

**ADAMAS UNIVERSITY**

**SCHOOL OF ENGINEERING**

**AND**

**TECHNOLOGY**

**DEPARTMENT**

**OF**

**COMPUTER SCIENCE AND ENGINEERING**

**Course Structure & Syllabus**

**For**

**Master of Technology (M.Tech)**

**In**

**Computer Science & Engineering**

**W.e.f. AY 2019-20**

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **PG PROGRAM: Master of Technology (M.Tech) (CSE)**    **SEMESTER I** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | ECS61101 | Foundation of Computing Science | 3 | 1 | 0 | 4 | 4 |
| 2 | Theory | ECS61103 | Advanced Algorithms | 3 | 1 | 0 | 4 | 4 |
| 4 | Theory |  | Elective I | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory |  | Elective II | 3 | 0 | 0 | 3 | 3 |
| 6 | Seminar | ECS61301 | Seminar I | 0 | 2 | 0 | 2 | 2 |
| 7 | Practical | ECS61201 | Computing Lab - I | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **15** | **4** | **3** | **22** | **21** |

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **PG PROGRAM: Master of Technology (M.Tech) (CSE)**    **SEMESTER II** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | ECS61102 | Parallel & Distributed Computing | 3 | 1 | 0 | 4 | 4 |
| 2 | Theory |  | Elective III | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory |  | Elective IV | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory |  | Elective V | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory |  | Elective VI | 3 | 0 | 0 | 3 | 3 |
| 6 | Seminar | ECS61302 | Seminar II | 0 | 2 | 0 | 2 | 2 |
| 7 | Practical | ECS61202 | Computing Lab – II | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **15** | **3** | **3** | **21** | **20** |

**Total Credits (First Year): 41**

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **PG PROGRAM: Master of Technology (M.Tech) (CSE)**    **SEMESTER III** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory |  | Elective VII | 3 | 0 | 0 | 3 | 3 |
| 2 | Seminar | ECS62301 | Technical Report Writing & Seminar – I | 0 | 0 | 6 | 6 | 4 |
| 3 | Project | ECS62402 | Thesis (Part – I) | 0 | 0 | 24 | 24 | 16 |
| **Total** | | | | **3** | **0** | **30** | **33** | **23** |

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **PG PROGRAM: Master of Technology (M.Tech) (CSE)**    **SEMESTER IV** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Seminar | ECS62302 | Technical Report Writing & Seminar - II | 0 | 0 | 6 | 6 | 4 |
| 2 | Project | ECS62402 | Thesis(Part – II) | 0 | 0 | 27 | 27 | 18 |
| 3 | Viva | ECS62502 | Comprehensive Viva |  |  |  |  | 4 |
| **Total** | | | | **0** | **0** | **33** | **33** | **26** |

**Total Credits (Second Year): 49**

**Total Credits (Over Two Years): 90**

**List of Elective Papers:**

**Elective – I:**

**ECS61105 Pattern Recognition**

**ECS61107** **Artificial Intelligence**

**ECS61109** **Logic Programming**

**ECS61111** **Soft Computing**

**Elective – II:**

**ECS61113 Image and Video Processing**

**ECS61115** **Advanced Graph Theory**

**EEC61127** **VLSI Design**

**EEC61129** **Mobile Computing**

**Elective – III:**

**ECS61104** **Advanced Database System**

**ECS61106** **Cloud Computing**

**ECS61108** **Neural Network and Deep Learning**

**ECS61110** **Advances in Compiler Design**

**Elective – IV:**

**ECS61112** **Machine Learning**

**ECS61114** **Information Retrieval**

**ECS61116** **Computational Complexity**

**Elective – V:**

**ECS61118** **Formal Systems**

**ECS61120** **Principles of Programming Languages**

**ECS61122** **High Performance Computer Architecture**

**Elective – VI:**

**ECS61124**  **Natural Language Processing**

**EEC61128 Internet of Things**

**MBA61142 E-Commerce**

**Elective – VII:**

**ECS62101** **Cryptography & Cryptosystems**

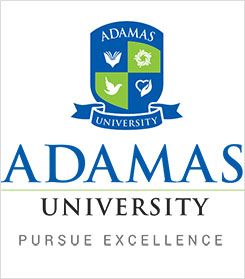
**ECS62103** **Information Security**

**ECS62105** **Cyber Security**

**ADAMAS UNIVERSITY**

**Master of Technology (M.Tech) (CSE)**

**SEMESTER – I**

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| **Foundation of Computing Science** | **ECS61101** | **3-1-0** | **4 Credits** |

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| **Module 1:**  **Discrete Structures:** Sets, Relations and Functions, Morphisms; Posets and Lattices, Boolean Algebra, Proof Techniques: Inductive and Deductive Reasoning, Proof by Contradiction; Recurrence Relations, Algebraic Structures – Semigroup, Monoid, Group, Ring and Field. | | **[12]** |
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| **Module 2:**  **Logic:** Statements and Symbolic Representation, Propositional Calculus and Predicate Calculus, Inference Rules, Satisfiability and Validity, Resolution Principle, Notions of Soundness and Completeness. | | **[12]** |
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| **Module 3:**  **Automata and Languages:** Strings, Phrase Structured Grammar and Formal Languages: Finite Automata and Regular Expressions, Closure Properties of Regular Languages, Pumping Lemma and Non-Regular Languages. Context Free Languages (CFL) and Pushdown Automata (PDA), Normal Forms of Context Free Languages, Closure Properties of CFLs, Pumping Lemma and Non-Context Free Languages, Deterministic Pushdown Automata and DCFLs. Chomsky Hierarchy of Grammars and Corresponding Acceptors ; Turing Machines, and Type 0 Languages, Recursive and Recursively Enumerable Languages, Turing Computable Functions, Primitive and µ-recursive functions. | | **[15]** |
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| **Module 4:**  **Computability:** Church-Turing Thesis, Decision Problems, Decidability and Undecidability, Universal Turing Machine, Halting Problem of Turing Machines, Problem Reduction (Turing and Mapping Reduction). | | **[13]** |
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| **Module 5:**  **Computational Complexity:** Time and Space Complexity Measures; Class P and Class NP and Co-NP problems NP-Completeness. | | **[8]** |

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| **Text Books:** | |
| 1 | “Discrete Mathematical Structures with Applications to Computer Science”, J.P. Trembley and R. Manohar, McGraw Hill Book Co. |
| 2 | “ Introduction to The Theory of Computation”, Michael Sipser, Thomson Course Technology. |
| **Reference Books:** | |
| 1 | “Inrtroduction to Automata Theory, Languages and Computation”, John E. Hopcroft and J.D.Ullman, Narosa Pub. House, N. Delhi. |
| 2 | “Elements of the Theory of Computation”, H.R. Lewis and C.H.Papadimitrou, Prentice Hall, International, Inc. |

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| **Advanced Algorithms** | **ECS61103** | **3-1-0** | **4 Credits** |

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| **Module 1**  **Data Structures:**Basic Data Structuring Problems: Fibonacci Heaps, Priority Queues, Dynamic Data Structures for Graph Connectivity/Reachability. | | **[10]** |
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| **Module 2:**  **Bit Tricks:** Word-level Parallelism. Trans dichotomous Model. o(nlogn) Integer Sorting.  **String Algorithms:** Rabin-Karp Fingerprinting Algorithm, Suffix Trees.  **Maximum Flows:** Augmenting Paths and Push-Relabel Methods. Minimum Cost Flows. Bipartite Matching. | | **[10]** |
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| **Module 3:**  **Linear Programming:** Formulation of Problems as Linear Programs. Duality. Simplex, Interior Point, and Ellipsoid Algorithms. | | **[12]** |
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| **Module 4:**  **Online Algorithms:**Ski Rental. River Search Problem. Paging. The k-Server Problem. List Ordering and Move-to-Front.  **Approximation Algorithms:**One Way of Coping with NP-Hardness. Greedy Approximation Algorithms. Dynamic Programming and Weakly Polynomial-Time Algorithms. Linear Programming Relaxations. Randomized Rounding. Vertex Cover, Wiring, and TSP. | | **[12]** |
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| **Module 5:**  **Fixed-Parameter Algorithms:** Another Way of Coping with NP-Hardness. Parameterized Complexity, Kernelization, Vertex Cover. Connections to approximation.  **Parallel Algorithms:** PRAM. Pointer Jumping and Parallel Prefix. Tree Contraction. Divide and Conquer. Randomized Symmetry Breaking. Maximal Independent Set. | | **[8]** |
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| **Module 6:**  **External-Memory Algorithms:** Accounting for the Cost of Accessing Data from Slow Memory. Sorting. B-trees. Buffer Trees. Cache-oblivious Algorithms for Matrix Multiplication and Binary Search.  **Computational Geometry:** Convex Hull. Line-segment Intersection. Sweep Lines. Voronoi Diagrams. Range Trees. Seidel's Low-dimensional LP Algorithm.  **Streaming Algorithms:** Sketching, Distinct and Frequent Elements. | | **[8]** |
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| **Text Books:** | |
| 1 | “Introduction to Algorithms”, Cormen, Leiserson, Rivest, and Stein, 2nd ed. Cambridge, MA: MIT Press, 2001. ISBN: 0262032937. |
| 2 | “Network Flows”, Ahuja, Magnanti, and Orlin, Upper Saddle River, NJ: Prentice Hall, 1993. ISBN: 013617549X. |
| 3 | “Randomized Algorithms”, Motwani and Raghavan, Cambridge, UK: Cambridge University Press, 1995. ISBN: 0521474655. |
| **Reference Books:** | |
| 1 | “Data Structures and Network Algorithms”, Tarjan, Robert, Philadelphia, PA: Society for Industrial and Applied Mathematics, 1983. |
| 2 | “Computational Geometry: Algorithms and Applications”, Berg, Mark de, Marc van Kreveld, Mark Overmars, and Otfried Schwarzkopf, New York, NY: Springer-Verlag, 2000. |
| 3 | “Approximation Algorithms for NP-Hard Problems”, Hochbaum, Dorit, ed. , Boston, MA: PWS Publishing Company, 1997. |

