RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Artificial Intelligence and Data Science, IV- Semester

Branch- Common to All Discipline

BT401	**Mathematics-III**	**3L-1T-0P**	**4 Credits**

OBJECTIVES: The objective of this course is to fulfill the needs of engineers to understand applications of Numerical Analysis, Transform Calculus and Statistical techniques in order to acquire mathematical knowledge and to solving wide range of practical problems appearing in different sections of science and engineering. More precisely, the objectives are:

- To introduce effective mathematical tools for the Numerical Solutions algebraic and transcendental equations.
- To enable young technocrats to acquire mathematical knowledge to understand Laplace transformation, Inverse Laplace transformation and Fourier Transform which are used in various branches of engineering.
- To acquaint the student with mathematical tools available in Statistics needed in various field of science and engineering.

Module 1: Numerical Methods – 1: (8 hours): Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Module 2: Numerical Methods – 2: (6 hours): Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.,

Module 3: Numerical Methods – 3: (10 hours): Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender- Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Module 4: Transform Calculus: (8 hours): Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

Module 5: Concept of Probability: (8 hours): Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution:

Normal Distribution, Exponential Distribution.

Textbooks/References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
9. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. Statistics

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Artificial Intelligence and Data Science, IV- Semester

AD402: Database Management System

Course Outcomes: After completion of the course students will be able to

1. Understand the different issues involved in the design and implementation of a database system.
2. Study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. Understand and use data manipulation language to query, update, and manage a database
4. Develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency,
5. Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. Evaluate a business situation and designing & building a database applications

Unit I:

DBMS Concepts and architecture Introduction, Database approach v/s Traditional file accessing approach, Advantages, of database systems, Data models, Schemas and instances, Data independence, Data Base Language and interfaces, Overall Database Structure, Functions of DBA and designer, ER data model: Entitles and attributes, Entity types, Defining the E-R diagram, Concept of Generalization, Aggregation and Specialization. transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model, Comparison between the three types of models.

Unit II

Relational Data models: Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages: SQL-DDL, DML, integrity con straints, Complex queries, various joins, indexing, triggers, assertions , Relational algebra and relational calculus, Relational algebra operations like select, Project
,Join, Division, outer union. Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations.

Unit III

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies. Query Optimization: Introduction, steps of optimization, various algorithms to implement select, project and join operations of relational algebra, optimization methods: heuristic based, cost estimation based.

Unit IV

Transaction Processing Concepts: -Transaction System, Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling. Concurrency Control Techniques: Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction. Introduction to Distributed databases, data mining, data warehousing, Object Technology and DBMS, Comparative study of OODBMS Vs DBMS . Temporal, Deductive, Multimedia, Web & Mobile database.

Unit V

Study of Relational Database Management Systems through Oracle/PL SQLQL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi threaded server. Distributed database, database links, and snapshot. Data dictionary, dynamic performance view. Security, role management, privilege management, profiles, invoker defined security model. SQL queries, Data extraction from single, multiple tables equi- join, non equi-join, self -join, outer join. Usage of like, any, all, exists, in Special operators. Hierarchical quires, inline queries, flashback queries. Introduction of ANSI SQL, anonymous block, nested anonymous block, branching and looping constructs in ANSI SQL. Cursor management: nested and parameterized cursors, Oracle exception handling mechanism. Stored procedures, in, out, in out type parameters, usage of parameters in procedures. User defined functions their limitations. Triggers, mutating errors, instead of triggers. Introduction to NoSql Database.

Suggested list of experiments:- Lab Assignments:

1. Delete duplicate row from the table.
2. Display the alternate row from table.
3. Delete alternate row from table.
4. Update multiple rows in using single update statement.
5. Find the third highest paid and third lowest paid salary.
6. Display the 3rd, 4th, 9th rows from table.
7. Display the ename, which is start with j, k, l or m.
8. Show all employees who were hired the first half of the month.
9. Display the three record in the first row and two records in the second row and one record in the third row in a single sql statements.
10. Write a sql statements for rollback commit and save points.
11. Write a pl/sql for select, insert, update and delete statements.
12. Write a pl/sql block to delete a record. If delete operation is successful return 1 else return 0.
13. Display name, hire date of all employees using cursors.
14. Display details of first 5 highly paid employees using cursors.
15. Write a database trigger which fires if you try to insert, update, or delete after 7'o' clock.
16. Write a data base trigger, which acts just like primary key and does not allow duplicate values.
17. Create a data base trigger, which performs the action of the on delete cascade.
18. Write a data base trigger, which should not delete from emp table if the day is Sunday.
19. In this subject the students are supposed to prepare a small database application in complete semester like financial accounting system, Railway reservation system, institute timetable management system. Student record system, library management

system, hospital management system etc. in RDBMS as follows:

Section A: Solving the case studies using ER data model (design of the database)

Section B: Implement a mini project for the problem taken in section A.

