GURU KASHI UNIVERSITY

B. Voc.in – Artificial Intelligence & Machine Learning

Session: 2024-25

Department of Computer Science & Engineering

Semester: IV						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BMA401	Introduction to Machine Learning with Python	Core	4	0	0	4
BMA402	Java Programming	Core	4	0	0	4
BMA403	Relational Database Management System	Core	4	0	0	4
BMA404	Introduction to Robotics	Core	4	0	0	4
BMA405	Relational Database Management System Lab	Skill based	0	0	2	1
BMA406	Introduction to Machine Learning with Python Lab	Skill based	0	0	4	2
BMA407	Java Programming Lab	Skill based	0	0	2	1
BMA499	xxx	MOOC	0	0	0	3
Discipline Elective-II(Any one of the following)						
BMA408	Data ware housing & Data Mining	Discipline Elective-II	3	0	0	3
BMA409	Big Data					
Total			**18**	**0**	**8**	**26**

Semester: IV

Course Title: Introduction to Machine Learning with Python	L	T	P	Credits
Course Code: BMA401	4	0	0	4

Total Hours- 60

Learning Outcomes: After completion of this course, the learner will be able to:
1. The students will be able to handle various datatypes and datasets in python.
2. They will also be able to implement various machine learning models in python.

Course Content

UNIT I   **10 Hours**

Introduction to Python: Data Types, Operators, Expression, Indexing & Slicing, Strings, Conditionals, Functions, Control Flow, Nested Loops, Sets & Dictionaries.

UNIT II   **20 Hours**

Introduction to Machine Learning: Machine Learning Vs Statistical Modelling, Supervised vs Unsupervised Learning, Supervised Learning Classification, Unsupervised Learning, Reinforcement Learning, Applications, Python libraries suitable for Machine Learning: Pandas, Numpy, Scikit-learn, visualization libraries: matplotlib etc.

UNIT III   **15 Hours**

Regression: Simple Linear Regression, Multiple Linear Regression, Non-linear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models

Classification: Introduction to Classification, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Logistic regression vs Linear regression, Evaluation Metrics in Classification.

UNIT IV   **15 Hours**
Unsupervised Learning: Intro to Clustering, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering.

Transaction Modes
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings
- Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
- Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer (2009) (freely available online)
- Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
- Tamodt, Agnar, and Enric Plaza. "Case-based reasoning: Foundational issues, methodological variations, and system approaches." AI communications

Course Title: JAVA PROGRAMMING	L	T	P	Credits
Course Code: BMA402	4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Discuss the basic concepts of java like if-else, control structures, array and strings.
2. Classify the structure and model of the Java programming language.
3. Synthesize Java programming language for various programming technologies
4. Develop software in the Java programming language on different platforms.

Course Content

UNIT I   **15 Hours**

An overview of Java: Object oriented programming, Two paradigms, abstraction, the OOP principles, Java class libraries

Date types, variables and arrays: Integers, floating-point types, characters, Boolean, Iterates, Variable, Data types and casting, array operators.

Operators: Arithmetic operators, bit wise operators, relational operators, Boolean logical operators, assignment operators, operator precedence

Control Statement: Java's selection Statement, iteration Statement, jumps Statement.

Introduction to classes: Class fundamentals, declaring object reference variable, introducing methods, constructors, the keywords, garbage collection, the finalize () method.

Methods and Classes: Overloading methods, using objects as parameters, recursion.

UNIT II   **15Hours**

Inheritance: Inheritance basics, using super, method overriding, dynamic method dispatch, using abstract Classes, using final with inheritance, Package and Interfaces, Package protection, importing packages

Exception handling: Exception handling fundamentals, Exception types, Uncaught Exceptions, using try and catch, multiple catch clauses, nested try Statement throw, and finally Java built in exception creating your own exception, sub classes, using exceptions

UNIT III   **15 Hours**

Multithreaded Programming: The Java thread model, the main thread, creating thread, creating multiple thread, using is alive () and join (). Thread priorities, synchronization, inter thread communications, suspending resuming and stopping thread using multithreading.

String handling: The string constructor, string length, special string operator character extraction, string comparison, searching string, modifying string, data conversion, changing the case of characters, string buffer.

