# School of Computer Science and Engineering

## Department of Computer Science and Engineering

## (Artificial Intelligence and Machine Learning) Program: AY 2020_21 AME/P/00

**Structure for B. Tech Third Year Semester V**

| Course Code | Course Title | L | T | P | C | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Component | Exam | WT% | Min. Pass% |
| **AMT1501** | Advanced Statistics | 3 | 1 | - | 4 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1502** | Internet of Things | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1503** | Design and Analysis of Algorithms | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1504** | Machine Learning | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1505** | Program Elective - I | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1506** | Internet of Things Laboratory | - | - | 2 | 1 | Practical | FEP | 50 | 40 |
| | | | | | | | POE | 50 | 40 |
| **AMT1507** | Machine Learning Laboratory | - | - | 2 | 1 | Practical | FEP | 50 | 40 |
| | | | | | | | POE | 50 | 40 |
| **AMT1508** | Program Elective - I Laboratory | - | - | 2 | 1 | Practical | FEP | 100 | 40 |
| **AMT1509** | Software Proficiency Program II - R Language | - | - | 2 | 1 | Practical | FEP | 50 | 40 |
| | | | | | | | POE | 50 | 40 |
| **AMT1510** | Scholastic Aptitude | 3 | - | - | Au | Theory | FET | 100 | 40 |
| **Total** | | **18** | **01** | **08** | **20** | **Total Hours: 26, Total Credits: 20, Audit: 1** | | | |

**FET – Faculty Evaluation Theory; FEP - Faculty Evaluation Practical; CAT – Continuous Assessment Test; ESE – End Semester Examination; Au - Audit Course**

# School of Computer Science and Engineering

## Department of Computer Science and Engineering

## (Artificial Intelligence and Machine Learning) Program: AY 2020_21 AME/P/00

**Structure for B. Tech Third Year Semester VI**

| Course Code | Course Title | L | T | P | C | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Component | Exam | WT % | Min. Pass% |
| **AMT1601** | Natural Language Processing | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1602** | Big Data Analytics | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1603** | Program Elective II | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1604** | Fuzzy Logic | 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | | | CAT I | 15 | |
| | | | | | | | CAT II | 15 | |
| | | | | | | | ESE | 50 | 40 |
| **AMT1605** | Natural language processing Laboratory | - | - | 2 | 1 | Practical | FEP | 100 | 40 |
| **AMT1606** | Big Data Analytics Laboratory | - | - | 2 | 1 | Practical | FEP | 50 | 40 |
| | | | | | | | POE | 50 | 40 |
| **AMT1607** | Program Elective II Laboratory | - | - | 2 | 1 | Practical | FEP | 100 | 40 |
| **AMT1608** | Fuzzy Logic Laboratory | - | - | 2 | 1 | Practical | FEP | 100 | 40 |
| **AMT1609** | Web Technology Laboratory | - | - | 4 | 2 | Practical | FEP | 50 | 40 |
| | | | | | | | POE | 50 | 40 |
| **AMT1610** | Mini Project II | - | - | 2 | 1 | Practical | FEP | 50 | 40 |
| | | | | | | | POE | 50 | 40 |
| **AMT1611** | MOOC course | - | - | - | 1 | Practical | FEP | 100 | 40 |
| **AMT1612** | Foreign Language | 2 | - | - | Au | Theory | FET | 100 | 40 |
| **Total** | | **14** | - | **14** | **20** | **Total Hours: 28, Total Credits: 20, Audit: 1** | | | |

**FET – Faculty Evaluation Theory; FEP - Faculty Evaluation Practical; CAT – Continuous Assessment Test; ESE – End Semester Examination; Au - Audit Course**

# School of Computer Science and Engineering

## Department of Computer Science and Engineering

## (Artificial Intelligence and Machine Learning) Program: AY 2020_21 AME/P/00

### Program Electives

| **AMT1505** | **Program Elective - I** |
|---|---|
| AMT15051 | Business Intelligence |
| AMT15052 | Cloud Computing |
| AMT15053 | Information Security |
| **AMT1508** | **Program Elective - I Laboratory** |
| AMT15081 | Business Intelligence |
| AMT15082 | Cloud Computing |
| AMT15083 | Information Security |

| AMT1603 | Program Elective II |
|---|---|
| AMT16031 | Digital Image Processing |
| AMT16032 | Data Visualization |
| AMT16033 | Speech Processing |
| AMT1606 | Program Elective II Laboratory |
| AMT16061 | Digital Image Processing |
| AMT16062 | Data Visualization |
| AMT16063 | Speech Processing |

| **AMT1704** | **Program Elective III** |
|---|---|
| AMT17041 | Computer Vision |
| AMT17042 | Introduction to Robotics |
| AMT17043 | Fundamentals of Tensors |
| **AMT1708** | **Program Elective III Laboratory** |
| AMT17081 | Computer Vision |
| AMT17082 | Introduction to Robotics |
| AMT17083 | Fundamentals of Tensors |

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1501 : Advanced Statistics

**(Ver 1.0, Basic Science, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) | |
| 3 | - | 1 | 4 | Theory (100) | FET | 20 | 40 | 40 |
| | | | | | CAT-I | 15 | | |
| | | | | | CAT-II | 15 | | |
| | | | | | ESE | 50 | 40 | |

**Prerequisite:** Complex numbers, Probability rules, Matrices, Vector operations.

**Course Outcomes:** After the end of this course students will be able to

**CO1** **Identify**[3] central tendency of given data

**CO2** **Select**[3] appropriate model of analysis

**CO3** **Transform**[3] datasets for further analysis

**CO4** **Apply**[3] goodness of fit tests

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Descriptive Statistics**<br>Counts and specific values, Measures of central tendency, Measures of spread, Measures of distribution shape, Statistical indices, Moments. | 7 |
| II | **Key Functions and Expressions**<br>Key functions, Measures of Complexity and Model selection, Matrices. | 7 |
| III | **Data transformation and standardization**<br>Box-Cox and Power transforms, Freeman-Tukey (square root and arcsine) transforms, Log and Exponential transforms, Logit transform, Normal transform (z-transform). | 7 |
| IV | **Goodness of Fit Tests**<br>Anderson-Darling, Chi-square test, Kolmogorov-Smirnov, Ryan-Joiner, Shapiro-Wilk, Jarque-Bera. | 7 |
| V | **Z-tests**<br>Test of a single mean, standard deviation known, Test of the difference between two means, standard deviations known, Tests for proportions. | 7 |

| | | |
|---|---|---|
| **VI** | **T-tests**<br>Test of a single mean, standard deviation not known,Test of the difference between two means, standard deviation not known. | **7** |

**Textbooks**

1. Dr Michael J de Smith, “Statistical Analysis Handbook, A Comprehensive Handbook of Statistical Concepts, Techniques and Software Tools”, 2018 Edition

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1502: Internet of Things

**Ver 1.0, Program Core, School of Computer Science and Engineering**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** Networking Concepts

