**ADAMAS UNIVERSITY**

**SCHOOL OF ENGINEERING & TECHNOLOGY**

**UG PROGRAM**

**Course Structure of**

**B.Tech in Computer Science & Engineering**

**Applicable for Academic Year: 2016-17**

**ADAMAS UNIVERSITY**

Adamas Knowledge City

Barasat-Barrackpore Road

P.O. –Jagannathpur, District -24 Parganas (North)

Kolkata -700126, West Bengal, India

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **UG PROGRAM: B.Tech in Computer Science & Engineering**  **SEMESTER I** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | SMA41101 | Engineering Mathematics -I | 3 | 0 | 0 | 3 | 3 |
| 2 | Theory | SPH41109 | Applied Physics | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory | ECS41101 | Computer Programming | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory | EME41101 | Engineering Mechanics | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory | HEN41117 | English Communication | 3 | 0 | 0 | 3 | 3 |
| 6 | Theory | LWJ41111 | Value Education, Human Rights and Legislative Procedures | 3 | 0 | 0 | 3 | 3 |
| 7 | Practical | EME41201 | Engineering Graphics Lab | 0 | 0 | 3 | 3 | 2 |
| 8 | Practical | SPH41209 | Applied Physics Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical | ECS41201 | Computer Programming Lab | 0 | 0 | 3 | 3 | 2 |
| 10 | Practical | HEN41219 | English Communication Lab | 0 | 0 | 2 | 3 | 1 |
| **Total** | | | | **18** | **0** | **11** | **30** | **25** |

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **UG PROGRAM: B.Tech in Computer Science & Engineering**  **SEMESTER II** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | SMA41102 | Engineering Mathematics - II | 3 | 1 | 0 | 4 | 4 |
| 2 | Theory | ECS41102 | Introduction to Data Structures | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory | EEE41102 | Electrical and Electronics Technology | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory | SCY41106 | Chemistry | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory | SBT41108 | Life Sciences | 3 | 0 | 0 | 3 | 3 |
| 6 | Practical | ECS41202 | Data Structures Lab | 0 | 0 | 3 | 3 | 2 |
| 7 | Practical | EEE41202 | Electrical and Electronics Technology Lab | 0 | 0 | 3 | 3 | 2 |
| 8 | Practical | SCY41206 | Chemistry Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical | EME41204 | Manufacturing Process Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **15** | **1** | **12** | **28** | **26** |

**Engineering Mathematics-I: Calculus & Differential Equations**

**Engineering Mathematics–II: Linear Algebra, PDE, Complex Analysis**

**Total Credits (First Year): 51**

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **UG PROGRAM: B.Tech in Computer Science & Engineering**    **SEMESTER III** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | SMA42103 | Discrete Structures and Logic | 3 | 1 | 0 | 4 | 4 |
| 2 | Theory | EEE42101 | Signals and Networks | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory | EEC42107 | Introduction to Electronics | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory | ECS42101 | Algorithms - I | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory | ECS42103 | Formal Languages and Automata Theory | 3 | 0 | 0 | 3 | 3 |
| 6 | Theory | HEN42111 | HSS –III (English Communication) | 3 | 0 | 0 | 3 | 3 |
| 7 | Theory |  | Non Credit Course – III |  |  |  |  |  |
| 8 | Practical | EEE42201 | Signals and Networks Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical | EEC42203 | Introduction to Electronics Lab | 0 | 0 | 3 | 3 | 2 |
| 10 | Practical | ECS42201 | Algorithms - I Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **18** | **1** | **9** | **28** | **25** |

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| **SEMESTER IV** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | SMA42102 | Probability and Statistics | 3 | 0 | 0 | 3 | 3 |
| 2 | Theory | EEC42102 | Digital Electronics | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory | ECS42102 | Computer Architecture | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory | ECS42104 | Algorithms – II | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory | ECS42106 | Object Oriented Programming | 3 | 0 | 0 | 3 | 3 |
| 6 | Theory | HEC42180 | HSS-IV (Economics For Engineers) | 3 | 0 | 0 | 3 | 3 |
| 7 | Theory |  | Non Credit Course – IV |  |  |  |  |  |
| 8 | Practical | EEC42202 | Digital Electronics Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical | ECS42202 | Computer Architecture Lab | 0 | 0 | 3 | 3 | 2 |
| 10 | Practical | ECS42204 | Algorithms – II Lab | 0 | 0 | 3 | 3 | 2 |
| 11 | Practical | ECS42206 | Object Oriented Programming Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **18** | **0** | **12** | **30** | **26** |

**HSS-III: From a list of Language related topics**

**HSS-IV and V: From a list of Economics and Finance related topics**

**Total Credits (Second Year): 51**

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **UG PROGRAM: B.Tech in Computer Science & Engineering**    **SEMESTER V** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | ECS43101 | Theory of Computation | 3 | 0 | 0 | 3 | 3 |
| 2 | Theory | ECS43103 | Operating Systems | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory | ECS43105 | Computer Networks | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory | SGY43113 | Environmental Science | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory |  | Elective – I | 3 | 0 | 0 | 3 | 3 |
| 6 | Theory | HEC43181 | HSS -V (Financial Accounting) | 3 | 0 | 0 | 3 | 3 |
| 7 | Theory |  | Non Credit Course – V |  |  |  |  |  |
| 8 | Seminar | ECS43301 | Seminar | 0 | 2 | 0 | 2 | 2 |
| 9 | Practical | ECS43203 | Operating Systems Lab | 0 | 0 | 3 | 3 | 2 |
| 10 | Practical | ECS43205 | Computer Networks Lab | 0 | 0 | 3 | 3 | 2 |
| 11 | Practical |  | Elective – I Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **18** | **2** | **9** | **29** | **26** |

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| **SEMESTER VI** | | | | | | | | |
| **S. No** | **Type of Course** | **Course Code** | **Course Title / Project** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | ECS43102 | Database Management Systems | 3 | 0 | 0 | 3 | 3 |
| 2 | Theory | ECS43104 | Software Engineering | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory | ECS43106 | Artificial Intelligence | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory |  | Elective – II | 3 | 0 | 0 | 3 | 3 |
| 5 | Theory | MBA43144 | Management – I | 3 | 0 | 0 | 3 | 3 |
| 6 | Project | ECS43402 | Design / Mini project | 0 | 0 | 3 | 3 | 2 |
| 7 | Practical | ECS43202 | Database Management Systems Lab | 0 | 0 | 3 | 3 | 2 |
| 8 | Practical | ECS43204 | Software Engineering Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical |  | Elective – II Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **15** | **0** | **12** | **27** | **23** |

**Summer / Industrial Training: 2 Credits**

**Total Credits (Third Year): 51**

**Elective I and II: From the list of Departmental Electives**

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| **ADAMAS UNIVERSITY**  **SCHOOL OF ENGINEERING & TECHNOLOGY**  **UG PROGRAM: B.Tech in Computer Science & Engineering**    **SEMESTER VII** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title / Project** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory | EEC44101 | Embedded Systems Design | 3 | 0 | 0 | 3 | 3 |
| 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 | HPS44101 | HSS - VI (Basics of Organizational Behaviors) | 3 | 0 | 0 | 3 | 3 |
| 6 | Project | ECS44401 | Project – I | 0 | 0 | 6 | 6 | 4 |
| 7 | Practical | EEC44201 | Embedded Systems Lab | 0 | 0 | 3 | 3 | 2 |
| 8 | Practical |  | Elective – IV Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical |  | Elective – V Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **15** | **0** | **15** | **30** | **25** |

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| **SEMESTER VIII** | | | | | | | | |
| **Sl. No** | **Type of Course** | **Course Code** | **Course Title / Project / Viva** | **L** | **T** | **P** | **Contact**  **Hrs./Wk.** | **Credits** |
| 1 | Theory |  | Elective – VI | 3 | 0 | 0 | 3 | 3 |
| 2 | Theory |  | Elective – VII | 3 | 0 | 0 | 3 | 3 |
| 3 | Theory |  | Elective – VIII | 3 | 0 | 0 | 3 | 3 |
| 4 | Theory | MBA44142 | Entrepreneurship Development | 3 | 0 | 0 | 3 | 3 |
| 5 | Project | ECS44402 | Project – II | 0 | 0 | 12 | 12 | 8 |
| 7 | Viva | ECS44502 | Comprehensive Viva | 0 | 2 | 0 | 2 | 2 |
| 8 | Practical |  | Elective – VII Lab | 0 | 0 | 3 | 3 | 2 |
| 9 | Practical |  | Elective – VIII Lab | 0 | 0 | 3 | 3 | 2 |
| **Total** | | | | **12** | **2** | **18** | **32** | **26** |

**HSS -VI: From a list of Psychology / Behavioral Science related topics**

**Elective V and VII: From a list of Departmental Electives**

**Total Credits (4th Year): 51**

**Total Credits (Over Four Years): 204**

**List of Elective Papers:**

**Elective – I (Theory):**

**List of Electives (From B.Tech):**

**ECS43107 Computer Graphics and Visualization**

**ECS43109** **Machine Learning**

**List of Electives (From M.Tech):**

**ECS61105** **Pattern Recognition**

**ECS61109** **Logic Programming**

**ECS61111** **Soft Computing**

**ECS61113 Image and Video Processing**

**ECS61115 Advanced Graph Theory**

**Elective – I (Lab):**

**List of Electives (From B.Tech):**

**ECS43207 Computer Graphics and Visualization Lab**

**ECS43209** **Machine Learning Lab**

**List of Electives (From M.Tech):**

**ECS61205** **Pattern Recognition Lab**

**ECS61209** **Logic Programming Lab**

**ECS61211** **Soft Computing Lab**

**ECS61213 Image and Video Processing Lab**

**ECS61215 Advanced Graph Theory Lab**

**Elective – II (Theory):**

**List of Electives (From B.Tech):**

**ECS43108 Applied Graph Theory**

**ECS43110** **Cryptography and Cyber Security**

**List of Electives (From M.Tech):**

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

**ECS61106** **Cloud Computing**

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

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

**ECS61116** **Computational Complexity**

**Elective – II (Lab):**

**List of Electives (From B.Tech):**

**ECS43208 Applied Graph Theory Lab**

**ECS43210** **Cryptography and Cyber Security Lab**

**List of Electives (From M.Tech):**

**ECS61204** **Advanced Database System Lab**

**ECS61206** **Cloud Computing Lab**

**ECS61208** **Neural Network and Deep Learning Lab**

**ECS61210** **Advances in Compiler Design Lab**

**ECS61216** **Computational Complexity Lab**

**Elective – III (Theory):**

**EEC44119** **Mobile Computing**

**SMA44101** **Number Theory**

**Elective – IV (Theory):**

**EEC43102 VLSI System Design**

**EEE43115** **Control System**

**Elective – IV (Lab):**

**EEC43202 VLSI System Design Lab**

**EEE43215** **Control System Lab**

**Elective – V (Theory):**

**List of Electives (From B.Tech):**

**ECS44101** **Compiler Design**

**ECS44103** **Computer Vision**

**List of Electives (From M.Tech):**

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

**ECS62105** **Cyber Security**

**Elective – V (Lab):**

**List of Electives (From B.Tech):**

**ECS44201** **Compiler Design Lab**

**ECS44203** **Computer Vision Lab**

**List of Electives (From M.Tech):**

**ECS62201** **Cryptography & Cryptosystems Lab**

**ECS62205** **Cyber Security Lab**

**Elective – VI (Theory):**

**List of Electives (From B.Tech):**

**MBA61142** **E-Commerce**

**EEC61128 Internet of Things**

**SPH44102** **Quantum Computing**

**Elective – VII (Theory):**

**List of Electives (From B.Tech):**

**ECS44102** **Distributed Computing**

**ECS44104** **Information Retrieval**

**List of Electives (From M.Tech):**

**ECS61118** **Formal Systems**

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

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

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

**Elective – VII (Lab):**

**List of Electives (From B.Tech):**

**ECS44202** **Distributed Computing Lab**

**ECS44204** **Information Retrieval Lab**

**List of Electives (From M.Tech):**

**ECS61218** **Formal Systems Lab**

**ECS61220** **Principles of Programming Languages Lab**

**ECS61222** **High Performance Computer Architecture Lab**

**ECS61224**  **Natural Language Processing Lab**

**Elective – VIII (Theory):**

**SMA44102** **Numerical Analysis**

**SMA44104** **Operation Research**

**SPH44104** **Medical Electronics**

**Elective – VIII (Lab):**

**SMA44202** **Numerical Analysis Lab**

**SMA44204** **Operation Research Lab**

**SPH44204** **Medical Electronics Lab**



**ADAMAS UNIVERSITY**

**B. Tech in Computer Science and Engineering**

**SEMESTER – I**

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| **Engineering Mathematics -I** | **SMA41101** | **3-0-0** | **3 Credits** |

