYLLABUS

Unit I : Theory of Probability and Mathematical Expectation **(8 Hrs)**

Probability: Review of probability of an event, Conditional probability, Baye's rule, Review of discrete and continuous random variables, Joint probability function and Joint probability distribution of DRV, Marginal probability function and Conditional distribution of DRV.

Mathematical Expectation (DRV): Mathematical expectation, Variance and Standard deviation, Moments, Moment generating function, Expectation, Variance and Covariance of Joint Distribution, Measures of central tendency: Mean, Median, Mode, Skewness and Kurtosis.

Unit II: Special Probability Distributions **(7Hrs)**

Introduction to discrete and continuous distributions, Geometric distribution, Binomial distribution,Poisson distribution, Normal distribution, Exponential distribution, Uniform distribution.

Unit III : Sampling Theory and Estimation **(7Hrs)**

Sampling Theory: Definition of population, sampling, static parameter, Types of sampling,Expectedvalues of sample mean and variance, Standard error, Sampling distribution of meanandsampling distribution of variance.

Estimation: Estimation of parameters, Point estimation,Interval estimation, Bayesian estimation.

Unit IV : Testing of Hypothesis **(7Hrs)**

Hypothesis, Null hypothesis, Alternative hypothesis, Testing a hypothesis, Level of significance,Confidence limits, Test of significance of difference of means, t-test, F-test and Chi-squaretest, One way and two way Analysis of Variance (ANOVA).

Unit V : Multidimensional Analysis **(7 Hrs)**

Multiple Linear Regression Model: Least square estimation, R^2 and adjusted R^2 coefficients, Problem of multi-colinearity, Regression equation of three variables, Lasso regression, Ridge regression.

Factor Analysis: Centroid method, Principal component method.

Cluster Analysis: Non-hierarchical clustering, Hierarchical clustering.

Text/ Reference Books:

(1) Advanced Engineering Mathematics (Wiley), Erwin Kreyzig.
(2) Higher Engineering Mathematics (Khanna Publishers), B. S. Grewal.
(3) Advanced Engineering Mathematics (S. Chand), H. K. Dass.
(4) Probability and Statistics (Schaum's Outline Series), Murray Spiegel, John Schiller, R. A. Srinivasan.
(5) Fundamentals of Statistics (Himalaya Publishing House), S. C. Gupta.
(6) Research Methodology Methods and Techniques (New Age Publications), C.R. Kothari, Gaurav Garg.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: **Object Oriented Programming using Java** Subject Code: **BTAI&ML-405T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	3	30	70	100

Aim:

This course explains the fundamental ideas behind the object-oriented approach to programming. Knowledge of java helps to create the latest innovations in programming. Like the successful computer languages that came before, java is the blend of the best elements of its rich heritage combined with the innovative concepts required by its unique environment. This course involves OOP's concepts, java basics concepts, inheritance, polymorphism, interfaces, inner classes, packages, Exception handling, multithreading and objects Oriented Methodology basic concepts.

Prerequisite(s): Knowledge of structure programming language and

Application development Course Objectives:

1	To impart fundamentals of object-oriented programming in Java, including defining object and classes
2	To inculcate concepts of inheritance to create new classes from existing one, Design & implement various forms of inheritance and to analyze the Programming through examples.
3	To familiarize the concepts of packages and interfaces & to demonstrate the concept of String Handling
4	To Explore exception handling and various Concepts of Multithreading & to understand the basic concept of Object Oriented Methodology

Course Outcomes:

At the end of the course students will be able to:

1	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in Java
2	Design and develop concept of Inheritance and Polymorphism.
3	Design and object oriented system with packages and interfaces.
4	To demonstrate the concept of String handling
5	Design an object-oriented system, AWT components and multithreaded processes as per needs and Specifications

SYLLABUS

UNIT – I **[7 Hours]**

Java Basics: Basics of objects and classes in java: Constructors, Visibility modifier, History of Java, JVM architecture, Data types, Variables, arrays, operators, control statements .Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

UNIT – II **[7 Hours]**

Inheritance And Polymorphism: Basic concepts of Inheritance, Types of inheritance, Member access rules, this keyword, Super keyword, Method Overloading, Method overriding, abstract classes, final keyword.

UNIT – III **[8 Hours]**

Interfaces And Packages: Defining an interface, implement interfaces, accessing implementations through interface references, Extending interface. Packages: Defining, creating and accessing a package, understanding Class path, importing packages.

UNIT – IV **[7 Hours]**

I/O Streams: Concepts of streams, Stream classes- Byte and Character stream, reading console Input and Writing Console output, File Handling.

UNIT – V **[7 Hours]**

Multithreading in java : Thread life cycle and methods, Runnable interface, Thread synchronization, Exception Handling: Benefits of exception handling, the classification of exceptions , exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally.

