# E.G.S. PILLAY ENGINEERING COLLEGE

*(Autonomous)*

NAGAPATTINAM – 611 002.

(Affiliated to Anna University, Chennai | Accredited by NAAC with 'A++' Grade
Accredited by NBA | Approved by AICTE, New Delhi)

## B.TECH - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE (R–2023)

## CURRICULUM AND SYLLABUS FOR SECOND YEAR: THIRD SEMESTER (III)

| B.Tech - AI&DS (R2023) – III Semester | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **COURSE CODE** | **COURSE NAME** | **CATEGORY** | **L** | **T** | **P** | **C** | **MAX. MARKS** | | |
| | | | | | | | **CA** | **ES** | **TOTAL** |
| **Theory Courses** | | | | | | | | | |
| 2301HSX01 | Universal Human Values & Ethics | HSMC | 1 | 0 | 2 | 2 | 50 | 50 | 100 |
| 2301MA301 | Probability & Statistics | BSC | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 2301GEX05 | Applied Digital Logic & Design | ESC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2302AS301 | Design and Analysis of Algorithms | PCC | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 2302AS302 | Database Systems | PCC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2302AS303 | Artificial Intelligence | PCC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Laboratory Courses** | | | | | | | | | |
| 2301GEX54 | Applied Digital Logic & Design Laboratory | ESC | 0 | 0 | 2 | 1 | 60 | 40 | 100 |
| 2302AS351 | Statistical Analysis and Computing | PCC | 0 | 0 | 2 | 1 | 60 | 40 | 100 |
| 2302AS352 | SQL for Data Science | PCC | 0 | 0 | 4 | 2 | 60 | 40 | 100 |
| **Other Courses** | | | | | | | | | |
| 2304GE301 | Professional Development Course - I | EEC | 0 | 0 | 2 | 1 | 100 | - | 100 |
| 2301LS301 | Life Skills – III | LS | 0 | 0 | 0 | 0 | 100 | - | 100 |
| **TOTAL** | | | **16** | **4** | **12** | **24** | **630** | **470** | **1100** |

| 2301HSX01 | UNIVERSAL HUMAN VALUES AND ETHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**PREREQUISITE:**

1. Professional Ethics

**COURSE OBJECTIVES:**

1. Reinstate India‘s rich cultural legacy and human values of which we are the custodians.
2. Focus on professional ethics, which help citizens to discern desirable and undesirable actions.
3. Re-emphasize constitutional values, universal values, and holistic education to create integrated citizens.
4. Lay down broader guidelines of human values and ethics for internal and external stakeholders.

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Create such an environment, it is essential to ensure the inclusion of the learning process for holistic development. |
| **CO2:** | Create such an environment, it is essential to ensure the inclusion of impeccable governance. |
| **CO3:** | Create such an environment, it is essential to ensure the inclusion of effective institutional management. |
| **CO4:** | Create such an environment, it is essential to ensure the inclusion of well-laid system of rewards and reprimand. |
| **CO5:** | Create such an environment, it is essential to ensure the inclusion of institutional climate where ―rights‖ are encouraged and ―wrongs‖ are discouraged. |
| **CO6:** | Create such an environment, it is essential to ensure the inclusion of inward-looking groups and communities that have the potential to develop the capacity of individuals, source their potential and universal values, and ensure that their actions enable justice and equity to all. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | - | - | 1 | 1 | 3 | 1 | - | - | 1 |
| **CO2** | 2 | 1 | 2 | - | - | 1 | 2 | 2 | 1 | - | - | 1 |
| **CO3** | 2 | 1 | 2 | - | - | 1 | 1 | 2 | 1 | - | - | 1 |
| **CO4** | 2 | 1 | 2 | - | - | 1 | 1 | 2 | 1 | - | - | 1 |
| **CO5** | 2 | 1 | 2 | - | - | 1 | 2 | 3 | 1 | - | - | 1 |
| **CO6** | 2 | 1 | 2 | - | - | 1 | 2 | 2 | 2 | - | - | 1 |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | - | - | - |
| **CO2** | - | - | - |
| **CO3** | - | - | - |
| **CO4** | - | - | - |
| **CO5** | - | - | - |
| **CO6** | - | - | - |

**COURSE CONTENTS:**

| | | |
|---|---|---|
| **MODULE I** | **INTRODUCTION TO INDIAN ETHOS** | **08 Hours** |

Meaning of ethos and cultural essence of India – Scriptures as the base of the Indian Knowledge System (IKS) – Integrating the two methodologies: interiorization process for self-exploration, and exterior scientific pursuit for the prosperity of world –The Law of Karma and Nishkama Karma (The Law of action and selfless action).

