NOTIFICATION

No. 117 /2023 Date : 17 /08/2023

Subject: Revised Syllabus of Semester III & IV of B.E. (Artificial Intelligence & Data Science) (CBCS) as per AICTE model Curriculum.

It is notified for general information of all concerned that the authorities of the University have accepted to implement revised syllabus of Semester III & IV of B.E. (Artificial Intelligence & Data Science) (CBCS) as per AICTE Model Curriculum to be implemented from the academic session 2023-2024 onwards as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

Revised Syllabus of Semester III & IV of B.E. (Artificial Intelligence & Data Science) (CBCS)

3AD05 ANALOG & DIGITAL ELECTRONICS

Course Prerequisite: Basic knowledge of Physics

Course Objectives: Throughout the course, students will be expected to learn the following:

1. To get the introductory knowledge of basic analog devices like PN Junction Diode, Bipolar Junction Transistor and Field Effect Transistor.
2. To understand the basic concepts & working of operational amplifier
3. To understand number systems and conversion between different number systems.
4. To get basics knowledge about digital ICs and digital systems.
5. To study the design of combinational circuits and sequential circuits

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the basic concepts of semiconductor devices.
2. Explain BJT operations and characteristics.
3. Examine different operational amplifier and its application.
4. Compare and contrast different Number System and basics of conversion of number systems.
5. Realize different minimization techniques to obtain minimized expressions.
6. Design Combinational and Sequential Circuits.

Unit I: Unit Title: PN Diode and its application **(Hours 7)**

PN-Junction Diode, Characteristics and Parameters, Static and Dynamic Resistance, Zener diode: Characteristics and application as Voltage regulator

Unit II: BJT, FET and MOSFET **(Hours: 7)**
BJT operation, BJT Voltages and Currents, BJT as Switch, Common-Base Characteristics, Common-Emitter Characteristics, Common-Collector Characteristics. Basic operation of Junction Field Effect Transistors, MOSFETs & CMOS.

Unit III: Operational Amplifiers **(Hours: 7)**
Introduction to Operation amplifier; Block schematic, study of IC 741 op-amp, op-amp parameter, Application of Op-amps: Inverting and non-inverting amplifiers, voltage follower, integrator, differentiator differential amplifier, op amp as adder and subtractor.

Unit IV: Unit Title: Number System & Minimization Technique **(Hours: 7)**
Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, 1s and 2s Complements Representation, Subtraction using 1″s and 2″s Complements, Gray Code **Minimization Technique:** Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 4 variable), Limitation of Karnaugh Map.

Unit V: Unit Title: Combinational Circuits **(Hours: 6)**

Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Lookahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers

Unit VI: Unit Title: Sequential Circuits **(Hours: 6)**
Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter,

Text Books:
1. David A. Bell: “Electronic Devices and Circuits”, 5th Ed, Oxford University Press.
2. Jain R.P. “Modern Digital Electronics”, 3rd Ed, TMH.
3. Gayakwad R. A. “Op-Amp & Linear Integrated Circuit, PHI publications 4th Ed.

Reference Books:
1. Anand Kumar, Pulse and Digital Circuits, Prentice-Hall Of India Pvt. Limited.
2. Morris Mano, "Digital Design", Prentice-Hall, 3rd Edition.
3. Millman & Halkies: “Electronic Devices & Circuits”, 2e, McGraw Hill.
4. Sedra& Smith: “Microelectronics Circuits”, 5e, Oxford University Press.
5. Anand Kumar: “Switching Theory and Logic Design”, 3e, PHI Learning Private Limited
6. Wakerly, “Digital Design: Principles and Practices”, 3 e, Pearson Education, 2004.

4AD01 ARTIFICIAL INTELLIGENCE

Course Pre-requisite: Discrete Structure, Data Structures and Computer Programming

Course Objectives:
1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem.

Course Outcomes: On completion of the course, the students will be able to
1. Describe concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Explain different types of uninformed search strategies.
3. Illustrate different types of heuristic search strategies.
4. Investigate various knowledge representation issues.
5. Use predicate logic for knowledge representation.
6. Inspect adversarial search and game theory.

Unit I: Introduction to AI **(Hours: 7)**
Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI, **Intelligent Agents:** Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Uninformed Search Strategies: **(Hours: 6)**
Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit III: Informed Search Strategies: **(Hours: 7)**
Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis

Unit IV: Knowledge Representation and Issues: **(Hours: 7)**
Representation and Mapping. Approaches to Representation, Issues in Representation: Important attribute, relationship among attributes, choosing the granularity of representation, representing sets of Objects, finding the right structures as needed.

