ANNAMACHARYA INSTITUTE OF TECHNOLOGY ANDSCIENCES,
TIRUPATI (AUTONOMOUS)
B. Tech - Artificial Intelligence & Data Science (AI & DS)
(Effective for the batches admitted from 2020-21)

Semester V (Third year)

Sl.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	TOTAL
				L	T	P	C			
1	PC	20APC3015	Principles of Data Science	3	0	0	3	30	70	100
2	PC	20APC3017	Artificial Intelligence	3	0	0	3	30	70	100
3	PC	20APC3019	Big data Technologies	3	0	0	3	30	70	100
4	OE –I	20AOE9925	Deterministic and Stochastic Statistical Methods	3	0	0	3	30	70	100
		20AOE0303	Optimization Techniques	3	0	0				
		20AOE0552	Internet of Things	3	0	0				
5	PE - I	20APE3001	Design And Analysis of Algorithms	3	0	0	3	30	70	100
		20APE3002	Computer Graphics	3	0	0				
		20APE3003	Adhoc & Sensor Networks	3	0	0				
6	PC LAB	20APC3018	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
7	PC LAB	20APC3016	Principles of Data Science Lab	0	0	3	1.5	30	70	100
8	SC	20ASC3003	Conversational AI	1	0	2	2	100	0	100
9	MandatoryCourse (AICTE Suggested)	20AMC9901	Biology for Engineers	2	0	0	0	30	0	30
10	PR	20APR3001	Evaluation of Community Service Project	0	0	0	1.5	100	0	100
Total credits							**21.5**	**440**	**490**	**930**
Honors/Minor courses (The hours distribution can be 3-0- 2 or 3-1-0 also)				**4**	**0**	**0**	**4**	**0**	**0**	**0**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III **Semester: I** **Branch of Study: AI & DS**

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
20APC3015	Principles of Data Science	3	0	0	3

Course Outcomes

CO1: Recognize the different levels of Data Science concepts for visualization of data
CO2: Demonstrate the data visualization and statistical techniques, for describing data structure properties.
CO3: Describe the R programming for manipulation of data sets .
CO4: Apply the advanced data structure for efficient data storage.
CO5: Analyse the basics of probability and statistics models for data exploration

UNIT - I

Structured versus unstructured data, Quantitative and qualitative data, The four levels of data: Nominal level, Ordinal level, Interval level, and Ratio level, The five steps of Data Science: Ask an interesting question, obtain the data, explore the data, model the data, communicate and visualize the results, Explore the data.

UNIT – II

Mathematics: Vectors and matrices, Arithmetic symbols, Graphs, Logarithms/exponents, Set theory, Linear algebra. Probability: Basic definitions, Probability, Bayesian versus Frequentist, Compound events, Conditional Probability, The rules of probability, Collectively exhaustive events, Bayes theorem, Random variables.

UNIT – III

Statistics: Obtaining data, Sampling data, Measuring Statistics, The Empirical rule, Point estimates, Sampling distributions, Confidence intervals, Hypothesis tests.

UNIT – IV

Identifying effective and ineffective visualizations: Scatter plots, Line graphs, Bar charts, Histograms, Box plots. Graphs and Statistics lie: Correlation versus causation, Simpson's paradox, Verbal Communication, Thewhy/how/what strategy of presenting.

UNIT – V

Applications of Data Science- Technologies for visualisation, Bokeh (Python), recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Text Books:

1. Sinan Ozdemir, "Principles of Data Science", Packt, 2016.
2. "Algorithms for Data Science", 1st edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

References:

1.Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
2. G. Jay Kerns, "Introduction to Probability and Statistics Using R", First Edition.
3. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 1st Edition, 2014.
4. Doing Data Science: Straight Talk From The Frontline, 1st edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
5. Mining of Massive Datasets, 2nd edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2										2	
CO2	3	2	2	3									2	
CO3	3	2	2	3									2	
CO4		3	2	2	3								2	2
CO5		2	2	2	3								2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20APC3017	**Artificial Intelligence (Common to : CSE, CIC, AI & ML, AI & DS)**	**3**	**0**	**0**	**3**