Suggested Reading:-

1. Date C J, “An Introduction To DatabaseSystem”, Pearson Educations
2. Korth, Silbertz,Sudarshan, “Fundamental of Database System”, McGraw Hill
3. Rob, “ Data Base System:Design Implementation & Management”, Cengage Learninig
4. Elmasri, Navathe, “Fundamentals Of Database Systems”, Pearson Educations

5 . Atul Kahate , “ Introduction to Database Management System”, Pearson Educations

6. Oracle 9i Database Administration Fundamental-I, Volume I, Oracle Press,TMH.
7. Paneerselvam,”DataBase Management System”, PHI Learning
8. dev.mysql.com www.postgressql.org

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Artificial Intelligence and Data Science, IV-Semester

AD403: Software Engineering with Agile Methodology

Rationale:

1. The purpose of this subject is to cover the underlying concepts and techniques used in Software Engineering. Some of these techniques can be used in software design & its implementation.
2. To understand the modern way of Software development using Agile methodology.

Prerequisite: - The students should have at least one year of experience in programming a high-level language and databases. In addition, a familiarity with the software development life cycle will be useful in studying this subject.

Course Outcomes: After completing the course student should be able to:

1. Describe the Fundamentals of software Engineering.
2. To Understand Software Development Life Cycle phases and their Role in Software Development.
3. Understand the Software development using Agile methodology.
4. Understand the implementation principles and guidelines for software development using Agile methodology
5. Use implementation techniques of Software architecture for effective software development.
6. Apply core values and principles of Agile for enterprise application development

Unit I: Introduction to Software Engineering

Software Development Life Cycles, SDLC Models: Waterfall, V-Model, Prototype Model, Incremental, Evolutionary, RAD, Spiral. Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Requirements Gathering and Analysis, Software Requirements Specification (SRS). Software Product and Process Characteristics, Software Process Models, Evolutionary Process Models and Agile processes. Software Process customization and improvement, CMM, Product and Process Metrics, Functional and Non-functional requirements, Requirement Sources and Elicitation Techniques,

Analysis Modeling for Function-oriented and Object-oriented software development, Use case Modeling, System and Software Requirement Specifications, Requirement Validation, Traceability

Unit II: Software Design, Analysis and Testing

The Software Design Process, Design Concepts and Principles, Software Modeling and UML, Architectural Design, Architectural Views and Styles, User Interface Design, Function oriented Design, SA/SD Component Based Design, Design Metrics.

Software Static and Dynamic analysis, Code inspections, Software Testing, Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, Test Oracles, Test Techniques, Testing Frameworks, Test Plan, Test Metrics, Testing Tools.

Unit-III: Software Maintenance & Software Project Measurement

Need and Types of Maintenance, Software Configuration Management (SCM), Software Change Management, Version Control, Change control and Reporting, Program

Comprehension Techniques, Re-engineering, Reverse Engineering, Tool Support. Project Management Concepts, Feasibility Analysis, Project and Process Planning, Resources Allocations, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance (SQA). Project Plan, Project Metrics.

Unit-IV: Fundamentals of Agile Methodology

Introduction to Agile software development methodology, Life Cycle of Agile development, Agile v/s Traditional software development(Waterfall model)Agile Manifesto: Principles, Benefits and Challenges of Agile, Agile Values, Agile Model, Phases of Agile Model.

Unit-V: Software Development using Agile Methodology

Gathering requirement using Agile way, User Stories: The currency of agile development, Characteristics of good user stories, Generating User Stories, Agile estimation and planning, Implementation of agile, Applying an Agile Mindset to a Project, Roles in agile development, Agile Frameworks: Scrum, Kanban, Crystal, XP, ASD, DSDM.