**ELECTIVE – II**

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| **Pattern Recognition** | **ECS61105** | **3-0-0** | **3 Credits** |

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| **Module 1**  **Introduction:** Paradigms for pattern recognition, Statistical and Syntactic pattern  Recognition, Soft and Hard computing schemes for pattern recognition. Statistical Pattern Recognition: Patterns and classes, Supervised, Semi-supervised, and Unsupervised classification. | | **[6]** |
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| **Module 2:**  **Representation:** Vector space representation of patterns and classes, patterns and  Classes as strings, Tree-based representations, Frequent item sets for representing classes and clusters, Patterns and classes as logical formulas. | | **[8]** |
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| **Module 3:**  **Proximity Measures:** Dissimilarity measures, metrics, similarity measures, Edit  Distance, Hausdorff metric between point sets, Kernel functions, Contextual and conceptual similarity between points. | | **[8]** |
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| **Module 4:**  **Dimensionality Reduction:** Feature selection: Branch and bound, Sequential feature election, Feature extraction: Fisher's linear discriminant, Principal components as features; Nearest Neighbour Classifiers: Nearest neighbour classifier, Soft nearest neighbour classifiers, Efficient algorithms for nearest neighbour classification, K-Nearest Neighbour classifier, minimal distance classifier, condensed nearest neighbour classifier and its modifications. | | **[10]** |
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| **Module 5:**  **Bayes Classifier:** Bayes classifier, naïve Bayes classifier, Belief net, Decision Trees Axis parallel and oblique decision trees, Learning decision trees, Information gain and Impurity measures.  **Linear Discriminant Functions**: Characterization of the decision boundary,  Weight vector and bias, Learning the discriminant function, Perceptron’s; Support Vector Machines Maximizing the margin, Training support vector machines, Kernel functions. | | **[8]** |
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| **Module 6:**  **Clustering:** Clustering process, Clustering algorithms, and Clustering large datasets.  **Combination of Classifiers:** AdaBoost for classification, Combination of  Homogeneous classifiers, Schemes for combining classifiers. | | **[5]** |
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| **Text Books:** | |
| 1 | “Pattern Recognition: An Introduction”, V. Susheela Devi and M. NarasimhaMurty, Universities Press ,Hyderabad, 2011. |
| 2 | “Pattern Classification”, R. O. Duda, P. E. Hart and D. G. Stork, John Wiley and Sons, 2000. |
| **Reference Books:** | |
| 1 | “Introduction to statistical pattern recognition”, Academic press, Fukunaga K. 2013. |

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| **Artificial Intelligence** | **ECS61107** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** What is intelligence? Foundations of artificial intelligence (AI). History of AI, Problem Solving: Formulating problems, problem types, states and operators, state space, search strategies. | | **[5]** |
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| **Module 2:**  **Informed Search Strategies:** Best first search, A\* algorithm, heuristic functions, Iterative deepening A\*(IDA), small memory A\*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning. | | **[10]** |
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| **Module 3:**  **Reasoning:** Representation, Inference, Propositional Logic, predicate logic (first order predicate logic), logical reasoning, forward chaining, backward chaining; AI languages and tools: Lisp, Prolog, CLIPS**.** | | **[10]** |
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| **Module 4:**  **Planning:** Basic representation of plans, partial order planning, planning in the blocks world, hierarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints. | | **[8]** |
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| **Module 5:**  **Uncertainty:** Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic, Decision making: Utility theory, utility functions, and Decision, theoretic expert systems. | | **[5]** |
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| **Module 6:**  **Inductive learning:**Decision trees, rule based learning, current-best-hypothesis search, least commitment search, neural networks, reinforcement learning, Other learning methods - neural networks, reinforcement learning, genetic algorithms. | | **[7]** |
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| **Text Books:** | |
| 1 | “Artificial Intelligence – A Modern Approach”, Stuart Russell and Peter Norvig, Pearson Education Press, 2001. |
| 2 | “Artificial Intelligence”, Kevin Knight, Elaine Rich, B. Nair, McGraw Hill, 2008. |
| **Reference Books:** | |
| 1 | “Artificial Intelligence”, George F. Luger, Pearson Education, 2001. |
| 2 | “Artificial Intelligence: A New Synthesis”, Nils J. Nilsson, Morgan Kauffman, 2002. |

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| **Logic Programming** | **ECS61109** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **propositional logic:** syntax and semantics, natural deduction proofs, decision procedures, Horn fragment | | **[10]** |
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| **Module 2:**  **predicate calculus:** syntax and semantics , natural deduction proofs, un-decidability and incompleteness | | **[15]** |
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| **Module 3:**  **Logic Programming:** Horn fragment of predicate logic , unification and top-down operational semantics , use of a logic programming language , Data log and bottom up operational semantics | | **[13]** |
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| **Module 4:**  **Reasoning about sequential programs:** partial correctness assertions, computing weakest preconditions, loop invariants, reasoning about termination | | **[7]** |
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| **Text Books:** | |
| 1 | “Logic in Computer Science: Modelling and Reasoning about Systems”, M.R. Huth and M.D. Ryan, Cambridge University Press 2000. |
| **Reference Books:** | |
| 1 | “Prolog Programming for Artificial Intelligence”, Ivan Bratko, 3rd Edition, Addison-Wesley Publ., 2000. |

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| **Soft Computing** | **ECS61111** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing. | | **[3]** |
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| **Module 2:**  **Introduction to Genetic Algorithms:** Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.  **Genetic algorithms operators:** Methods of selection, crossover and mutation, Simple GA(SGA), other variant of GA, generation gap, steady state GA, Applications of GA. | | **[12]** |
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| **Module 3:**  **Neural Networks:** Concept, biological neural system, Evolution of neural network, McCulloch-Pitts neuron model, activation functions, feed-forward networks, feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff, winner-take-all. | | **[10]** |
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| **Module 4:**  **Supervised learning:** Perceptron learning, single layer and multilayer perceptron, linear reparability, hidden layers, back propagation algorithm, Radial Basis Function network, Unsupervised learning: Kohonen, Self-Organizing Mapping, Counter-propagation, ART, Reinforcement learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing. | | **[8]** |
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| **Module 5:**  **Fuzzy systems:**Basic definition and terminology, set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules & Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling, Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rule-base Structure Identification and Neuro-Fuzzy Control , Applications of neuro-fuzzy modelling. | | **[7]** |
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| **Module 6:**  **Swarm Intelligence:** What is swarm intelligence? Various animal behaviour which have been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant based routing, particle swarm optimization | | **[5]** |
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| **Text Books:** | |
| 1 | “Principle of soft computing”, S.N. Shivanandam, Wiley. ISBN13: 9788126527410, 2011. |
| 2 | “Neuro-Fuzzy and Soft Computing”, Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, Prentice Hall of India, 2003. |
| 3 | “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, George J. Klir and Bo Yuan, Prentice Hall, 1995. |
| **Reference Books:** | |
| 1 | “Neural Networks Algorithms, Applications, and Programming Techniques”, James A. Freeman and David M. Skapura, Pearson Education, 2003. |
| 2 | “Genetic Algorithms in Search, Optimization & Machine Learning”, David E. Goldberg, Addison Wesley, 1997. |
| 3 | “An Introduction to Genetic Algorithm”, Mitchell Melanie, Prentice Hall, 1998. |