Text Books:

1. C++: The Complete Reference, by Herbert Schildt4th edition Mc-Graw-Hill.
2. The C++ Programming Language by BjarneStroustrupe 3rd edition Pearson EducationHerbert Schildt, "Java the complete reference", McGraw Hill, Osborne, 7th Edition, 2011.
3. T.Budd, "Understanding Object- Oriented Programming with Java", Pearson Education, Updated Edition (New Java 2 Coverage), 1999.
4. Object Oriented Modeling and Design by James Rumbaugh, Michal Blaba, William Premerlani, Frederic Eddy, William Lorerson, PHI, 1997

Reference Books:

1. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, Pearson Education, India.

2. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
3. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.
4. Object Oriented Programming with C++ by E Balagurusamy, Fifth Edition, TMH.

NAGPUR FOUR YEAR BACHELOR OF ENGINEERING
(B.TECH.)

DEGREE COURSE

SEMESTER: IV (C.B.C.S.) BRANCH:

ARTIFICIAL INTELLIGENCE AND

MACHINE LEARNING

Subject: **Professional Skills II (Java)** Subject Code: **BTAI&ML-405P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	**1**	**25**	**25**	**50**

Aim:

Object oriented Programming with java is intended for software engineers, systems analysts, program managers and user support personnel who wish to learn the Java programming language. Java programming aims to implement real-world entities like inheritance, hiding, polymorphism, etc in programming. The main aim of OOP is to bind together the data and the functions that operate on them so that no other part of the code can access this data except that function

Prerequisite(s): Experience with a high level language C & Programming Fundamentals, is a prerequisite

Course Objectives:

1	The objectives of the course are to have students identify and practice the java programming concepts and techniques, practice the use of java classes and class libraries, arrays, vectors, inheritance and file I/O stream concepts
2	The objective of course is to develop programming skills of students, using object oriented programming concepts, learn the concept of class and object using java and develop classes for simple applications

Course Outcomes:

At the end of this course Student are able to:

CO1	Identify classes, object, and members of a class using the concept of java programming.
CO2	Create a java application program using OOP principles and proper program structuring.
CO3	Analyze, write, debug, and test basic OOPS with java codes using the approaches introduced in the course.
CO4	Demonstrate the concepts of polymorphism and inheritances.
CO5	To demonstrate the concept of String handling.
CO6	Create java program to implements error handling techniques using exception handling

Programming Language/Tools to be used
Hardware Requirement: Desk Top Computer

Software Requirement: Linux Operating System with g++ or eclipse

Practicals:

1. Programs using constructor and destructor.
2. Creation of classes and use of different types of functions.
3. Count the number of objects created for a class using static member function.
4. Write programs on interfaces.
5. Write programs on packages.
6. Write programs using function overloading.
7. Programs using inheritance.
8. Programs using IO streams.
9. Programs using files.
10. Write a program using exception handling mechanism.
11. Programs using AWT
12. Programs on swing.
13. Programs using JDBC.
14. Database Connectivity

Instructions

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY,NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Database Management System Subject Code: **BTAI&ML-403T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**3**	**30**	**70**	**100**

Course Objectives:

1	To explain basic database concepts, applications, data models, schemas and instances.
2	Describe the basics of SQL and construct queries using SQL.
3	To emphasize the importance of normalization in databases.
4	To facilitate students in Database design

Course Outcomes:

At the end of this course Student are able to:

CO1	Apply the basic concepts of Database Systems and Applications.
CO2	Understand database concepts and structures and query language
CO3	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
CO4	Understand Functional Dependency and Functional Decomposition.
CO5	Understand query processing and techniques involved in query optimization and the principles of storage structure and recovery management.

UNIT I: **[7 Hours]**

General introduction to database systems, Database-DBMS distinction, Approaches to building a database, Data models, Three-schema architecture of a database, various components of a DBMS, Data Abstraction, Data Independence, E/R Data model. SQL Concept.

UNIT II: **[7 Hours]**

Relational Data Model, Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys, Relational algebra operators, Tuple relation calculus.

UNIT III: **[7 Hours]**

Physical and logical hierarchy Concept of index, B-trees,Concepts of Functional dependency, Normalization, Business data analysis.

UNIT IV: **[7 Hours]**

Overview: Query Processing and Optimization, measures of query cost estimation in query optimization, Structure of query evaluation plans.

UNIT V: **[8 Hours]**

Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log based recovery, Locking mechanism, deadlock, two-phase locking protocol, Isolation. Recovery System: failure classification, recovery and atomicity, log based recovery, checkpoints, buffer management, Introduction to Web databases.