Practical and Lab work: Lab work should include a running case study problem for which different deliverables set at the end of each phase of a software development life cycle are to be developed. This will include modeling the requirements, analysis, detailed design, implementation, testing, deployment, and maintenance. Subsequently the design models will be coded and tested. For modeling, Open Source tools like StarUML and Licensed Tools like Rational Rose products. For coding and testing, IDE like Eclipse, Net Beans, and Visual Studio can be used.

Text Books:

1. Pankaj Jalote ,"An Integrated Approach to Software Engineering", Narosa Pub, 2005
2. Rajib Mall, "Fundamentals of Software Engineering" Second Edition, PHI Learning
3. James Shore and Shane Warden, "The Art of Agile Development 1st Edition", o'reilly books.
4. Dikel, David, D. Kane, and J. Wilson, "Software Architecture: Organizational Principles and Practices", Prentice-Hall.
5. Mike Cohn, "Agile Estimating and Planning, 1st (first) edition", Prentice-Hall.

References:

1. R S. Pressman ,"Software Engineering: A Practitioner's Approach", Sixth edition, 2006, McGraw-Hill.
2. Sommerville,"Software Engineering", Pearson Education.
3. Richard H.Thayer,"Software Engineering & Project Managements", Wiley India.
4. Waman S.Jawadekar,"Software Engineering", TMH.
5. Bob Hughes, M.Cotterell, Rajib Mall "Software Project Management", McGraw Hill.
6. Bennett, Douglas, "Designing Hard Software: The Essential Tasks", Prentice-Hall, 1997.
7. The Deadline: A Novel about Project Management, Dorset House

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Artificial Intelligence and Data Science, IV-Semester

AD404: DATA SCIENCE

Rationale:

- The purpose of this subject is to cover the underlying concepts and techniques used in Data Science. Some of these techniques can be used in Data Analysis & in prediction.
- To understand modern way to get insights from the data.

Prerequisite: - The students should have knowledge of Probability and Statistics.

Course Outcomes: After completing the course student should be able to:

- To expose students to various perspectives and concepts in Data Science
- To Understand the Concept of Advance Excel
- Data visualization techniques and ability to implement data visualization techniques
- Student should be able to get insights from the data.

Unit-I: Introduction to Data Science-Types of Data: structured and unstructured data, Data Science Road Map: Frame the Problem; Understand the Data, Data Wrangling, Exploratory Analysis, Extract Features, Model and Deploy Code. Graphical Summaries of Data: Pie Chart, Bar Graph, Pareto Chart, Histogram. Measures of central tendency of Quantitative Data: Mean, Median, Mode. Measures of Variability of Quantitative Data: Range, Standard Deviation and Variance. Probability: Introduction to Probability, Conditional Probability.

Unit II: Unstructured Data Analytics- Importance of Unstructured Data, Unstructured Data Analytics: Descriptive, diagnostic, predictive and prescriptive data Analytics based on Case study. Data Visualization: boxplots, histograms, scatterplots, features map visualization, t-SNE **. Overview of Advance Excel-** Introduction, Data validation, Introduction to charts, pivot table, Scenario manager, Protecting data, Excel minor, Introduction to macros.

Unit III: Statistical & Probabilistic analysis of Data, Multiple hypothesis testing, Parameter Estimation methods, Confidence intervals, Correlation & Regression analysis, logistic regression, Shrinkage Methods, Lasso Regression, Bayesian statistics. L1 and L2 regularizations. **POWERFUL DATA ANALYSIS**—SUMIFS, SUMPRODUCT, VLOOKUP | XLOOKUP, INDEX + MATCH, Handling Formula Errors, Dynamic Array Formulas, Circular References, Formula Auditing, Pivoting.

Unit IV: Data Manipulation With Pandas- Introduction to Pandas, understanding DataFrame, Missing Values, Data operation, String Manipulation, Regular Expressions and Data learning, Outlier and Error. Visualization tool in Python: Representation of Pie Chart, Bar Chart, Histogram, Scatterplots using Python. Data Analysis, performance metrics, ROC curve, types of errors, Overfitting & Under fitting, evaluating performance of learning model: Holdout, Random sampling, cross validation and Bootstrap method. Bagging & boosting, Gradient Boosting, Random Forests, Committee Machines.