**Elective - III**

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| **Image and Video processing** | **ECS61113** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Fundamentals of Image processing and Image Transforms:**  Basic steps of Image processing system sampling and quantization of an Image: Basic relationship between pixels Image Transforms: 2D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms. | | **[8]** |
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| **Module 2:**  **Image Processing Techniques:** Image Enhancement, Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters, Frequency Domain methods - Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation. | | **[15]** |
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| **Module 3:**  **Image Compression:** Image compression fundamentals: coding Redundancy, spatial and temporal redundancy. Compression models: Lossy and Lossless, Huffman coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards. | | **[10]** |
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| **Module 4:**  **Basic Steps of Video Processing:** Analog video, Digital Video, Time varying Image Formation models, 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations.  **2-D Motion Estimation:** Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding. | | **[12]** |
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| **Text Books:** | |
| 1 | “Digital Image Processing”, Gonzaleze and Woods, 3 rdedition , Pearson. |
| 2 | “Handbook of image and video processing”, Bovik, Alan C. Academic press, 2010. |
| **Reference Books:** | |
| 1 | “Digital video Processing”, M. Tekalp, Prentice Hall International. |
| 2 | “Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab”, Chris Solomon, Toby Breckon, John Wiley & Sons. |

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| **Advanced Graph Theory** | **ECS61115** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Review of basics:** Graphs and digraphs, incidence and adjacency matrices, isomorphism, the auto morphism group; Trees: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem, minimum spanning trees. Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem; Paths and Cycles: Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal, girth, circumference. | | **[14]** |
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| **Module 2:**  **Matchings:** Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching  (bipartitie and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem. | | **[10]** |
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| **Module 3:**  **Extremal Problems:** Independent sets, covering numbers, Turan's theorem, Ramsey theorems; Colorings: Brooks’s theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem, Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2cell embeddings, and graphs on other surfaces. | | **[9]** |
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| **Module 4:**  **Directed Graphs:** Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branching.  **Networks and flows:** Flow cuts; max flow min cut theorem; perfect square.  **Random Graphs:** The basic models - use of expectations, simple properties of almost all graphs, almost determined variables – use of variance, Hamiltonian cycles, the phase transition. | | **[12]** |
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| **Text Books:** | |
| 1 | “Introduction to Graph Theory”, Douglas B. West, Prentice Hall of India, 2000. |
| 2 | “Graph Theory with Applications to Engineering and Computer Science”, NarsinghDeo, Prentice-Hall, 2004. |
| **Reference Books:** | |
| 1 | “Network Flows: Theory, Algorithms, and Applications”, R. Ahuja, T. Magnanti, and J. Orlin, Prentice Hall. |
| 2 | “Graph Theory”, Frank Harary, Narosa, 2002. |

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| **VLSI Design** | | **EEC61127** | **3-0-0** | **3 Credits** | |
| **Module 1:Introduction to VLSI Design:**  Historical Perspective and Future Trends, Moor’s Law;Scale of Integration (SSI, MSI, LSI, VLSI, ULSI), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioural, Structural ); VLSI design styles: Full custom, Gate array, Standard cell, Micro-cell based design, Field programmable device; Design quality. | | | | | **[9]** |
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| **Module 2:Fabrication technology**  Si semiconductor technology: Wafer preparation, Oxidation, Ion implantation, Different deposition processes, Metallization, Etching, Lithography; Bipolar, CMOS and Bi-CMOS fabrication processes; Layout design rule. | | | | | **[7]** |
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| **Module 3:MOSFET**  MOSFET characteristics threshold voltages, body effect, Chanel length modulation, MOSFET scaling, MOS switch and inverter, The complementary CMOS inverter-DC characteristic, Alternate CMOS inverter, latch up. | | | | | **[7]** |
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| **Module 4:MOS & CMOS Circuit Characterization and Performance Estimation**  Resistance Estimation, Capacitance Estimation: MOS Device Capacitance, Diffusion Capacitance, Routing Capacitance, RC Effects, Capacitance Design Guide; Switching Characteristic: Fall Time, Rise Time, Delay Time; RC Circuit Delay Computation: Cascaded RC Stages, Elmore Delay. Propagation Delay Calculation with Elmore Model for Multiple RC Stages; CMOS Gate Transistor Sizing, Determination of Conductor Size, Power Consumptions: Static Dissipation, Dynamic Dissipation | | | | | **[7]** |
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| **Module 5:CMOS circuit and logic design**  CMOS logic circuit, NMOS and CMOS Logic, Dynamic and Pass-transistor logic, Design of logic gate: Inverter, NAND and NOR gate, CMOS Full Adder ,Multiplexer, Decoder, logic minimization, Advanced CMOS Logic circuits; Sequential CMOS logic circuits; SR Latch circuit, clocked JK Latch/ Master-Slave JK , CMOS D-latch & Edge triggered flip-flop , Series and parallel transistor connection, source drain capacitance, charge sharing, Logic style comparison, Physical layout logic gate, CMOS standard cell design, Layout and layout design rules. | | | | | **[8]** |
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| **Module 6: Semiconductor memories**  SRAM: CMOS SRAM cell, Bipolar SRAM cell; DRAM: basic DRAM cell and its Operation Device design and scaling Considerations for a DRAM Cell; Non-volatile memories: MOSFET nonvolatile memory devices, Flash Memory Arrays, Floating-Gate Nonvolatile Memory Cells, Nonvolatile Memory Cells with Charge Stored in Insulator | | | | | **[7]** |

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| **Text Books:** | |
|  | Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education,2nd edition 2003 |
|  | Weste and Eshrighian, ―Principle of CMOS VLSI Design‖ Pearson Education |
|  | Wayne, Walf, “Modern VLSI design: System on Silicon” Pearson Education, 2nd Edition, 1998 |
| **Reference Books:** | |
|  | Pucknull, “Basic VLSI Design” PHI 3rd Edition |

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| **Mobile Computing** | | **EEC61129** | **3-0-0** | **3 Credits** | |
| **Module 1: Introduction**:Introduction to mobile computing,basics ofdigital communication and computer networks,Convergence of Internet. Overview of Global System for Mobile Communication (GSM) system: GSM Architecture, Mobility management, Overview of General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes.Sharing of wireless channels: FDMA, TDMA, and CDMA. MAC layer issues in wireless communication. | | | | | **[11]** |
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| **Module 2: Computational Model and algorithm:** Influence of portability and mobility in computational model and algorithms for mobile environment. Handling handoffs, disconnected operation. Analysis of algorithms and termination detection. | | | | | **[8]** |
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| **Module 3: Mobility in cellular based wireless network**: Different types of Mobility, channel allocation, interferences, handoffs, Frequency reuse and location management. IP mobility: Mobile IP and IDMP  Wireless Local Loop (WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. Wireless LAN, Personal Area Network: Bluetooth Wi-Max, Wi-Fi and ZigBee, Familiarization with UWB, LTE, EDGE & MIMO Technologies | | | | | **[10]** |
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| **Module 4: Data delivery models in wireless channel**: push based mechanism and pull based mechanism. Data distribution or dissemination in wireless channels. Broadcast disks. Caching effects. | | | | | **[8]** |
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| **Module 5:Ad Hoc and Sensor Networks:** Introduction, Protocols Challenges. Indexing in Air, Mobile Databases, Distributed file system for mobile environment | | | | | **[8]** |
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| **Text Books:** | |
|  | Wireless Communications and Networking, Willam Stallings, Pearson Education. (2002) |
|  | Wireless Communication: Principles and Practice ,T. Rappaport , Pearson Education. |
| **Reference Books:** | |
|  | Reza B'Far (Ed), "Mobile Computing Principles", Cambridge University Press |
|  | R. Dayem, "Mobile Data & Wireless Lan Technologies," Prentice-Hall (2005) |

**Subject Name: Computing Lab - I**

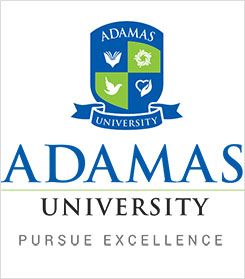
**Code: ECS61201**

**Credit: 2**

**Contact Hours: 3**

Familiar with object-oriented programming concepts and implementation of abstract data types. Implementation of graph algorithms. Linear programming with applications. Basics of OS programming: process creation and synchronization, shared memory and semaphore, shell programming.