**Practical**: Five hours of Yoga practice per week, Ethics through Music and Indian Poetry, Community Engagement.

| | | |
|---|---|---|
| **MODULE II** | **HUMAN VALUES AND ETHICS** | **09 Hours** |

Knowing the Self and the universal values that we stand for - This is self enquiry&self discovery– Background conversations and deep listening - recognizing the assumptions that we make - the biases we have - and the implications for ethical action –Self-identity: distinguishing and embracing oneself (and others) four profiles (inner-potential, social, professional, personality)–Distinguish ideology, perspectives beliefs from embodying values.

**Practical:**Self discovery, self enquiry and Mindfulness, Yama &Niyama of Ashthang Yoga.

| | | |
|---|---|---|
| **MODULE III** | **CONSTITUTIONAL VALUES AND GLOBAL CITIZENSHIP** | **09Hours** |

Values embedded in the Preamble of the Indian Constitution Integration of Human Rights and duties – Directive principles and responsibilities as citizens of India – Sensibility and responsibilities towards global environment, Loksangraha and Vasudhaiva Kutumbakam.

**Practical:** Debates and Theatre on diversity and plurality, research on similarities and differences in the ethos of different countries.

| | | |
|---|---|---|
| **MODULE IV** | **VALUES AND SKILLS FOR YOUTH** | **09 Hours** |

Designing to make a difference through strategies using the Conscious Full SpectrumResponse model– Listening for commitment behind complaints to transform contentious arguments and create a space for listening and change – Distinguishing judgement from discernment – Being assertive and confident (assertiveness incorporates self-confidence).

**Practical :** Development of concentration among students through music, fine arts, mathematics, sports, yoga and mindfulness

| | | |
|---|---|---|
| **MODULE V** | **INTEGRATED PERSONALITY AND WELL-BEING** | **10 Hours** |

The three gunas (qualities of sattva—purity and harmony, rajas —activity and passion,tamas —darkness and chaos), the four antah-karanas (inner instruments), and panchkosha (five sheaths) – Stress management: meditated personality and agitated personality – Oneness, non-duality, and equanimity – Physical, mental, social, and spiritual well-being.

**Practical :** Talks on importance of the Ayurvedic concept of well being and nutrition,sports activities

**TOTAL: 45 HOURS**

**TEXT BOOKS:**

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

**REFERENCES:**

*1. Blanchard, Kenneth and Peale, Norman Vincent. 1988. The Power of Ethical Management. New York: William Morrow and Company, Inc.*

*2. Gandhi, Mohandas Karamchand. 1971. Pathway to God compiled by MS Deshpande. Ahmedabad: NavajivanMudranalaya, Navjivan Trust.*

*3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php*

| 2301MA301 | PROBABILITY AND STATISTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 2 | 0 | 4 |

**PREREQUISITE:**

1. Basic Concept of Probability
2. Basic Concept of Statistics

**COURSE OBJECTIVES:**

1. To introduce the basic concepts of probability and random variables.
2. To acquaint the knowledge of testing of hypothesis for small and largesamples this plays an important role in real life problems.
3. To impart knowledge of handling random vectors which represent random variables in multi-dimensional.

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Use the fundamental concepts of probability and have knowledge of standard distributions which can describe real life phenomenon. |
| **CO2:** | Apply the basic concepts of one and two dimensional random variables in engineering applications. |
| **CO3:** | Simulate the concept of testing of hypothesis for small and large samples in real life problems. |
| **CO4:** | Apply the basic concepts of classifications of design of experiments in the field of statistical quality control. |
| **CO5:** | Develop exposure to the principal component analysis of random vectors and Time Series. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | | | | | | | 1 |
| **CO2** | 3 | 2 | 1 | | | | | | | | | 1 |
| **CO3** | 3 | 2 | 1 | | | | | | | | | 1 |
| **CO4** | 3 | 2 | 1 | | | | | | | | | 1 |
| **CO5** | 3 | 2 | 1 | | | | | | | | | 1 |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | - | - | - |
| **CO2** | - | - | - |
| **CO3** | - | - | - |
| **CO4** | - | - | - |
| **CO5** | - | - | |