Course Outcomes

CO1: Understand the basic concepts of Artificial Intelligence
CO2: Apply searching techniques for solving a problem
CO3: Analyze the concepts of Reinforcement Learning
CO4: Develop Natural Language Interface for Machines
CO5: Understanding the concepts to design a robotics

UNIT - 1:

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.
Intelligent Agents: Agents and Environments **Good Behavior:** The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT - 2:

Solving Problems by searching: Problem Solving Agents, Example problems, searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

UNIT - 3:

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

UNIT - 4:

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition

Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT - 5:

Robotics: Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains

Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Text Books:

1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence A Modern Approach”, 3rd Edition, Pearson Education, 2019.

Reference Books:

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2											
CO2	3	3	3	2	3								2	2
CO3	2	2	2	2	2									3
CO4		3	3		3									3
CO5	3	2	1			1		1				1	1	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III **Semester: I** **Branch of Study: AI & DS**

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
20APC3019	BIG DATA TECHNOLOGIES	3	0	0	3

Course Outcomes:

Student should be able to

CO1: Understand the elements of Big data

CO2: Use different technologies to tame Big Data

CO3: Process Given data using Map Reduce

CO4: Develop applications using Hive, NoSQL.

UNIT - 1:

Getting an Overview of Big Data: Introduction to Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. Exploring the use of Big Data in Business Context Use of Big Data in Social Networking, Use of Big Data Preventing Fraudulent Activities, Use of Big Data in Retail Industry

UNIT - 2:

Introducing Technologies for Handling Big Data Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-memory Computing Technology for Big Data.

Understanding Hadoop Ecosystem Hadoop Ecosystem, Hadoop Distributed File System, Map Reduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT - 3:

Understanding Map Reduce Fundamentals and H Base The Map Reduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of H Base in Big Data Processing. Processing Your Data with Map Reduce Recollecting he Concept of Map Reduce Framework, Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.

UNIT - 4:

Customizing Map Reduce Execution and Implementing Map Reduce Program Controllong Map Reduce Execution with Input Format, Reading Data with Custom Record Reader, Organizing Output Data with Output Formats, Customizing Data with Record Writer, Customizing the Map Reduce Execution in Terms of YARN, Implementing a Map Reduce Program for Sorting Text Data.

Testing and Debugging Map Reduce Application Debugging Hadoop Map Reduce Locally, Performing Unit Testing for Map Reduce Applications.

UNIT - 5:

Exploring Hive: Introducing Hive, Hive Service, Built-In Functions in Hive, Hive DDl, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive.

NoSQL Data Management Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models, Sharding.

Text Books:

1. Big Data Black Book, DT Editorial services ,Dreamtech Press

Reference Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Media.
4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2												
CO2	3	3	3	2	3								2	2
CO3	2	2	2	2										3
CO4		3	3		3									3
CO5	3	2	1			1		1				1	1	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20AOE9925	**Deterministic and Stochastic Statistical Methods (Common to : CSE, CIC, AI & ML, AI & DS)**	**3**	**0**	**0**	**3**

Course Outcomes:

After completion of the course, students will be able to

- Identify logical thinking to problem-solving in context.
- Employ methods related to these concepts in a variety of data science applications.
- Solve problems by using appropriate technology to aid problem-solving and data analysis.
- Analyze Distribution Theory and Bayesian process of inference in probabilistic reasoning system.
- Develop skills in solving unconstrained optimization problems.

UNIT - 1:

Distance measures, Projections, Notion of hyper planes, half-planes. Principal Component Analysis- Population Principal Components, sample principal coefficients, covariance, matrix of data set, Dimensionality reduction, Singular value decomposition, Gram Schmidt process.

UNIT - 2:

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation- Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution.

UNIT - 3:

Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, step transition probabilities, Markov chain, Steady state condition, Markov analysis.

UNIT - 4:

Multivariate Normal distribution – Properties, Distributions of linear combinations, independence, marginal distributions, conditional distributions, Partial and Multiple correlation coefficient. Moment generating function. BAYESIAN INFERENCE AND ITS APPLICATIONS: Statistical tests and Bayesian model comparison, Bit, Surprisal,Entropy, Source coding theorem, Joint entropy, Conditional entropy, Kullback-Leibler divergence.