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| **Seminar-I** | **ECS61301** | **0-2-0** | **2 Credits** |
| The course involves presentation and report submission by every student. Reference search and technical writing skills along with effective presentation skills are focused. The course strengthens the research attributes including literature survey and make themselves industry ready. | | | |

**ADAMAS UNIVERSITY**

**Master of Technology (M. Tech) (CSE)**

**SEMESTER – II**

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| **Parallel & Distributed Computing** | **ECS61102** | **3-1-0** | **4 Credits** |

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| **Module 1:**  Characterization of Distributed Systems- Introduction, Examples of distributed systems, Resource sharing and the Web Challenges, System Models- Architectural models, Fundamental Models Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport’s& vectors logical clocks, Causal ordering of messages, global state, termination detection. | | **[10]** |
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| **Module 2:**  Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms | | **[12]** |
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| **Module 3:**  Agreement Protocols- Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system. Distributed Objects and Remote Invocation- Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study. Distributed Shared Memory-Architecture and motivations. Algorithms for implementing DSM. Memory Coherence | | **[14]** |
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| **Module 4:**  Security- Overview of security techniques, Cryptographic algorithms, Digital signatures Cryptography pragmatics, Case studies- Needham Schroeder, Kerberos, SSL and Millicent. Distributed File Systems: File service architecture, Sun Network File System, The Andrew File System, Recent advances, Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data. | | **[13]** |
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| **Module 5:**  Distributed Algorithms- Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave and traversal algorithms, Election algorithm CORBA Case Study- CORBA RMI, CORBA services. | | **[11]** |
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| **Text Books:** | |
| 1 | "Distributed System: Concepts and Design”, Coulouris, Dollimore, Kindberg, Pearson Education. |
| **Reference Books:** | |
| 1 | “Advanced Concept in Operating Systems", Singhal&Shivaratri, McGraw Hill |
| 2 | "Distributed Algorithms", Gerald Tel, Cambridge University |

**Elective – IV**

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| **Advanced Database System** | **ECS61104** | **3-0-0** | **3 Credits** |

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| **Module 1:**  Data Base Analysis and Design Techniques- Review of basic Database Concepts, Database Design Methodologies. ER Modeling: Specialization, Generalization, Aggregation, Normalization Theory. Database Implementation using UML- Introduction to UML, Structure diagrams, behavioral diagrams, object oriented analysis, class diagram.  Advanced Transaction Processing and Concurrency Control- Transaction Concepts, Concurrency Control- Locking Methods, Time stamping Methods, Optimistic Methods for Concurrency Control, Concurrency Control in Distributed Systems | | **[10]** |
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| **Module 2:**  Query Compiler: Introduction, parsing, generating logical query plan from parse tree. Query Processing: Physical Query plan Operators. Operations- selection, sorting, join, project, set. Query Evaluation: Introduction, Approaches to QE, Transformation of relational expressions in Query optimization, heuristic optimization, cost estimation for various operations, transformation rule. | | **[10]** |
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| **Module 3:**  Distributed Database- Centralized DBMS and Distributed DBMS, functions and architecture of a DDBMS, Distributed Data Storage, Transparency issues in DDBMS, Query Processing DDBMS, Distributed transaction Management and Protocols, Distributed Concurrency Control and Deadlock Management.  Object Oriented DatabaseLimitations of RDBMS, Need of Complex Data type, Data Definition, ODBMS Fundamentals, issues in OODBMS, Object oriented database design. Comparison of ORDBMS and OODBMS | | **[10]** |
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| **Module 4:**  Emerging Database Models, Technologies and Applications Multimedia databaseEmergence, difference from other data types, structure, deductive databases, GIS and spatial databases, Knowledge database, Information Visualization, Wireless Networks and databases, Personal database, Digital libraries, web databases, case studies. | | **[10]** |
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| **Module 5:**  Data Warehousing: Introduction, basis concepts, data warehouse architecture, data characteristics, reconciled data layer, data transformation, derived data layer, user interface**.**  Authentication and Security – Authentication and Access, DAC, MAC, RBAC, ABAC  SQL Injection Problem, Intrusion Detection and Recovery | | **[5]** |
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| **Text Books:** | |
| 1 | “Database System Concepts”, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Tata McGraw-Hill. |
| 2 | “Advanced database management system”,RiniChkrabarti and ShibhadraDasgupta, Dreamtech. |
| **Reference Books:** | |
| 1 | “Fundamentals of Database Systems”RamezElmasri, ShamkantNavathe, Pearson Education |
| 2 | “Distributed Databases” Ozsu and Valduriez ,Pearson Education |

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| **Cloud Computing** | **ECS61106** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Shift from distributed computing to cloud computing; principles and characteristics of cloud computing- IaaS, PaaS, SaaS, service oriented computing and cloud environment | | **[10]** |
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| **Module 2:**  **Cloud Computing Technology:** Client systems, Networks, server systems and security from services perspectives, Accessing the cloud with platforms and applications, cloud storage. | | **[8]** |
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| **Module 3:**  Working with Cloud- Infrastructure as a Service: conceptual model and working Platform as a Service: conceptual model and functionalities Software as a Service: conceptual model and working Technologies and Trends in Service provisioning with clouds. | | **[12]** |
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| **Module 4:**  Using Cloud Services- Cloud collaborative applications and services – technology, applications and case studies with calendars, schedulers and event management; cloud applications in project management. | | **[15]** |
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| **Text Books:** | |
| 1 | “Cloud Computing – A Practical Approach”, AnthonyT.Velte, Toby J.Velte and Robert E, TMH , 2010. |
| **Reference Books:** | |
| 1 | “Cloud Computing – Web based Applications”, Michael Miller, Pearson Publishing, 2011. |

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| **Neural Network and Deep Learning** | **ECS61108** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks  **Learning Process:** Error Correction learning, Memory based learning, Hebbianlearing, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process | | **[10]** |
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| **Module 2:**  **Single Layer Perceptron’s:** Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception –convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment.  **Multilayer Perceptron:** Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection. | | **[5]** |
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| **Module 3:**  **Back Propagation:** Back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.  **Self Organization Maps:** Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps.  **Neuro Dynamics:** Dynamical systems, stability of equilibrium states, attractors, neuro-dynamical models, manipulation of attractors’ as a recurrent network paradigm | | **[10]** |
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| **Module 4:**  **Deep Learning:** Recent developments in deep neural networks, Limiting the size of the weights, Using noise as a regularize, The ups and down of back propagation, Introduction to full Bayesian approach, The Bayesian interpretation of weight decay, Mackay's quick and dirty method of setting weight costs.  **Convolutional Neural Networks:** Invariance, stability. Variability models (deformation model, stochastic model),Scattering networks Group Formalism, Supervised Learning: classification, Properties of CNN representations: inevitability, stability, invariance, covariance/invariance: capsules and related models,Connections with other models: dictionary learning, LISTA, other tasks: localization, regression, Embedding (DrLim), inverse problems, Extensions to non-euclideandomains, Dynamical systems: RNNs.  **Deep Unsupervised Learning:** Autoencoders (standard, Denoising, contractive, etcetc), VariationalAutoencoders ,Adversarial Generative Networks , Maximum Entropy Distributions. | | **[15]** |
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| **Module 5:**  **Advance Topics:** Non-convex optimization for deep network, Stochastic optimization, Attention and Memory Models , Open Problems. | | **[5]** |

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| **Text Books:** | |
| 1 | “Neural networks A comprehensive foundations”, Simon Hhaykin, Pearson Education 2nd  Edition 2004.” |
| 2 | “Deep Learning”, Ian Goodfellow, YoshuaBengio, and Aaron Courville, MIT press, 2016. |
| **Reference Books:** | |
| 1 | “Artificial neural networks”, B.Vegnanarayana Prentice Halll of India P Ltd, 2005. |
| 2 | “Neural networks in Computer intelligence”, Li Min Fu, TMH, 2003. |
| 3 | “Neural networks”, James A., Freeman David, M. S. Kapura, Pearson Education. |