Unit V: Introduction to Business Intelligence- Introduction, Types of Business Intelligence, Modern Business Intelligence Tools, Modern Business Intelligence. **Data Science and Ethical Issues-** Unfair discrimination, Reinforcing human biases, Lack of transparency. Discussions on privacy, security, ethics, Role of Next-generation data scientists.

Reference Books

1. The Data Science Workshop, Anthony So, Thomas V. Joseph, Robert Thas John, Andrew Worsley, and Dr. Samuel Asare, Packt Publication
2. Python Data Science Handbook, Jake VanderPlas, OREILLY
3. The Data Science HandBook, Wiley Publication.
4. Principles of Data Science, Packt Publication.
5. Microsoft Excel 2019: Data Analysis & Business Modelling, L. Winston Wayne, PHI
6. Data Collection: Methods, Ethical Issues & Future Directions (Government Procedures and Operations: Ethical Issues in the 21st Century), by Susan Elswick, Nova Science Publishers Inc

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Artificial Intelligence and Data Science, IV-Semester

AD405: Operating Systems

RATIONALE: The purpose of this subject is to cover the underlying concepts Operating System. This syllabus provides a comprehensive introduction of Operating System, Process Management, Memory Management, File Management and I/O management.

PREREQUISITE:

UNIT 1 **Introduction to Operating Systems**: Function, Evolution, Desirable Characteristics and features of an O/S, Operating Systems Services: Types of Services, Different ways of providing these Services – Utility Programs, System Calls.

UNIT 2 **Process Management**: Concept of a process, Process State Diagram, Process based kernel, Dual mode of process execution, CPU scheduling algorithms, deterministic modeling, and System calls for Process Management, Concept of Threads: User level & Kernel level Threads. Process Management in UNIX & Windows

Inter Process Communication: Real and Virtual Concurrency, Mutual Exclusion, Synchronization, Critical Section Problem, Solution to Critical Section Problem : Semaphores and their Operations and their implementation.Deadlocks: Deadlock Problems, Characterization, Prevention, Avoidance, Recovery. IPC in UNIX & Windows

UNIT 3 **Memory Management**: Different Memory Management Techniques – Partitioning, Swapping, Segmentation, Paging, Paged Segmentation, Comparison of these techniques, Techniques for supporting the execution of large programs: Overlay, Dynamic Linking and Loading, Virtual Memory – Concept, Implementation by Demand Paging etc. Memory management in UNIX & Windows

UNIT 4 **File Systems Management**: File Concept, User's and System Programmer's view of File System, Disk Organization, Tape Organization, Different Modules of a File System, Disk Space Allocation Methods – Contiguous, Linked, Indexed. Directory Structures, File Protection, System Calls for File Management, Disk Scheduling Algorithms. File Systems in UNIX & Windows.

UNIT 5 **Input / Output Management** : Principles and Programming, Input/Output Problems, Different I/O operations: Program Controlled, Interrupt Driven, Concurrent I/O, Asynchronous Operations, Logical structure of I/O function, I/O Buffering,Kernel I/o Subsystem.Introduction to Network, Distributed and Multiprocessor Operating Systems. I/O management in UNIX & Windows

TEXT BOOKS RECOMMENDED:

1. Silberschatz, Galvin, Gagne, “Operating System Concepts’’, Wiley, 9/E

2. William Stalling, “Operating Systems”, Pearson Education

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, 3/e, Prentice Hall

2. Maurice J. Bach, “ The Design of Unix Operating System”, Prentice Hall of India,

3. Bovet & Cesati, “Understanding the Linux Kernel”, O’Reily, 2/E.

List of Experiment

1. Write a program to implement FCFS CPU scheduling algorithm.
2. Write a program to implement SJF CPU scheduling algorithm.
3. Write a program to implement Priority CPU Scheduling algorithm.
4. Write a program to implement Round Robin CPU scheduling algorithm.
5. Write a program to compare various CPU Scheduling Algorithms over different Scheduling Criteria.
6. Write a program to implement classical inter process communication problem (producer consumer).
7. Write a program to implement classical inter process communication problem (Reader Writers).
8. Write a program to implement classical inter process communication Problem (Dining_Philosophers).
9. Write a program to implement & Compare various page replacement algorithms.
10. Write a program to implement & Compare various Disk & Drum scheduling Algorithms
11. Write a program to implement Banker’s algorithms.
12. Write a program to implement Remote Procedure Call (RPC).
13. Write a Devices Drivers for any Device or peripheral.