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| **Module 1: Differential  Calculus:**  Successive differentiation, Leibnitz’s Theorem, Rolle’s  theorem,  Mean  value  theorems, Taylor’s and Maclaurin’s theorems with remainders, Expansions, indeterminate forms, infinite Series, curve tracing, functions of several variables, partial Differentiation,   total differentiation, Euler’s theorem and generalization,    maxima  and  minima  of functions of several variables (two and three variables), Lagrange’s method of multipliers, change of variables, Jacobean’s,  asymptote, curvature. |
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| **Module 2: Integral Calculus:** Fundamental theorem of integral calculus and mean value theorems; Evaluation of plane areas, volume and surface area of a solid of revolution and lengths. Convergence of Improper integrals, Beta and Gamma integrals, Elementary properties, Differentiation under integral sign, Double and triple integrals, computation of surface areas and volumes, change of variables in double and triple integrals. |
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| **Module 3: Ordinary  differential  equations of first order:**   Formation  of differential equations; Separable equations; equations  reducible to  separable form; exact equations, integrating factors,  linear first   order   equations;   Bernoulli’s   equation;    Orthogonal trajectories. |
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| **Module 4: Ordinary linear differential equations of higher order:**  Homogeneous linear equations of arbitrary order with constant coefficients, Non homogeneous linear equations with constant coefficients, Euler and Cauchy’s equations, Method of variation of parameters, System of linear differential equations., modelling of electrical circuit. |
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| **Module 5:** Series solution of differential equation, power series method, Legendre’s equation and Legendre’s polynomials, Bessel’s equation, Bessels function and its application. |

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| **Text Books:** | |
| 1 | Erwyn Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons |
| 2 | Higher Engineering Mathematics by B.V. Ramana, Tata McGraw-Hill. |
| 3 | B.S.Grewal  : Higher Engineering Mathematics, Khanna Publications |
| 4 | C B Gupta, S R Singh, Mukesh Kumar: Engineering Mathematics, Mc Graw Hill Publication. |

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| **Applied Physics** | **SPH41109** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Interference of Light:** Interference due to division of wavefront and division of amplitude, Young’s double slit expt., Interference, Principle of Superposition, Interference from parallel thin films, wedge shaped films.    **Diffraction:** Single slit diffraction, Diffraction grating, dispersive power of Grating, resolving power of prism and grating.  **Polarization:** Introduction, production of plane polarized light by different methods, Brewster and Malus Laws. Double refraction, Nicol prism, specific rotation, |
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| **Module 2:**  Laser: Introduction, temporal and spatial coherence, principle of Laser, stimulated and spontaneous emission, Einstein’s Coefficients, He-Ne Laser, Ruby Laser, Application of Lasers.    Fibre Optics: Introduction, numerical aperture, step index and graded index fibres, attenuation & dispersion mechanism in optical fibers (Qualitative only), application of optical fibres, optical communication (block diagram only) |
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| **Module 3:**  **Electromagnetic Theory (EMT):**  Motion of Charged Particles in crossed electric & magnetic fields, Velocity Selector & Magnetic focussing, Gauss law, continuity equation, inconsistency in Ampere’s Law, Maxwell’s equations (differential and integral forms), poynting vector, Poynting Theorem (Statement only), propagation of plane electromagnetic waves in conducting and non-conducting medium. |
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| **Module 4:**  **Mechanics**  Central and non-central forces, Inverse square force, SHM, Damped, undamped and forced Oscillations (no derivations).  **Special theory of Relativity:**Frame of reference, basic postulates of special relativity, Lorentz transformations (space – time coordinates & velocity only), mass energy relation, length contraction, time dilation. |
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| **Module 5:**  **Quantum Mechanics & Statistical Physics:**  De-Broglie Hypothesis, wave function and its properties, expectation value, Wave Packet, Uncertainity principle. Schrodinger Equation for free Particle, Time Dependent Schrodinger Equation, Particle in a box (1-D), Single step Barrier, Tunnelling effect.  Qualitative Features of Maxwell Bollzman, Bose-Einstein and Fermi-Dirac statistics distribution, functions & their comparison (no derivation) |
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| **Module 6:**  **Solid State Physics**  Formation of energy bands in metals, semiconductors and insulators; intrinsic and extrinsic semiconductors, Fermi energy levels for doped, undoped semiconductors and pn junction; Tunnel diode, Zener diode.  **Superconductivity:** Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), properties of superconductors & applications. |
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| **Module7:**  **X-Rays**:  production and properties, Crystalline and Anorphous solids (Brief) Bragg’s Law, Applications.  **Ultrasonics:**Introduction, Production of Ultrasonics (Magentostriction and piezoelectric methods), engineering applications. |
| **Text Books:** |
| Arthur Beiser, S RaiChoudhury, ShobhitMahajan, (2009), Concept of Modern Physics, 6th Edition, Tata-McGraw Hill. |
| V. Rajendran, Engineering Physics, Tata McGraw Hill, 1st Edition, 2010 |
| **Reference Books:** |
| Hitendra K Malik, A. K. Singh, Engineering Physics, McGraw Hill, 1st Edition, 2009 |
| A J Dekker, Solid State Physics, Mcmillan India Ltd, 1st Ed. 2009 |

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| **Computer Programming** | | **ECS41101** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  **Basic Concepts of Programming:** Introduction to components of a Computer System (disks, memory, processor, where a program is stored and executed, operating systems, compilers, etc.), Idea of Algorithm: steps to solve logical and numerical problems, Representation of Algorithms: Flowchart/Pseudo code with examples, From Algorithms to Programs; source code, variables and memory locations, Syntax and Logical Errors in compilation, Object and Executable code | | | | | **[08]** |  |
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| **Module 2:**  **Basics of C Programming :**Characters used in C, Identifiers, Keywords, Data type & sizes, Constants &Variables, Various Operators used such as Arithmetic Operators, Relational & Logical Operators, Increment & Decrement Operators, Assignment Operators, Conditional or Ternary Operators, Bitwise Operators & Expressions; Standard Input & Output, formatted input scanf( ), formatted output printf( ); Flow of Control, if-else, switch-case, Loop Control Statements, for loop, while loop, do-while loop, nested loop, break, continue, goto, label and exit( ) function | | | | | **[10]** |  |
|  | | | | | |  |
| **Module 3:**  **Functions and Pointers:** Definition of Function, Declaration or Prototype of Function, Various types of Functions, Call by Value, Call by Reference, Recursion, Tail Recursion, Definition of Pointer, Declaration of Pointer, Operators used in Pointer, Pointer Arithmetic, Functions with Pointer | | | | | **[10]** |  |
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| **Module 4:**  **Arrays and String:** Definition, Single and Multidimensional Arrays, Representation of Arrays - Row Major Order, and Column Major Order, Application of arrays – searching and sorting, Sparse Matrices and their representations. Definition of a String, Declaration of a String, Initialization of a String, Various String Handling Functions with example  **Structures and Unions:** Definition of a Structure, Declaration of a Structure & Structure Variable, Initialization of a Structure, Operators used in Structure, Structure within Structures, Union, Difference between a Structure and a Union  **Files:** Types of File, File Processing, Handling Characters, Handling Integers, Random File Accessing, Errors During File Processing | | | | | **[17]** |  |
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| **Text Books:** | | | | | | |
| Let Us Cby YashavantP*.* Kanetkar, Fifth Edition – BPB Publication | | | | | | |
| Programming in C by Balagurusamy, Fourth Edition – McGraw Hill Publication | | | | | | |
| **Reference Books:** | | | | | | |
| “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company | | | | | | |
| “How to Solve it by Computer”, 2nd Impression by R. G. Dromey, Pearson Education | | | | | | |

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| **Engineering Mechanics** | **EME41101** | **3-0-0** | **3 Credits** |

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| **Module 1** - **Introduction to Statics**  Concept of particle and Rigid body, Vector, Introduction to Vector Algebra, Addition and subtraction of Vectors and different laws, Lami’s theorem, Free Vector, Bound Vector, Representation of Vectors in terms of I, j and k, Cross product and Dot product and their application, scalar. |
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| **Module 2** - **Force System**  Introduction, Force, Two-Dimensional Force system, Resolution of Force, Moment, Couple, Varignon’s Theorem, Resultant of Forces. |
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| **Module 3** – **Equilibrium**  Introduction, Equilibrium in Two-Dimension, Free body Concept and Diagram, Equation of Equilibrium. |
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| **Module 4 - Distributed Force**  Introduction, Center of Mass and Centroid, Centroid of Mass, Centroid of Line and Area (Triangle, Circular section, Quadrilateral, Composite Area etc.). |
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| **Module 5** – **Friction**  Introduction, Concept of Friction, Law of Coulomb Friction, Angle of Repose, Coefficient of Friction, Application of Friction in Machines. |
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| **Module 6** - **Moment of Inertia**  Mass Moment of Inertia of Symmetrical bodies, Area Moment of Inertia, Introduction, M.I of Plane figures w.r.t an axis on its plane, M.I of plane figures w.r.t an axis perpendicular to its plane, Parallel axis theorem. |
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| **Module 7** – **Virtual Work**  Introduction of Virtual work, Principal of Virtual work, Application of Principal of Virtual work. |

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| **Text Books:** | |
| 1 | Engineering Mechanics [Vol-I & II] by Meriam&Kraige, 5th ed. – Wiley India |
| 2 | Engineering Mechanics by S.S. Bhavikatti and K.G. Rajashekarappa – New Age International |
| 3 | Mechanics of Solids by Crandall,Dahl and Sivakumar-MC Graw Hill ,5th Edition 2015,New Delhi |
| **Reference Books:** | |
| 1 | Engineering Mechanics: Statics & Dynamics by I.H.Shames, 4th ed. – PHI |
| 2 | Engineering Mechanics by Timoshenko , Young and Rao, Revised 4th ed. – TMH |

**English Communication (HEN41117) students have to choose from anyone of the offered courses**

**Level 2 A**

**Unit-I: Oral Skill I**

Interactions in different situations- Formal dialogues- Group interactions

**Unit-II: Oral Skill II**

Inviting people to a programme- Apologizing and responding to apologies- Congratulations and response-Showing appreciation- Expressing sympathy, regret or consolation-Asking for, granting and refusing permission

**Unit-III: Oral Skill III**

Debates and Extempore

**Unit-IV: Reading Skill**

Newspaper Reading and Interpretation

**Unit-V (Writing Skill I)**

Importance of writing skills – Effective means of written communication –Report Writing – Memo writing – Summary writing

**Unit-VI (Writing Skill II)**

Article, Paragraph, Applications, Emails and Drafts

**Suggested Reading:**

1. *Spoken and Written Communication*. Board of Editors. Orient Blackswan.
2. M. S Gupta. *Current English Grammar and Usage*. Prentice Hall India Learning Private Limited; 2016.
3. P. C. Das. *Spoken English and Functional Grammar*.