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| **Advances in Compiler Design** | **ECS61110** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Review of compiler structure:**lexical analysis, parsing, semantic analysis, error recovery and intermediate code generation; Runtime storage management; Code optimization; Code generation;  **Retargetable compiler:** an overview. | | **[10]** |
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| **Module 2:**  **Introduction to Code optimization:** The importance of code optimization. Structure of optimizing compilers. Placement of optimizations in hugely optimizing compilers. Importance of individual optimizations. Order and repetition of optimization. | | **[5]** |
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| **Module 3:**  **Optimizing compilers::Basic block:** Peephole optimization.  **Loop optimization:**[Induction variable](https://en.wikipedia.org/wiki/Induction_variable), [Strength reduction](https://en.wikipedia.org/wiki/Strength_reduction), [Loop fusion](https://en.wikipedia.org/wiki/Loop_fusion), [Loop inversion](https://en.wikipedia.org/wiki/Loop_inversion), [Loop interchange](https://en.wikipedia.org/wiki/Loop_interchange), [Loop-invariant code motion](https://en.wikipedia.org/wiki/Loop-invariant_code_motion), [Loop nest optimization](https://en.wikipedia.org/wiki/Loop_nest_optimization), [Loop unrolling](https://en.wikipedia.org/wiki/Loop_unrolling), [Loop splitting](https://en.wikipedia.org/wiki/Loop_splitting), [Loop unswitching](https://en.wikipedia.org/wiki/Loop_unswitching), [Bounds-checking elimination](https://en.wikipedia.org/wiki/Bounds-checking_elimination); [Software pipelining](https://en.wikipedia.org/wiki/Software_pipelining)**,** [Automatic parallelization](https://en.wikipedia.org/wiki/Automatic_parallelization)  [**Data-flow analysis**](https://en.wikipedia.org/wiki/Data-flow_analysis)**:**[Common subexpression elimination](https://en.wikipedia.org/wiki/Common_subexpression_elimination); [Constant folding](https://en.wikipedia.org/wiki/Constant_folding)**,** [Induction variable recognition and elimination](https://en.wikipedia.org/wiki/Induction_variable_recognition_and_elimination)**,** [Dead store](https://en.wikipedia.org/wiki/Dead_store) elimination**,** [Use-define chain](https://en.wikipedia.org/wiki/Use-define_chain)**,** [Live variable analysis](https://en.wikipedia.org/wiki/Live_variable_analysis)  **Static single assignment form based:**[Global value numbering](https://en.wikipedia.org/wiki/Global_value_numbering)**,** [Sparse conditional constant propagation](https://en.wikipedia.org/wiki/Sparse_conditional_constant_propagation).  [**Code generation**](https://en.wikipedia.org/wiki/Code_generation_(compiler))**:**[Register allocation](https://en.wikipedia.org/wiki/Register_allocation), [Instruction selection](https://en.wikipedia.org/wiki/Instruction_selection), [Instruction scheduling](https://en.wikipedia.org/wiki/Instruction_scheduling), [Rematerialization](https://en.wikipedia.org/wiki/Rematerialization)  **Procedure optimizations**: Tail recursion elimination and tail call optimization, Procedure integration; In-line expansion.  **Global**: Inter-procedural optimizations  **Static analysis:**[Alias analysis](https://en.wikipedia.org/wiki/Alias_analysis), [Pointer analysis](https://en.wikipedia.org/wiki/Pointer_analysis), [Shape analysis](https://en.wikipedia.org/wiki/Shape_analysis_(software)), [Escape analysis](https://en.wikipedia.org/wiki/Escape_analysis), [Array access analysis](https://en.wikipedia.org/wiki/Array_access_analysis); [Dependence analysis](https://en.wikipedia.org/wiki/Dependence_analysis), [Control flow analysis](https://en.wikipedia.org/wiki/Control_flow_analysis),  [Data flow analysis](https://en.wikipedia.org/wiki/Data_flow_analysis). | | **[20]** |
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| **Module 4:**  **Optimizing for parallelism and locality**: Loop level parallelism and data locality, Execution order for loop nests, controlling the order of execution, data reuse; Data dependence analysis; Synchronization-Free Parallelism; Locality Optimizations. | | **[10]** |

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| **Text Books:** | |
| 1 | Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley. |
| 2 | Michael L. Scott, Programming Language Pragmatics, Elsevier. |
| 3 | Andrew W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press. |
| 4 | Steven S. Muchnik, Advanced Compiler Design and Implementation, Elsevier. |
| **Reference Books:** | |
| 1 | Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures, Elsevier. |
| 2 | Allen I. Holob, Compiler Design in C, Prentice-Hall |

**Elective - V**

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| **Machine Learning** | **ECS61112** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Machine learning applications, concepts learning | | **[2]** |
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| **Module 2:**  **Introduction to Bayesian learning theory:** Regression, feature selection, supervised learning, class conditional probability distributions, Examples of classifiers Bayes optimal classifier and error, learning classification approaches, handling continuous attributes. | | **[8]** |
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| **Module 3:**  **Decision tree learning algorithms:** Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples, entropy, mutual information, handling continuous and missing attributes, confidence, overfitting, pruning, learning with incomplete data.  **Instance-based Learning:** Nearest neighbor classification, k-nearest neighbour, nearest neighbor error probability. | | **[10]** |
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| **Module 4:**  **Machine learning concepts and limitations:** Learning theory, formal model of the learnable, sample complexity, learning in zero bayes And realizable case, VC-dimension, PAC learning, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff. | | **[10]** |
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| **Module 5:**  Machine learning assessment: Statistical model selection, structural risk minimization  Ensemble learning methods: Voting, bagging, boosting.  Unsupervised learning: Introduction, Hierarchical clustering, K- means clustering  Semi-supervised learning: Introduction, self-training, co-training  Sequence learning: Hidden Markov Model (HMM), Viterbi algorithm  Curse of dimensionality: Subset selection, PCA | | **[10]** |
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| **Module 6:**  Support Vector Machines: Margin of a classifier, dual perceptron algorithm, learning non-linear hypotheses with perceptron kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier. | | **[5]** |
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| **Text Books:** | |
| 1 | “Machine Learning”, T. M. Mitchell, McGraw-Hill, 1997. |
| 2 | “Introduction to Machine Learning”, E. Alpaydin**,**  Prentice Hall of India, 2006. |
| 3 | “Pattern Recognition and Machine Learning”, C. M. Bishop, Springer, 2006. |
| **Reference Books:** | |
| 1 | “Pattern Classification”, R. O. Duda, P. E. Hart, and D.G. Stork, John Wiley and  Sons, 2001. |
| 2 | “Statistical Learning Theory”, Vladimir N. Vapnik, John Wiley and Sons, 1998. |

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| **Information Retrieval** | **ECS61114** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Basics of Information Retrieval and Introduction to Search Engines; Boolean Retrieval: Boolean queries, Building simple indexes, Processing Boolean queries | | **[5]** |
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| **Module 2:**  **Term Vocabulary and Posting Lists:**Choosing document units, Selection of terms, Stop word elimination, Stemming and lemmatization, Skip lists, Positional postings and Phrase queries; Dictionaries and Tolerant Retrieval: Data structures for dictionaries, Wildcard queries, Permuterm and K-gram indexes, Spelling correction, Phonetic correction. | | **[10]** |
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| **Module 3:**  **Index Construction:** Single pass scheme, Distributed indexing, Map Reduce, Dynamic indexing; Index Compression - Statistical properties of terms, Zipf's law, Heap's law, Dictionary compression, Postings file compression, Variable byte codes, Gamma codes. | | **[8]** |
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| **Module 4:**  **Vector Space Model:** Parametric and zone indexes, Learning weights, Term frequency and weighting, Tf-Idf weighting, Vector space model for scoring, variant tf-idfunctions.  **Computing Scores in a Complete Search System:** Efficient scoring and ranking, Inexact retrieval, Champion lists, Impact ordering, Cluster pruning, Tiered indexes, Query term proximity, Vector space scoring and query operations. | | **[12]** |
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| **Module 5:**  **Evaluation in Information Retrieval:** Standard test collections, unranked retrieval sets, Ranked retrieval results, Assessing relevance, User utility, Precision and Recall, Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Evaluation of relevance feedback. | | **[10]** |
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| **Text Books:** | |
| 1 | “An Introduction to Information Retrieval”, C. D. Manning, P. Raghavan, and H. Schutze, Cambridge University Press, 2009. |
| **Reference Books:** | |
| 1 | “Modern Information Retrieval”, R. Baeza Yates and B. Ribeiro-Neto, Pearson Education, 1999. |

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| **Computational Complexity** | **ECS61116** | **3-0-0** | **3 Credits** |

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| **Module 1:**  Models of computation, Problem Definitions , Models of Computation , FSM Language Recognition , TM Language Recognition , The Classes P and NP , NP-complete Languages | | **[5]** |
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| **Module 2:**  Classes P and NP, The classes P and NP, NP-complete languages, Proof that CIRCUIT SAT is NP-complete.  NP-complete languages, NAESAT is NP-complete, 0-1 integer programming is NP-complete, INDEPENDENT SET is NP-complete, CLIQUE is NP-complete. | | **[8]** |
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| **Module 3:**  Space complexity, Complexity Classes, Proper Resource Bounds, Hierarchy Theorems, Savitch's Theorem.  Complements of Complexity classes, Review of Space Complexity, Complements of Complexity Classes, coNP , Polynomial Time Hierarchy. | | **[7]** |
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| **Module 4:**  PSPACE- complete Languages, Complexity Class Containment, Polynomial Hierarchy, **PH** Complete Problems, Games and TQBF , TQBF is **PSPACE**-Complete.  Diagonalization and Reduction, A First Application of Diagonalization, Halting is Undecidable Resource-Bounded Reductions , Log space Reductions , Hard and Complete, Problems, Diagonalization , Time Hierarchy Theorem , Oracle Turing Machines, Under Relativization Both **P** = **NP** and **P** ≠ **NP.** | | **[10]** |
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| **Module 5:**  Parallel Complexity Classes, Turing Machines and Complexity, Parallel Models of Computation, The PRAM and Complexity Classes, Circuits and Complexity Classes **NC** and **P**/poly*.*  Randomized Computation, Randomized algorithms, Average case complexity, Bounded-error complexity classes, Identity and Primality testing. | | **[6]** |
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| **Module 6:**  Interactive Proof I, Randomized Reductions, Two- and Three-Stage Proofs, Interactive Proofs and IP.  Interactive proofs II, Interactive Proofs, Private versus Public Randomness, Bounding the Prover's Resources.  Interactive Proofs III, interactive Proofs, One-way functions, Zero-Knowledge Proofs  IP and PSPACE, The Power of Interactive Proofs , Probabilistically Checkable Proofs. | | **[9]** |
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| **Text Books:** | |
| 1 | “Computational Complexity: A Modern Approach”, SanjeevArora and Boaz Barak, Cambridge University Press. |
| 2 | “Models of Computation, Exploring the Power of Computing”, John E. Savage, Pearson, 1997. |
| **Reference Books:** | |
| 1 | “Elements of The Theory of Computation”, H. Lewis and C. Papadimitriou, Prentice Hall, 1998. |
| 2 | “Introduction to automata theory, languages, and computation”, J Hopcroft and J Ullman, Addison-Wesley, 1979. |