**COURSE CONTENTS:**

| MODULE I | RANDOM VARIABLES AND DISTRIBUTIONS | 9 Hours |
|---|---|---|

Random variable –Distribution function – properties – Probability mass function – Probability density function – moments – Standard Distributions-Binomial, Poisson and Normal distributions

| MODULE II | TWO DIMENSIONAL RANDOM VARIABLES | 9 Hours |
|---|---|---|

| | | |
|---|---|---|
| Joint distributions – Marginal and conditional distributions – Expected values of functions of two variables–Correlation and regression(for discrete data only)- Central limit theorem– Statement | | |
| **MODULE III** | **TESTING OF HYPOTHESIS** | **9 Hours** |
| Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples)–Tests for single variance and equality of variances–Chi square test for goodness of fit–Independence of attributes. | | |
| **MODULE IV** | **DESIGN OF EXPERIMENTS** | **9 Hours** |
| Onewayandtwowayclassifications-Completelyrandomizeddesign–Randomizedblockdesign–Latinsquaredesign-$2^2$factorialdesigns. | | |
| **MODULE V** | **MULTIVARIATE ANALYSIS AND TIME SERIES** | **9 Hours** |
| Random vectors and matrices – Mean vectors and covariance matrices –Principal components – Population principal components–Principal components from standardized variables. Time series - components - Trend-Determination of trend by moving averages – Least square method-Seasonal Variations-Ratio to moving average method. | | |
| | | **TOTAL: 45 HOURS** |

**REFERENCES:**

1. *Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, 9th Edition, Boston, 2016.*
2. *Johnson, R.A., and Wichern, D.W., "Applied Multivariate Statistical Analysis", Pearson Education, Sixth Edition, New Delhi, 2013.*
3. *Devore.J.L.,"ProbabilityandStatisticsforEngineeringandtheSciences",CengageLearning,NewDelhi, 8th Edition,2014.*
4. *GuptaS.C.andKapoorV.K.,"FundamentalsofMathematicalStatistics",SultanChand&Sons,NewDelhi,12th Edition,2020*
5. *Johnson,R.A.,Miller,IandFreundJ.,"MillerandFreund'sProbabilityandStatisticsforEngineers",PearsonEducation,Asia,8thEdition,2015.*
6. *https://onlinecourses.nptel.ac.in/noc23_ma24/preview*

*(Link for NPTEL/SWAYAM/MOOC Courses)*

| 2301GEX05 | APPLIED DIGITAL LOGIC AND DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | Common to B.E-CSE, BME, B.Tech -IT, and AIDS | 3 | 0 | 0 | 3 |

**PREREQUISITE:**

1. Basic Mathematic Skills

**COURSE OBJECTIVES:**

1. To present the fundamentals of digital circuits and simplification methods.
2. To practice the design of various combinational and sequential digital circuits using logic gates.
3. To introduce semiconductor memories and programmable logic devices.
4. To practice the HDL programming for combinational and sequential circuits.

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Use Boolean algebra, K-map and tabulation method to simplify Boolean functions. |
| **CO2:** | Construct different combinational circuits using logic gates. |
| **CO3:** | Develop different sequential circuits using logic gates and flip flops. |
| **CO4:** | Compare different semiconductor memory devices. |
| **CO5:** | Build programmable devices using logic gates. |
| **CO6:** | Develop Verilog program for combinational and sequential circuits. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO4** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO6** | 3 | 2 | 1 | - | 3 | - | - | - | 2 | 1 | - | 1 |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | - | - | - |
| **CO2** | - | - | - |
| **CO3** | - | - | - |
| **CO4** | - | - | - |
| **CO5** | - | - | - |
| **CO6** | - | - | - |

**COURSE CONTENTS:**

| MODULE I | BOOLEAN ALGEBRA AND LOGIC GATES | 9Hours |
|---|---|---|

Review of Number system – Boolean expression and minimization – Logic Gates and its implementation – Simplification of Boolean Functions using Boolean algebra, Karnaugh Map and Tabulation Method.