**Level 2 B**

**Unit-I**

**Short Stories**— Sherlock Holmes: “The Speckled Band”

**Unit-II**

**Poetry**— Wilfred Owen: “Strange Meeting”; W H Auden: “The Unknown Citizen”

**Unit-III**

**Drama**— William Shakespeare: *As You Like It*

**Unit-IV**

Newspaper Reading and Interpretation

**Unit-V (Writing Skill I)**

Importance of writing skills – Effective means of written communication – Letter Writing – Report Writing – Memo writing – Summary writing

**Unit-VI (Writing Skill II)**

Article, Paragraph, Report, Applications, Emails and Drafts

**Suggested Reading:**

1. Sir Arthur Conan Doyle: *Sherlock Holmes and the Adventure of the Speckled Band*. Lerner Books.
2. W. H. Auden: *Collected Poems*, Vintage International.
3. *The Poems of Wilfred Owen*. Wordsworth Poetry Library
4. *Spoken and Written Communication*. Board of Editors. Orient Blackswan.
5. M. S Gupta. *Current English Grammar and Usage*. Prentice Hall India Learning Private Limited; 2016.
6. William Shakespeare: *As You Like It*. Arden Edition

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| **Value Education, Human Rights and Legislative Procedures** | **LWJ41111** | **3-0-0** | **3 credits** |

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| **Module 1**: An attempt to define and identify the contours of Ethics and its relation with Religion, Aesthetics and Professional Education Human Values including basic five human values (against Satya (Truth), Dharam (Righteous conduct), Prem (Love), Shanti (Peace), Ahinsa (Non-violence), Ethics & Morality in Law, General-Lectures by distinguished persons on this subject on regular basis.  Fundamental Duties of citizen. Basic values of the Constitution: Democracy, Republicanism, Rule of law, Constitutionalism and Respect for Minority Rights. |

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| **Module 2: Human Rights** – Jurisprudence of human rights nature and definition, Universal protection of human rights, Regional protection of human rights, National level protection of human rights, Human Rights and vulnerable groups. |

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| **Module 3**: **Theory and Nature of Political Institutions**  Concept of State / Nation  Organs of Government – Legislative, Executive and Judiciary  Separation of Powers – Parliamentary Sovereignty and Judicial Independence  Constitutional Framework of India. |

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| **Module 4: Nature and Sources of Law**  Legislation – Process, delegated and subordinate legislation  Case law- Stare decises, precedents within the hierarchy of courts  Authoritative Sources, Custom, Law reform |

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| **Module 5: Historical Evolution of Indian Legal System**  Ancient Indian Law, English Law in India  Administration of Justice in British India  Charter of 1861 and subsequent Charters  Establishment of High Courts and the Federal Courts  Drafting of the Indian Constitution  Ancient Indian Law in Modern Legal Framework |

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| **Module 6: Civil and Criminal Courts And Process**  The Civil Court Structure, The Criminal Court Structure  The Civil Process, The Criminal process- Investigation and Prosecution |

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| **Module 7: Miscellaneous Laws**  Growing importance of intellectual property rights and related laws in India  Industrial relations laws  An overview of the Law of Contract  Human resource and related laws |

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| **Text Books:** | |
| 1 | AroraVibha, AroraKunwar, Laws for Engineers, Central Law Publications, 1st Edition, 2017 |
| 2 | Fledderman Charles B., Engineering Ethics, Pearson Education Inc., 4th Edition, 2012 |
| 3 | Govindarajan M., Natarajan S., Senthilkumar V. S., Engineering Ethics Includes Human Values, PHI Learning Private Limited, 1st Edition, 2010 |
| **Reference Books:** | |
| 1 | Govindarajan M., Natarajan S., Senthilkumar V. S., Professional Ethics and Human Values, PHI Learning Private Limited, 1st Edition, 2017 |
| 2 | Harris Charles E., Jr., Pritchard Michael S., Rabins Michael J., Engineering Ethics, Wadsworth Cengage Learning, 4th Edition, 2009 |

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| **Engineering Graphics Lab** | **EME41201** | **0-0-3** | **2 Credits** |

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| **Module 1**: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales; |
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| **Module 2**: Orthographic Projections covering, Principles of Orthographic Projections Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; |
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| **Module 3**: Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; |
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| **Module 4**:Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; |
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| **Module 5**: Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; |

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| **Text Books:** | |
| 1 | Bhat, N.D.& M. Panchal (2008), Engineering Drawing, Charotar Publishing House |
| 2 | Shah, M.B. & B.C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education |
| 3 | Dhawan, R.K. (2007), A Text Book of Engineering Drawing, S. Chand Publications |
| 4 | Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers |

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| **Applied Physics Lab** | **SPH41209** | **0-0-3** | **2 Credits** |

**List of Laboratory Experiments**:

1. Determination of Young’s Modulus of a Beam by travelling microscope by FLEXURE method.
2. Carry Foster’s Method to Determine Resistance of a Given Coil.
3. Determination of the Coefficient of viscosity of water by Poiseulle’s Capillary Flow method.
4. To determine the wavelength of sodium light by forming Newton’s Ring.
5. Determination of Rigidity Modulus by dynamical method.
6. Determine the **Plank’s constant** using photocell.
7. To verify **Stefan’s law** by electrical method.
8. To study the **temperature** dependence of **reverse saturation current** in a junction diode and hence to determine the **Band gap.**
9. Determination of **specific charge** **(e/m)** of electron by J.J. Thomson’s method.
10. Determination of the **Rydberg constant** by studying hydrogen or helium spectrum.
11. Determination of **dielectric constant** of a given dielectric material.
12. Determination of **Hall coefficient** of Semiconductor.
13. Study **current – voltage characteristic load response** of photovoltaic solar cells.

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| **Computer Programming Lab** | **ECS41201** | **0-0-3** | 1. **Credits** |

**List of Programs**:

1. Familiarization with LINUX commands and vi editor.
2. Programs to demonstrate Decision Making, Branching and Looping, Use of break and continue statement etc.
3. Implementation involving the use of Arrays with subscript, String operations and pointers.
4. Implementation involving the use Functions and Recursion.
5. Implementation involving the use Structures and Files.

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| **English Communication Lab** | **HEN41219** | **0-0-3** | 1. **Credits** |

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| 1 | Activities on Interpersonal Communication and  Building Vocabulary |
| 2 | Activities on Reading Comprehension |
| 3 | Activities on Writing Skills |
| 4 | Activities on Presentation Skills |
| 5 | Activities on Group Discussion and Interview Skills |
| 6 | Conflict Management |
| 7 | Leadership Skills |
| 8 | Team Building |

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**ADAMAS UNIVERSITY**

**B. Tech in Computer Science and Engineering**

**SEMESTER – II**

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| **Engineering Mathematics -II** | **SMA41102** | **3-1-0** | **4 Credits** |

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| **Module 1: Linear Algebra:**  Elementary row and column operations on a matrix; Rank of matrix , Normal form, Inverse of a matrix using elementary operations, Consistency and solutions of systems of linear equations using elementary operations, Gauss Elimination method, Caley-Hamillton theorem, eigen values and eigen vectors, Symmetric and skew-symmetric matrices, orthogonal matrices, complex matrices, Hermitian and skew-Hermitian matrices, unitary matrices and similarity of matrices, Unitary matrix, Normal matrix, Algebraic and geometric multiplicity, Diagonalization, spectral theorem for Real symmetric matrices, Application of quadratic forms. |
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| **Module 2: Vector space and Linear transformations:** Definition of vector space, subspaces, linear combination, Linearly dependent and linearly independent vectors, Basis of vector space, Dimension, Rank-Nullity theorem (statement and verification by examples), Definition of linear transformation, types of linear transformations (Rotation, Reflection, Expansion, Contraction, Projection), Matrix of Linear transformations, Change of basis and similarity. |
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| **Module 3: Functions Of Complex Variables:** Reorientation, Analytic function, Cauchy – Riemann equation (Cartesian and Polar forms), Harmonic functions, conformal mappings, complex integration, Cauchy’s theorem and integral formula, Singularities, Taylor’s and Laurent’s Series theorem, evaluation of integrals using residues. |
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| **Module4 Partial Differential Equation:** Introduction, classification, construction and geometrical interpretation of first order partial differential equations (PDE), method of characteristic and general solution of first order PDE, canonical form of first order PDE, equations solvable by direct integration, Langrange’s method, solution of non-linear first order partial differential equation by Charpit’s method, special types of first order PDE, solution satisfying given conditions, Jacobi’s method. |

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| **Text Books:** | |
| 1 | Erwyn Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons |
| 2 | Higher Engineering Mathematics by B.V. Ramana, Tata McGraw-Hill. |
| 3 | David C. Lay, Linear algebra and its application, (Latest edition), Pearson publication, New Delhi. |
| 4 | E. Kreyszig, Advanced engineering mathematics (Latest edition), John Wiley. |
| 5 | H. Anton, Elementary linear algebra with applications (Latest edition), John Wiley. |
| 6 | Erwyn Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons |

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| **Introduction to Data Structures** | | **ECS41102** | **3-0-0** | **3 Credits** | |
| **Module 1:**  **Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.  **Arrays:** Array Definition: 1D array and 2D array, Different array operations: Insertion, deletion, traversing etc.; Algorithms for various operations and Complexity Analysis,  **Searching:** Linear Search and Binary Search Techniques and their complexity analysis. | | | | | **[9]** |
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| **Module 2:**  **Stacks and Queues:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis. | | | | | **[9]** |
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| **Module 3:**  **Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. | | | | | **[9]** |
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| **Module 4:**  **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.  **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis. | | | | | **[9]** |
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| **Module 5:**  **Sorting and Hashing**: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. | | | | | **[9]** |

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| **Text Books:** | |
| 1 | “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni and Computer Science Press. |
| 2 | “Introduction To Algorithms”, [Thomas H.Cormen](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Thomas+H..+Cormen%22), [Thomas H Cormen](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Thomas+H+Cormen%22), [Charles E Leiserson](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Charles+E+Leiserson%22), [Ronald L Rivest](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Ronald+L+Rivest%22), Clifford Stein . |
| **Reference Books:** | |
| “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company | |
| “How to Solve it by Computer”, 2nd Impression by R. G. Dromey, Pearson Education | |

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| **Electrical and Electronics Technology** | **EEE41102** | **3-0-0** | **3 Credits** |

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| **Module 1: Introduction to Electrical Engineering**  Sources of energy; General structure of electrical power systems; Steam power generation; Hydel power generation; Gas and Nuclear power generation; Power Transmission and Distribution; overhead lines; underground cables; Transformers; Basic Principle and operation |
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| **Module 2: DC Networks**  Kirchoff’s laws; node voltage method; mesh current method; Delta-star and star-delta conversion; Network theorems; Superposition principle; Thevenin’s theorem; Norton’s theorem |
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| **Module 3: AC Circuits**  Definitions: average and effective values of Sinusoids; Solution of R,L,C series circuits; Significance of j operator; complex representation of impedances; Phasor diagram; power factor, power in complex notation; solution of parallel and series – parallel Circuits; Three phase EMF generation; delta and Y – connections; line and phase quantities |
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| **Module 4: Basics of Semi-Conductors and PN Junction**  Introduction; Carrier Concentrations- the Fermi Level; Electron and Hole Concentration at Equilibrium; Temperature Dependence of Carrier Concentration; Drift and diffusion current; The Hall Effect; Optical Absorption, Luminescence; PN Junction Diode in Equilibrium Conditions; PN Junction Diode in Forward Biased and Reverse Biased Condition; Breakdown in PN Junction Diodes. |
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| **Module 5: Bipolar Junction Transistors**  Introduction, Types: NPN and PNP; Current Components; Early Effect Ebber’s Moll Model; Different Configurations of a Transistor and its Characteristics; Transistor as an Amplifier (CE, CB, CC); Transistor as a Switch |
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| **Module 6: Field Effect Transistors**  Introduction; JFET and MOSFET; Realization of digital logic circuit using MOSFET (AND, OR, NOT etc.); Realization of switching circuits using MOSFET |
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| **Module 7: Electronics Instruments & Digital Electronics Fundamental:**  Signal generator, Multimeter, operation of CRO and its application. Number systems, Conversions and codes, Logic gates and truth tables. |

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| **Text Books:** | |
| 1 | Basic Electrical Engineering-Abhijit Chakrabarti, SudipNath, Chandan Kumar Chnada, Tata McGraw-Hill publishing Limited, New Delhi |
| 2 | Principles of Electrical Engineering and Electronics- V K Mehta, Rohit Mehta , S Chand and Company , New Delhi |
| 3 | Solid State Electronic Devices- Ben G. Streetman and Sanjay Kumar Banerjee, PHI. |
| **Reference Books:** | |
| 1 | Basic Electrical Engineering-D P Kothari, I J Nagrath, Tata Mcgraw-Hill Publishing Company, New Delhi |
| 2 | Integrated Electronics: Analog & Digital Circuit Systems – Jacob Millman & Halkias, TMH |
| 3 | Digital Principles & Applications, 8th Edition by Donald P Leach, Albert Paul Malvino, Goutam Saha (Tata Mcgraw Hill Publishing Co Ltd, 2014) |