**Elective – VI**

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| **Formal Systems** | **ECS61118** | **3-0-0** | **3 Credits** |

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| **Module 1:**  Formal languages and their related automata, Turing machines, type-0 languages, linear bounded automata and CSLs. Time and tape bounded Turing machines, time and space bounds for recognizing CFLs. | | **[10]** |
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| **Module 2:**  Turing Computability- number theoretic computations by Turing machines and indexing. Axiomatic systems, their soundness and completeness. | | **[13]** |
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| **Module 3:**  Recursive function theory- primitive recursive functions and primitive recursive predicates. Ackermann’s function, recursive and general recursive functions. | | **[12]** |
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| **Module 4:**  Computability and decidability- computable functions, computable sets, decision problems. Fix point theory of programs, functions and functional, verification methods, Lambda calculus and applications. | | **[10]** |
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| **Text Books:** | |
| 1 | “Introduction to Automata Theory Languages and Computation”. Hopcroft H.E. and Ullman J. D. Pearson Education |
| 2 | “An Introduction to Functional Programming Through Lambda Calculus”, Greg Michaelson |
| 3 | “Introduction to Theory of Computation” Sipser M. 2nd edition Thomson |
| **Reference Books:** | |
| 1 | “Theory of Computer Science - Automata languages and computation”, Mishra and Chandrashekaran, 2nd edition, PHI |

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| **Principles of Programming Languages** | **ECS61120** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Programming language definition, brief history of programming  Languages, overview of programming paradigms.  **Language design principles:** Design criteria, efficiency, regularity | | **[5]** |
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| **Module 2:**  **Syntax:** Lexical structure, Context free grammar, BNF, syntax tree, parse tree, Expression syntax.  **Semantics:** Declaration, allocation, evaluation, symbol table, runtime environment, data types, type checking, weak typing, strong typing, parameter passing methods such as pass by value, pass by name, pass by result, pass by value-result, pass by reference, exceptions and exceptions handling. | | **[8]** |
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| **Module 3:**  **Garbage collection:** Advantages, explicit garbage collection, automatic garbage  Collection compacting.  **Imperative programming:** Impact of Von-Neumann architectures on programming  language, assignments, names, locations, L-value, R-value, memory allocation, scope rules, control flow, control abstraction, functions, exception handling, primitive and constructed data types, data abstraction. | | **[7]** |
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| **Module 4:**  **Object oriented programming:** Objects, classes, methods, dynamic binding,  inheritance, polymorphism, design and implementation issues in object oriented  Languages, case study.  **Declarative programming:** Distinctive features of declarative programming, first order logic, Horn clauses, resolution unification, sequencing of control, negation,  Implementations issues, the language Prolog, constraint logic programming. | | **[10]** |
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| **Module 5:**  **Functional programming:** Distinctive features of functional programming languages, functional programming in imperative language, recursion, tail recursion, higher order functions, lazy evaluation, types in functional programming, mathematics of functional programming: lambda calculus. introduction to functional programming using Scheme HaskellML. | | **[10]** |
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| **Module 6:**  **Brief introduction to multi-paradigm languages** (Python/Leda/Ada/C#).  **Formal semantics:** Operational semantics, denotational semantics, axiomatic semantics, proof of program correctness. | | **[5]** |
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| **Text Books:** | |
| 1 | “Programming Languages: Principles and practice”, Kenneth C. Louden, 2003. |
| 2 | “Programming Languages and Paradigms”, D. A. Watt, Prentice-Hall, 1990. |
| 3 | “Advanced Topics in Types and Programming Languages”, Benjamin C. Pierce, ed., MIT Press, 2005. |
| 4 | “Foundations of Logic Programming”, J. Lloyd, Springer Verlag, 1984. |
| **Reference Books:** | |
| 1 | “The Semantics of Programming Languages”, M. Hennessey, John Wiley, 1990. |
| 2 | “Elements of Functional Programming”, C. Reade, Addison Wesley, 1989. |

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| **High Performance Computer Architecture** | **ECS61122** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Review of basic computer architecture, Quantitative techniques in  Computer design, measuring and reporting performance. CISC and RISC processors. | | **[5]** |
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| **Module 2:**  **Pipelining:** Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance. Hierarchical memory technology: Inclusion, Locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, Mapping and management techniques, Memory replacement policies. | | **[10]** |
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| **Module 3:**  **Instruction-level parallelism:** Basic Concepts, Techniques for increasing ILP, Dynamic scheduling (Tomasulo's Algorithm), Reorder buffer and instruction commit, Branch prediction and advanced instruction delivery, Speculative execution. Superscalar, Super pipelined and VLIW processor architectures. Array and vector processors. | | **[12]** |
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| **Module 4:**  **Multiprocessor architecture:** Taxonomy of parallel architectures. Centralized shared memory Architecture. Synchronization, Memory consistency, Interconnection networks. Distributed shared memory architecture. Model of memory consistency, Cache coherency, Multiprocessing snooping protocol, Multiprocessing directory protocol. Cluster computers. | | **[10]** |
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| **Module 5:**  **Non von Neumann architectures:** Data flow computers, Reduction computer  Architectures, Systolic architectures. Multicore Architectures. | | **[8]** |
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| **Text Books:** | |
| 1 | “Computer Architecture: A Quantitative Approach”, John L. Hennessy and David A. Patterson, Morgan Kaufmann. |
| 2 | “Modern Processor Design: Fundamentals of Superscalar Processors”, John Paul Shen and Mikko H. Lipasti, Tata McGraw-Hill. |
| **Reference Books:** | |
| 1 | “Computer Architecture: Pipelined and Parallel Processor Design”, M. J. Flynn, Narosa  Publishing. |
| 2 | “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, Kai Hwang, McGraw-Hill. |

**Elective – VII**

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| **Natural language processing** | **ECS61124** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Knowledge in Speech and Language Processing, Ambiguity , Models and Algorithms ,Language, Thought, and Understanding, Machine Learning and NLP. | | **[10]** |
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| **Module 2:**  **Words:** Regular Expressions and Automata; Morphology fundamentals; Morphological Diversity in Languages; Morphology Paradigms; Probabilistic Models of Pronunciation and Spelling; N-grams, N-grams for Spelling and Pronunciation ;Overview of Hidden Markov Models; Maximum Entropy Models | | **[10]** |
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| **Module 3:**  **NLP tasks:** A coarse division **Syntax:** [Lemmatization](https://en.wikipedia.org/wiki/Lemmatisation), [Morphological segmentation](https://en.wikipedia.org/wiki/Morphology_(linguistics)), [Part-of-speech tagging](https://en.wikipedia.org/wiki/Part-of-speech_tagging), [Parsing](https://en.wikipedia.org/wiki/Parsing), combination of rule Based and probabilistic Parsing, Scope Ambiguity resolution, [Sentence boundary disambiguation](https://en.wikipedia.org/wiki/Sentence_boundary_disambiguation), [Stemming](https://en.wikipedia.org/wiki/Stemming), [Word segmentation](https://en.wikipedia.org/wiki/Word_segmentation).  **Semantics:**[Lexical semantics](https://en.wikipedia.org/wiki/Lexical_semantics), [Machine translation](https://en.wikipedia.org/wiki/Machine_translation), [Named entity recognition](https://en.wikipedia.org/wiki/Named_entity_recognition), [Topic segmentation](https://en.wikipedia.org/wiki/Topic_segmentation) and recognition; [Word sense disambiguation](https://en.wikipedia.org/wiki/Word_sense_disambiguation); WSD and Multilinguality; Metaphors.  **Discourse:**[Automatic summarization](https://en.wikipedia.org/wiki/Automatic_summarization); [Coreference resolution](https://en.wikipedia.org/wiki/Coreference); [Discourse analysis](https://en.wikipedia.org/wiki/Discourse_analysis)  **Speech**: [Speech recognition](https://en.wikipedia.org/wiki/Speech_recognition); [Speech segmentation](https://en.wikipedia.org/wiki/Speech_segmentation); [Text-to-speech](https://en.wikipedia.org/wiki/Text-to-speech). | | **[15]** |
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| **Module 4:**  **Applications:**  Sentiment Analysis, [Recognizing Textual entailment](https://en.wikipedia.org/wiki/Textual_entailment); [Relationship extraction](https://en.wikipedia.org/wiki/Relationship_extraction); Robust and Scalable Machine Translation; Question Answering; Information Retrieval across languages. | | **[10]** |