Text books:

1. Database System Concepts by AviSilberschatz, Henry F. Korth , S. Sudarshan, Tata McGraw Hill, Fifth Edition
2. Fundamentals of Database Systems – Elmasiri and Navathe, Addison Wesley, 2000.
3. An introduction to Database Systems,C J Date,A.Kannan,S.Swamynathan –Eight Edition.

Reference books:

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

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY,
NAGPUR FOUR YEAR BACHELOR OF ENGINEERING
(B.TECH.)

DEGREE COURSE

SEMESTER: IV (C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Database Management System **Subject Code: BTAI&ML-403P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	**1**	**25**	**25**	**50**

Aim: This course introduces the core principles and techniques required in the design and implementation of database systems

Course Objectives:

1	To explain basic database concepts, applications, data models, schemas and instances.
2	To demonstrate the use of constraints and relational algebra operations
3	To emphasize the importance of normalization in databases
4	To facilitate students in Database design

Course Outcomes:

At the end of this course Student are able to:

CO1	Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
CO2	Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
CO3	Formulate, using SQL, solutions to a broad range of query and data update problems.
CO4	Use a desktop database package to create, populate, maintain, and query a database.
CO5	Demonstrate a rudimentary understanding of programmatic interfaces to a database and be able to use the basic functions of one such interface.
CO6	Analyze an information storage problem and derive an information model expressed in the Form

Programming Language/Tools to be used: SQL PLUS, ORACLE, MY SQL

List of Experiments:

1. Introduction to MYSQL
2. Data Definition Language(DDL) commands
3. Data Manipulation Language (DML)
4. Sub Queries and Joins
5. Views
6. Procedures
7. PL-SQL

8. Cursors
9. Triggers
10. Exception Handling
11. Sub-Programs, Procedures
12. Normalization
13. Checking Normalization
14. Java –Mysql Database Connectivity
15. PHP-Mysql Database Connectivity

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE
SEMESTER: IV (C.B.C.S.)
BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject:: **Microcontroller And Embedded Systems** Subject Code: **BTAI&ML-406T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12] Hrs	**3+1=4**	**30**	**70**	**100**

Prerequisites:

1. Digital Circuits & Microprocessor concepts and applications
2. Assembly language concepts
3. Operating system concepts
4. Basics of all electronics components

Course Objectives:

1. To study fundamentals of microcontroller systems.
2. To study architecture of microcontroller & to understand the concept of memory organization. stack memory.
3. To study Assembly language programming & interfacing of microcontroller with different peripheral devices.
4. To give sufficient background for understanding embedded systems design.

Outcome:

After completing this course students shall be able to:

6. Describe internal organization of 8051 microcontrollers.
7. Describe the concept of addressing modes and assembly language programming of 8051 microcontroller.
8. Interface 8051 with various peripheral devices.
9. Understand basic concept of embedded systems.
10. Describe several communication devices and Buses.

SYLLABUS

Unit 1: Introduction to Microcontroller: (7 Hours)

8-bit Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. , Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures,Data and Program Memory

Unit 2 : Instruction Set and Programming (7 Hours)

Addressing modes: Introduction, Instruction syntax, Data types, Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Counters/Timers, Serial port and Interrupts of 8051, Assembly language programs

Un i t 3: Memory and I/O Interfacing (8 Hours)

Interfacing of external RAM & ROM with 8051, I/O expansion using 8255, Interfacing keyboard, LEDdisplay, ADC & DAC interface, stepper motor interface

Unit 4: Introduction to Embedded System: (7 Hours)

Embedded system vs General computing system, History of Embedded system, Classification of ES, Skills required in Embedded system design, Design metrics, Characteristics and quality attributes of Embedded system.Processor used in Embedded system, Embedded hardware units and devices in a system,Embedded software in a system, examples of embedded system, Design process in ES,

Unit 5: Devices and Communication: (7 Hours)

Serial Communication devices, Parallel device port, Serial Communication standards and Buses: I2C, UART,USART, CAN Bus

Devices : Wireless Devices, Timer and Counting Devices, Watch Dog Timer, Real Time Clock

Text / References:

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The8051Microcontroller and Embedded Systems: UsingAssembly and C",Pearson Education, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning,2004.
3. The 8051 Microcontroller Based Embedded System By Manish K. Patel TMH.
4. Embedded System Architecture, Programming and Design by Raj Kamal, 3rd Edition TMH.
5. Introduction to Embedded System by Shibu K. V. 3rd Edition TMH

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Microcontroller And Embedded Systems Lab

Subject Code: BTAI&ML-406P

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	**1**	**25**	**25**	**50**

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

SEMESTER: IV(C.B.C.S.)

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject: Internship **Subject Code: BTAI&ML-407P**

Load	Credit	College Assessment Marks	University Evaluation	Total Marks
1 Hrs	1	50	-	50

Internship (Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship for 2- 3 week)