**Course Outcomes:** After the end of this course students will able to

**CO1** **Explain**[2] the basics of IoT and its application sectors

**CO2** **Describe** [2] Machine to Machine(M2M) in IoT

**CO3** **Develop** [3] Applications IoT platforms

**CO4** **Apply** [3] IoT protocols appropriately for developing application

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction and concepts of IoT**<br>Introduction to IOT, definition and characteristics of IoT Architecture of Internet of Things, Physical and logical design of IOT, IOT enabling technologies, IOT levels and deployment templates Domain specific IOTs. | 07 |
| II | **IoT and M2M Communication**<br>M2M, difference between IOT and M2M, ETSI M2M Architecture, system architecture ETSI M2M SCL resource structure, Security in ETSI M2M framework, SDN and NFV for IOT, IOT system management, SNMP, Network operator requirements, NETCONF-YANG, IOT system management with NETCONF-YANG. | 07 |
| III | **IoT Platforms**<br>Hardware Platforms and Energy Consumption, Operating Systems, Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors. Introduction to Arduino, Pi, Spark, Intel Galileo. | 07 |
| IV | **IoT Technical standards and protocols** | 07 |

RF Protocols: RFID, NFC; IEEE 802.15.4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy (BLE), IPv6 for Low Power and Lossy Networks (6LoWPAN) and Routing Protocol for Low power and lossy networks (RPL) CoAP ,XMPP, Web Socket, AMQP, MQTT, WebRTC, PuSH . Architectural Considerations in Smart Object Networking

**V** **Developing Internet of Things** **07**

IoT platforms design methodology, IoT Physical devices and endpoints, IoT Systems: Logical design using Python, IoT physical servers and clou offerings (Cloud computing for IoT). Domain specific IOTs, Energy, retail, agriculture, industry, health and lifestyle

**Textbooks:**

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things, A Hands -on Approach”, 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7
2. Oliver Hersent, David Boswarthick, Omar Elloumy, “The Internet of Things”,1st Edition ,2015,ISBN: 978-81-265-5686-1 3.

**References :**

1. Michael Miller, “The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World”, First edition ,2015, Pearson , ISBN:978-93-325-5245-6
2. https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects, as on date: 25/04/16
3. https://tools.ietf.org/html/rfc7452, as on date: 25/04/2016
4. Hersent Olivier, Boswarthick David , Elloumi Omar , “The Internet of Things: Key Applications and Protocols”, Wiley-Blackwell, Second Edition ,2012
5. http://dret.net/lectures/iot-spring15/protocols, as on date: 25/04/2016
6. http://iot.intersog.com/blog/overview-of-iot-development-standards-and-frameworks, as on date: 25/04/2016

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**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1503: Design and Analysis of Algorithms

**Ver 1.0, Program Core, School of Computer Science and Engineering**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** Data Structures

**Course Outcomes:** After the end of this course students will be able to

**CO1** **Solve**[3] real time problems based on different algorithmic strategies

**CO2** **Analyse**[4] the complexity of different algorithms based on different techniques

**CO3** **Classify**[4] real time problems into different algorithmic techniques

**CO4** **Compare**[4] different algorithms based on different techniques

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction to Algorithms:** Introduction to Algorithm, Growth of Functions-Solving Recursive Equation: Substitution method, Iteration Method and Master Method. Divide and Conquer: Finding maximum and minimum, Selection, Stassen's matrix multiplication. | 07 |
| II | **Greedy Algorithms:** Greedy Approach-General Method, Knapsack Problem, Minimum cost spanning tree, Prim's and Kruskal's algorithms,Single Source Shortest Path. | 07 |
| III | **Dynamic Programming:** Principle of Optimality, All Pair Shortest Path, longest Common Sequence, Optimal binary search algorithm, Travelling Salesman Problem, Reliability Design. | 07 |
| IV | **Backtracking:** General Method, 8-Queen Problem, Sum-of-Subset Problem, Hamilton Cycle, Branch and Bound Knapsack Problem,Travelling Salesman Problem. | 07 |
| V | **String Matching and Parallel Algorithm**: Simple String matching, The 7 naive string-matching algorithm, The Rabin- Karp algorithm, PRAM Computation Model, Fundamental techniques, MESH -Computation | 07 |

| | | |
|---|---|---|
| | model, Packet Routing, Fundamental techniques, HYPERCUBE- Computation model, PPR Routing, Fundamental techniques. | |
| VI | **NP-Hard and NP-Complete Problems :** Basic concept of N, NP, NP- **7** Hard, NP-Complete, NP-Hard Graph Problems-Clique Decision Problem(CDP), Node Cover Decision Problem (NCDP), Chromatic number decision problem (CNDP), Directed Hamiltonian Cycle (DHC), Traveling salesman Problem (TSP), AND/OR Graph decision Problem (AOG). | **07** |

**Textbooks:**

2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, Hyderabad, 2008.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, Prentice Hall of India, New Delhi, 2007.

**References:**

1. Kenneth A. Berman and Jerome L. Paul, "Algorithms", Cengage learning India Edition, New Delhi, 2002.
2. Sara Baase and Allen Van Gelder, "Computer Algorithms – Introduction to Design & Analysis", Third Edition, Pearson Education, New Delhi, 2000.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1504: Machine Learning

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| 3 | - | - | 3 | Theory 100 Marks | FET | 20 | 40% |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40% |

**Prerequisite:** - Basic concepts of computer algorithm

**Course Outcomes:** After the end of this course students will able to

**CO1** **Explain**[2] the basic concept of machine learning

**CO2** **Identify**[3] machine learning techniques suitable for problem

**CO3** **Solve**[3] the problem using various machine learning techniques

**CO4** **Compare**[2] various machine learning techniques for optimization

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction**<br>Supervised and unsupervised learning, Hypothesis space, Applications of machine learning, Feature selection and extraction, Principal component analysis. | 07 |
| II | **Supervised learning**<br>Bias-Variance Dichotomy, Linear regression in one variable: Cost Function, Gradient descent; Linear Regression with Multiple Variables: Gradient descent; Logistic regression, KNN. | 07 |
| III | **Supervised Learning**<br>Bayesian Learning and Decision Trees, SVM, Ensemble Methods | 07 |
| IV | **Unsupervised Learning**<br>Clustering, k-means, Hierarchical agglomeration, EM | 07 |
| V | **Evaluation of Learning Algorithms**<br>Cross-validation, learning curves, and statistical hypothesis testing | 07 |

| | | |
|---|---|---|
| **VI** | **Machine Learning based Artificial Neural Networks**<br>Fundamentals of Artificial Neural Networks, Perceptron, Model of Neuron in an ANN, Backpropagation, Introduction to deep learning | **07** |

**Textbooks:**

1. Coursera online course byAndre NG, on Machine Learning.
2. http://www.stanford.edu/class/cs229/materials.html
3. T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning (2ed.), 2008.