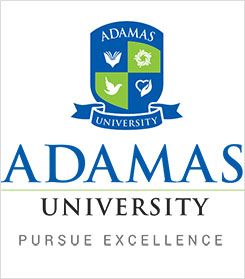
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| **Text Books:** | |
| 1 | Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995. |
| 2 | Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008. |
| **Reference Books:** | |
| 1 | Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999. |
| 2 | Charniack, Eugene, Statistical Language Learning, MIT Press, 1993. |

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| **Internet of Things (IoT)** | | **EEC61128** | **3-0-0** | **3 Credits** | |
| **Module 1:Introduction to Internet On Things(IoT) :**Technologies involved in IoT Development. IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols.  **Applications of IoT**: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis. The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN architecture. | | | | | **[12]** |
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| **Module 2:Internet/Web and Networking Basics:** OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing.  **Overview of IoT Platform**: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.  **Network Fundamentals**: Overview and working principle of Wired Networking equipment’s; Router, Switches, Overview and working principle of Wireless Networking equipment’s; Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions | | | | | **[12]** |
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| **Module 3:IoT Application Development**: Application Protocols MQTT, REST/HTTP, CoAP, MySQL  **Back-end Application Designing**: Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools | | | | | **[13]** |
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| **Module 4:Case Study & advanced IoT Applications**: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino) | | | | | **[8]** |
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| **Text Books:** | |
|  | Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. OvidiuVermesan, Dr. Peter Friess, River Publishers |
|  | 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley |
| **Reference Books:** | |
|  | Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010 |
|  | Internet of Things (A Hands-on-Approach) , Vijay Madisetti , ArshdeepBahga |
|  | Data and Computer Communications; By: Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition |

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| **E-Commerce** | | | **MBA61142** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  E-commerce: The revolution is just beginning, Ecommerce : A Brief History, Understanding E-commerce: organizing Themes | | | | | | **[7]** | |
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| **Module 2:**  E-commerce Business Models, Major Business to Consumer (B2C) business models, Major Business to Business (B2B) business models, Business models in emerging E-commerce areas, How the Internet and the web change business: strategy, structure and process, The Internet: Technology Background, The Internet Today, Internet II- The Future Infrastructure, The World Wide Web, The Internet and the Web : Features | | | | | | **[16]** | |
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| **Module 3:**  Building an E-commerce Web Site: A systematic Approach, The e-commerce security environment, Security threats in the e-commerce environment, Technology solution, Management policies, Business procedures, and public laws, Payment system, E-commerce payment system, Electronic billing presentment and payment . | | | | | | **[10]** | |
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| **Module 4:**  Consumer online: The Internet Audience and Consumer Behaviour, Basic Marketing Concepts, Internet Marketing Technologies, B2C and B2B E-commerce marketing and business strategies, The Retail sector, Analyzing the viability of online firms, E-commerce in action: E-tailing Business Models, Common Themes in online retailing, The service sector: offline and online, Online financial services, Online Travel Services, Online career services | | | | | | **[12]** | |
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| **Text Books:** | | | | | | | |
| 1 | “ . Kenneth C. Laudon, E-Commerce : Business, Technology, Society, 4th Edition, Pearson | | | | | | |
| 2 | “ S. J. Joseph, E-Commerce: an Indian perspective, PHI | | | | | | |
| **Reference Books:** | | | | | | | |
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| **Seminar-II** | **ECS61302** | **0-2-0** | **2 Credits** |
| The course involves presentation and report submission by every student. Reference search and technical writing skills along with effective presentation skills are focused. The course strengthens the research attributes including literature survey and make themselves industry ready. | | | |

**ADAMAS UNIVERSITY**

**Master of Technology (M.Tech) (CSE)**

**SEMESTER – III**

**Elective – VIII**

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| **Cryptography & Cryptosystems** | **ECS62101** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Mathematical Preliminaries:**Modular arithmetic, Division theorem, Equivalence relation, Residue class, GCD and its properties, Euler-Toient Function, Fermat’s Little Theorem, Groups, Abelian Groups, Monoids, Group isomorphisms, Ring, Field, Prime and Galois Field, Binary field, Isomorphic field mappings in GF(24 ) multiplication, Finite Fields and their Irreducible Polynomials, Composite Fields. | | **[5]** |
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| **Module 2:**  **Analyzing Unconditional Security :**Plaintext Distribution, Key Distribution, Ciphertext Distribution, Attacker’s Probabilities, Condition for Perfect Secrecy, Mechanism of Twisted Shift Cipher, Shannon’s Theorem, One Time Pad (Verman’s Cipher), Limitations of Perfect Secrecy.  **Quantification of Information :**Entropy, Entropy and Coding, Measurement of the Redundancy in a Language, Conditional Entropy, Joint Entropy, Entropy and Encryption, Unicity Distance.  **Classical Cryptosystems :** Ciphers, Symmetric Algorithms, Asymmetric Algorithms, Encryption, Attacker’s Capabilities, Kerckhoff’s Principle for cipher design, Shift Cipher, Substitution Cipher, Polyalphabetic Ciphers, Vigenère Cipher, Affine Cipher, Hill Cipher, Permutation Cipher, Block Ciphers, Stream Ciphers, Product Ciphers, Affine Cipher, Idempotent Ciphers, Iterative Cipher. | | **[10]** |
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| **Module 3:**  **Public key Cryptosystems:** One Way Functions, Trapdoor One Way Function, RSA Algorithm, RSA Encryption and Decryption, Software Implementation of RSA Algorithm using Multi-precision Arithmetic(Multi-precision Addition, Multi-precision Subtraction, Multi-precision Multiplication using Karatsuba’s Algorithm, Test for Primes, Great Internet Mersenne Prime Search, Primality Tests with Trial Division, Randomized Algorithms for Primality Testing using Monte-carlo method, Finding Large Primes (using Fermat’s Theorem), Fermat’s Primality Test and its limitation, Strong probable-primality test, Miller-Rabin Primality Test, Miller-Rabin Algorithm (test for composites), Quadratic Residues, Legendre Symbol, Euler’s Criteria, Quadratic Non Residue, SolovayStrassenPrimality Test, Jacobi Symbol and its properties, Digital Signatures, Digital Certificates  **Factoring Algorithms :** Pollard p-1 Factorization, Pollard Rho Algorithm, ElGamal Public Key Cryptosystem, Shank’s Algorithm (also known as Baby-step Giant-step)  **Key Exchange Protocols :** Diffie Hellman Problem  **Hash Functions :** Avalanche Effect, Hash Family, UnkeyedHash Function, Preimage Resistant of Hash Function (one-wayness problem), Second Preimage of Hash Function, Collision Resistance of Hash Function, Random Oracle Model, Independence Property of Hash Function, RO model and Las Vegas randomized algorithm, Birthday Paradox, Iterated Hash Functions, Merkle-Damgard Iterated Hash Function, some popular Hash Functions MD5 algorithm (MD5) and Secure Hash Algorithm 1 (SHA 1) | | **[15]** |
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| **Module 4:**  **Elementary Concepts of Coding Theory :** Basic assumptions about channels (Code length preservation, Independence of errors) , Basic strategy for decoding (maximal likehood principle, nearest neighbour decoding strategy etc.), Hamming distance and its properties, Basic error correcting theorem, Binary symmetric channel, parity-check bit, two-dimensional parity code, Hadamard code, International Standard Book Number (ISBN)-code, Single error detection, Transposition detection, Equivalence of codes, Criteria for good code, The sphere-packing or Hamming bound, Gilbert-Varshanov bound, Huffman's code, Applications of Algebraic Coding Theory to Cryptography | | **[8]** |
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| **Module 5:**  **Private Key Cryptosystems :** Modern techniques, algorithms like DES, AES, IDEA, RC5,Blowfish etc. | | **[2]** |
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| **Module 6:**  **Elliptic Curves Theory and Applications to Factorization :** [Elliptic curve Diffie–Hellman](https://en.wikipedia.org/wiki/Elliptic_curve_Diffie–Hellman) (ECDH) key agreement scheme, Elliptic Curve [Integrated Encryption Scheme](https://en.wikipedia.org/wiki/Integrated_Encryption_Scheme) (ECIES), [Elliptic Curve Digital Signature Algorithm](https://en.wikipedia.org/wiki/Elliptic_Curve_DSA) (ECDSA), deformation scheme using Harrison's p-adic Manhattan metric,  [Edwards-curve Digital Signature Algorithm](https://en.wikipedia.org/wiki/EdDSA) (EdDSA), Elliptic Curve Menezes–Qu–Vanstone (ECMQV) key agreement scheme is based on the Menezes–Qu–Vanstone ([MQV](https://en.wikipedia.org/wiki/Menezes–Qu–Vanstone)) key agreement scheme, Elliptic Curve Qu-Vanstone (ECQV) implicit certificate scheme | | **[5]** |