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| **Chemistry** | **SCY41106** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Thermodynamics:** Zeroth law, definition of temperature, 1st law, concept of enthalpy, specific heat of gases, 2nd law and definition of entropy, free energy, chemical potential, spontaneity criteria of chemical reaction |
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| **Module 2:**  **Reaction Kinetics, Catalysis & Electrochemistry:** Differential and integrated rate laws,order and molecularity of reactions, rate determining step, zero order, 1st order & 2nd order reaction, Arrhenius equation, theories of reaction rates, theories of catalysis, electrode potential, redox reaction, Nernst Equation. |
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| **Module 3:**  **Solid State and Molecular Spectroscopy:**. Unit cells, Bravias lattice, packing fraction of SCC, BCC and FCC, Van der waals bonding, hydrogen bonding, band theory, conductors, semiconductors and insulators. Basic concepts of spectroscopy, selection rule, fundamentals of IR, UV-Vis, NMR spectroscopy |
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| **Module 4:**  **Co-Ordination Chemistry:** Transition elements, concept of complex, Warner’s co-ordination theory, structure of co-ordination compounds, co-ordination number, types of ligands, isomerism: geometrical, optical, ionization, linkage & co-ordination isomerism, Theories of bonding in co-ordination compounds :crystal field theory |
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| **Module 5:**  **Reactivity of Organic Molecules, Different Types of Organic Reactions and Stereochemistry:** Inductive effect, hyper conjugation, resonance, carbocation, carbanion & free radicals, substitution reactions, addition reactions, elimination reactions, and their mechanisms. Introduction to stereochemistry, stereochemical nomenclature & terminology (chiral carbons, allenes, biphenyls, etc.) and nomenclature (R/S, E/Z, D/L, d/l). Identification of stereo chemical relationship (enantiomers, diastereomers, epimers, etc.). |
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| **Module 6:**  **Polymers& Fuel Chemistry:** Polymerization, addition and condensation polymerization, and their mechanism, classification of plastics, synthesis, properties & industrial applications of PVC, teflon, polyester and phenolic resin, conducting polymers & biopolymers. Solid Fuel: Coal, Different types of coal, coal analysis. Liquid fuel: petroleum, classification of petroleum, Thermal cracking and reforming, octane number, cetane number, biodiesel, aviation Fuel. Gaseous fuels: natural, producer, water and bio gas. |

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| **Text Books:** | |
| 1 | P. W. Atkins, Physical Chemistry, ELBS/Oxford, 7th Edition, 1995 |
| 2 | G.W.Castellan, Physical Chemistry |
| 3 | D. A. McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998) |
| 4 | P. C. Rakshit, Physical Chemistry, Sarat Book House (7thEdition) |
| 5 | Cotton, F A,Wikinson G. and Gaus, P L,Basic Inorganic Chemistry |
| 6 | J. D. Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991 |
| 7 | I.L. Finar,Organic Chemistry,Vol – I & II, Pearson Education |
| 8 | Morrison & Boyd, Organic Chemistry |
| 9 | P. Sykes, Mechanism in Organic Chemistry, Orient Longman |
| 10 | Joel R. Fried, Polymer Science and Technology, Pearson Education (2ndEdition) |
| 11 | S. Sarkar, Fuels and Combustion, Taylor & Francis (3rdEdition), 2009 |
| 12 | Kuriacose& Raja Ram ,Chemistry in Engineering and Technology, Vol.1 & 2 by, Tata McGraw Hill & Co |

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| **Life Sciences** | **SBT41108** | **3-0-0** | **3 Credits** |

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| **Module 1: BASIC CELL BIOLOGY**  Introduction; Living Organisms; Cells and Cell theory, Cell Structure and Function, Genetic information, protein synthesis, and protein structure, Cell metabolism; Cell growth, reproduction, and differentiation; Cell division, cell cycle and apoptosis; ATP synthesis and Glycolysis; Respiration and photosynthesis. |
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| **Module 2: BIOCHEMISTRY AND TRANSPORT PROCESS**  Chemistry of life: chemical bonds; Non-covalent interactions and free energy changes in biological processes; Fundamentals of momentum, heat and mass transport as applied to biological systems; Human body as a thermodynamic system; Blood Rheology, Fluid mechanical aspects of some diseases and organs; Biochemistry and Human biology; Stem cells and Tissue engineering. |
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| **Module 3: CHEMICAL BIOLOGY**  Carbohydrates; Lipids; Proteins: structure and sequencing; DNA: structure and sequence, replication, recombination; RNA synthesis; Genetic code and protein biosynthesis; Recombinant DNA technology. |
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| **Module 4: ENZYMES AND INDUSTRIAL APPLICATIONS**  Enzymes: mechanism, kinetics and inhibition; Biological catalysts, Proteases, Carbonic anhydrase, Restriction enzymes, and Nucleoside monophosphate kinases. |
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| **Module 5: FERMENTATION TECHNOLOGY AND APPLICATIONS**  Introduction and scope of microbial processes. Sources of industrial cultures and maintenance. Alcoholic fermentation: Production of Industrial Alcohol. Brewing and malting, manufacture of wine and other distilled liquors. Microbial Foods – Food, Fodder and Baker's yeast, applications of the nonconventional raw materials; Nutritional characteristics of food yeast, mushroom production; Vitamins- Vitamin B-2, Riboflavin, Soya-sauce & cheese production. Production of acids, viz., citric, lactic and gluconic acid. Mechanism of each fermentation, their uses. Production of Amino acids and Antibiotics and its new Developments. Production of Organic Acids its spoilage and prevention. |
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| **Module 6: MECHANOCHEMISTRY**  Molecular Machines/Motors; Cytoskeleton; Biosensors; Bio-Micro devices. |
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| **Module 7: HUMAN PHYSIOLOGY**  Physiology of cells and molecules; cellular physiology of the nervous system; cardiovascular and respiratory systems; gastrointestinal and renal systems; endocrine and reproductive systems. |
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| **Module 8: IMMUNE SYSTEM AND CELL SIGNALING**  Immune system; General principles of cell signaling. |
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| **Module 8: IMPACT OF BIOLOGY ON SOCIETY AND MANKIND**  Crop management, Disease control, Biological Hazards and safety; Unsolved Problems in Biology. |

**Text Book:**

S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj,   S. Barathi, and M. K. Jaganathan, "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012.

**Reference Book:**

Biology for Engineers. Arthur T. Johnson. 2010 by CRC Pres. ISBN 9781420077636

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| **Chemistry Lab** | **SCY41206** | **0-0-3** | **2 Credits** |

**List of experiments (Any 8 Experiments)**

1. Determination of total hardness of water by complexometric titration method
2. Determination of carbonate and bicarbonate in water
3. Estimation of iron by permanganometry
4. Estimation of ferrous ion in Mohr salt
5. Dissolved oxygen by Winkler's method
6. Measurement of the coefficient of viscosity
7. Measurement of the surface tension
8. Kinetics of ester hydrolysis
9. pH metric titration
10. Conductometric titration
11. Determination of standard EMF of a Daniel Cell
12. Verification of Beer Lambert's law
13. Partition coefficient of iodine
14. Identification of organic Compounds using melting point
15. Solubility, functional group test of organic compounds

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| **Electrical and Electronics Technology Lab** | **EEE41202** | **0-0-3** | **2 Credits** |

**List of experiments (Electronics Part):**

1. Familiarization of bread board and electronics elements such as R, L, C, diode, and BJT etc.
2. Familiarization of Function generator and measuring instruments such as CRO and mustimeter.
3. Study the V-I characteristic of PN junction diode and find knee voltage.
4. Study the input and output characteristic of bipolar junction transistor (BJT):
5. Common emitter (CE) configuration
6. Study the transfer and drain characteristic of junction field-effect transistor (JFET),hence determine the drain resistance, transconductance factor, amplification factor.
7. Study the transfer and drain characteristic of MOSFET,hence determine the drain resistance, transconductance factor, amplification factor.
8. Realization of digital logic circuit using MOSFET (AND, OR, NOT etc.).

**List of experiments (Electrical Part):**

1. Characteristic of lamps

2. Calibration of wattmeter & ammeter

3. Study of R.L.C. circuit.

4. Characteristic of fluorescent lamp

5. Thevenin’s Theorem

6. Superposition Theorem

7. Maximum power transfer theorem

8. Norton's Theorem

9. Open circuit and short circuit test of single-phase transformer.

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| **Data Structures Lab** | **ECS41202** | **0-0-3** | **2 Credits** |

1. Write a menu based C program to insert a node at the beginning, after a specified position, at the end of a singly linked list.
2. Write a menu based C program to delete a node from the beginning, from a specified position, from the end of a singly linked list.
3. Write a menu based C program to display the data part of the nodes in reverse order, reverse the list and sort the elements of a singly linked list.
4. Write a menu based C program to insert a node at the beginning, after a specified position, at the end of a doubly linked list.
5. Write a menu based C program to delete a node from the beginning, from a specified position, from the end of a doubly linked list.
6. Write a menu based C program to display the data part of the nodes in reverse order, reverse the list and sort the elements of a doubly linked list.
7. Write a menu based C program to insert, delete and display operation of a linear queue by using singly linked list.
8. Write a menu based C program to insert, delete and display operation of a linear queue by using an array.
9. Write a menu based C program to implement push, pop and display operation of a linear queue by using singly linked list.
10. Write a menu based C program to implement push, pop and display operation of a linear queue by using an array.
11. Write a menu based C program to implement insert, delete and display operation of a circular queue by using an array.
12. Write a menu based C program to implement insert, delete and traverse operation of a binary search tree using doubly linked list.
13. Write a menu based C program to implement linear search, binary search and interpolation search algorithm.
14. Write a menu based C program to implement bubble sort, selection sort, and quick sort, merge sort, insertion sort, heap sort and radix sort algorithm.
15. Implement Tree Traversals, BFS, Graph Traversal, Shortest path and some topics on Spanning Tree using C.

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| **Manufacturing Processes Lab** | **EME41204** | **0-0-3** | **2 Credits** |

1. Pattern Making; pattern material, pattern allowances and types of patterns;
2. Mould making Practice:
3. Uses of moulding tools: green sand moulding, gating system, risering system, core making; Making a product using sheet metal;
4. Basic Forging processes like upsetting, drawing down and forge welding; Practicing Resistance Spot Welding, Arc Welding and Gas Welding;
5. Machining of products involving lathe (operations: Straight Turning, Taper Turning, Chamfering, Grooving and Thread cutting), milling/shaping operations and finishing process(es).



**ADAMAS UNIVERSITY**

**B. Tech in Computer Science and Engineering**

**SEMESTER – III**

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| **Discrete Structures and Logic** | | **SMA42103** | **3-1-0** | **4 Credits** | |
| **Module 1:**  **Sets, Relation and Function:** Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.  **Principles of Mathematical Induction:** The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. | | | | | **[16]** |
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| **Module 2:**  **Propositional Logic:** Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers.  **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency. | | | | | **[14]** |
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| **Module 3**  **Algebraic Structures and Morphism:** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields, Boolean Algebra, Boolean Expression and Boolean Function, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Sum-of-Product, Functional Completeness, Switching Function: Disjunctive and Conjunctive Normal Form, Logic Gates, Minimization of Circuits, Boolean Ring. | | | | | **[14]** |
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| **Module 4:**  **Graphs and Trees:** Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances. | | | | | **[16]** |

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| **Text Books:** | |
| 1 | Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill. |
| 2 | Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co Inc. |
| 3 | C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill. |
| **Reference Books:** | |
| 1 | J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It’s Application to Computer Science”, TMG Edition, TataMcgraw-Hill |
| 2 | Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. |
| 3 | Schaum’s Outlines Series, Seymour Lipschutz, Marc Lipson, Discrete Mathematics, Tata McGraw - Hill. |