UNIT IV **15Hours**

Networking: Networking basics, Java and the Internet Address, TCP/IP client Sockets URL, URL connection, TCP/IP server Sockets, the Applet Class. Stream API

The Applet Class: Architecture displays method, The HTML APPLET, Passing parameters to Applet. The get Documentation Base () and get Code Base () methods Applet Context and Show Document ().

Micro servicing: Standards and Syntax, Advantages of Micro services, Java Micro Services Framework, Spring Cloud and Spring Boot, Different strategies used in Micro service deployment, Domain-Driven Design containers in Microservices, Contract Testing, Monolithic, SOA, and Micro Services Architecture, Docker, DC, Bounded Context

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning **Suggested Readings**

- *McGraw-Hill. (1999). Java 2 Computer Reference. Tata McGraw Hill.*
- *Horstmann. (2018). Core Java-I. Addison Wesley.*
- *E Balagurusami. (2006). Programming with JAVA. Tata McGraw-Hill Education.*
- *Ken Arnold, James Gosling and David Holmes, "The Java Programming Language", 4th ed, 2005.*
- *Bruce Eckel, "Thinking in Java", 4th ed, 2007.*

Web Links

- *https://www.codementor.io/@sureshatta/11-websites-that-help-   Java Programming*
- *https://www3.ntu.edu.sg/home/ehchua/programming/howto/References.html- Java Programming*
- *https://www.tradepub.com/free-offer/advanced-java-tutorial/w_java34?sr=hicat&_t=hicat:827- Java Programming*

Course Title: RELATIONAL DATABASE MANAGEMENT SYSTEM

Course Code: BMA403

L	T	P	Credits
4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:
1. Develop the queries using SQL, solutions to a broad range of query and data update problems.
2. Describe various database concepts and database management system software.
3. Understand the major DBMS components and their function.
4. Design a model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.

Course Content

UNIT I   **15 Hours**

Database Management: Introduction, Types of DBMS and their advantages and disadvantages, Characteristics of Database Approach, Data Models, Data Abstraction and Knowledge Representation, Database Language.

DBMS Architecture and Data Independence: Attributes and Keys, Relationships, Relationship Types, Roles, ER Diagrams, Relational Model concepts, functional dependence.

UNIT II   **15 Hours**

SQL, PL SQL, SQL *PLUS, Managing Database and Queries: Creating, Defining and Modifying Table structure, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations, Example of Queries in Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus, granting and revoking privileges.

UNIT III   **15 Hours**

Normalization: Overview of Recovery and Backup, Normalization & its forms. **Transaction:** Processing Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes. Database recovery.

UNIT IV   **15 Hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, Integrity in Data Base. Types of Integrity, SQL injection.

SQL Server: Introduction to SQL Server and Oracle Server, Indexes, Views, Cursors, Packages, Triggers, Stored Procedures.

No SQL: Introduction to NoSQL, Key Features, Advantages and Disadvantages of NoSQL, Types of NoSQL database.

Non-relational data and NoSQL: Document data stores, columnar data stores, Key/value data stores, Graph data stores, Object data stores, External index data stores, typical requirements.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning **Suggested Readings**

- *J. D. Ullman,Computer Science Press. (2016). Principles of Database and Knowledge– Base Systems. Vol1*
- *R. Elmasri and S. Navathe,Pearson Education.(1905). Fundamentals of Database System.5th Edition*
- *Serge Abiteboul, Richard Hull, Victor Vianu,Addison-Wesley. (1995). Foundations of Databases Reprint.*
- *Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning-Course Technology, Seventh Edition, 2007.*
- *Shio Kumar Singh, Database Systems Concepts, Designs and Application, Pearson Education, Second Edition, 2011.*

   Web Links

   - https://cloud.google.com/learn/- Relational Database Management System
   - https://codeinstitute.net/global/blog/what-is-a-relational-database-management-system/- Relational Database Management System
   - https://zenkit.com/en/blog/everything-you-need-to-know-about-web-databases/- Relational Database Management System

Course Title: Introduction to Robotics

Course Code: BMA404

L	T	P	Credits
4	0	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:
1. Understand the basics of robotics
2. Understand game playing concepts involving robotics and AI.
3. Apply robotics to create robot driven systems.
4. Analyze and co-relate robotics with AI and use in real-world applications

Course Content

UNIT I   **15 Hours**

Introduction: Introduction to Robotics Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis and Forces, Robot Programming languages & systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

UNIT II   **10 Hours**

Need of AI in Robotics: History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.