| MODULE II | COMBINATIONAL LOGIC | 9Hours |
|---|---|---|

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders / Encoders – Multiplexers / DE multiplexers – Parity generators / checkers – Magnitude Comparator.

| MODULE III | SEQUENTIAL CIRCUITS | 9Hours |
|---|---|---|

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|---|---|---|
| Sequential logic-Basic latch-Flip-flops (SR, D, JK, T and Master-Slave)-Counters-Ripple counters-BCD and Binary-Synchronous counters, Registers-Shift registers-Registers, Hazards | | |
| **MODULE IV** | **MEMORY AND PROGRAMMABLE LOGIC** | **9Hours** |
| Classification of memories (RAM, ROM, PROM, EPROM, EEPROM) Programmable Logic Devices (PLA,PAL,FPGA)-Implementation of circuits using ROM, PLA, PAL. | | |
| **MODULE V** | **VERILOG HDL MODELING** | **9Hours** |
| Three types of Verilog modeling (gate-level, dataflow, and behavioral)-Verilog programming for combinational and sequential circuits. | | |
| | | **TOTAL: 45 HOURS** |

**REFERENCES:**

1. *Morris Mano and Michael D. Ciletti, "Digital Design", 5th edition, Prentice Hall of India,2012*
2. *Samir Palnitkar, "Verilog HDL", 2nd Edition, Pearson Education, 2003*
3. *https://archive.nptel.ac.in/courses/108/105/108105132/ (Link for NPTEL/SWAYAM/MOOC Courses)*
4. *https://www.vlab.co.in/broad-area-electronics-and-communications (Link for modern tool usage)*

| 2302AS301 | DESIGN AND ANALYSIS OF ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 2 | 0 | 4 |

**PREREQUISITE:**

**NIL**

**COURSE OBJECTIVES:**

| | |
|---|---|
| | 1.To analyse various algorithms mainly for time and space complexity. |
| | 2.To develop algorithm for solving various computational problems by applying various algorithm design strategies. |
| | 3.To understand the effect of choice of data structures on the complexity of algorithm. |

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Apply the appropriate data structure for designing an algorithm to solve a given problem |
| **CO2:** | Evaluate different algorithms with respect to time and space complexity |
| **CO3:** | Create algorithms to solve various computational problems |
| **CO4:** | Describe various methods of solving scientific problems using iterative methods |
| **CO5:** | Analyse the different algorithm design techniques for a given problem based on its time and space complexity. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | 2 |
| **CO2** | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | 1 | 2 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | 1 | 2 |
| **CO4** | 2 | 2 | 2 | 1 | 1 | - | - | - | - | - | 2 | 1 |
| **CO5** | 1 | **2** | 3 | 3 | 3 | - | - | - | - | - | **2** | **2** |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | | - |
| **CO2** | 3 | 3 | - |
| **CO3** | 3 | 3 | - |
| **CO4** | 3 | 3 | - |
| **CO5** | 3 | 3 | - |

| **COURSE CONTENTS:** | | |
|---|---|---|
| | | |
| **MODULE-I** | **BASIC CONCEPTS OF ALGORITHMS** | **9 Hours** |
| Notion of Algorithm, Fundamentals of Algorithmic Solving, Important problem types, Fundamentals of the Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical analysis of non-recursive algorithms. Mathematical analysis of recursive algorithm: recurrence relations, solution of recurrence relations using substitution method. | | |
| **MODULE-II** | **BRUTE FORCE, DIVIDE AND CONQUER STRATEGY** | **9 Hours** |
| Selection sort, Bubble sort, Sequential searching (Linear Search), Brute force string matching, General method, Merge sort, Quick Sort, Binary Search, Strassen‘s matrix multiplication. | | |
| **MODULE-III** | **GREEDY APPROACH AND DYNAMIC PROGRAMMING** | **9 Hours** |
| Fractional Knapsack problem, Minimum cost spanning tree: Prim‘s and Kruskal‘s algorithm, Single source shortest path problem, Principle of optimality, Multi-stage graph problem, all pair shortest path problem, 0/1 Knapsack problem, Traveling salesperson problem. | | |
| **MODULE-IV** | **BACKTRACKING AND BRANCH AND BOUND** | **9 Hours** |
| General method backtracking, N-Queen problem, Knight‘s Tour Problem, General method of branch & bound, Fractional vs 0/1 knapsack problem,Traveling sales person problem using branch & bound. | | |
| **MODULE-V** | **LOWER BOUND THEORY AND COMPLEXITY CLASSES** | **9 Hours** |
| Lower bounds, Decision trees, P, NP and NP Complete problems. | | |
| | | **TOTAL: 45 HOURS** |
| | | |
| **TEXT BOOKS:** | | |
| 1. Algorithm Design, Jon Kelinberg and Eva Tardos, 1st Edition, Pearson Education 2014 | | |
| 2. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing 2018. | | |
| 3. Fundamentals of algorithms, Horowitz E, Sahini S, Rajasekaran S., University Press 2008 | | |
| | | |
| **REFERENCES:** | | |
| *1. Introduction to algorithms, Cormen, Leiserson, Rivest, Stein, 3rd Edition, PHI. 2012* | | |
| *2. An introduction to analysis of algorithms, R. Sedgewick, 1st edition, Pearson Education 1996* | | |
| *3. Data Structures and Program Design in C, Robert L. Kruse, C.L. Tondo, Bruce Leung, Pearson Education. 2007* | | |
| *4. https://archive.nptel.ac.in/courses/106/106/106106131/* | | |
| *5. https://archive.nptel.ac.in/courses/106/101/106101060/* | | |
| *6.https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/pages/syllabus/* | | |