UNIT - 5:

Unconstrained optimization, Necessary and sufficiency conditions for optima, Gradient descent methods, Constrained optimization, KKT conditions, Introduction to non-gradient techniques, Introduction to least squares optimization, Optimization view of machine learning. Data Science Methods: Linear regression as an exemplar function approximation problem, linear classification problems.

Text Books:

1. Mathematics for Machine Learning by A. Aldo Faisal, Cheng Soon Ong, and Marc Peter Deisenroth
2. Dr.B.S Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers.
3. Operations Research, S.D. Sharma

Reference Books:

1. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
2. A Probabilistic Theory of Pattern Recognition by Luc Devroye,. Laszlo Gyorfi, Gabor Lugosi.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2		2												
CO3		2												
CO4		2												
CO5		2												

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20AOE0303	**Optimization Techniques**	**3**	**0**	**0**	**3**

Course Outcomes

- Explain the need of optimization of engineering systems
- Understand optimization of electrical and electronics engineering problems
- Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- Apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

UNIT - 1:

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT - 2:

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel¨s approximation method – testing for optimality of balanced transportation problems.

UNIT - 3:

Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method, Powell¨s method and steepest descent method.

UNIT - 4:

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT - 5:

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution

Text Books:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009. 2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

Reference Books:

1. George Bernard Dantzig, Mukund Narain Thapa, “Linear programming”, Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, “Operations Research: An Introduction”, 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, “Optimization for Engineering Design – Algorithms and Examples”, PHI Learning Pvt. Ltd, New Delhi, 2005

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2		1												
CO3				3										
CO4		3												
CO5	2													

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20AOE0552	**Internet of Things**	**3**	**0**	**0**	**3**

Course Outcomes

CO1: Able to understand the applications of IOT
CO2: Able to understand build blocks of IOT
CO3: Apply IOT design methodologies
C04: Able to understand the HADOOP and IEEE standard protocol
CO5: Able to understand the Zigbee devices

UNIT-1:

Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies. Domain Specific IoTs Introduction, Home Automation, cities, Environment, Retail, Agriculture, Industry, Health & Lifestyle.

UNIT-2:

Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT. IoT System Management with NETCONF-YANG Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG.

UNIT-3:

Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring. Case Studies Illustrating IoT Design: Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.

UNIT-4:

Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis. IEEE 802.15.4: The IEEE 802 committee family of protocols, The physical layer, The Media Access control layer, Uses of 802.15.4, The Future of 802.15.4: 802.15.4e and 802.15.4g.

UNIT-5:

Development of the standard, ZigBee Architecture, Association, The ZigBee network layer, The ZigBee APS Layer, The ZigBee Devices Object (ZDO) and the ZigBee Device Profile (ZDP), Zigbee Security, The ZigBee Cluster Library (ZCL), ZigBee Applications profiles, The ZigBee Gateway Specifications for network devices.

Text Books:

1. Internet of Things a Hands-on Approach by Arshdeep Bahga and Vijay Madisetti. University Press.
2. The Internet of Things key applications and protocols by Oliver Hersent, David Boswarthick and Omar elloumi, Wiley Student Edition.

Reference Books:

1. Internet of Things: Architecture, Design Principles and Applications by Raj Kamal MCGraw Hill Edition.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2											
CO2	2	3											2	2
CO3	2	2	2	2	2									3
CO4		3	3		3									3
CO5	3	2	1			1		1				1	1	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20APE3001	**Design And Analysis of Algorithms (Common to : CSE, CIC, AI & ML, AI & DS)**	**3**	**0**	**0**	**3**

Course Outcomes

CO1: Analyze the complexity of the algorithms

CO2: Use techniques of greedy and dynamic programming to solve the problems.

CO3: Implement traversal, backtracking and searching techniques.

CO4: Choose the appropriate algorithm for solving minimization problem.

CO5: Able to prove that a certain problem is NP-Complete

UNIT - 1:

Introduction: What is an Algorithm, Algorithm specification, Performance analysis.

Divide and Conquer: General method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Selection sort, Stressen's matrix multiplication.

UNIT - 2:

Greedy Method: General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths.