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| **Text Books:** | |
| 1 | "Cryptography Theory and Practice", Douglas Stinson, 2nd Edition, Chapman & Hall/CRC. |
| 2 | "Cryptography & Network Security", B. A. Forouzan, Tata McGraw Hill. |
| 3 | "Cryptography and Network Security", W. Stallings, Pearson Education. |
| **Reference Books:** | |
| 1 | "Modern Cryptography, Theory & Practice", Wenbo Mao, Pearson Education. |
| 2 | "An Introduction to Mathematical Cryptography", Hoffstein, Pipher, Silvermman, Springer. |
| 3 | "The Design of Rijndael", J. Daemen, V. Rijmen, Springer. |
| 4 | "Algorithmic Cryptanalysis", A. Joux, CRC Press. |
| 5 | "Number Theory", S. G. Telang, Tata McGraw Hill. |

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| **Information Security** | **ECS62103** | **3-0-0** | **3 Credits** |

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| **Module 1**  **Information Security and its necessity :** Basics Principles of Confidentiality, Integrity Availability Concepts Policies, procedures, Guidelines, Standards, Administrative Measures and Technical Measures | | **[5]** |
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| **Module 2:**  **Information Security issues in Cloud Computing :** Benefits and major issues related to information Security  **Standards available for Information Securities** : A brief overview on Cobit, Cadbury, ISO 27001, Open Web Application Security Project (OWASP), Open Source Security Testing Methodology Manual  (OSSTMM) etc. , Certifiable Standards | | **[8]** |
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| **Module 3:**  **Vulnerability, Threat and Remedies :** Introduction to BCP / DRP / Incident management, Segregation and Separation of Duties & Roles and responsibilities, IT ACT 2000 | | **[8]** |
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| **Module 4:**  **Information Security Assessments** : Vulnerability Assessment and Penetration Testing (VAPT), Web Application Audits, IT assessments or audits, Assessment of Network Equipment, Assessment of Security Devices (Web Filtering, Firewalls, IDS / IPS, Routers etc.), Data Centre Assessment, Business Continuity and Disaster Recovery Plans (BCP/DRP) assessments  **Security of Application Software :** SAP Security, Desktop Security, RDBMS Security | | **[8]** |
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| **Module 5:**  **Inbuilt Securities Provided in Windows and Linux :**Types of audits in Windows environment, Server Security, Security for active directories (Group Policy), Anti-Virus, Malware, End point protection, Shadow Passwords, SUDO (Super-user do) users etc. | | **[8]** |
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| **Module 6:**  **Security issues in Web Application :**Open Web Application Security Project (OWASP), Cross-site scripting (XSS), SQL injection, Cross-Site Request Forgery (CSRF), Password Vulnerabilities, Secure Sockets Layer (SSL) , Completely Automated Public Turing test to tell Computers and Humans Apart (CAPTCHA), Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues, etc. | | **[8]** |

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| **Text Books:** | |
| 1 | “Elementary Information Security ”, Richard E. Smith, Jones & Bartlett Learning, LLC. [ISBN-13: 978-1-4496-4820-6](http://www.amazon.com/Elementary-Information-Security-Richard-Smith/dp/1449648207/ref=sr_1_1?ie=UTF8&qid=1345937483&sr=8-1&keywords=9781449648206) |
| **Reference Books:** | |
| 1 | “ The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws”, DafyddStuttard, Marcus Pinto, Wiley, ISBN-13: 9780470170779 |
| 2 | “ Hacking: The Art of Exploitation”, Jon Erickson, 2nd edition, No Starch Press, ISBN-10: 1593271441 |
| 3 | “Exploiting Software - How to Break Code”, Greg Hoglund and Gary McGraw, Addison Wesley, ISBN: 0-201-78695-8 |
| 4 | “The Art of Deception: Controlling the Human Element of Security”, Kevin D. Mitnick, Wiley, ISBN-10: 076454280X |
| 5 | *“*Introduction to Computer Security”, Matt Bishop, Addison Wesley, ISBN: 0-321-24744-2 |

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| **Cyber Security** | **ECS62105** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Systems Vulnerability Scanning :**Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit.  **Networks Vulnerability Scanning :**Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – N map, THC-A map and System tools. **Network Sniffers and Injection tools :**Tcp dump and Win dump, Wireshark, Ettercap, Hping Kismet | | **[10]** |
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| **Module 2:**  **Network Protection tools :** Firewalls and Packet Filters, Firewall Basics, Comparison between Packet Filter and Firewall, Protection mechanism of Firewall, Packet Characteristic to Filter, Stateless and Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, [Snort - Network Intrusion Detection and Prevention System](https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj9l-_K7_jTAhUNTo8KHdCTAhgQFggnMAA&url=https%3A%2F%2Fwww.snort.org%2F&usg=AFQjCNGcM-QbwviBIcCdsQyHnySpBKzvDA&sig2=PM8STvgTGHcJLMM-FJ_TQg) | | **[10]** |
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| **Module 3:**  **Protection tools against web vulnerabilities :** Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sql map, Damn Vulnerable Web App (DVWA), Webgoat  **Password Cracking and Brute-Force Tools :** John the Ripper, L0htcrack, Pwdump, HTC-Hydra | | **[10]** |
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| **Module 4:**  **Cyber Crime and law :**Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000. 10 | | **[8]** |
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| **Module 5:**  **Cyber Crime Investigation :** Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks | | **[7]** |
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| **Text Books:** | |
| 1 | “Anti-Hacker Tool Kit (Indian Edition)”, Mike Shema, Publication McGraw Hill |
| 2 | " Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Nina Godbole and SunitBelpure, Publication Wiley |

**Subject Name: Computing Lab - II**

**Code: ECS61202**

**Credit: 2**

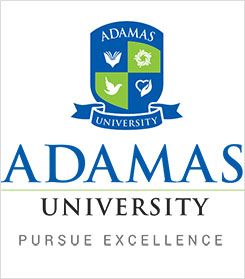
**Contact Hours: 3**

Familiar Socket programming, database creation and update, building large client server applications. Basics of compiler writing using lex and yacc.

Familiar with Python fundamentals continues, covering: objects, variables, and types, duck typing, equality vs. identity testing, additional useful string methods, string formatting, running Python as a script, and the basics of imports, Data Structures, Functions, Functional Programming, Object-Oriented Python, Standard Library, Third-Party Tools.

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| **Technical Report Writing & Seminar – I** | **ECS62301** | **0-0-6** | **4 Credits** |
| The course involves technical presentation and technical report submission by every student. Reference search and technical writing skills along with effective presentation skills are focused. The course strengthens the research attributes including literature survey and make themselves industry ready. | | | |

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| **Thesis (Part – I)** | **ECS62401** | **0-0-24** | **16 Credits** |
| The course involves technical presentation and technical report submission by every student. Reference search and technical writing skills along with effective presentation skills are focused. The course strengthens the research attributes including literature survey and make themselves industry ready. | | | |



**ADAMAS UNIVERSITY**

**Master of Technology (M.Tech) (CSE)**

**SEMESTER – IV**

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| **Technical Report Writing & Seminar – II** | **ECS62302** | **0-0-6** | **4 Credits** |
| The course involves technical presentation and technical report submission by every student. Reference search and technical writing skills along with effective presentation skills are focused. The course strengthens the research attributes including literature survey and make themselves industry ready. | | | |

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| **Thesis (Part – II)** | **ECS62402** | **0-0-27** | **18 Credits** |
| The course involves technical presentation and technical report submission by every student. Reference search and technical writing skills along with effective presentation skills are focused. The course strengthens the research attributes including literature survey and make themselves industry ready. | | | |

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| **Comprehensive Viva** | **ECS62502** |  | **4 Credits** |
| The course tests the technical knowledge acquired during the study, spoken skills, and the ability to think logically under time pressure. The course proves extremely useful for placement interviews. | | | |