| 2302AS302 | DATABASE SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PREREQUISITE:**

**NIL**

**COURSE OBJECTIVES:**

| | |
|---|---|
| | To understand the concept of DBMS and ER Modeling |
| | To explain the normalization and relational algebra. |
| | To apply the concurrency control, recovery, security and indexing for the real time data. |

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Illustrate the design principles for database designand ER model |
| **CO2:** | Construct SQL Queries using relational algebra concepts |
| **CO3:** | Compare the basic database storage structure and access techniques indexing and hashing |
| **CO4:** | Apply Concurrency control and recovery mechanisms for the desirable database problem |
| **CO5:** | Review the fundamental view on unstructured data and its management |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 2 | - | - | - | 2 | 2 | - | - |
| **CO2** | 3 | 2 | 3 | 3 | 2 | - | - | - | 2 | 2 | 1 | - |
| **CO3** | 3 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | - |
| **CO4** | 3 | 3 | 2 | 2 | 1 | - | - | - | 1 | 2 | 1 | - |
| **CO5** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | | - |
| **CO2** | 3 | 3 | - |
| **CO3** | 3 | 3 | - |
| **CO4** | 3 | 3 | - |
| **CO5** | 3 | 3 | - |

**COURSE CONTENTS:**

| MODULE-I | INTRODUCTION TO DATABASE SYSTEMS | 9 Hours |
|---|---|---|

Introduction to Database Systems: Overview – Data Models – Database System Architecture – History of Database Systems. Entity-Relationship Model: Basic Concepts – Constraints – Keys – Design Issues – Entity Relationship Diagram – Weak Entity Sets – Extended E-R Features – Design of an E-R Database Schema.