Dynamic programming: General Method, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, The traveling sales person problem.

UNIT - 3:

Basic Traversal and Search Techniques: Techniques for binary trees, Techniques for Graphs,
Connected components and Spanning trees, Bi-connected components and DFS

Back tracking: General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.

UNIT - 4:

Branch and Bound: The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency Considerations.

Lower Bound Theory: Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.

UNIT - 5:

NP – Hard and NP – Complete Problems: NP Hardness, NP Completeness, Consequences of beingin P, Cook's Theorem, Reduction Source Problems, Reductions: Reductions for some known problems

Text Books:

1. "Fundamentals of Computer Algorithms", Ellis Horowitz, S. Satraj Sahani and Rajasekhran, 2nd edition, University Press.2014,
2. "Design and Analysis of Algorithms", Parag Himanshu Dave, Himanshu Bhalchandra Dave, Pearson Education, Second Edition, 2009.

Reference Books:

1. "Introduction to Algorithms", second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd./

Pearson Education.
2. “Introduction to Design and Analysis of Algorithms A strategic approach”, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
3. “Design and Analysis of algorithms”, Aho, Ullman and Hopcroft, Pearson education.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	2	3	2										3	
CO2	2	2	2										2	
CO3	2	2	2	2									2	
CO4	2	2	2	2									2	
CO5	2	1	2										2	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III **Semester: I** **Branch of Study: AI & DS**

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
20APE3002	Computer Graphics	3	0	0	3

Course Outcomes:

CO1: Explain the basic concepts in computer Graphics

CO2: Design algorithms based on output primitives

CO3: Construct 2D graphics transformations

CO4: Construct 3D graphics transformations

CO5: Remove hidden surfaces from graphs and anime

UNIT-1:
Overview of Computer Graphics System – Video display devices – Raster Scan and random scan system – Input devices – Hard copy devices.

UNIT-2:
Drawing line, circle and ellipse generating algorithms – Scan line algorithm – Character Generation – attributes of lines, curves and characters – Antialiasing.

UNIT-3:
Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and clipping of polygons.

UNIT-4:
Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces, Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing - Parallel and perspective projections.

UNIT-5:
Visible Surface Detection Methods – Computer Animation.

TEXTBOOK

1. Hearn, D. and Pauline Baker,M., Computer Graphics (C-Version), 2nd Edition, Pearson Education, 2002.

REFERENCES

1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, Mc Graw Hill Book Co., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill Book Co., 1985.
3. Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub. (P) Ltd., 1996.
4. Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, Pearson Education, 2001.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2											
CO2	3	3	3	2									2	2
CO3	2	2	2	2										3
CO4		3	3											3
CO5	3	2	1											1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20APE3003	**ADHOC & SENSOR NETWORKS**	**3**	**0**	**0**	**3**

Course Outcomes

CO1: List the design issues for Adhoc and sensor networks

CO2: Analyze the use of TCP in Wireless networks.

CO3: Justify the need for new MAC Protocols for Adhoc networks.

CO4: Extend the existing protocols to make them suitable for Adhoc Networks.

CO5: Evaluate the performance of Protocols in Adhoc and sensor networks. Design new Protocols for Adhoc and Sensor networks.

UNIT-1:
IEEE 802 Networking Standard. Fundamentals of WLANs, IEEE 802.11 standard. What is Wireless Internet? Mobile IP, Cellular and Adhoc Wireless Networks, Applications of Adhoc Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.

UNIT-2:
Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that used Directional Antennas,
Other MAC Protocols.

UNIT-3:
Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power-Aware Routing Protocols.

UNIT-4:
Multicast Routing in Ad hoc Wireless Networks- Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An architecture reference model for multicast routing protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols, Mesh-Based Multicast Routing Protocols, Summary of Tree and Mesh-Based Protocols. Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions. TCP over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks.

UNIT-5:
Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Wireless Sensor Networks- Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other issues.

Text book:

1. Murthy, C. Siva Ram, and B. S. Manoj. Ad hoc wireless networks: Architectures and protocols. Pearson Education India, 2004.

References:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication -2002.
3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”,Wiley, 2005

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2											
CO2	3	3	3											2
CO3	2	2	2											3
CO4		3	3											3
CO5	3	2	1											1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20APC3018	**Artificial Intelligence Lab (Common to : CSE, CIC, AI & ML, AI & DS)**	**0**	**0**	**3**	**1.5**

Course Outcomes

Up on the completion of Course, The student will be able to

CO1: Implement search algorithms

CO2: Solve Artificial Intelligence Problems

CO3: Develop the solutions using Backtracking

CO4: Design Chatbot

CO5: Implement basic problems by using NLTK(Natural Language Tool Kit)

List of Tasks

1. Write a Program to Implement BFS and DFS.
2. Write a Program to find the solution for travelling sales person problem.
3. Write a program to implement simulated annealing Algorithm.
4. Write a Program to Implement Tic-Tac-Toe game.
5. Write a Program to Implement 8-Puzzle problem.
6. Write a program to implement Towers of Hanoi problem.
7. Write a program to implement A* Algorithm.
8. Write a Program to Implement Water-Jug problem.
9. Write a program to implement Hangman game.
10. Write a program to solve N Queen problem using backtracking.
11. Generate Calendar for the given month and year using a python program.
12. Write a program to implement simple Chatbot.
13. Write a program to remove stop words for a given passage from a text file using NLTK.
14. Write a program to implement stemming for a given sentence using NLTK.
15. Write a program to POS (Parts of Speech) tagging for the give sentence using NLTK.
16. Write a program to implement Lemmatization using NLTK.

Reference Books:

1. Tensorflow: https://www.tensorflow.org/
2. Pytorch: https://pytorch.org/,
3. https://github.com/pytorch
4. Theano: http://deeplearning.net/software/theano/ https://github.com/Theano/Theano
5. https://www.nltk.org/

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3									3		3
CO2	3	3	2	2								3		3
CO3	3	2	3		3	3						3	2	3
CO4	3	2	3		3	3						3		3
CO5	3	3	3	3									3	3

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AID			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20APC3016	**Principles of Data Science Lab**	**0**	**0**	**3**	**1.5**

Course Outcomes

Upon the completion of Course, The student will be able to

CO1: Understand precisely about functional and non-functional requirements.
CO2: Gained knowledge in project management and its principles.
CO3: Identify the relationship between requirements and Usecase.
CO4: Know the interface of modules such as cohesion and coupling.
CO5: Able to detect the bugs during testing.

List of Tasks

WEEK – 1 : INTRODUCTION TO COMPUTING
a) Installation of R
b) The basics of R syntax, workspace
c) Matrices and lists
d) Subsetting
e) System-defined functions; the help system
f) Errors and warnings; coherence of the workspace

WEEK – 2 GETTING USED TO R: DESCRIBING DATA
a) Viewing and Manipulating Data
b) Plotting Data
c) Reading the Data from console, file (.csv) local disk and Web
d) Working with larger datasets

WEEK – 3 VISUALIZING DATA
a) Tables, charts and plots.
b) Visualizing Measures of Central Tendency, Variation, and Shape.
c) Box plots, Pareto diagrams.
d) Find the mean, media, standard deviation and quantiles of a set of observations. Note: Experiment with real as well as artificial data sets.

WEEK – 4 BINOMIAL DISTRIBUTION
a) Study of binomial distribution.
b) Plots of density and distribution functions.
c) Normal approximation to the Binomial distribution.

WEEK – 5 PROBABILITY DISTRIBUTIONS
a) Random number generation Distributions, the practice of simulation
b) Generate and Visualize Discrete and continuous distributions using the statistical environment.
c) Demonstration of CDF and PDF uniform and normal, binomial Poisson distributions.
d) Generate artificial data using and explore various distribution and its properties. Various parameter changes may be studied.