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| **Signals and Networks** | | **EEE42101** | **3-0-0** | **3 Credits** | |
| **Module 1: Introduction of signals and systems:** signal and system types and classifications, basic Operations on signals, Parseval’s theorem, step response, impulse response and convolution integral, concepts of correlation, power spectral density. | | | | | **[6]** |
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| **Module 2: Periodic and aperiodic signal analysis:** Periodic signal analysis: Fourier series and properties; Aperiodic signal analysis :Fourier Transform - its properties and sinusoidal steady state analysis of systems | | | | | **[8]** |
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| **Module 3: Elements of electrical network and analysis:** Dependent and independent sources, active and passive components; linear and nonlinear circuit, lateral and bilateral circuit, lumped and distributed circuit, Generalized formulation of KCL, KVL, State Variable descriptions; Thevenin, Norton, Maximum Power Transfer, Tellegen and Reciprocity Theorems; classical differential equations for description of transient conditions of Network; Solutions of linear time invariant networks with initial conditions; Unilateral and Bilateral Laplace Transforms and properties; Transient analysis of RL and RC circuits using Laplace Transform; Network functions: poles, zeros, transfer function. | | | | | **[20]** |
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| **Module 4: Network Topology:** Graph theory: Tree, Co-tree, fundamental cut-set, fundamental loop analysis of network | | | | | **[8]** |
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| **Module 5:One and two port network parameters and functions:** Z, Y and ABCD parameters, driving point and transfer impedances and admittances. | | | | | **[8]** |
| **Module 6: Analog filter design:** HP, LP, BP, BR Filter, Butterworth, Sallen Key, frequency transformation and scaling. | | | | | **[10]** |

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| **Text Books:** | |
| **1** | “Signals & Systems” by Oppenheim, Willsky and Nawab, Pearson, PHI |
| **2** | “Network Analysis” by M.E. Van Valkenburg, Third Edition; Prentice Hall, 1986. |
| **3** | “Network Analysis & Synthesis” by F.F.Kuo; John Wiley & Sons Inc. |
| **Reference Books:** | |
| **1** | “Signals and systems”, by A Nagoor Kani, Tata McGraw Hill, Indian Reprint, 2010 |
| **2** | “Digital Signal Processing”, by Proakis : Pearson. |
| **4** | “Fundamental of electric circuit theory”, by D. Chattopadhyay and P.C.Rakshit, S. Chand, 2009 |

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| **Introduction to Electronics** | | **EEC42107** | **3-0-0** | **3 Credits** | |
| **Module 1: Review of semiconductor, P-N junction Diode and Transistors** | | | | | **05** |
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| **Module 2: Diode Circuits**  Introduction, Simple Diode Circuits, Concept of Load Line, Linear Piecewise Model; Rectifier Circuits (Half-Wave, Full-Wave and Bridge), Peak Detector; Filter Circuits for Power Supply: Inductor Filter, Capacitor Filter, LC Filter, Multiple LC Filter, CLC Filter or Π Filter; Load Regulation, Diode Clipper and Clamper Circuits. | | | | | **05** |
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| **Module 3: Transistor Biasing and Stabilization**  Biasing Schemes for BJT and FET Amplifiers, Bias Stability, Various Configurations (Such As CE/CS, CB/CG, CC/CD) and Their Features; Thermal Runaway, Thermal Stability; Compensation Techniques: Diode Compensation, Transistor Compensation and Thermistor &Sensistor Compensation. | | | | | **09** |
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| **Module 4: Integrated Circuits (IC)**  Introduction to IC, Concept of Operational Amplifier (OP-AMP), Ideal OP-AMP, Virtual Ground, Inverting & Non-Inverting Operational Amplifier; Differential Amplifier: Basic Structure and Principle of Operation, Calculation of Differential & Common Mode Gain, CMRR & ICMR; Summing Amplifier, Integrator & Differentiator, Current-to-Voltage Converter & Voltage-to-Current Converter; Instrumentation Amplifier, Logarithmic & Anti-Logarithmic Amplifier; Precision Rectifier. | | | | | **08** |
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| **Module 5: Frequency Response and Transistors Amplifier**  **Low Frequency Transistor Amplifier:** h-parameter Models for CB, CE, CC configurations and their interrelationship; Linear analysis of Transistor Circuits; Miller's Theorem; Single stage amplifier: Simplified models and calculation of gain for CE and CC Amplifiers; Effect of emitter resistance in CE amplifiers; Darlington Pair; Single stage FET amplifier: CS and CD Configuration.  **High Frequency Transistor Amplifiers**: CE hybrid-π model; Validity and parameter Variation; Current Gain with resistive load; frequency response of a single stage CE Amplifier; Gain Bandwidth product; CC stage High frequencies. | | | | | **06** |
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| **Module 6: Multi-stage and Power Amplifiers**  **Multi-stage Amplifiers:** Distortion in Amplifiers**;** Frequency Response of an Amplifier: Bode plots, Step Response; Cascaded Stages: Response of a Two-stage RC Coupled Amplifier at Low and high frequencies; Direct Coupled Amplifiers; Differential Amplifiers.  **Power Amplifiers:** Large Signal Amplifiers; Harmonic Distortions; Class A; Class B; Class AB; Push Pull Amplifiers; Class C and Class D Amplifiers. | | | | | **07** |
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| **Module7:Feedback Amplifier and Oscillators**  **Feedback Amplifiers:** Classification; Feedback concept; Ideal Feedback amplifier: Properties of Negative Feedback Amplifier Topologies: Method of Analysis of Feedback amplifiers: Voltage series Feedback: Voltage series Feedback pair: Current series, Current shunt and Voltage shunt feedback; Effect of feedback on amplifier Bandwidth and stability.  **Oscillators:**  The oscillator feedback loop; Oscillation criterion; Sinusoidal oscillator: phase shift oscillators, Wien Bridge oscillator; Resonant circuit oscillators: General form of oscillator configuration; LC Colpitts & LC Hartley oscillators; Crystal oscillator; Amplitude Frequency and phase stability analysis of all Oscillators. | **05** |

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| **Text Books:** | |
| 1 | Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford University Press, YMCA Library Building Jai Singh Road, New Delhi – 110 001 |
| 2 | Integrated Electronics (Second Edition), Jacob Millman, Christos Halkias, and Chetan Parikh, McGraw Hill Education |
| 3 | Electronics –Fundamental and Application-D. Chattopadhyay and P.C Rakshit-11th edition(New age International) |
| **Reference Books:** | |
| 1 | Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092 (Selected Portions). |
| 2 | Electronics Principles (7th Edition), Albert Malvono and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi. |

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| **Algorithms - I** | | **ECS42101** | **3-0-0** | **3 Credits** | |
| **Module 1:**  **Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.  **Arrays:** Array Definition: 1D array and 2D array, Different array operations: Insertion, deletion, traversing etc.; Algorithms for various operations and Complexity Analysis,  **Searching:** Linear Search and Binary Search Techniques and their complexity analysis. | | | | | **[10]** |
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| **Module 2:**  **Stacks and Queues:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis. | | | | | **[8]** |
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| **Module 3:**  **Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.  **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis. | | | | | **[14]** |
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| **Module 4:**  **Sorting and Hashing**: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.  **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis. | | | | | **[13]** |
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| **Text Books:** | |
| 1 | “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press. |
| **Reference Books:** | |
| 1 | “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company |
| 2 | “How to Solve it by Computer”, 2nd Impression by R. G. Dromey, Pearson Education |

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| **Formal Languages and Automata Theory** | | **ECS42103** | **3-0-0** | **3 Credits** | |
| **Module 1**  **Introduction:** Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. | | | | | **[8]** |
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| **Module 2:**  **Regular languages and finite automata:** Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata. | | | | | **[12]** |
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| **Module 3:**  **Context-free languages and pushdown automata:** Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata and deterministic CFLs, closure properties of CFLs. | | | | | **[14]** |
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| **Module 4:**  **Context-sensitive languages:** Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. | | | | | **[4]** |
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| **Module 5:**  **Turing machines:** The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. | | | | | **[14]** |
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| **Module 6:**  **Undecidability:** Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages. | | | | | **[8]** |
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| **Text Books:** | |
| 1 | “Introduction to the Theory of Computation”, 3rd Edition, Michael Sipser, Cengage Learning. |
| 2 | “Introduction to Automata Theory, Languages, and Computation”, 3rd Edition, John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education. |
| **Reference Books:** | |
| 1 | “Introduction to Computability”, Illustrated Edition by Frederick C. Hennie, Addison-Wesley. |
| 2 | “The Theory of Computation”, EE Edition by Bernard M. Moret, Pearson Education Asia. |
| 3 | “Computational Complexity: A Conceptual Perspective”, 1st Edition by OdedGoldreich, Cambridge University Press. |
| 4 | “Automata and Computability, Undergraduate Texts in Computer Science”, 2002 Reprint Edition by Dexter C. Kozen, Springer. |
| 5 | “Introduction to Languages and the Theory of Computation”, Illustrated Edition by John C. Martin, Tata McGraw Hill. |

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| **HSS –III (English Communication)** | **HEN42111** | **3-0-0** | **3 Credits** |

**Module I: 9 lecture hours**

**Communication Level 1**: Basics of Communication, Means of Communication, Barriers of Communication

**Module II: 9 lecture hours**

**Grammar and Syntax Level 1**:Tense: types and uses, Idioms, One Word Substitutes, Discussion on the use of Articles and related exercises, Discussion on the use of Prepositions and related exercises, Exercises on Sentence –Making (Syntax), Practice exercises on Voice change, Class Exercises on Synonyms and Antonyms.

**Module III: 9 lecture hours**

**Reading and Listening Skills Level 1**: Introduction to listening skills: purposes and practice, Discussion on types of listening: difference between listening and hearing, Active listening: introduction listening exercises, Elementary level listening exercise, Intermediate level listening exercise, Advance level listening exercise, Introduction to Reading Skills, Strategies of reading, Skimming, Scanning and Summarizing, Comprehension exercises.

**Module IV: 9 lecture hours**

**Speaking Skills Level 1**: Introduction to Speaking Skills: Mother tongue influence, Discussion on various kinds of narrative styles and techniques: Welcome speech, Vote of Thanks, Farewell Speech, Debate and Elocution, Class Exercises on Descriptive narration, Practical Exercises on Narration styles, Presentation of small skits, Practicing Extempore in the class, Mock practices of Group discussion, Practicing speaking in pairs, Mock practice of job interviews.

**Module V: 9 lecture Hours**

**Writing Skills Level 1**: Business letters: definition, types and format, Practice exercises, Business reports: definition, types and format, Practice exercises, CV and Application letters: types and formats, Practice exercises, Compositions: Essays, precis paragraph writing

**Text Books:**

1. Kaul Asha. Effective Business Communication. PHI Learning Pvt Ltd. 2014.
2. Wren and Martin. High School Grammar and Composition. S. Chand, 1995.
3. Gupta, A. English Reading Comprehension. Ramesh Publishing House, 2009.

**Reference Book:**

1. Lewis, Norman. Word Power Made Easy. Anchor: 2014.
2. Riordan, Daniel G & Pauley Steven A. :Technical Report Writing Today. 2004.
3. Hamp-Lyons and Heasely, B . Study Writing; A Course in Written English. For Academic and Professional Purposes, Cambridge Univ. Press, 2006.
4. Quirk R., Greenbaum S., Leech G., and Svartik, J. A Comprehensive Grammar of the English language, Longman:London, 1985.
5. Balasubramaniam, T. A Textbook of English Phonetics for Indian Students. Macmillan: 2012.

**Subject Name: Signals and Networks Lab**

**Code: EEE42201**

**Credit: 2**

**Contact Hours: 3**

**List of experiments:**

1. Familiarization with MATLAB.

2. Generation of common Periodic (Sinusoidal, Square, sawtooth), common aperiodic (Gaussian Pulse, and Damped Sinusoidal Signal), impulse, Unit Step, ramp signal using MATLAB

3. Generation of Delayed Unit Step and Delayed Unit Impulse Signal.

4. Determination of Laplace Transform and Inverse Laplace transform of variables, functions.

5. Generate Transfer Function of 1st order and 2nd order system (including feedback) and compute Poles and zeros of a given TF in S domain.

6. Perform Convolution and Deconvolution one sinusoidal with one unit step signal.

7. Determine the convolution of

i) Two vectors u = [1 2 3 4], v = [10 20 30], also recover vector v after deconvolving the result with u.

ii) A sinusoidal signal with a random noise.

8. Determination of impulse response of the system governed by the transfer function G(S) = 1/(s2+s+1) . Determine the step response of the circuit defined by an impulse response of h(t)= 5e-t sin2t u(t).

9. Design an analog high pass Butterworth filter of the order 4th, with a Sampling frequency of 1000 Hz, cutoff frequency of 300 Hz, which corresponds to a normalized value of 0.6.