UNIT III   **15 Hours**

Game Playing: AI and game playing, plausible move generator, static evaluation move generator, game playing strategies, problems in game playing.

UNIT IV   **20 Hours**

Robotics fundamentals: Robot Classification, Robot Specification, notation, kinematic representations and transformations, dynamics techniques; trajectory planning and control.

Robotics and Its applications: DDD concept, Intelligent robots, Robot anatomy- Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot, Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system

Suggested References:
1.   Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke, Springer,

2011.

2.   Robotics: Everything You Need to Know About Robotics from Beginner to Expert, Peter McKinnon, Createspace Independent Publishing Platform, 2016.

3. Introduction to AI Robotics, Second Edition, By Robin R. Murphy, MIT press, 2001.

4.   Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques, Francis X. Govers, Packt Publishers, 2018.

Course Title:

RELATIONAL DATABASE MANAGEMENT SYSTEM LAB

Course Code: BMA405

L	T	P	Credits
0	0	2	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:
1. Explain the features of database management systems and Relational database.
2. Design conceptual models of a database using ER modeling or real-life Applications and also construct queries in Relational Algebra.
3. Create and populate a RDBMS for a real-life application, with constraints and keys, using SQL.
4. compile any type of information from a data base by formulating complex queries in SQL.

Course Content

List of Experiments:
1. Introduction to SQL and installation of SQL Server / Oracle.
2. Data Types, Creating Tables and Retrieval of Rows using Select Statement, Conditional Retrieval of Rows, Alter and Drop Statement.
3. Working with Null Values, matching a Pattern from a Table, Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statement.
4. Set Operators, Nested Queries, Joins, Sequences.
5. Views, Indexes, Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands.
6. PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing, Non-SQL parameters.
7. Stored Procedures and Exception Handling.
8. Triggers and Cursor Management in PL/SQL.
9. Suggested Tools – My SQL, DB2, Oracle, SQL Server 2012

Course Title:

Introduction to Machine Learning with python LAB

Course Code: BMA406

L	T	P	Credits
0	0	4	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:
The students will be able to handle various datatypes and datasets in python. They will also be able to implement various machine learning model sin python.

Course Content

List of Experiments:
1. Classification and regression algorithms.
2. Artificial Neural Network (with back-propagation).
3. Mathematical computing with Python packages like: numpy, Mat-plotLib, pandas Tensor Flow, Keras.
5. Implement basic ML models like SVM, KNN, K-Means, Logistic Regression, Linear Regression

Course Title: **JAVA PROGRAMMING LAB**	**L**	**T**	**P**	**Credits**
Course Code: BMA407	**0**	**0**	**2**	**1**

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Solve the computational problems using basic statements like if-else, control structures, array, and strings.
2. Learn about the user requirements for software functionality and Run software applications in Java programming language.
3. Know about basic principles of creating Java applications with Applet programming.
4. Develop a given program using the basic elements like Control and Conditional statements

Course Content List

of Programs:

1. Introduction to JAVA, its features & basic program
2. Write a program for Operators in JAVA
3. Write a program to show use of IF-Else Statements in JAVA
4. Write a program use switch case in JAVA
5. Write a program to use looping in JAVA
6. Write a program to use methods in JAVA
7. Write a program to create class and objects
8. Write a program to use Method Overloading a method overriding
9. Write a program to use Final Keyword.
10. Write a program to show Implementation of Array.
11. Write a program to show Implementation of Inheritance
12. Write a program to show creation and use of package
13. Write a program to show use of Interface
14. Write a program to apply replace, concate methods on String.
15. Write a program to sort strings of array
16. Write a program to Show Implementation of Threads
17. Write a program to create applet
18. Write a program to create applet with passing parameters
19. Write a program to show use of Exception Handling
20. Write a program to make usage of JAVA lang.awt package and design GUI.
21. Usage of event handling in Java GUI (Graphical user interface) programs.