WEEK - 6 EXPLORATORY DATA ANALYSIS Demonstrate Range, summary, mean, variance, median, standard deviation, histogram, box plot, scatterplot

WEEK – 7 DENSITIES OF RANDOM VARIABLES
a) Distributions in R
b) Matching a Density to Data

c) Making Histograms
WEEK - 8 CORRELATION
a) How to calculate the correlation between two variables.
b) How to make scatter plots. c) Use the scatter plot to investigate the relationship between two variables

WEEK - 9 TESTS OF HYPOTHESES
a) Perform tests of hypotheses about the mean when the variance is known.
b) Compute the p-value.
c) Explore the connection between the critical region, the test statistic, and the p-value

WEEK – 10 ESTIMATING A LINEAR RELATIONSHIP Demonstration on a Statistical Model for a Linear Relationship
a) Least Squares Estimates
b) The R Function lm
c) Scrutinizing the Residuals

WEEK – 11 APPLY-TYPE FUNCTIONS
a) Defining user defined classes and operations, Models and methods in R
b) Customizing the user's environment
c) Conditional statements
d) Loops and iterations

WEEK – 12 STATISTICAL FUNCTIONS IN R
a) Demonstrate Statistical functions in R
b) Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods IV.

REFERENCE BOOKS:
1. Maria Dolores Ugarte , Ana F. Militino , Alan T. Arnholt “Probability and Statistics with R” 2nd Edition on, CRC Press, 2016.
2. P. Dalgaard. “Introductory Statistics with R” Springer, 2nd Edition, 2008. V.

WEB REFERENCES:
1. http://nptel.ac.in/courses/106104135/48 2. http://nptel.ac.in/courses/110106064/

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2											
CO2	3	3	3										2	2
CO3	2	2	2											3
CO4		3	3											3
CO5	3	2	1										1	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III	Semester: I	Branch of Study: AI & DS			
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**CREDITS**
20ASC3003	**Conversational AI**	**1**	**0**	**2**	**2**

Course Outcomes:

Upon completion of the course, the students should be able to:

CO1: Develop a fair understanding of AI applications and to know where and how to apply these tools to improve productivity.
CO2: Understand AI as a tool pretty much like they treat calculator as a tool for simple calculation
CO3: Apply methods for different training and testing assistance
CO4: Design classifier for voice assistants

UNIT – 1:
Introduction to Chatbots, Setting Up the Developer Environment, What are chatbots? Journey of Chatbots, Rise of Chatbots, Messaging Platforms, Botframework, Local Installation

UNIT – 2:
Basics of Bot Building, Advanced Bot Building, Intents, Entities, Design principles, showing product results, saving messages, Building your own intent classifier

UNIT – 3:
Building Chatbots the easy way, Introduction to dialog flow, building a food ordering chatbot, deploying dialog flow chatbot on the web, Integrate dialog flow chatbot on Facebook messenger, Fulfilment

UNIT – 4:
Building Chatbots the hard way, What is Rasa NLU? Training and building a chatbot from scratch, Dialog management using Rasa core, writing custom actions of chatbot, Data preparing for training the bot, Testing the bot

UNIT – 5:
Deploying your chatbot, First steps, Rasa's credential management, Deploying the chatbot on Facebook, Deploying the chatbot on slack, Deploying the chatbot on your own

Textbooks:
1. Rashid Khan, Anik Das "Build Better Chatbots", Apress, 2018.
2. Sumit Raj "Building Chatbots with Python", Apress, 2019.

Reference Books:
1. Conversational AI: Chatbots that workBy Andrew Freed,2021

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2											
CO2	3	3											2	2
CO3	2	2												3
CO4		3												3
CO5	3	2	1			1		1				1	1	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI(AUTONOMOUS)

Year: III **Semester: I** **Branch of Study: AI & DS**

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
20AMC9901	Biology for Engineers	2	0	0	0

Course Outcomes

Upon completion of the course, the students should be able to:

CO1: Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.

CO2: Explain about biomolecules, their structure, function and their role in the living organisms. How biomolecules are useful in Industry.

CO3: Brief about human physiology.

CO4: Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.

CO5: Know about application of biological principles in different technologies for the production of medicines and pharmaceutical molecules through transgenic microbes, plants and animals.

UNIT - 1:

Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

UNIT - 2:

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

UNIT - 3:

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

UNIT - 4:

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

UNIT - 5:

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

Text Books:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A Global Approach”, Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2							3
CO2	2					3								2
CO3	2		2			3								
CO4	1			3	2									
CO5				3		2								3

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)