10. Determine the h and ABCD parameters of a two port network.

11. Determine the Z parameters and Y of a two port network.

**Subject Name: Introduction to Electronics Lab**

**Code: EEC42203**

**Credit: 2**

**Contact Hours: 3**

**List of experiments:**

1. Study the half wave rectifier circuit: find ripple factor and observe output waveform without and with RC filter circuit.
2. Study center-tap full wave rectifier circuit: find ripple factor and observe output waveform without and with RC filter.
3. Study the diode clipper and Clamper circuits.
4. Study full wave bridge rectifier circuit: find ripple factor and observe output waveform without and with RC filter.
5. Study the V-I characteristic of Zener diode and find the breakdown voltage.
6. Study the voltage regulator circuit using full wave rectifier and Zener diode and find the percentage of voltage regulation.
7. Study the characteristics of a common emitter RC couple transistor amplifier circuits.
8. Design, study and plot the input, output waveforms of following circuits using OP-AMP:
9. Adder
10. Subtracter
11. Integrator
12. Differentiator
13. Voltage follower
14. Study RC phase shift oscillator and find the oscillation frequency.
15. Study the Wien bridge oscillator and find the oscillation frequency.

**Subject Name: Algorithms -I Lab**

**Code: ECS42201**

**Credit: 2**

**Contact Hours: 3**

Implementation of array operations, Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem, Evaluation of expressions operations on multiple stacks & queues: Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists, Polynomial addition, Polynomial multiplication, Sparse Matrices: Multiplication, addition. Recursive and No recursive traversal of Trees, Threaded binary tree traversal. AVL tree implementation Application of Trees. Application of sorting and searching algorithms, Hash table implementation: searching, inserting and deleting, searching & sorting techniques.



**ADAMAS UNIVERSITY**

**B.Tech in Computer Science and Engineering**

**SEMESTER – IV**

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| **Probability and Statistics** | | **SMA42102** | **3-0-0** | **3 Credits** | |
| **Module 1:**  **Probability and random variable:** Introduction, Probability of an event, additive rule and multiplication rule, conditional probability, total probability theorem, Bayes’ rule and applications in engineering, random variable, discrete and continuous probability distribution, joint probability distribution, mathematical expectation, variance and co-variance of random variables, mean and co-variance of linear combination of random variables, Binomial, Hyper-geometric, Geometric, Poisson distribution, Uniform, Normal, Exponential Distribution, Weibull’s distribution, Chi-square distribution and its applications in engineering. | | | | | **[14]** |
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| **Module 2:**  **Sampling Distribution:** Introduction, types of sampling, parameter and statistics, test of significance, tests of significance for large samples, sampling of attributes, sampling of variables, distribution, some theorem on Chi-Square distribution, linear transformation, applications of Chi-Square distribution, Student’s ‘t’ distribution and F-distribution and its applications, estimation, methods of estimation, estimating the mean of a single sample, standard error, prediction interval, tolerance limits, estimating the difference between means of two samples, estimating proportion and variance of a single sample, estimating the difference between two proportions and variances of two samples, maximum likelihood estimation. | | | | | **[16]** |
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| **Module 3**  **Test of Hypothesis:** Basic concepts, statistical hypothesis, simple and composite, steps in solving testing of hypothesis problem, one and two tailed test, test on a single mean when variance is known and variance is unknown, test on two means, test on a single mean population and test on two populations, one and two sample test for variance, -Test for goodness of fit and test for independence. | | **[08]** |
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| **Module 4:**  **Correlation and Regression:** Introduction, Karl Pearson correlation coefficient, rank correlation, regression analysis, fitting straight lines, method of least square, regression coefficients, properties of regression coefficients and its applications. | | **[10]** |
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| **Text Books:** | |
| 1 | ErwynKreyszig, Advanced Engineering Mathematics, John Wiley and Sons |
| 2 | Ronald E. **Walpole**, Raymond H. Myers, Sharon L. Myers & Keying Ye, “*Probability & Statistics for Engineers & Scientists*", Eighth Edition, 2007, Pearson Education Inc., New Delhi. |
| 3 | Vijay K. Rohatgi, A.K. Md. EhsanesSaleh, An Introduction to Probability and Statistics,  Second edition, Wiley. |
| **Reference Books:** | |
| 1 | R. V. Hogg, J Mckean, A T Craig, Introduction to Mathematical Statistics, 7e, Pearson Education India. |
| 2 | S C Gupta and V K Kapoor, Fundamentals of Mathematical Statistics, S Chand & Sons |

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| **Digital Electronics** | | **EEC42102** | **3-0-0** | **3 Credits** | |
| **Module 1: Minimization Techniques And Logic Gates**  Introduction,Minimization Techniques: Boolean postulates and laws, De-Morgan’s Theorem, Principle of Duality, Boolean expression, Minimization of Boolean expressions,8-4-2-1 BCD code, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS),Karnaugh map Minimization, Don’t care conditions, Quine - Mc Cluskey method of minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR, Implementations of Logic Functions using gates, NAND–NOR implementations ,Multi level gate implementations, Multi output gate implementations, TTL and CMOS Logic and their characteristics, Tristate gates. | | | | | **[10]** |
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| **Module 2: Combinational Circuits**  Introduction, Design Procedure of Adder & Subtractor: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Binary adder, Look Ahead carry adder, Serial adder, BCD adder. Other Combinational Circuits: Binary Multiplier, Binary Divider, Parity Bit Generator/Checker, Magnitude Comparator, Code Converter, Encoder, Decoder, Multiplexer, De-Multiplexer. | | | | | **[8]** |
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| **Module 3: Sequential Circuits**  Introduction, Types of Sequential circuits, Comparison between Combinational and Sequential Circuits, Comparison between Synchronous and Asynchronous sequential circuit, Latches and Flip-Flops: Gated S-R Latch, D Latch, J-K Latch, T Latch, Edge Triggered S-R Flip Flop, Edge Triggered D Flip Flop, Edge Triggered J-K Flip Flop, Edge Triggered T Flip-Flops, Master - Slave Flip-Flops, Direct Preset and Clear Input.  Counters and Shift Registers: Asynchronous Counter, Ripple Counters, Design of asynchronous counters, Effects of propagation delay in Ripple counters, Synchronous Counters, 4-bit synchronous up down counter, Design of synchronous counters, Ring counter, Johnson counter, Pulse train generators using counter, Design of Sequence Generators, Digital Clock using Counters, Parallel In Parallel Out Shift Register , Serial In Parallel Out Shift Register, Parallel In Serial Out Shift Register, Serial In Serial Out Shift Register, Bi-Directional Shift Registers, Universal Shift register | | | | | **[10]** |
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| **Module 4: Semiconductor Memory and Programmable Logic**  Introduction, Classification of memories:Programmable Read Only Memory, Erasable Programmable Read Only Memory, Electrically EPROM, EAPROM,RAM – RAM organization, Write and Read operation, Memory cycle and Timing wave forms, Memory decoding and memory expansion, Static RAM Cell, Bipolar RAM cell, MOSFET RAM cell, Dynamic RAM cell, Programmable Logic Devices, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA), Implementation of combinational logic circuits using ROM, PLA, PAL. | | | | | **[10]** |
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| **Module 5: Synchronous And Asynchronous Sequential Circuits:**:  Synchronous Sequential Circuits: Introduction, General Model, Classification and Design, Use of Algorithmic State Machine, Analysis of Synchronous Sequential Circuits.  Asynchronous Sequential Circuits: Introduction, Design of fundamental mode and pulse mode circuits, Incompletely specified State Machines, Problems in Asynchronous Circuits , Design of Hazard Free Switching circuits | | | | | **[7]** |

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| **Text Books:** | |
| 1 | “Fundamentals of Digital Circuits ” by A. Anand Kumar (PHI). |
| 2 | “Digital Electronics And Logic Design” by M.Mano (PHI) |
| 3 | Digital Circuits and Design (Fourth Edition-2012) by S. Salivahanan and S. Arivazhagan, Vikas Publishing House |
| **Reference Books:** | |
| 1 | Digital Circuits & Logic Design – LEE, PHI |
| 2 | Digital Fundamentals: Floyd & Jain: Pearson Education |

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| **Computer Architecture** | | **ECS42102** | **3-0-0** | **3 Credits** | |
| **Module 1**  **Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.  **Data representation:** signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic. | | | | | **[12]** |
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| **Module 2:**  **Introduction** to x86 architecture.  **CPU control unit design:** hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.  **Memory system design:** semiconductor memory technologies, memory organization.  **Peripheral devices and their characteristics:** Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB | | | | | **[10]** |
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| **Module 3:**  **Pipelining:** Basic concepts of pipelining, throughput and speedup, pipeline hazards.  **Parallel Processors:** Introduction to parallel processors, Concurrent access to memory and cache coherency. | | | | | **[10]** |
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| **Module 4:**  **Memory organization:** Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies. | | | | | **[11]** |
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| **Text Books:** | |
| 1 | “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier. |
| 2 | “Computer Organization and Embedded Systems”, 6th Edition by CarlHamacher, McGraw Hill Higher Education. |
| **Reference Books:** | |
| 1 | “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill |
| 2 | “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education. |
| 3 | “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education |

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| **Algorithms -II** | **ECS42104** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters’ theorem. | | **[8]** |
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| **Module 2:**  **Fundamental Algorithmic Strategies:** Brute-Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving. Heuristics – characteristics and their application domains. | | **[13]** |
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| **Module 3:**  **Graph and Tree Algorithms:** Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm. | | **[12]** |
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| **Module 4:**  **Tractable and Intractable Problems:** Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook’s theorem, Standard NP-complete problems and Reduction techniques. | | **[6]** |
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| **Module 5:**  **Advanced Topics:** Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE. | | **[6]** |
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| **Text Books:** | |
| 1 | Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill. |
| 2 | Fundamentals of Algorithms – E. Horowitz et al. |
| **Reference Books:** | |
| 1 | Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson. |
| 2 | Algorithm Design: Foundations, Analysis, and Internet Examples,SecondEdition,Michael T Goodrich and Roberto Tamassia, Wiley. |
| 3 | Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA. |

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| **Object Oriented Programming** | | **ECS42106** | **3-0-0** | **3 Credits** | |
| **Module 1:**  **OOP concept:** Data abstraction, encapsulation, inheritance, polymorphism, classes and objects; Properties of OOP, Procedural and object oriented programming paradigms.  Introduction to C++ / Java / Python, data types, variables, constants, scope and validity of variables, various operators, operator hierarchy, expressions, data type conversion and casting, enumerated types, control flow and scope of blocks, conditional statements, loops, break and continue statements, stand-alone java programs, arrays, console input-output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, method overloading and overriding, recursion, garbage collection, building and exploring string class. | | | | | **[8]** |
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| **Module 2:**  **Inheritance:** Inheritance hierarchy, sub and super classes, Member accessing rules, super keyword, preventing inheritance: using final classes and methods, the Object class and its methods.  **Polymorphism:** dynamic binding, method overriding, abstract classes and methods.  **Interfaces:** Interfaces and Abstract classes, definition and implementation of interfaces, accessing through interface references, extending interfaces.  **Inner classes:** uses of inner classes, Various inner classes: local inner class, anonymous inner class, static inner class.  **Packages:** Definition, Creation and Access of a Package, Understanding “classpath”, importing packages. | | | | | **[8]** |
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| **Module 3:**  **Exception handling:** errors/exceptions occur in OOP, Benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions; usage of try-catch block, throw, throws and finally, re-throwing exceptions, exception specification, built in exceptions, user defined exceptions.  **Multithreading:** multiple processes vs. multiple threads, states of a thread, creating threads, interrupting threads, thread priorities, thread synchronization, inter-thread communication, producer-consumer pattern. | | | | | **[8]** |
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| **Module 4:**  **Collection Framework:** Introduction to Collections, Overview of Collection frame work, Generics, Basic Collection classes: Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calendar.  **Files:** streams- byte streams, character streams, text input/output, binary input/output, random access file operations, File management.  **Connecting to Database:** JDBC / ODBC Type 1 to 4 drives, database connectivity, database query and result processing, data updation with JDBC. | | | | | **[10]** |
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| **Module 5:**  **GUI Programming:** AWT class hierarchy, Fundamentals of Swing, Swing vs. AWT, Hierarchy of Swing components, Containers - JFrame, JApplet, JDialog, JPanel; Overview of swing components - Jbutton, JLabel, JTextField, JTextArea; Applications of swing, Layout management - Layout manager types - border, grid and flow.  **Event handling:** Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation of event model, handling of a button click, handling of mouse events, Adapter classes.  **Applets:** Basics, Inheritance hierarchy for applets, applets vs. applications, life cycle of an applet, passing parameters to applets, security issues. | | | | | **[11]** |

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| **Text Books:** | |
| 1 | “Java Fundamentals - A comprehensive Introduction”, Illustrated Edition by DaleSkrien, Herbert Schildt, McGraw-Hill Education. |
| **Reference Books:** | |
| 1 | “Java for Programmers”, 2nd Edition by Paul Deitel and Harvey Deitel, Pearson Education. |
| 2 | “Thinking in Java”, Low Price Edition by Bruce Eckel, Pearson Education |

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| **HSS-IV (Economics For Engineers)** | **HEC42180** | **3-0-0** | **3 Credits** |

**Module 1: Basic Concepts of Economics: 10 lecture hours**

Introduction to the Literature of Microeconomics centering around Decision Making at Individual Level. Some Fundamental Concepts: Maximization, Equilibrium and Efficiency.