| MODULE-II | RELATIONAL MODEL | 9 Hours |
|---|---|---|

| | | |
|---|---|---|
| Structure of Relational Databases – Relational Algebra – Extended - Relational Algebra Operations – Modification of Database – Views – Tuple Relational Calculus – Domain Relational Calculus. SQL: Background – Basic Structure – Set - Operations – Aggregate Functions – Null Values – Nested Sub queries – Modification of the database – Joined Relations – Data Definition Language . | | |
| **MODULE-III** | **INTEGRITY SECURITY AND FILE STRUCTURES** | **9 Hours** |
| Domain Constraints – Referential Integrity – Assertions–Security and Authorization – Authorization in SQL-Relational-Database Design: Normalization -first normal form , second normal form, third normal form, Boyce-Codd normal form-Indexing and Hashing: Basic Concepts – Ordered Indices – Static Hashing – Dynamic Hashing . | | |
| **MODULE-IV** | **TRANSACTION CONCEPT** | **9 Hours** |
| Two-Phase Locking Techniques for Concurrency Control – Concurrency Control based on timestamp – Recovery Concepts – Recovery based on deferred update – Recovery techniques based on immediate update - Shadow Paging . | | |
| **MODULE-V** | **CLOUD AND NO SQL DATABASES** | **9 Hours** |
| Cloud databases- Data Storage Systems on the Cloud, Data Representation, Partitioning and Retrieving Data, Challenges with Cloud-Based Databases- NoSQL Data model: Aggregate Models, Document Data Model, Key-Value Data Model, Columnar Data Model, Graph-Based Data Model . | | |
| | | **TOTAL: 45 HOURS** |
| | | |
| **TEXT BOOKS:** | | |
| 1. Fred R McFadden, Jeffery A Hoffer, Mary B. Prescott, Modern Database Management, Fifth Edition, Addison Wesley, 2000 | | |
| 2. Abraham Silberschatz, Henry F. Korth, and S. Sudharsan, ―Database System Concepts‖, 7th Edition, McGraw Hill, 2019 | | |
| | | |
| **REFERENCES:** | | |
| *1. JefreyD.Ulman, Jenifer Widom, A First Course in Database Systems, Pearson Education Asia, 2001* | | |
| *2. Elmasri, Navathe, Fundamentals of database Systems, Seventh Edition, Addison Wesley, 2016* | | |
| *3. Raghu Ramakrishnan, Database Management Systems,Mcgraw-Hill,4th edition,2015* | | |
| *4. 3. Bipin C Desai, An Introduction to Database Systems, Galgotia Publications Pvt Limited, 2001* | | |
| *4. https://hyperskill.org/tracks/31* | | |
| *5. https://nptel.ac.in/courses/106106220* | | |

| 2302AS303 | ARTIFICIAL INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PREREQUISITE:**

NIL

**COURSE OBJECTIVES:**

1.To provide an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science through classroom program that covers fascinating and compelling topics related to human intelligence and its applications in industry, defence, healthcare, agriculture and many other areas.

2.To offer the students a rigorous, advanced and professional graduate-level foundation in Artificial Intelligence.

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Infer knowledge about intelligent agents for search and state space representation |
| **CO2:** | Solve AI problems through programming |
| **CO3:** | Build different models and apply theoretical concepts to real-world problems |
| **CO4:** | Design and develop programs for an agent to learn and act in a structured environment |
| **CO5:** | Analyze AI Ethics and industrial use cases for real-time problem solving using AI |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - |
| **CO3** | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - |
| **CO4** | 3 | 2 | 3 | 2 | 1 | - | - | - | - | - | - | - |
| **CO5** | 3 | 1 | - | 2 | - | - | 1 | 1 | - | - | - | - |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | - | - |
| **CO2** | 3 | 3 | - |
| **CO3** | 3 | 3 | - |
| **CO4** | 3 | 3 | - |
| **CO5** | 3 | 3 | - |

| **COURSE CONTENTS:** | | |
|---|---|---|
| | | |
| **MODULE-I** | **INTRODUCTION** | **6 Hours** |
| Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree., Case study: Talkie.ai, ada.cx. | | |
| **MODULE-II** | **SEARCH ALGORITHMS** | **12 Hours** |
| Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search, Hill climbing search, Search with non-determinism, Constraint satisfaction problems, Map coloring, Job-shop scheduling, Backtracking for CSPs . | | |
| **MODULE-III** | **REASONING& MARKOV DECISION PROCESS** | **12 Hours** |
| Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model, MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs. Case study: How many patients to admit, Reducing wait time at a traffic intersection. | | |
| **MODULE-IV** | **REINFORCEMENT LEARNING** | **9 Hours** |
| Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning. Case Study: AWS Deep Racer, DeepMind'sAlphaZero, Arcade Learning Environment &Procgen. | | |
| **MODULE-V** | **AI APPLICATIONS & AI ETHICS** | **6 Hours** |
| IBM Watson - Create a retail customer service chatbot, AWS AI Services - Monitor and predict health data using AWS AI services, Automate insurance document processing with AI, The Ethics of AI - Lethal autonomous weapons, Surveillance, security, and privacy, Fairness and bias, Trust and transparency, The future of work, Robot rights, AI Safety . | | |
| | | **TOTAL: 45 HOURS** |
| | | |
| **TEXT BOOKS:** | | |
| 1. Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖ , 4th Edition, Prentice Hall | | |
| 2. Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill | | |
| | | |
| **REFERENCES:** | | |
| *1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.* | | |
| *2. SarojKaushik, "Artificial Intelligence", Cengage Learning India, 2011* | | |
| *3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010* | | |
| *4. https://nptel.ac.in/courses/106105077* | | |
| *5. https://nptel.ac.in/courses/106106126* | | |
| *6. https://aima.cs.berkeley.edu* | | |
| *7. https://developer.ibm.com/tutorials/create-your-first-assistant-powered-chatbot/* | | |
| *8. https://youtu.be/UDFl_bBGDzQ* | | |

| 2301GEX54 | APPLIED DIGITAL LOGIC AND DESIGN LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | Common to B.E-CSE, BME, B.Tech – IT and AIDS | 0 | 0 | 2 | 1 |