L	T	P	Credits
3	0	0	3

Course Title: Data ware Housing & Data Mining

Course Code: BMA408

Total Hours: 45

Course Learning Outcome: On successful completion of this course, the students will be able to:

1. Design and deploy appropriate classification techniques
2. Cluster the high dimensional data for better organization of the data
3. Discover the knowledge imbibed in the high dimensional system
4. Evolve Multidimensional Intelligent model from typical system
5. Evaluate various mining techniques on complex data objects

Course Content

UNIT-1   **10 Hours**

Need for strategic information, difference between operational and Informational data stores Data warehouse definition, characteristics, Data warehouse role and structure, OLAP Operations, Data mart, Different between data mart and data warehouse, Approaches to build a data warehouse, Building a data warehouse, Metadata & its types.

UNIT-II   **10 Hours**

Data Pre-processing: Need, Data Summarization, Methods. De-normalization, Multidimensional data model, Schemas for multidimensional data (Star schema, Snowflake Schema, Fact Constellation Schema, Difference between different schemas. Data warehouse architecture, OLAP servers, Indexing OLAP Data, OLAP query processing, Data cube computation

UNIT-III   **10 Hours**

Data Mining: Definition, Data Mining process, Data mining methodology, Data mining tasks, Mining various Data types & issues. Attribute-Oriented Induction, Association rule mining,

Frequent itemset mining, The Apriori Algorithm, Mining multilevel association rules.

UNIT-IV **15 Hours**

Overview of classification, Classification process, Decision tree, Decision Tree Induction, Attribute Selection Measures. Overview of classifier's accuracy, Evaluating classifier's accuracy, Techniques for accuracy estimation, increasing the accuracy of classifier. Introduction to Clustering, Types of clusters, Clustering methods, Data visualization & various data visualization tools.

Suggested Readings

1. Data Warehousing, Data Mining &Olap by Berson, Tata McGraw- Hill.

2.   Han J., Kamber M. and Pei J., Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.

3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.

4. Adriaans P., Zantinge D., Data mining, Pearson education press (1996), 1st Ed.

5.   Pooniah P., Data Warehousing Fundamentals, Willey interscience Publication, (2001)

L	T	P	Cr
3	0	0	3

Course Title: Big Data Course

Code: BMA409

Total Hours:45

Course Learning Outcome Outcomes: On successful completion of this course, the students will be able to:

1. Develop a dynamic webpage by using java script.

2. Connect a java program to a DBMS.
3. Design a well formed and valid XML and DHTML document.

4. Write a server side java application called Servlet to update and delete operations on DBMS table.
5. Design a page for internal links; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.

Course Content

UNIT-I   **10 Hours**
Introduction to Big Data: Overview of Big Data, Stages of analytical evolution, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs. Reporting, Modern Data Analytic Tools, Statistical Concepts: Sampling Distributions - Re-Sampling, Statistical Inference - Prediction Error

UNIT-II   **10 Hours**
Mining Data Streams: Introduction To Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform(RTAP) Applications

UNIT-III   **15 Hours**
Hadoop: History of Hadoop, The Hadoop Distributed File System, Components of Hadoop, Analyzing the Data with Hadoop, Scaling Out- Hadoop Streaming, Design of HDFS-Java interfaces to HDFSBasics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run-Failures, Job Scheduling-Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features

UNIT-IV   **10 Hours**
Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig Hive services, HiveQL, Querying Data in Hive, Fundamentals of HBase and Zookeeper, Visualizations: Visual data analysis techniques, interaction techniques. Systems and applications

Suggested Readings

1. Michael Berthold, David J. Hand.(2007*). Intelligent Data Analysis. Springer.*
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos.(2012).*Understanding Big Data: Analytics for Enterprise ClassHadoop and* Tom White, Hadoop.(2012). *The Definitive Guide Third Edition. O'reillyMedia.*
3. AnandRajaraman and Jeffrey David Ullman.(2012). *Mining of Massive Datasets.* Cambridge UniversityPress.
4. Bill Franks. (2012*). Taming the Big Data Tidal Wave: Finding Opportunitiesin Huge Data Streams with Advanced B Analytics.* JohnWiley&sons.