**Module 2: Theories of Economics: 12 lecture hours**

The Theory of Consumer Choice and Demand, the Theory of Supply, market equilibrium, market structure, market failure and environmental issues, Game Theory, concept of yield and Theories of Term Structure, the Theory of Asset Pricing, decision-making under uncertainty: risk and insurance.

**Module 3: Sustainability Study of a Project: 5 lecture hours**

Budget plan, estimation of the project cost, prices, fees and cost recovery, financing of recurrent costs, sustainability of the activities generated by the project.

**Module 4: Economic Feasibility Study: 12 lecture hours**

Problem of pricing under oligopoly, problem of market stagnation, problem of volatility in open economy, problem of global meltdown, problem of financing a project.

**Module 5: Project Report: 6 lecture hours**

Facets of project viability – commercial, technical, financial, outline of a model project report, a real life case study.

**Text Books:**

1. R. Panneersalvam, *Engineering Economics*, 2nd Ed., Prentice Hall of India, 2014.
2. James Riggs, *Engineering Economics*, 4th Ed., McGraw Hill Education, 2004.

**Reference Books:**

1. Donald G. Newnan, Ted G. Eschenbach and Jerome P. Lavelle, *Engineering Economic Analysis*, 13th Ed., Oxford University Press, 2017.

Chan S. Park, *Contemporary Engineering Economics*, 6th Ed., Pearson, 2015.

**Subject Name: Digital Electronics Lab**

**Code: EEC42202**

**Credit: 2**

**Contact Hours: 3**

**List of Experiments:**

1. Study of Basic Logic Gates and Universal Gate

2. Study of Half Adder

3. Study of Half Subtractor

4. Study of Full Adder

5. Study of Full Subtractor

6. Study of Binary to Gray Code Conversion

7. Study of Gray to Binary Code Conversion

8. Study of 4:1 Multiplexer.

9. Study of 1:4 De-multiplexers.

10. Study of S-R Flip Flop using Universal NAND Gate

11. Study of J-K Flip Flop using Universal NAND Gate

12. Study of D and T Flip Flop using Universal NAND Gate

13. Study of 2 Bit Asynchronous counter.

14. Study of 2 Bit Synchronous counter.

**Subject Name: Computer Architecture Lab**

**Code: ECS42202**

**Credit: 2**

**Contact Hours: 3**

Implementation based on basic Logic Gates (AND, OR, NOT, NAND, NOR, XOR, XNOR)

Implementation based on Half adder and Full adder (using data flow, behavioral, structural modeling)

Implementation based on Half subtractor and Full subtractor (using data flow, behavioral, structural modeling)

Implementation based on Full adder using two half adders and Full subtractor using two half subtractors

Implementation based on multiplexer, demultiplexer, Encoder and Decoder

Implementation based on D Flip Flop, SR Flip Flop, JK Flip Flop, T Flip Flop

Implementation based on 4 Bit Register (using Structural modeling)

Implementation based on 4 Bit Comparator (using Behavioral modeling)

Implementation based on 4 Bit ALU

**Subject Name: Algorithms –II Lab**

**Code: ECS42204**

**Credit: 2**

**Contact Hours: 3**

1. Implementation based on Divide and Conquer: Binary Search using Divide and Conquer approach, Quick sort and Merge Sort
2. Implementation based onDynamic Programming : Implement all pair of Shortest path for a graph ( Floyd-Warshall Algorithm ), Dijkstra , Bellman Ford Algorithm and Implement Traveling Salesman Problem
3. Implementation based onBrunch and Bound :Implement 15 Puzzle Problem
4. Implementation based onBacktracking :Implement 8 Queen problem, Graph Coloring Problem, Hamiltonian Problem
5. Implementation based onGreedy method**:** Knapsack Problem and Job sequencing with deadlines, Minimum Cost Spanning Tree by Prim's Algorithm and Minimum Cost Spanning Tree by Kruskal's Algorithm
6. Implementation based onGraph Traversal Algorithm **:** Implement Breadth First Search (BFS) and Implement Depth First Search (DFS)

**Subject Name: Object Oriented Programming Lab**

**Code: ECS42206**

**Credit: 2**

**Contact Hours: 3**

Programs to demonstrate class and constructor.

Programs to demonstrate overloading.

Programs to demonstrate inheritance, overriding.

Programs to demonstrate wrapper class, arrays.

Programs to demonstrate developing interfaces- multiple inheritances, extending interfaces

Programs to demonstrate creating and accessing packages

Programs to demonstrate multithreaded programming

Programs to demonstrate applet programming

Programs to demonstrate servlet.

Programs to demonstrate JSP.



**ADAMAS UNIVERSITY**

**B.Tech in Computer Science and Engineering**

**SEMESTER – V**

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| **Theory of Computation** | | **ECS43101** | **3-0-0** | **3 Credits** | |
| **Module 1:**  Review of 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. Propositional and Predicate Calculus. | | | | | **[14]** |
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| **Module 2:**  Automata and Languages:   * Strings, Phrase Structured Grammar and Formal Languages -- Finite Automata andRegular 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 mu-recursive functions. | | | | | **[20]** |
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| **Module 3:**  **Computability:** Church-Turing Thesis, Decision Problems, Decidability and Undecidability, Universal Turing Machine, Halting Problem of Turing Machines, Problem Reduction (Turing and Mapping Reduction). | | | | | **[14]** |
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| **Module 4:**  **Computational Complexity:** Time and Space Complexity Measures; Class P and Class NP problems NP-Completeness, Time and space-bounded Turing machines, Oracle machines and the polynomial hierarchy, Randomized computation, Parallel computation. | | | | | **[12]** |
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| **Text Books:** | |
| 1 | “Introduction to the Theory of Computation”, 3rd Edition, Michael Sipser, Cengage Learning. |
| 2 | “Discrete Mathematical Structures with Applications to Computer Science”, J. P. Trembley and R. Manohar, McGraw Hill Book Co. |
| **Reference Books:** | |
| 1 | “Introduction to Automata Theory, Languages, and Computation”, 3rd Edition, John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education. |
| 2 | “Elements of the Theory of Computation”, H. R. Lewis and C. H. Papadimitrou, Prentice Hall, International Inc. |

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| **Operating Systems** | **ECS43103** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System. | | **[8]** |
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| **Module 2:**  **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching  **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,  **Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Types and performance evaluation. | | **[12]** |
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| **Module 3:**  **Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation , Peterson’s Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader’s & Writer Problem, Dinning Philosopher Problem etc. | | **[4]** |
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| **Module 4:**  **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: banker’s algorithm, Deadlock detection and Recovery. | | **[7]** |
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| **Module 5:**  **Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.  **Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU). | | **[8]** |
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| **Module 6:**  **I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms  **File Management:** Concept ofFile, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table),efficiency and performance.  **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. | | **[6]** |

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| **Text Books:** | |
| 1 | Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition. |
| 2 | Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India. |
| **Reference Books:** | |
| 1 | Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing. |
| 2 | Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley. |
| 3 | Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India. |
| 4 | Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates. |

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| **Computer Networks** | **ECS43105** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Data communication Components:** Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum | | **[10]** |
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| **Module 2:**  **Data Link Layer and Medium Access Sub Layer:** Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA | | **[10]** |
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| **Module 3:**  **Network Layer:** Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols | | **[10]** |
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| **Module 4:**  **Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm | | **[7]** |
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| **Module 5:**  **Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography | | **[8]** |
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| **Text Books:** | |
| 1 | Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill. |
| 2 | Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India. |
| **Reference Books:** | |
| 1 | Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition. |
| 2 | Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India. |
| 3 | TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America |

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| **Environmental Science** | **SGY43113** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Basics of Environmental Sciences :**Definition, Scope and objectives, classification of environment, interrelationship between the components, ecology and ecosystem, structural and functional component of ecosystem, energy flow in an ecosystem, biogeochemical cycles, human impact on the environment, The IPAT equation, Ecological foot print, ecology and environment, ecosystem concept, energy flow in an ecosystem | | **[6]** |
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| **Module 2:**  **Energy resources:** Concept of energy, SI Units of Work, Heat and Power, World energy use, Energy consumption pattern in India and U.S., Environmental aspects of energy utilization Renewable and non-renewable sources; Fossil fuel: types, use and environmental impacts, Solar energy: Solar Radiation – Passive and active solar systems – Flat Plate and Concentrating Collectors – Solar direct Thermal Application– Fundamentals of Solar Photo Voltaic Conversion- advantages and disadvantages of Solar Power generation, Solar energy status in India, Wind Energy: site selection, Wind turbine: basic working principle and types, Wind energy status in India, advantages and disadvantages of Wind Power generation, Hydroelectric power : How it is generated, advantages and disadvantages, Biomass energy: various types, generations of biofuel, Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel, Geothermal Energy: source, various methods of extraction: wet steam, dry steam and hot water flashed, advantages and disadvantages | | **[10]** |
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| **Module 3:**  **Air pollution and control:** Classification of air pollutants, Criteria air pollutants and their impacts, Major global impacts of air pollution on man: Global warming, Ozone layer depletion, Acid rain; Air quality standards, Air pollution control methods, Methods of reducing air pollutants from IC engines, particulate pollutant and gaseous pollutant | | **[8]** |
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| **Module 4:**  **Water pollution fundamentals and control strategies:** Water quality: physical, chemical and biological characteristics, drinking water quality standard, effluent water quality, waste water sources and constituents, waste water treatment: preliminary treatment, primary treatment, secondary treatment, sedimentation, coagulation, floatation, aerobic and anaerobic biological treatment, activated sludge process, lagoons, trickling filters, rotating biological contractor | | **[10]** |
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| **Module 5:**  **Solid waste management:** Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes, Recycling of waste material. Waste minimization technologies.Hazardous Wastes Management and Handling Rules, 1989 | | **[6]** |
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| **Module 6:**  **Environmental impact assessment:**Introduction to Environmental Impact Analysis. Environmental Impact Statement and Environmental Management Plan.EIA guidelines 1994, Notification of Government of India. Impact Assessment Methodologies. Generalized approach to impact analysis. Procedure for reviewing Environmental impact analysis and statement. Guidelines for Environmental audit. | | **[5]** |
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| **Text Books:** | |
| 1 | “Principles of Environmental Science”, 4th edition by Cunningham, W.P. and Cunningham, M.A. (2002),Tata McGraw-Hill Publishing Company, New Delhi |
| 2 | “Introduction to Environmental Engineering”, 2nd Ed. by Davis, M. L. and Cornwell D. A. McGraw Hill, Singapore. |
| **Reference Books:** | |
| 1 | “Introduction to Environmental Engineering and Science”, by Masters, G.M., PrenticeHall of India, Second Indian Reprint. |
| 2 | “Wastewater Engineering: Treatment and Reuse”, 4th Edition, Metcalf and Eddy, Inc. McGraw-Hill, Inc., New York, 2002 |