Unit V: Knowledge Representation using Predicate Laogic: **(Hours: 6)**
Representing Simple Facts in Logic, Representing Instance and ISA relationship, Computable Functions and Predicates, Resolution

Unit VI: Adversarial Search & Games: **(Hours: 7)**

Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Text Books:
1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)

Reference Books:

1. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by RajendraAkerkar (PHI Learning Pvt. Ltd.)

4AD02 STATISTICAL METHODS

Course Pre-requisite: Engineering Mathematics-I and II, Linear Algebra

Course Objectives: The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

1. To understand nature of data used for statistical methods and its representation.
2. To incorporate the concepts of probability theory
3. Understand the most common discrete and continuous probability distributions and their real life applications.
4. Understand Estimation theory
5. Understand Test of Hypothesis.

Course Outcomes: After successful completion of this course, students will be able to:

1. Describe source of data and types of data in statistics.
2. Compare statistical data given in forms of graph using Frequency Distributions and Cumulative Frequency Distributions.
3. Examine characteristics of good estimator.
4. Analyze data and draw conclusion about collection of data using Point estimation.
5. Analyze data and draw conclusion about collection of data using Interval estimation.
6. Assess the tests and types of errors for large samples.

Unit I: Introduction to Data: Introduction to statistics, sources of data, Types of Data: Concepts of a statistical population and sample from a population; qualitative and quantitative data; nominal and ordinal data; cross sectional and time series data; discrete and continuous data; frequency and non- frequency data. Different types of scales - nominal, ordinal, ratio and interval.

Unit II: Data Representations: Different types of presentations of data, data tabulation, describing categorical data, frequency distribution of categorical data, Describing numerical data, frequency table for numerical data, graphical representation, Frequency Distributions and Histograms; Pie Charts; Bar Charts: Pareto Chart, Scatter Plots (Degree of Association); Line Charts.

Unit III: Basic Concepts: Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency –Factorization Theorem –Minimal sufficiency; Efficiency –Most efficient estimator, likelihood equivalence, Uniformly minimum variance unbiased estimator, applications of Lehmann-Scheffe's Theorem, Rao -Blackwell Theorem and applications

Unit IV: Point Estimation: Point Estimation-Estimator, Estimate, Methods of point estimation –Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator (without proof)-applications, Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

Unit V: Interval Estimation: Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.

Unit VI: Testing of Hypotheses: Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.

Text Books:

1. Ken Black, "Business Statistics for Contemporary Decision Making", Wiley Student Edition, 2010.
2. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference –Testing of Hypotheses, Prentice Hall of India, 2014.

Reference Books:

1. Montgomery, D. C., G.C. Runger,Applied Statistics and Probability for Engineers. 5th ed.New Delhi:Wiley-India, 2011.
2. Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematics Statistics", Sultan Chand and Sons, 2001.
3. Miller and John E Freund, Probability and Statistics for Engineers, 5th Edition

4AD03 COMPUTER ARCHITECTURE AND OPERATING SYSTEM

Course Prerequisite: Discrete Structure, Data Structures and Computer Programming.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture and Operating System by being able to do each of the following:

1. To familiarize the basic concepts and structure of computers.
2. To make students aware of the kernel and shell structure of the operating systems.
3. To make students aware of the purpose, structure and functions of operating systems
4. To equip students with understanding of the various scheduling algorithms in OS.
5. To make students aware of understanding of memory management.

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

1. Describe basic structure and operation of computer.
2. Explain basic Components and Services of Operating system
3. Analyze and Solve CPU scheduling problems using different scheduling algorithms.
4. Examine the critical section problem and resolve it.
5. Investigate Memory Management issues like Fragmentation, Virtual Memory Management.
6. Inspect various disk scheduling algorithms.

Unit I: Basic Structure of Computer: **(Hours: 6)**
Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing

Unit II: Introduction to Operating System: **(Hours: 7)**
Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication, Threads Overview, Multithreading Models and Threading Issues

Unit III: Process Scheduling: **(Hours: 7)**
Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority.

Unit IV: Process Synchronization : **(Hours: 7)**
Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock.

Unit V: Memory Management: **(Hours: 7)**
Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing.

Unit VI: I/O System **(Hours: 6)**
I/O Systems : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, Disk Structure, Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, C- LOOK, Disk Management, Swap-Space Management, RAID Structure.

Text Books:
1. Avi Silberschatz, P.B.Galvin, G.Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.
2. Carl Hamacher, ZvonkoVranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw- Hill.

Reference Books:
1. A.S Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.
3. John P. Hayes, “Computer Architecture and Organization”, McGraw Hill Publication.
4. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition.

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