**References:**

1) Christopher Bishop, "Pattern Recognition and Machine Learning", 2016
2) Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "Introduction to Statistical Learning", Springer, 2013
3) Richard Duda, Peter Hart, David Stork, "Pattern Classification", John Wiley & Sons, Second edition 2001.
4) NPTEL online course by Prof. Balaraman Ravindran on Introduction to Machine Learning.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT15051: Business Intelligence

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| 3 | - | - | 3 | Theory 100 Marks | FET | 20 | 40% |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40% |

**Prerequisite:** - Algorithms & Data Structures

**Course Outcomes:** After the end of this course students will able to

**CO1** **Solve**[4] unstructured business problems using DSS

**CO2** **Demonstrate**[3] different mathematical models for decision making

**CO3** **Interpret**[3] data to understand relationships between the underlying business processes of an organization.

**CO4** **Recommend**[2] different strategic decisions using multi-criteria decision making expert systems.

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Overview of business intelligence, analytics, and decision support** Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics. | 07 |
| II | **Foundations and technologies for decision making** Decision Making: Introduction and Definitions, Phases of the Decision Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems: Capabilities, Classification, Components. | 07 |
| III | **Optimization and Multi-Criteria Decision Making Systems** Decision Support Systems Modelling, Structure of Mathematical Models for Decision Support, Decision Making Under Certainty, Uncertainty and Risk. Decision Modelling with Spreadsheets, Mathematical Programming | 07 |

Optimization Decision Analysis with Decision Tables and Decision Trees Multi-Criteria Decision Making with Pairwise Comparisons**.**

| | | |
|---|---|---|
| **IV** | **Automated Decision Systems and Expert Systems**<br>Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems, Location, Based Analytics for Organizations, Cloud Computing in Business | **07** |
| **V** | **Mathematical Models**<br>Mathematical Model for Decision Making, Structure of Model, Classes of Models, Regression Models, Simple Linear & Multiple Linear Regression, Validation of Regression Models, Selection of Predictive Variables with Example | **07** |
| **VI** | **Classification & Clustering**<br>Classification problems, evolution, Classification Tree, Clustering method, partition method, Hierarchical methods, Evaluation of clustering models. | **07** |

**Textbooks:**

3. Carlo Vercellis “Business Intelligence- Data mining & optimization for Decision Making”,Wiley
4. Ramesh Sharda, DursunDelen, Efraim Turban, J. E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013, ISBN: 9781292009209

**References:**

1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence", 2nd Edition, 2011, Wiley, ISBN: 9780470433744.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT15052: Cloud Computing

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| 3 | - | - | 3 | Theory 100 Marks | FET | 20 | 40% |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40% |

**Prerequisite:** - Basic knowledge of Operating System

**Course Outcomes:** After the end of this course students will able to

**CO1** **Analyze[4]** the basic concepts and services of cloud computing.

**CO2** **Demonstrate[2]** large scale distributed systems and cloud applications

**CO3** **List[1]** the importance of cloud security

**CO4** **Design[5]** Cloud services for IOT Application

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction to Cloud Computing:** Defining Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multitenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines. | 07 |
| II | **Virtualization, Server, Storage and Networking**: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of the virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V Different hypervisors and features, Containerization (Docker/Kubernetes) | 07 |
| III | **Monitoring and Management:** Architecture for federated cloud computing, SLA management in cloud computing: Service provider's perspective, performance prediction for HPC | 07 |

on Clouds, Monitoring Tools.

| | | |
|---|---|---|
| **IV** | **Security:**<br>Cloud Security risks, Security, Regulations/Privacy (GDPR/Cloud Act/German), Trust, Operating System Security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Trusted virtual machine monitor, application-level security. | **07** |
| **V** | **Cloud Implementation and Applications:**<br>Cloud Platforms: Amazon EC2 and S3, Cloud stack, Intercloud, Lamda/Serverless, Open-Source Cloud Eucalyptus, Open stack (CNCF), VPN connectivity, Direct Connect | **07** |
| **VI** | **Design Cloud Services for IoT Application:**<br>VPC design, Security design, Load balancing for Horizontal scaling, Edge computing aspect, VPN connectivity to edge, IoT – Farm use case (Agrikanti use case): Manufacturing, Agriculture, Retail | **07** |

**Textbooks:**

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley Publications
2. Gautham Shroff, “Enterprise Cloud Computing”, Cambridge University Press.

**References :**

1. Rajkumar Buyya, J.Broberg, A. Goscinski, “Cloud Computing Principles and Paradigms”, 1st Edition, Wiley Publications.
2. Ronald Krutz and Russell Dean Vines, “Cloud Security: Comprehensive guide to Secure Cloud Computing”, Wiley Publications.

# School of Computer Science and Engineering

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## AMT15053: Information Security

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| 3 | - | - | 3 | Theory 100 Marks | FET | 20 | 40% |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40% |

**Prerequisite:** -Computer Network fundamentals

**Course Outcomes:** After the end of this course students will able to

**CO1** **Illustrate**[2] symmetric and asymmetric cryptographic algorithms

**CO2** **Demonstrate**[2] Message Authentication Methods

**CO3** **Examine**[4] Key Management, Distribution Techniques

**CO4** **Determine**[5] the need for security services at the transport, application layers

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction:** Security goals, Cryptographic Attacks, Services and Mechanism, technique Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices Traditional. Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers. | 07 |
| II | **Data Encryption Standard:** Introduction, DES Structure, DES Analysis, Security of DES, IDEA Advanced Encryption Standard: Introduction, Transformations, Key Expansion, and Analysis of AES. | 07 |
| III | **Mathematics of Asymmetric Key Cryptography:** Primes, Primality testing, Factorization, Chinese remainder theorem, Asymmetric key cryptography: RSA Cryptosystem, Rabin Cryptosystem. | 07 |
| IV | **Message authentication:** Message authentication and Hash functions- Authentication functions, MACs, HMAC, CMAC, Hash functions, Digital signatures and authentication | 07 |

| | | |
|---|---|---|
| | protocols, Digital signature standard, Digital Signature Standard. Authentication Applications - Kerberos, X.509 Authentication Service, Public - Key Infrastructure. | |
| **V** | **Key management:** Symmetric Key Distribution, Kerberos, Symmetric Key Agreement, Security at the Application Layer: Email, PGP: scenarios, key rings, PGP certificate, Trust model in PGP, PGP Packet, PGP Messages, S/MIME: MIME, S/MIME | **07** |
| **VI** | **Security at the Transport Layer:** SSL Architecture, Services, Key Exchange Algorithm, Encryption/Decryption Algorithm, Hash Algorithm SSL Message Formats, Security At the Network Layer: Two Modes, Two Security Protocol and ISAKMP. | **07** |

**Textbooks:**

**5.** Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, McGraw Hill Education, 2014.

**References:**

7. William Stallings, “Cryptography and Network Security: Principles and Practice”, 5th Edition, Prentice Hall 2013
8. V.S. Bagad and I.A. Dhotre, “Cryptography and Network Security”, Technical Publications 2012.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1506: Internet of Things Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weigh tage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |
| | | | | | POE | 50 | 40 |

**Prerequisite:** Networking Concepts

**Course Outcomes:** After the end of this course students will able to

**CO1** **Construct**[3] applications in IOT

**CO2** **Evaluate**[5] the data received through sensors in IOT

## Practical

Two Hrs. per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1) Install IDE of Arduino and different types of Arduino.
2) Installation of OS on Raspberry-Pi/Beagle board.
3) Write program using Arduino IDE for Blink LED.
4) Write Program for RGB LED using Arduino.
5) Write Program for monitor temperature using Arduino.
6) Write a program to detect obstacle and notify using LED.
7) Write a program to capture and store image using Rasberr-pi/Beagle with camera
8) Program for LED bilking using Raspberry pi on Proteus using flowchart.
9) Implement RFID using Arduino.
10) Implement NFC using Arduino.
11) Configure Raspberry Pi
12) Implement MQTT protocol using Arduino.
13) Configure Raspberry Pi
14) WAP for LED blink using Raspberry Pi.
15) Implement Zigbee Protocol using Arduino.
16) Intrusion detection system for smart home
17) Implement Zigbee Protocol using Raspberry Pi.