**PREREQUISITE:**

1. Basic Mathematic Skills

**COURSE OBJECTIVES:**

1. To present the fundamentals of digital circuits and simplification methods.
2. To practice the design of various combinational and sequential digital circuits using logic gates.
3. To practice the HDL programming for combinational and sequential circuits.

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Construct differentcombinationalcircuits using logic gates. |
| **CO2:** | Develop differentsequentialcircuits using logic gates and flip flops. |
| **CO3:** | Build programmable devices using logic gates. |
| **CO4:** | Develop Verilog program for combinational and sequential circuits. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 |
| **CO4** | 3 | 2 | 1 | - | 3 | - | - | - | 2 | 1 | - | 1 |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | - | - |
| **CO2** | 3 | - | - |
| **CO3** | 3 | - | - |
| **CO4** | 3 | - | - |

**LIST OF EXPERIMENTS:**

**List of Lab experiments:**

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of half adder, half subtractor, full adder and full subtractor.
3. Design and implementation of code converters.
4. Design and implementation of multiplexer and de-multiplexer.
5. Design and implementation parity generator/checker.
6. Design and implementation counters.
7. Design and implementation shift register.
8. Develop and simulation of Verilog program for combinational circuits.
9. Develop and simulation of Verilog program for sequential circuits.

**Hardware/software requirement**

1. Digital trainer kit 10 Nos
2. Adequate numbers of IC‘s
3. XilinxISE (or)Altera Quartus II software

| |
|---|
| **TOTAL: 30 HOURS** |
| |
| **REFERENCES:** |
| |
| *1.Morris Mano and Michael D. Ciletti, "Digital Design", 5th edition, Prentice Hall of India,2012* |
| *2. Samir Palnitkar, "Verilog HDL", 2nd Edition, Pearson Education, 2003* |
| *3. https://archive.nptel.ac.in/courses/108/105/108105132/ (Link for NPTEL/SWAYAM/MOOC Courses)* |
| *4. https://www.vlab.co.in/broad-area-electronics-and-communications (Link for modern tool usage)* |

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| 2302AS351 | STATISTICAL ANALYSIS AND COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**PREREQUISITE:**

| | |
|---|---|
| | 2301GE201 - Programming using Python |
| | 2301MA301 - Probability and Statistics |

**COURSE OBJECTIVES:**

| | |
|---|---|
| | This course is intended for students to get introduced to methods and tools for statistical computing. |
| | The course aims at the contemporary tools and languages for the same using languages such as R, Python and MATLAB. |
| | The course shall be accompanied by computational lab for statistical analysis. |

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Develop a deeper understanding of different statistical distributions |
| **CO2:** | Enhance skills in applying and interpreting statistical methods |
| **CO3:** | Apply visualization techniques to understand data distributions and patterns |
| **CO4:** | Determine the important predictor variables in a regression analysis of the dataset |
| **CO5:** | Formulate hypothesis, perform a suitable hypothesis test and apply resampling techniques |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 3 | - | - | - | 2 | 1 | - | - |
| **CO2** | 3 | 3 | 2 | 2 | 3 | - | - | - | 2 | 1 | - | - |
| **CO3** | 3 | 2 | 2 | 2 | 3 | - | - | - | 2 | 1 | - | - |
| **CO4** | 3 | 3 | 2 | 2 | 3 | - | - | - | 2 | 1 | - | - |
| **CO5** | 3 | 3 | 2 | 2 | 3 | - | - | - | 2 | 1 | - | - |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 2 |
| **CO2** | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 |

