

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**B.Tech - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2019**

**CHOICE BASED CREDIT SYSTEM**

**OPEN ELECTIVE**



**Sri Eshwar College of Engineering**

(An Autonomous Institution)

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

Kondampatti (Post), Kinathukadavu,

Coimbatore – 641202

**B.Tech - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE  
OPEN ELECTIVE**

<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Contact Periods</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	U19AD601	Machine Learning Techniques	OE	3	3	0	0	3
2	U19AD602	Advanced Data Structures	OE	3	3	0	0	3
3	U19AD603	Introduction to Augmented Reality (AR)/Virtual Reality (VR)	OE	3	3	0	0	3
4	U19AD604	Introduction to Data Science	OE	3	3	0	0	3
5	U19AD605	Introduction to Artificial Intelligence	OE	3	3	0	0	3

**B.Tech - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE  
OPEN ELECTIVE**

<b>U19AD601</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	After completion of this course, the students will be able to				
<b>Outcomes</b>	<b>CO1 (Understand)</b> Understand the basic concepts and techniques of Machine Learning				<b>K2</b>
	<b>CO2 (Apply)</b> Implement feature extraction and selection to represent data as features to serve as input to machine learning models				<b>K3</b>
	<b>CO3 (Apply)</b> Apply the appropriate machine learning strategy for any given problem				<b>K3</b>
	<b>CO4 (Understand)</b> Select the suitable machine learning task for a given application				<b>K2</b>
	<b>CO5 (Understand)</b> Describe the differences in approaches and applicability of regression, classification, and clustering				<b>K2</b>
<b>MODULE I</b>	<b>INTRODUCTION TO MACHINE LEARNING</b>				<b>9</b>
	Introduction – Machine Learning Vs Traditional Programming – History of Machine Learning - Types of Machine Learning – Applications. – The Brain and the Neuron - Design a Learning System – Perspectives and Issues in Machine Learning - Concept Learning.				
<b>MODULE II</b>	<b>DIMENSIONALITY REDUCTION</b>				<b>9</b>
	Dimensionality reduction: Linear Discriminant Analysis – Feature extraction - Principal component analysis, Singular value decomposition. Feature selection – feature ranking and subset selection, filter, wrapper and embedded methods.				
<b>MODULE III</b>	<b>ARTIFICIAL NEURAL NETWORK</b>				<b>9</b>
	Artificial Neural Network - Perceptron – Multilayer Network and Back Propagation Algorithm –Example: Face Recognition				
<b>MODULE IV</b>	<b>SUPERVISED LEARNING</b>				<b>9</b>
	Supervised Learning: Classification - k-nearest neighbour (kNN) – Decision Tree: Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees. - Random Forest model – Support Vector Machines. Regression – Linear Regression – Logistic Regression.				
<b>MODULE IV</b>	<b>UNSUPERVISED LEARNING</b>				<b>9</b>
	Unsupervised Learning: Clustering - K means Algorithms – Vector Quantization – Finding pattern using Association Rule.				
					<b>TOTAL : 45 Hours</b>

**TEXTBOOKS**

- Machine Learning – An Algorithmic Perspective - Stephen Marsland, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, Second Edition, 2014.
- Introduction to Machine Learning, E. Alpaydin, MIT Press, 2nd Edition, 2010.
- Machine Learning - Tom. M. Mitchell- McGraw-Hill Edition, First Edition, 2019

**REFERENCES**

- Machine learning – Hands on for Developers and Technical Professionals, Jason Bell, First Edition, Wiley, 2014
- Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, First Edition, Cambridge University Press, 2012

<b>U19AD602</b>	<b>ADVANCED DATA STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	After completion of this course, the students will be able to				
<b>Outcomes</b>	<b>CO1 (Understand)</b> Understand the various iterative and recursive algorithms.				<b>K2</b>
	<b>CO2 (Apply)</b> Construct balanced tree structures for efficient operations on data.				<b>K3</b>

- CO3 (Apply)** Deploy search data structures for efficient range searching and string matching. **K3**
- CO4 (Analyze)** Identify the suitable algorithm design techniques for solving the program. **K4**
- CO5 (Understand)** Describe the concepts of NP-completeness, approximation and randomized algorithms. **K2**

**MODULE I ALGORITHM ANALYSIS 9**  
 Analysis of Iterative and recursive algorithms – Asymptotic Notations – Parallel Algorithms: Introduction – Scalar product of two vectors – Matrix multiplication.