**Textbooks:**

"IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017

**References :**

1. Arshdeep Bahga, Vijay Madisetti, —"Internet of Things – A hands-on approach", Universities Press, 2015
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1507: Machine Learning Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weigh tage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |
| | | | | | POE | 50 | 40 |

**Prerequisite:** Computer algorithm, basics of computer programming

**Course Outcomes:** After the end of this course students will able to

**CO1: Demonstrate[2]** basic concepts of machine learning

**CO2: Solve[3]** the problems using various machine learning techniques

## Practical

Two Hrs. per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Implementation of feature selection and extraction algorithm.
2. Implementation of linear regression
3. Implementation of logistic regression.
4. Implementation of KNN algorithm
5. Implementation of decision tree.
6. Implementation of Naïve Bayesian classifier.
7. Implementation of Bayesian network.
8. Clustering Based on EM algorithm.
9. Clustering based on K-Means Algorithm.
10. Implementation of evaluation techniques.
11. Implementation of back propagation for ANN.

**Textbooks:**

1. T. Hastie, R. Tibshirani, J. Friedman, "The Elements of Statistical Learning", 2nd Edition, 2008
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer 2006

**References :**

1. Christopher Bishop, "Pattern Recognition and Machine Learning", 2016

2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani , "Introduction to Statistical Learning", Springer, 2013
3. Richard Duda, Peter Hart, David Stork, "Pattern Classification", John Wiley & Sons, 2e,2001
4. NPTEL online course by Prof. Balaraman Ravindran on "Introduction to Machine Learning"

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT15081: Business Intelligence Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** - Data Structures, Database Management System.

**Course Outcomes:** After the end of this course students will able to

**CO1** **Interpret**[2] unstructured business problems using DSS

**CO2** **Use**[3] appropriate BI tool to solve given business problem

**CO3** **Develop**[3] mathematical model for decision support system

## Syllabus (Practical)

Two Hrs. per week per batch practical is to be utilized for writing to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum of 10-12 experiments. Students of different batches should implement different programs based on following guidelines

1. Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system.
2. Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver / Power BI.
3. Data Visualization from ETL Process
4. Creating a Cube in SQL server
5. Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
6. Implementation of Classification algorithm in R Programming.
7. Practical Implementation of Decision Tree using R Tool
8. Implementation of k-means clustering using R
9. Implementation of Prediction Using Linear Regression
10. Business analysis using different visualization.

**Textbooks:**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, J. E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10thEdition, Pearson Global Edition, 2013, ISBN: 9781292009209

**References:**

1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence", 2nd Edition, 2011, Wiley, ISBN: 9780470433744.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT15082: Cloud Computing Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weigh tage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** Basics of Computer Networks.

**Course Outcomes:** After the end of this course students will able to

**CO1** **Design**[6] Cloud Computing applications.

**CO2** **Develop**[3] Cloud applications using AWS, Azure and Aneka with Database.

## Practical

Four Hrs. per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Introduction to Amazon Web services AWS.
2. To create a free tire AWS account.
3. To launch an EC2 to instance.
4. To configure private and public key using Putty or GitBash.
5. To connect EC2 instance using Putty / GitBash
6. To install Linux on EC2 instance and demonstrate Linux basic commands
7. To launch S3 bucket from AWS management console.
8. To configure S3 bucket public policy
9. To deploy a HTML sample page using S3 bucket
10. To install GitHub on EC2 instance and demonstrate GitHub basic operations.

**Textbooks:**

1. Cloud Computing for Dummies" by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper, Publication Wiley India Edition.
2. Cloud Computing Black Book" by Jayaswal, Kallakurchi, Publication Dreamtech Pres.
3. Cloud Security" by Ronald Krutz and Russell Dean Vines, Publication Wiley-India.

**Reference books:**

1. Rajkumar Buyya, J.Broberg, A. Goscinski, Cloud Computing Principles and Paradigms, First Edition, Wiley Publications.
2. Ronald Krutz and Russell Dean Vines, Cloud Security: Comprehensive guide to Secure Cloud Computing, Wiley Publications.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT15083: Information Security Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weigh tage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** Computer Network fundamentals, Information Security

**Course Outcomes:** After the end of this course students will able to

**CO1** **Assess[5]** basic cryptographic algorithms.

**CO2** **Demonstarte[3]** standard security algorithm.

## Practical

Two Hrs. per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Implementation of Substitution Cipher
2. Implementation of Polyalphabetic Cipher (Vigenère Cipher and Vernam Cipher)
3. Implementation of Transposition Cipher
4. Implementation of Playfair Cipher
5. Implementation of DES algorithm
6. Implementation of AES algorithm
7. Implementation of Secure file transfer in Client/Server environment (use any one of above method for encryption and decryption)
8. Write a program to simulate RSA algorithm
9. Write a program to simulate any Authentication system.
10. Write a program to simulate the PGP.
11. Implementation the working Process of Kerberos
12. Implementation of Hash function

**Textbooks:**

**1.** Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security" 2nd Edition, McGraw Hill Education, 2014.

**References:**

1. William Stallings, "Cryptography and Network Security: Principles and Practice" 5th Edition, Prentice Hall 2013.
2. V.S. Bagad and I. A. Dhotre, "Cryptography and Network Security", Technical Publications 2012.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1509: Software Proficiency Program II - R Language Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |
| | | | | | POE | 50 | 40 |

**Prerequisite:** - Data Structures, Database Management System.

**Course Outcomes:** After the end of this course students will able to

**CO1: Apply[2]** R programming concepts for text processing and data analysis
**CO2: Summarize[5]** data sets using R Programming

## Syllabus (Practical)

Two Hrs. per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum of 10-12 experiments. Students of different batches should implement different programs based on following guidelines

1. Usage of R-declaring variables, expressions, control structures and functions and executing R script.
2. Working with R with data sets- create, read, write and R Tables- create, read, write
3. Manipulating and processing data in R- merging datasets, sorting data and putting data into shape
4. Managing data using data frames
5. Demonstration of Array and Matrices in R
6. Operations on Date and Time in R.
7. Accessing R packages
8. Demonstration of Debugging tools in R (swirl).
9. Perform linear and multiple regression in R
10. Use of Data visualization techniques in R
11. Perform Parametric T test in R
12. Develop and built web application in R

**Textbooks:**

1. Sandeep Rakshit , “R for beginners”, 1st edition, Mcgraw Hill Publications.
2. Roger D. Peng, “R Programming for Data Science”, LearnPublication 2015.

3. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press, 2011

**References:**

1. Hadley Wickham, Garrett Grolemund, "R for Data Science", O'Reilly Media; 1 edition (January 10, 2017).
2. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
3. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical
3. Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013
4. https://www.coursera.org/learn/r-programming

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1510: Scholastic Aptitude

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| 3 | - | - | Au | Theory | FET | 100 | 40% |