| **LIST OF EXPERIMENTS:** |
|---|
| |
| 1. Implement random number generation using R/Python or MATLAB drawn from various distributions such as Uniform, Normal, Exponential etc. Plot the histograms of the generated numbers and compute the mean and standard deviations |
| 2. Implement the sampling and verify the central limit theorem. |
| 3. Use the generators for certain distribution and compute the various moments and measures of the central tendency and statistical tests of significance. |
| 4. Use census data from the Govt. of India and perform statistical analysis as defined by the instructor (for example multivariate analysis to find correlation between various attributes of data) |
| 5. Perform linear regression to study the dependency of a dependent variable on various input/predictor variables |
| 6. Study various types of regularizations and determine which predictor variables are significant. |
| 7. Form a hypothesis and using the given dataset perform hypothesis testing (as defined by the instructor) |
| 8. Perform various types of resampling to address mixed distributions, removing bias |
| **TOTAL: 30 HOURS** |
| |
| **TEXT BOOK:** |
| 1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing House, 2010 |
| |
| **REFERENCES:** |
| *1. B. L. S. PrakasaRao, A First Course in Probability and Statistics, World Scientific/Cambridge University Press India, 2009.* |
| *2. R. V. Hogg, J. W. McKean and A. Craig, Introduction to Mathematical Statistics, 6th Ed., Pearson Education India, 2006* |
| *3. Gareth M. James, Introduction to statistical learning: With applications to R, Springer 2013* |
| *4. https://archive.nptel.ac.in/courses/111/105/111105077/* |
| *5. https://libguides.jcu.edu.au/statistics/training* |

| 2302AS352 | SQL for Data Science | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**PREREQUISITE:**

NIL

**COURSE OBJECTIVES:**

| | |
|---|---|
| | To design, create, and manage databases for data storage and retrieval. |
| | To apply advanced concepts like stored procedures, triggers, and database design principles. |
| | To use SQL in data science workflows, including data wrangling, feature engineering, and data visualization. |

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Implement typical data definitions and manipulation commands. |
| **CO2:** | Design applications to test Nested and Join Queries |
| **CO3:** | Implement simple applications that use Views |
| **CO4:** | Critically analyze the use of Functions and Procedures |
| **CO5:** | Apply data modeling techniques to design and implement databases for data science applications. |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 2 | - | - | - | 2 | 2 | - | - |
| **CO2** | 3 | 2 | 3 | 3 | 2 | - | - | - | 2 | 2 | 1 | - |
| **CO3** | 3 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | - |
| **CO4** | 3 | 3 | 2 | 2 | 1 | - | - | - | 1 | 2 | 1 | - |
| **CO5** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 1 | 2 | 2 |
| **CO2** | 2 | 1 | 3 |
| **CO3** | 1 | 1 | 2 |
| **CO4** | 2 | 1 | 2 |
| **CO5** | 3 | 3 | 2 |

**LIST OF EXPERIMENTS:**

1. Study of Basic SQL Commands
2. DDL and DML
3. Table creation with constraints

| |
|---|
| 4. Joins operations with views |
| 5. PL/SQL-Procedures |
| 6. PL/SQL-Cursors |
| 7. PL/SQL-Functions, Triggers |
| 8. Data Exploration and Cleaning |
| 9. Data Transformation |
| 10. Data Analysis |
| 11. Data Modelling |
| |
| **TOTAL: 60 HOURS** |
| **Mode of Assessment: PAT/Project Presentation** |
| |
| **TEXT BOOKS:** |
| 1. Fred R McFadden, Jeffery A Hoffer, Mary B. Prescott, Modern Database Management, Fifth Edition, Addison Wesley, 2000 |
| 2. Abraham Silberschatz, Henry F. Korth, and S. Sudharsan, ―Database System Concepts‖, 7th Edition, McGraw Hill, 2019 |
| |
| **REFERENCES:** |
| *1. JefreyD.Ulman, Jenifer Widom, A First Course in Database Systems, Pearson Education Asia, 2001* |
| *2. Elmasri, Navathe, Fundamentals of database Systems, Seventh Edition, Addison Wesley, 2016* |
| *3. Raghu Ramakrishnan, Database Management Systems,Mcgraw-Hill,4th edition,2015* |
| *4. 3. Bipin C Desai, An Introduction to Database Systems, Galgotia Publications Pvt Limited, 2001* |
| *4. https://hyperskill.org/tracks/31* |
| *5. https://nptel.ac.in/courses/106106220* |