**MODULE II BALANCED TREES 9**  
 Treaps - Red-Black trees – B\*tree – Splay trees - Binary heaps – Min-Max heaps - Leftist heaps – Binomial heaps – Fibonacci heaps.

**MODULE III SEARCH STRUCTURES 9**  
 k-d Trees – R-Trees – Tries – Suffix Trees and Arrays – String Matching: KMP and Boyer Moore algorithms.

**MODULE IV ALGORITHM DESIGN TECHNIQUES 9**  
 Dynamic programming: Elements of Dynamic Programming – Matrix-Chain Multiplication – Longest Common Subsequence – Rod Cutting problem - Wildcard Pattern Matching – Greedy Algorithms: An Activity selection problem - Shortest Superstring Problem.

**MODULE V ADVANCED ALGORITHM PARADIGMS 9**  
 Theory of NP completeness – Decision problems – Satisfiability problem – NP problems – Cooks Theorem – NP Complete problems – Randomized algorithms: Primality Testing – Approximation algorithms: Bin-packing, Vertex cover problem – Polynomial time Approximation Schemes : 0/1 Knapsack problem.

**TOTAL : 45 Hours**

**TEXTBOOKS**

- 1 Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein “Introduction to Algorithms”, Third Edition The MIT Press 2009
- 2 Jeff Edmonds, “How to think about Algorithms”, Cambridge University Press, 2008.

**REFERENCES**

- 1 Karumanchi Narasimha, “Data Structures and Algorithms Made Easy”, Fifth Edition, CareerMonk Publication, 2016
- 2 Adam Drozdek, “Data Structures and Algorithms in Java”, Cengage Learning, 4<sup>th</sup> Edition, 2013
- 3 R.C.T.Lee, S.S.Tseng, R.C.Chang and Y.T.Tsai, “Introduction to the Design and Analysis of Algorithms A Strategic Approach” Tata McGraw Hill, 2012
- 4 Richard F. Gillberg, Behrouz A. Forouzan, “Data structures: A Pseudocode Approach with C”, Cengage Learning, Second Edition, 2009.
- 5 Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.

**U19AD603 INTRODUCTION TO AUGMENTED REALITY(AR) / VIRTUAL REALITY(VR) L T P C 3 0 0 3**

After completion of this course, the students will be able to

- CO1 (Apply)** Identify the fundamentals of Augmented/Virtual Reality. **K3**
- CO2 (Apply)** Categorize the hardware requirements for 3-Dimension. **K3**
- CO3 (Analyze)** Classify the Software technologies used in 3 and 2 Dimension. **K4**
- CO4 (Analyze)** Dissect the Interaction techniques used in VR. **K4**
- CO5 (Apply)** Organize the AR/VR Applications used in real-world. **K3**

**MODULE I FUNDAMENTALS OF ARTIFICIAL AND VIRTUAL REALITY 8**

The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality.

**MODULE II 3D USER INTERFACE INPUT HARDWARE 9**

HARDWARE TECHNOLOGIES: Visual Displays Auditory Displays, Haptic Displays. Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.

**MODULE III SOFTWARE TECHNOLOGIES 10**

Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls.

**MODULE IV 3D INTERACTION TECHNIQUES 10**

3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Multimodal System Control Techniques, Design Guidelines.

**MODULE V VIRTUAL REALITY APPLICATIONS 8**

DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies for Designing and Developing Guidelines and Evaluation. Engineering, Architecture, Education, Medicine, Entertainment, Science, Training

**TOTAL : 45 Hours****TEXTBOOK:**

- 1 Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

**REFERENCES**

- 1 Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
- 2 Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
- 3 Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Merging Real and Virtual Worlds", 2005.
- 4 Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

U19AD604	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	CO1	CO2	CO3	CO4	CO5
	<b>(Understand)</b> Explain the roles and stages of data science projects and describe the data structures provided by numpy library.	<b>(Understand)</b> Explain data structures provided by pandas library for data analysis	<b>(Apply)</b> Perform data wrangling, cleaning and transformation using python	<b>(Apply)</b> Use matplotlib for plotting and visualizing the datasets	<b>(Apply)</b> Demonstrate data aggregation and time series analysis using python programming Language

**MODULE I INTRODUCTION TO DATA SCIENCE 9**

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modelling and validation.

**NUMPY BASICS: ARRAYS**

The NumPy ndarray: A Multidimensional Array Object – Universal Functions: Fast Element wise Array Functions – Data Processing Using Arrays.

**MODULE II VECTORIZED COMPUTATION AND PANDAS 9**

File Input and Output with Arrays – Linear Algebra – Random Number Generation – Random Walks.