**Prerequisite:** - Basic Mathematics skills

**Course Outcomes:** After the end of this course students will able to

**CO1** **Solve**[3] campus placement aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability

**CO2** **Compete**[3] in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

**Syllabus (Theory)**

| Units | Description | Hrs. |
|---|---|---|
| I | **Vedic Maths:**<br>1. 2 by 2 subtraction<br>2. 2 by 2 multiplication<br>3. Finding square of larger number quickly<br>4. To find table only within 5 sec | 03 |
| II | **Calendar:**<br>Special formulated speedy way of calculating calendars i.e.to find date in calendar within 5 to 10 sec. | 03 |
| III | **Ratio Proportion:**<br>1. Ratio.<br>2. Proportion.<br>3. Mean Proportional<br>4. Direct Proportion<br>5. Inverse proportion | 03 |
| IV | **Percentage:**<br>1. Percentage fraction conversion table<br>2. Percentage conversion in decimal method | 03 |
| V | **Blood relation:**<br>1. Blood relation by simple Relation method<br>2. Blood relation by coded method | 03 |
| VI | **Direction sense :** | 03 |

| | | |
|---|---|---|
| | 1. Concept Clarity<br>2. Problems based on distance<br>3. Problems based on directions<br>4. Pythagoras Theorem<br>5. Quick Method | |
| **VII** | **Profit and Loss :**<br>1. Basic Concepts<br>2. Various Prices<br>3. Key Terms<br>4. Study different Types of problems<br>5. Solving Problems | **03** |
| **VIII** | **Time rate work, Pipes and Tanks :**<br>1.Concept of Time, Rate, Work<br>2.Negative Work<br>3.Template of problem Solving<br>4.Faster method to solve problems | **03** |
| **IX** | **Simple interest and Compound interest :**<br>1. Meaning of Interest<br>2. Simple Interest Formula<br>3. Ratio Approach for problem Solving<br>4. Compound Interest Formula<br>5. Concept Of Depreciation | **03** |
| **X** | **Average :**<br>1. Average question on ages<br>2. Average questions on replacement | **03** |
| **XI** | **Speed, Time and Distance. Train, Race, Boat Stream :**<br>1.Basic Formula of Speed,Time and Distance<br>2.Concept of trains & boats<br>3.Upstream downstream<br>4.Application of LCM method & relative motion | **03** |
| **XII** | **Permutation, Combination and Probability :**<br>1.Concept Of Arrangement<br>2.Concept of Selection<br>3.Shortcut Probability methods<br>4.Application of Probability in dice, coin ,card and ball | **03** |
| | **Syllogism :**<br>1.Logical Deduction<br>2.Merging Concept<br>3.Positive & Negative Relation<br>4.Syllogistic Reasoning | **03** |

**Seating arrangements :** **03**

1. Circular Arrangement problems.
2. Linear Arrangement problems.
3. Square/Rectangular Arrangement(inward, outward, both side facing)
4. Combination of all Above

**Reference Books**

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Latest Edition
2. Arun Sharma, "Quantitative Aptitude for CAT", Latest Edition
3. Arihant Publication," Fast Track Objective Arithmetic", Latest Edition.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1601: Natural Language Processing

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** - Basic concepts of Mathematics

**Course Outcomes:** After the end of this course students will able to

**CO1** **Choose**[4] the models, methods, and algorithms of statistical natural language Processing
**CO2** **Distinguish**[5] core computer science concepts of NLP
**CO3** **Understand**[2] applications of NLP
**CO4** **Design**[6] linguistic phenomena relevant to each NLP task

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Overview**<br>Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes | 07 |
| II | **Linguistics**<br>Introduction to corpus, elements in balanced corpus, Resource management, with XML, Management of linguistic data with the help of GATE, NLTK, Regular expressions, Finite State Automata, word recognition, lexicon, Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF | 07 |
| III | **Tagging**<br>Stochastic POS tagging, HMM, Transformation based tagging , Handling of unknown words, named entities, multi word expressions. A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax | 07 |
| IV | **Parsing** | 07 |

Unification, probabilistic parsing, TreeBank. Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet Word Sense

**V** **Disambiguation and Disclosure** **07**

Selection restriction, machine learning approaches, dictionary based approaches. Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure

**VI** **Chatboat and other NLP applications** **07**

Chatboat: Concept of chatboat, working of chatboats –scripted, artificially intelligent chatboats, challenges Other applications: Spell-checking, Summarization Information Retrieval- Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries. Machine Translation– Overview

**Textbooks:**

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009
2. James A., Natural language Understanding 2e, Pearson Education, 1994 2. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2000 3. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2008

**References :**

1. James Allen, “Natural Language Understanding”, Pearson Education, 2003

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1602: Big Data Analytics

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** - Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

**Course Outcomes:** After the end of this course students will able to

**CO1** **Identify**[2] Big Data and its Business Implications.
**CO2** **List**[1] the components of Hadoop and Hadoop Eco-System
**CO3** **Execute**[3] Job Execution in Hadoop Environment
**CO4** **Apply**[3] Machine Learning Techniques using R.

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction to Big Data and Hadoop:** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets. | 07 |
| II | **Hdfs (Hadoop Distributed File System):** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. | 07 |
| III | **Map Reduce:** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. | 07 |

| | | |
|---|---|---|
| **IV** | **Hadoop Eco System:**<br>Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. | **07** |
| **V** | **Hadoop Eco System:**<br>Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions | **07** |
| **VI** | **Data Analytics with R:**<br>Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR. | **07** |

**Textbooks:**

1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

**References :**

1. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
3. Pete Warden, “Big Data Glossary”, O’Reily, 2011

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT16031: Digital Image Processing

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** - Basic concept of AI tools and technologies.

**Course Outcomes:** After the end of this course students will able to

**CO1** **Develop**[3] the algorithms for digital image processing.
**CO2** **Apply**[3] image processing algorithms for object recognition applications.
**CO3** **Describe**[1] theory and models in Image and Video Processing.
**CO4** **Analyze**[3] 2D signals in frequency domain through image transforms

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction Fundamental Steps in Digital Image Processing** Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Examples of fields that uses digital image processing | 07 |
| II | **Image Enhancement in The Spatial Domain** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods | 07 |
| III | **Image Segmentation** Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold. | 07 |

| | | |
|---|---|---|
| **IV** | **Image Compression:**<br>Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding | **07** |
| **V** | **Video formation, perception and representation:**<br>Sampling, video frame classifications, I, P and B frames, notation, ITU-RBT 601 digital video formats, digital video quality measure, video capture and display: principle of colour video camera, Digital video camera, digital video, sampling of video signals: required sampling rates, sampling in two dimensions and three dimensions, progressive virus interlaced scans, two dimensional motion estimation, block matching algorithms. | **07** |
| **VI** | Object Recognition and Applications<br>Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing | **07** |

**Textbooks:**

**2.** Gonzalez, R. Woods-ilovepdf-comp, "Digital Image Processing" 3rd Edition.

**References :**

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Edition, - Pearson Education.
2. S Sridhar, Digital Image Processing, Oxford University Press.
3. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Digital Image Processing Using MATLAB, Second Edition, – Tata McGraw Hill Publication.
4. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, Tata Mc Graw Hill Publication

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT16032: Data Visualization

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** - Basic Programming Skills

**Course Outcomes:** After the end of this course students will able to

**CO1** **Explain**[2] the basics of data visualization
**CO2** **Select**[2] the techniques of the visualization process
**CO3** **Choose**[3] the different techniques for data visualization.
**CO4** **Apply**[3] appropriate data visualization techniques from visualization systems.

**Syllabus (Theory)**

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction**<br>Introduction of visual perception, History of visualization, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics. | 07 |
| II | **Visualization Techniques**<br>Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents. | 07 |
| III | **Visualization Techniques for Tree, Graph and Networks**<br>Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization | 07 |
| IV | **Visualization of Spatial Data For Field Based GIS**<br>Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations | 07 |
| V | **Comparing and Evaluating Visualization Techniques**<br>User task, User characteristics, Data characteristic, Visualization characteristic, Structure for evaluating visualization, Benchmarking Procedure | 07 |

| | | |
|---|---|---|
| **VI** | **Visualization Systems:**<br>System based on Data Type, System based on Analysis Types, Text analysis and visualization, Modern integrated visualization system | **07** |

**Textbooks:**

1. Ben Fry, "Visualizing Data: Exploring and Explaining Data with the Processing Environment", O'Reilly Media, 1st Edition.
2. Chun-houh Chen, Wolfgang Härdle, Antony Unwin, "Handbook of Data Visualization", Springer

**References :**

1. Thomas Strothotte, "Computer Visualization–Graphics Abstraction and Interactivity, Springer, 2011.
2. Tufte, The Visual Display of Quantitative Information, 2nd ed. Graphics Press
3. Hansen and Johnson, Visualization Handbook. Academic Press.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT16033: Speech Processing

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** - Digital Signal Processing or Signals and System

**Course Outcomes:** After the end of this course students will able to

**CO1:** Create new algorithms with speech processing

**CO2:** Derive new speech models

**CO3:** Perform various language phonetic analysis

**CO4:** Create speech identification and recognition system

### Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction**<br>Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N grams. | 07 |
| II | **Speech Modelling**<br>Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation- based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling | 07 |
| III | **Speech Pronunciation and Signal Processing**<br>Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology. | 07 |
| IV | **Speech Identification**<br>Short-Time Fourier Transform, Analysis: - FT view and Filtering view, Synthesis: -Filter bank summation (FBS) Method and OLA Method. Features Extraction, Extraction of Fundamental frequency. | 07 |

| | | |
|---|---|---|
| **V** | **Speech Recognition**<br>Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a* (_stack‘) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans. | **07** |
| **VI** | **Applications of Speech Processing:**<br>Speech Prosody, Speech Prosody Modeling (Fujisaki Model), Speech based Applications (TTS, ASR and spoken language acquisition). Music synthesis concepts, reverberation Characteristics of packetized speech, speech coding and protocol implications. | **07** |

**Textbooks:**

1. Daniel Jurafsky and James H. Martin, ― Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, Person education,2013.

**References :**

1. Kai-Fu Lee, ―Automatic Speech Recognition‖, The Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, ―Soft Computing Implementation of Automatic Speech Recognition‖, LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, ―Speech Recognition: Theory and C++ implementation‖,Wiley publications 2008.
4. 4. Ikrami Eldirawy , Wesam Ashour, ―Visual Speech Recognition‖, Wiley publications , 2011

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1604: Fuzzy Logic

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| 3 | - | - | 3 | Theory | FET | 20 | 40 |
| | | | | | CAT I | 15 | |
| | | | | | CAT II | 15 | |
| | | | | | ESE | 50 | 40 |

**Prerequisite:** - Mathematics, Classification and Clustering techniques, basics of DSS

**Course Outcomes:** After the end of this course students will able to

**CO1** **Apply**[3] fuzzy arithmetic's to solve fuzzy problems

**CO2** **Make use**[3]of fuzzy rules in decision making

**CO3** **Evaluate**[4]similarity relationship through fuzzy classification and clustering

**CO4** **Develop**[3] fuzzy systems using fuzzification and defuzzification techniques

## Syllabus (Theory)

| Units | Description | Hrs. |
|---|---|---|
| I | **Introduction:** Classical Sets and Fuzzy Sets: Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity, Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions. Fuzzy Sets. | 07 |
| II | **Membership functions:** Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Inductive Reasoning. Fuzzy- To- Crisp Conversions: Lambda- Cuts for Fuzzy Sets, Lambda- Cuts for Fuzzy Relations, Defuzzification Methods | 07 |
| III | **Defuzzification techniques:** Lambda-cut method, Weighted average method, Maxima methods, Centroid methods, Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy | 07 |

| | | |
|---|---|---|
| **IV** | **Fuzzy Arithmetic:** Fuzzy Numbers, Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons. Fuzzy Vectors. Classical Logic And Fuzzy Logic: Classical Predicate Logic – Tautologies, Contradictions, Equivalence, Exclusive OR and Exclusive NOR | **07** |
| **V** | **Fuzzy Rule Based Systems:** Natural Language, Linguistic Hedges, Rule- Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference, Fuzzy Decision Making | **07** |
| **VI** | **Fuzzy Classification:** Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering-Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering | **07** |

**Textbooks:**

1. Fuzzy Logic with Engineering Applications by Timothy J. Ross, McGraw- Hill, II Edition

**References :**

1. James Allen, “Natural Language Understanding”, Pearson Education, 20031. Guanrong Chen & Trung Tat Pham Introduction to Fuzzy Systems, Chapman & hall /CRC, 2006.
2. Driankov D., Hellendoorn H., Reinfrank M, An Introduction to Fuzzy Control., Narosa Publications ,1993.
3. Robert Babuska, Fuzzy Modeling for Control, International Series in Intelligent Technologies, Kluwer Academic Publications, 1998.
4. Ronald R Yager and Dimitar P Filev, Essentials of Fuzzy Modelling & Control., John Wiley & Sons, Inc, 2002.
5. J.-S.R.Jang, C.-T.Sun, E.Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall, 1997.
6. B. Kosko, Fuzzy Engineering, Prentice Hall, 1997.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1605: Natural Language Processing Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** Python Programming

**Course Outcomes:** After the end of this course students will able to

**CO1** **Represent**[3] semantic meaning of a paragraph

**CO2** **Managae**[4] linguistic data by using appropriate tools

## Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Write a Program for Word Analysis from a paragraph
2. Write a Program for Word Generation program
3. Write a Program for Morphology program
4. Write a Program for N-Grams program
5. Write a Program for N-Grams Smoothing program
6. Write a Program for POS Tagging: Hidden Markov Model
7. Write a Program for POS Tagging: Viterbi Decoding
8. Write a Program for Building POS Tagger
9. Write a Program for Chunking
10. Write a Program for Building Chunker

**Textbooks:**

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009
2. James A., Natural language Understanding 2e, Pearson Education, 1994 2. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2000 3. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2008

**References :**

1. James Allen, “Natural Language Understanding”, Pearson Education, 2003

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1606: Big Data Analytics Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |
| | | | | | POE | 50 | 40 |

**Prerequisite:** Database Management System

**Course Outcomes:** After the end of this course students will able to

**CO1** **Solve**[5] real problems using Hadoop architecture

**CO2** **Apply**[3] NoSQL database manipulation operations

### Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. To draw and explain Hadoop Architecture and Ecosystem with the help of a case study using WorkCount example. To define and install Hadoop.
2. To implement the following file management tasks in Hadoop System (HDFS): Adding files and directories, retrieving files, Deleting files
3. To run a basic Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, to view the output file, and to calculate execution time.
4. To perform NoSQL database using mongodb to create, update and insert.
5. To study and implement basic functions and commands in R Programming.
6. To build WordCloud, a text mining method using R for easy to understand and visualization than a table data.
7. To implement Bloom Filters for filter on Stream Data in C++/java.
8. To implement Flajolet-Martin Algorithm for counting distinct elements in Stream Data.
9. To implement clustering program using R programming.
10. Find Term Frequency and Inverse Document Frequency (tf-idf) Matrix for Recommendation Systems and Plot TF Using R used.
11. To finding similar documents with Cosine Similarity in R.

**Textbooks:**

1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

**References :**

1. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT16071: Digital Image Processing Laboratory

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** MATLAB Basics

**Course Outcomes:** After the end of this course students will be able to

**CO1** **Demonstrate**[2] convolution and correlation operation.
**CO2** **Apply**[4] Image enhancement and noise removal techniques
**CO3** **Demonstrate**[2] lossless and lossy image compression method

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

**Experiments:**

**1.** MATLAB program or C++ program for generating the following discrete time signals
a. Exponential signal
b. Unit step and unit ramp signals
c. Sinusoidal signal
d. Composite signal with minimum 3 sinusoids added

**2.** MATLAB program to demonstrate convolution and correlation operations with different examples of discrete time sequences.