Introduction to pandas Data Structures – Essential Functionality – Summarizing and Computing Descriptive Statistics – Handling Missing Data – Hierarchical Indexing.

**MODULE III DATA LOADING, STORAGE, AND FILE FORMATS & DATA WRANGLING 9**

DATA LOADING, STORAGE, AND FILE FORMATS: Reading and Writing Data in Text Format – Binary Data Formats – Interacting with HTML and Web APIs – Interacting with Databases.

DATA WRANGLING: CLEAN, TRANSFORM, MERGE, RESHAPE Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation – USDA Food Database.

**MODULE IV PLOTTING AND VISUALIZATION 9**

Functions: Built-in Functions, User defined functions – Function Prototypes – Recursion – Command Line Argument – Arrays and Functions – Strings and Functions. Pointers: Declaration – Pointer operators – Pointer arithmetic – Passing Pointers to a Function – Pointers and one dimensional arrays – Dynamic Memory Allocation

**MODULE V DATA AGGREGATION AND GROUP OPERATIONS & TIME SERIES 9**

DATA AGGREGATION AND GROUP OPERATIONS: GroupBy Mechanics – Data Aggregation – Group-wise Operations and Transformations – Pivot Tables and Cross-Tabulation TIME SERIES: Date and Time Data Types and Tools – Time Series Basics – Date Ranges, Frequencies, and Shifting – Time Zone Handling – Periods and Period Arithmetic – Resampling and Frequency Conversion – Time Series Plotting – Moving Window Functions – Performance and Memory Usage Notes.

**TOTAL : 45 Hours**

**TEXTBOOKS**

- 1 Wes McKinney, "Python for Data Analysis", 2nd Edition, O'Reilly Media, 2017.
- 2 Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

**REFERENCES**

- 1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
- 2 Sebastian Raschka, "Python Machine Learning", Packpub.com, 2015
- 3 <https://www.datacamp.com/courses/statistical-thinking-in-python-part-1>.

<b>U19AD605</b>	<b>INTRODUCTION TO ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	After completion of this course, the students will be able to				
	<b>CO1 (Apply)</b> Make use of appropriate strategy to solve a given problem				<b>K3</b>
	<b>CO2 (Apply)</b> Identify suitable search algorithm to solve problems where artificial intelligence techniques are applicable				<b>K3</b>
<b>Outcomes</b>	<b>CO3 (Understand)</b> Infer the way to represent knowledge and plan it accordingly				<b>K2</b>
	<b>CO4 (Apply)</b> Utilize the learning model to model machines				<b>K3</b>
	<b>CO5 (Apply)</b> Design applications that use Artificial Intelligence				<b>K3</b>
<b>MODULE I</b>	<b>FUNDAMENTALS</b>				<b>9</b>
	Introduction - Definition - Examples of AI - History of AI - Future of AI - Intelligent Agents - Rational Agent - Nature of Environment - Structure of Agents				
<b>MODULE II</b>	<b>PROBLEM SOLVING APPROACH TO AI PROBLEMS</b>				<b>9</b>
	Problem Solving Methods – Problem Formulation – Toy Problems - Real World Problems – Search Strategies – Uninformed – Informed - Heuristics – Game Playing				
<b>MODULE III</b>	<b>KNOWLEDGE REPRESENTATION AND PLANNING</b>				<b>9</b>
	Logical Agents – Propositional Logic – First Order Logic – Planning with state space search – partial order planning – planning graph – Planning and Acting in real world				

**MODULE IV LEARNING**

**9**

Forms of Learning – Knowledge-Based Classification – Feedback-Based Classification – Learning from decision trees - Machine learning – Deep learning

**MODULE V APPLICATIONS OF ARTIFICIAL INTELLIGENCE**

**9**

AI Applications – Healthcare- Chat bots – AI in Finance- AI in Banking- Robots –AI Agriculture Bots  
- Expert Systems-Personalized Learning

**TOTAL : 45 Hours**

**TEXTBOOKS**

- 1 S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015
- 2 Dr.Nilakshi Jain, "Artificial Intelligence : Making a System Intelligent", Wiley,2019

**REFERENCES**

- 1 Nils J. Nilsson, –The Quest for Artificial Intelligencell, Cambridge University Press, 2009
- 2 Vinod Chandra S.S., Anand Hareendran S., "Artificial Intelligence And Machine Learning", PHI Learning Private Limited,2014
- 3 R.Radha, "Artificial Intelligence", Charulatha Publications, 2019