**3.** Program for the following point processing operations and compare the results with MATLAB built in function
a. Image negative
b. Gray level slicing with or without background
c. Power law transformations
d. Bit plane slicing
e. Histogram equalization

**4.** Program for image enhancement and compare the results with MATLAB built in functions.
a. Smoothing
b. Sharpening
c. High boost filtering

**5.** Write a program for image noise removal and analyze the results using,
a. Averaging
b. Median filter

**6.** MATLAB program for 2D Discrete Fourier Transform and Inverse transform using built in functions.

**7.** Write a MATLAB PROGRAM for Transform domain processing using low pass and high pass filters and analyze the results for the
a. Ideal filter
b. Butterworth filter
c. Gaussian filter

**8.** Write a MATLAB PROGRAM for edge detection in 2 directions and compare the results with built in functions for the following operators
a. Robert operator
b. Prewitt operator
c. Sobel operator

**9.** MATLAB PROGRAM to compress the image using lossless image compression techniques
a. Huffman
b. RLE
c. LZW

**10.** MATLAB PROGRAM to compress the image using lossy image compression techniques
a. JPEG
b. IGS
c. Predictive coding

**11.** MATLAB PROGRAM to perform basic and derived morphological operations
a. Dilation
b. Erosion
c. Opening

d. Closing
e. Boundary Detection

**12.** MATLAB PROGRAM to represent / describe the image using
a. Chain code / shape number
b. Moments
c. Fourier descriptors
d. Euler number

**Textbooks:**

1. Gonzalez & Woods, Digital Image Processing, Pearson Education, Third Edition.
2. W. Pratt, Digital Image Processing, Wiley Publication, Fourth Edition, 2013.

**References :**

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing Principals, Algorithms and Applications, PHI publications, Third edition,
2. Milan Sonka , Digital Image Processing and Computer Vision, Thomson publication, Second Edition.2007.
3. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
4. Gonzalez & Woods, Digital Image Processing using MATLAB, Pearson Education
5. S. Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Processing ,McGraw Hill Education (India) Private Limited, New Delhi, 2009.
6. S.Sridhar, Digital Image Processing ,Oxford University Press, New Delhi, 2011.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT16072: Data Visualization Laboratory

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** Basic programming skills

**Course Outcomes:** After the end of this course students will able to

**CO1** **Identify**[3] appropriate techniques for data visualization
**CO2** **Model**[3] different types of data using visualization tools
**CO3** **Make use of3** library functions to visualize data

### Practical

Two hours per week per batch practical is to be utilized for writing to ensure that students have properly learnt the topics covered in the lectures. This shall include extra problem statements and their implementations to strengthen the programming logic. It should comprise of minimum of 10-12 experiments. Students of different batches should implement different programs based on following guidelines –

1. Implementation of Basic plots in Data Visualization
2. Use of Different Data Visualization Libraries using R Programming
3. Customization or Styling the plot by setting different colors with different shapes sizes for different plots
4. Visualizing data with Data Visualization Functions
5. Implementation of Density Plot for given Data frame
6. Categorical composition of the total population using waffle chart and pie chart
7. Implementation of Tree Map for given dataset
8. Implementation of Time Series Plots from data formats
9. Program to define function in R programming.
10. Use of Correlogram plot for correlating multiple variables in given data frames
11. Implementation of Seasonal Plot for time series data frames
12. Program to implement matrix operations in R
13. Load the iGraph library and create an undirected star graph with 5 nodes and plot the graph.

**Textbooks:**

1. Kieran Healy, “Data Visualization: A Practical Introduction”, Princeton University Press, 1st Edition

2. Andy Kirk, "Data Visualization: A Handbook for Data Driven Design", 1st Edition, Kindle Edition

**References :**

1. Tufte, The Visual Display of Quantitative Information, 2nd ed. Graphics Press
2. Hansen and Johnson, Visualization Handbook. Academic Press

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT16073: Speech Processing Laboratory

**(Ver 1.0, Program Elective, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 50 | 40 |

**Prerequisite:** basic knowledge of signals & systems.

**Course Outcomes:** After the end of this course students will be able to-
**CO1 Demonstrate**[3] essential aspects of speech signal processing.
**CO2 Implement**[3] speech signal based applications to solve real world problems

### Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 7-10 experiments. It can be performed using simulation/ speech libraries etc. Students of different batches should implement different programs based on the following guidelines:

1. Realization of correlation of two discrete signals
2. Realization of sub band filter using linear convolution
3. Design and implementation of FIR filter
4. Design and implementation of IIR filter
5. Realization of STFT using FFT
6. Realization of STFT using FFT
7. Demonstration of Min-max technique
8. Realization of FIR Wiener filter
9. Orthogonal Frequency-division multiplexing (OFDM)
10. Multiple-input Multiple output (MIMO
11. Image compression using discrete cosine transformation (DCT).
12. Speech recognition using Support Vector Machine (SVM)

**Textbooks:**

1. Vinay K. Ingale, John G. Proakies, Digital Signal Processing using MATLAB: A problem solving companion, fourth edition, Pearson, 2017
2. Lawrence R. Rabiner and Ronald W. Schafer, Introduction to Digital Speech Processing, Foundations and Trends,2007

**References:**

1. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California Technical Publishing.

2. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education.
3. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999. 4.Ben gold and Nelson Morgan, “Speech and audio signal processing”, processing and perception of speech and music, Wiley- India Edition, 2006 Edition. 5.Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1608: Fuzzy Logic Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| - | - | 2 | 1 | Practical 100 Marks | FEP | 100 | 40 |

**Prerequisite:** Fuzzy logic concepts, python programming

**Course Outcomes:** After the end of this course students will able to

**CO1** **Apply**[3] various fuzzy operations

**CO2** **Apply**[3] different types of fuzzy membership functions and fuzzy relations

**CO3** **Develop**[3] fuzzy logic based decision support systems

### Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Implementation of fuzzy Operations.
2. Implementation of fuzzy Relations
3. Implementation of fuzzy membership functions
4. Implementation of FLC for Washing Machine
5. Implementation of FLC for robot movement
6. Implementation of FLC for tipping problem
7. Implementation of fuzzy Classification
8. Implementation of fuzzy c-means Clustering
9. Mini project on fuzzy logic based expert system

**Textbooks:**

1. Fuzzy Logic with Engineering Applications by Timothy J. Ross, McGraw- Hill, II Edition

**References :**

1. Guanrong Chen & Trung Tat Pham Introduction to Fuzzy Systems, Chapman & hall /CRC, 2006
2. Driankov D., Hellendoorn H., Reinfrank M, An Introduction to Fuzzy Control., Narosa Publications ,1993

3. Robert Babuska, Fuzzy Modeling for Control, International Series in Intelligent Technologies, Kluwer Academic Publications, 1998
4. Ronald R Yager and Dimitar P Filev, Essentials of Fuzzy Modelling & Control., John Wiley & Sons, Inc, 2002
5. J.-S.R.Jang, C.-T.Sun,E.Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall, 1997
6. B.Kosko, Fuzzy Engineering, Prentice Hall, 1997

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1609 : Web Technology Laboratory

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| - | - | 4 | 2 | Practical 100 Marks | FEP | 50 | 40 |
| | | | | | POE | 50 | 40 |

**Prerequisite:** Object oriented Programming Concepts

**Course Outcomes:** After the end of this course students will be able to

**CO1** **Design**[5] dynamic web pages using Scripting languages, php, jsp

**CO2** **Develop**[5] web pages using AngularJS

### Contents

Four hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Create a web page with the following using HTML.
   To embed an image map in a web page.
   To fix the hot spots.
   Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Design the static web pages required for college website with css and host it on free domain
4. Implement a Java script program for displaying and comparing two dates
5. Design a HTML page including any required Java script that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show “out of range” and if it is not a number, it should show “not a number” message in the result box.
6. Implement a Java script program for Form Validation including text field, radio buttons, check boxes, list box and other controls.
7. Write programs in Java to create three-tier applications using JSP and Databases
   For conducting on-line examination.
   For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
8. Implement JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.
9. Write a XML program for creating a cd catalog.

10. Write a XML program and DTD for a document
11. Design a web application using PHP that takes name and age from an HTML page. If the age is less than 18 it should send a page with "Hello, you are not authorized to visit this site" message, where should be replaced with the entered name. Otherwise it should send "Welcome to this site" message.
12. Design a web application using PHP for given statement: The user is first served a login page which takes user's name and password. After submitting the details the server checks these values against the data from a database and takes the following decisions. If name and password matches, serves a welcome page with user's full name.If name matches and password doesn't match, then serves "password mismatch" page If name is not found in the database, serves a registration page, where user's full name is asked and on submitting the full name, it stores, the login name, password and full name in the database (hint: use session for storing the submitted login name and password)
13. Create student registration form using angular js
14. Validate student registration form with reactive and template driven forms
15. Implement JWT-based authentication in Angular apps with the help of a simple Express server.
16. Incorporate animations in Angular 6 applications with the help of animation components and Bootstrap.
17. Deploy an App to Firebase with Angular CLI

**Textbooks:**

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Greg Lim, "Beginning Angular with Typescript (updated to Angular 6)", Kindle edition

**References :**

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown, "Core Web Programming", Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, ―Developing Web Applications, Wiley, 2006
5. Chandermani Arora, "Angular 6 by Example: Get up and running with Angular by building modern real-world web apps", 3rd Edition , Kindle Edition

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1610 : Mini Project II

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| - | - | 2 | 1 | Practical | FEP | 50 | 40 |
| | | | | | POE | 50 | 40 |

**Prerequisite:** Computer programming Language, Database Concepts, software engineering concepts, Operating System Concepts, Computer Network Concepts.

**Course Outcomes:** After the end of this course students will be able to

**CO1** **Apply[3]** the engineering approach to solve the real time problems.

**CO2** **Apply[3]** the skills of team building and team work.

### Contents

The Mini Project work should be carried out by using free and Open source softwares. The students should form group of 3 to 4 students each and every group is supposed to choose a specific domain in which they would like to develop their expertise. Further, the group should identify the relevant problem and propose the solution, which can be implemented as a mini-project using suitable technology.

Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report in the format provided by the department. Periodic internal review shall be conducted which is evaluated by panel of examiners. The mini project work will be evaluated in the mid and end of the semester during which the group should give presentation and demonstration of their work done.

Evaluation of the mini project will be based on the following criteria:

- Originality and Novelty
- Project Scope, Objectives and Deliverables
- Understanding of the Project Concept
- Output of Results and Proper Documentation
- Final Reports and Presentations

Two hours per week per batch practical is to be utilized for project work. Students should follow following sequence of activities :

1. Project topic and title finalization.
2. Submission of proposal for project work (Synopsis).
3. First presentation which includes
    a. Requirements analysis
    b. Architecture
    c. Data design
    d. Algorithm design
    e. Module identification
    f. Class properties
    g. Method identification.
    h. If applicable
    i. Level 0 & Level 1 DFD
    j. Object oriented analysis (UML diagrams).
4. Second presentation.
5. End Semester Review in 3rd Presentation (after 100 % implementation of all modules).
6. Project report preparation.

**Textbooks:**

1. Pankaj Jalote, Software Engineering: A precise Approach, Wiley India, 2010.
2. Yashvant Kanetkar, Let Us C, BPB Publications, 2016.

**References :**

1. Paul Cobbaut, Linux Fundamentals, CEST, 2015.

# School of Computer Science and Engineering

**Department of Computer Science and Engineering**

**(Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00**

## AMT1611: Massive Open Online Course

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | Weightage | Pass % |
| - | - | - | 1 | Online Course 100 Marks | FEP | 100 | 40 |

**Course Outcomes:** After the end of this course students will be able to

**CO1** Develop[3] self-learning skills.

**CO2** Apply[3] the knowledge to better learn the core/elective courses.

### Instructions for MOOC Selection and Validation.

1. Student shall register the course (Minimum of 40 hours) offered by authorized institutions/Agencies, through online with the approval of Head of the Department.
2. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered and the mentor appointed shall conduct the internal examinations
3. MOOCs courses may be studied either in MOOCs manner or in conventional manner. In case of conventional manner, there will be an external exam for course at University.
4. Allowed MOOC courses agencies are NPTEL/ SWAYAM/ EDX/Coursera only
5. A student desirous of opting for a MOOC shall submit an application not later than one week prior to the scheduled normal date of semester registration to the concerned Head of the Department (HoD) giving the following details: Course Title, Agency Offering MOOC, Examination system and Credits of the Course. Timing and duration of course and its examination, centres of conducting of examination.
6. On receipt of the application by the HoD, he/she shall constitute a committee of at least 3 members with himself as Chairman and two other members. This committee shall examine the proposal in detail regarding course contents, examination system, suitability of the course and equivalence of course as per the Institute norms and give its recommendations for approval or non-approval including any special conditions to be imposed.
7. Fee and other charges, if any, payable to MOOC providing and certification agency shall be borne by concerned student at his/ her own level.

| | |
|---|---|
| 8 | The student shall submit to the Department the original certificate issued by MOOC authorities along with a photocopy of the same. The original will be returned after verification and verification shall be certified by the HOD on the photocopy which shall be kept in records. |

# School of Computer Science and Engineering

## Department of Computer Science and Engineering

## (Artificial Intelligence and Machine Learning) Program: AY 2021_22 AME/P/00

# AMT1612: Foreign Language

**(Ver 1.0, Program Core, School of Computer Science and Engineering)**

| Lect. | Tut. | Pract. | Credits | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|
| | | | | Component | Exam | WT | Min Pass (%) |
| 2 | - | - | Au | Theory | FET | 100 | 40 |

**Prerequisite: Nil**

**Contents**

**Theory**

Lesson 1- Managing conversation
Lesson 2- Months and days of week
Lesson 3- Numbers
Lesson 4- Time
Lesson 5- Asking for Telephone number
Lesson 6- Directions
Lesson 7- Everyday life
Lesson 1- Map of Germany
Lesson 2- Countries and Nationalities
Lesson 3- Family

**Grammar**

Lesson 1- Alphabets
Lesson 2- German nouns
Lesson 3- Nominative case
Lesson 4- Negation
Lesson 5- Pronouns - nominative case
Lesson 6- Regular verb and their conjugation
Lesson 7- Irregular verbs
Lesson 1- Possessive pronouns
Lesson 2- Interrogative pronouns
Lesson 3- Demonstrative pronouns