**Elective - I**

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| **Computer Graphics and Visualization** | | **ECS43107** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  Primitive Output Design: Algorithms for Line, Circle and Ellipse drawing; Attributes of output primitives: Two dimensional Geometric transformation, 2D viewing: Line, Polygon, Curve and Text clipping algorithms. | | | | | **[8]** | |
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| **Module 2:**  Parallel and Perspective projections, Three dimensional object representation, Polygons, Curved lines, Splines, Quadric Surfaces, Data set visualization, 3D transformations and viewing, Identification of visible surface. | | | | | **[9]** | |
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| **Module 3:**  Different Color Models – RGB, CMY, YIQ, HSV; General Computer Animation, Raster, Key-frame, Graphics programming using OPENGL, Graphics primitives, Drawing three dimensional objects and scenes. | | | | | **[10]** | |
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| **Module 4:**  Fundamentals of Shading model, Flat and Smooth shading, Adding texture on faces, Adding shadow of an object, Building camera in a program, Creating shaded objects, Rendering texture and Drawing Shadows. | | | | | **[8]** | |
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| **Module 5:**  Self similarity and Fractals, Random Fractals, Piano curves, Image creation by iterative functions, Mandelbrot sets, Julia Sets, Overview of Ray Tracing, Ray intersection, Adding Surface texture, Transparency and Reflections, Boolean operations on Objects. | | | | | **[10]** | |
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| **Text Books:** | |
| 1 | Computer Graphics with Open GL, 4th Edition, Donald D. Hearn, M. Pauline Baker, Warren Carithers, Pearson Education |
| 2 | Computer Graphics using OPENGL, Third Edition,F.S. Hill, Pearson Education. |
| **Reference Books:** | |
| 1 | Computer Graphics- Principles and Practice, Third Edition,[John F. Hughes](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22John+F.+Hughes%22), [AndriesHYPERLINK "https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Andries+Van+Dam%22" Van Dam](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Andries+Van+Dam%22), [James D. Foley](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22James+D.+Foley%22), [Steven K. HYPERLINK "https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Steven+K.+Feiner%22"Feiner](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Steven+K.+Feiner%22), Addison-Wesley |

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| **Machine Learning** | | **ECS43109** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  **Introduction:** Overview of machine learning, related areas, applications, software tools, course objectives.  **Parametric regression:** linear regression, polynomial regression, locally weighted regression, numerical optimization, gradient descent, kernel methods. | | | | | **[6]** | |
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| **Module 2:**  **Generative learning**: Gaussian parameter estimation, maximum likelihood estimation, MAP estimation, Bayesian estimation, bias and variance of estimators, missing and noisy features, nonparametric density estimation, Gaussian discriminant analysis, naive Bayes. | | | | | **[8]** | |
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| **Module 3:**  **Discriminative learning**: linear discrimination, logistic regression, logit and logistic functions, generalized linear models, softmax regression. **Neural networks**: the perceptron algorithm, multilayer perceptrons, back-propagation, nonlinear regression, multiclass discrimination, training procedures, localized network structure, dimensionality reduction interpretation. | | | | | **[12]** | |
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| **Module 4:**  **Support vector machines**: functional and geometric margins, optimum margin classifier, constrained optimization, Lagrange multipliers, primal/dual problems, KKT conditions, dual of the optimum margin classifier, soft margins, kernels, quadratic programming, SMO algorithm. | | | | | **[7]** | |
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| **Module 5:**  **Graphical and sequential models**: Bayesian networks, conditional independence, Markov random fields, inference in graphical models, belief propagation, Markov models, hidden Markov models, decoding states from observations, learning HMM parameters. | | | | | **[4]** | |
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| **Module 6:**  **Unsupervised learning**: K-means clustering, expectation maximization, Gaussian mixture density estimation, mixture of naive Bayes, model selection. | | | | | **[4]** | |
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| **Module 7:**  **Dimensionality reduction**: feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, manifold learning | | | | | **[4]** | |
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| **Text Books:** | |
| 1 | “Elements of Statistical Learning”, T. Hastie, R. Tibshirani and J. Friedman, Springer, 2001. |
| 2 | “Machine Learning”, E. Alpaydin, MIT Press, 2010. |
| **Reference Books:** | |
| 1 | “Pattern Recognition and Machine Learning”, C. Bishop, Springer, 2006. |
| 2 | “Pattern Classification”, R. Duda, E. Hart, and D. Stork, Willey-Interscience, 2000. |

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| **Pattern Recognition** | | **ECS61105** | **3-0-0** | **3 Credits** | |
| **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. Narasimha Murty, 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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| **Logic Programming** | | **ECS61109** | **3-0-0** | **3 Credits** | |
| **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** | |
| **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, Eiji Mizutani, 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. |

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| **Image and Video processing** | | **ECS61113** | **3-0-0** | **3 Credits** | |
| **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 rd edition , 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** | |
| **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”, Narsingh Deo, 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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| **HSS -V(Financial Accounting)** | **HEC43181** | **3-0-0** | **3 Credits** |

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| **Unit 1:** Meaning and scope of accounting- introduction, meaning of accounting, objectives of accounting, functions of accounting, book-keeping, distinction between book-keeping and accounting, sub-fields of accounting, users of accounting information, relationship of accounting with other disciplines, limitations of accounting, use of mathematics in accounting, accounting concepts, principles and conventions. | | **15** |
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| **Unit 2:** Basic accounting procedures in journal entries, accounting equation approach, traditional approach, ledgers, trial balance. | | **06** |
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| **Unit 3:** Subsidiary books – other than cashbook, cashbook, capital and revenue expenditures, capital and revenue receipts, contingent assets and contingent liabilities. | | **06** |
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| **Unit 4:** Rectification of errors, basis of inventory valuation and record keeping, average due date and current account. | | **05** |
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| **Unit 5:** Bank reconciliation statement, depriciation accounting, consignment and joint ventures. | | **05** |
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| **Unit 6:** Preparation of final accounts of sole proprietors, final accounts of manufacturing entities, accounting of non-profit organisation, preparation of receipt and payment account, income and expenditure account and balance sheet. | | **08** |

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| **Text Books:** | |
| 1 | B.K Banerjee, Financial Accounting- Concept, Analysis, Methods and Uses, P.H.I Learning Pvt. Ltd |
| 2 | Basu and Das, Financial Accounting(vol-1), - Rabindra library |
| 3 | Prof. Amitabh Basu, Financial Accounting(vol-1), Tee Dee publication pvt.ltd |

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| **Seminar** | **ECS43301** | **0-2-0** | **2 Credits** |

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| 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. |

**Subject Name: Operating Systems Lab**

**Code: ECS43203**

**Credit: 2**

**Contact Hours: 3**

Basic Commands in **LINUX.**

**Shell programming:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).

**Process:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

**Signal:** signal handling, sending signals, signal interface, signal sets.

**Semaphore:** programming with semaphores (use functions semctl, semget, semop, set\_semvalue, del\_semvalue, semaphore\_p, semaphore\_v)

**Inter-process communication:** pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO)

**Subject Name: Computer Networks Lab**

**Code: ECS43205**

**Credit: 2**

**Contact Hours: 3**

Configuring, testing and measuring Network devices and parameters/policies; Network management experiments. Exercises in Network programming.

NIC Installation & Configuration: Familiarization with Networking cables (CAT5, UTP) Connectors (RJ45, T-connector), Hubs and Switches.

Implementation based on TCP/UDP Socket: Multicast & Broadcast Sockets

Implementation based on Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) and Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)

**Subject Name: Computer Graphics and Visualization Lab**

**Code: ECS43207**

**Credit: 2**

**Contact Hours: 3**

01 Implement Brenham‟s line drawing algorithm for all types of slope

02 Create and rotate a triangle about the origin and a fixed point

03 Draw a color cube and spin it using OpenGL transformation matrices

04 Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing

05 Clip a lines using Cohen-Sutherland algorithm

06 To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene

07 Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user

08 Develop a menu driven program to animate a flag using Bezier Curve algorithm

09 Develop a menu driven program to fill the polygon using scan line algorithm

**Subject Name: Machine Learning Lab**

**Code: ECS43209**

**Credit: 2**

**Contact Hours: 3**

**Experiments:**

1. Implementation of search strategies (Informed/Heuristics) in PROLOG/C/PYTHON
2. Introduction to various libraries and the most frequently used functions, methods, constants required for the implementation of any machine learning algorithm.
3. Loading of Dataset. Splitting into Test and Train set using Pandas. Visualizing DataSet using MatplotLib.
4. Implementation of Regression:
   1. Linear
   2. Logistic
5. Implementation of K-Nearest Neighbour (KNN).
6. Implementation of K-Means Clustering.
7. Implementation of various weight update methods of Artificial Neural Network using CIFAR10/MNIST Dataset.
8. Implementation of Decision Tree algorithm
9. Implementation of Linear Separator (Linear SVM).

**Subject Name: Pattern Recognition Lab**

**Code: ECS61205**

**Credit: 2**

**Contact Hours: 3**

**Unit I:**

Simulation of various Statistical measurements using Python.

**Unit II:**

Implementation of vector and tensor representation of data and classes using Python.

**Unit III:**

**Unsupervised feature extraction –** PCA, LDA, SVD, EVD.

**Unit IV:**

**Clustering –** K-Means, Fuzzy C-Means, K-Medoids, Agglomerative, Spectral Clustering, DBScan, Cluster validity index

**Unit V:**

**Expectation maximization.**

**Unit VI:**

**Supervised –** K-NN, Artificial Neural Network, Simulated Annealing, Genetic Algorithm, Particle Swarm Optimization.

**Subject Name: Logic Programming Lab**

**Code: ECS61209**

**Credit: 2**

**Contact Hours: 3**

1 Study of Prolog.

2 Write simple fact for the statements using PROLOG.

3 Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.

4 Write a program to solve the Monkey Banana problem.

5 WAP in turbo prolog for medical diagnosis and show t he advantage and disadvantage of green and red cuts.

6 WAP to implement factorial, fibonacci of a given number.

7 Write a program to solve 4-Queen problem.

8 Write a program to solve traveling salesman problem.

9 Write a program to solve water jug problem using LISP

**Subject Name: Soft Computing Lab**

**Code: ECS61211**

**Credit: 2**

**Contact Hours: 3**

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| **Sl No.** | **List of Experiments** |
| 1 | Implementation of Fuzzy Operations. |
| 2 | Implementation of Fuzzy Relations (Max-min Composition). |
| 3 | Implementation of Fuzzy Controller (Washing Machine). |
| 4 | Implementation of Simple Neural Network (McCulloh-Pitts model). |
| 5 | Implementation of Perceptron Learning Algorithm. |
| 6 | Implementation of Unsupervised Learning Algorithm. |
| 7 | Implementation of Simple Genetic Application. |
| 8 | Study of ANFIS Architecture. |
| 9 | Study of Derivative-free Optimization. |
| 10 | Use of NN-Toolbox in Matlab. |

**Subject Name: Image and Video Processing Lab**

**Code: ECS61213**

**Credit: 2**

**Contact Hours: 3**

**Experiments:**

1. i.Write a program to read a color image and convert it into grey scale image.

ii. Write a program to add the salt & pepper noise into the image

iii. Write a program to add the speckle noise into the image

2. Write a program to apply medial filter and averaging on the image

3. Write a program to detect the edge using Sobel and Prewitt operator

4. Write a program to detect the edge using Laplecian and Canny operator

5. Write a program to find the corner of an image using Harris Corner Detector

6. Experiment on line fiiting and circle fitting using Hough Transform

7. Experiment on Image Segmentation

8. Experiment on **Camera Calibration**

9. Implementation of  **Tomasi**–**Kanade Factorisation Algorithm**

10. **Scale Invariant Feature Transform**(**SIFT**) to establish point correspondence

**Subject Name: Advanced Graph Theory Lab**

**Code: ECS61215**

**Credit: 2**

**Contact Hours: 3**

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| List of Experiments |
| 1. Write a program to find total number of edges in a complete graph. |
| 2. Write a program to implement graph traversal. |
| 3. Write a program to implement graph using adjacency matrix. |
| 4. Write a program to implement a Heuristic to find the vertex cover of a graph. |
| 5. Write a program to implement Euler’s method. |
| 6. Write a program to implement Hamilton cycle. |
| 7. Write a program to implement graph coloring problem. |



**ADAMAS UNIVERSITY**

**B.Tech in Computer Science and Engineering**

**SEMESTER – VI**

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| **Database Management Systems** | | **ECS43102** | **3-0-0** | **3 Credits** | |
| **Module 1**  **Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).  **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations. | | | | | **[8]** |
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| **Module 2:**  **Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.  **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.  **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. | | | | | **[12]** |
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| **Module 3:**  **Storage strategies:** Indices, B-trees, hashing. | | | | | **[6]** |
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| **Module 4:**  **Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery. | | | | | **[7]** |
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| **Module 5:**  **Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. | | | | | **[6]** |
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| **Module 6:**  **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining. | | | | | **[6]** |
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| **Text Books:** | |
| 1 | “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill |
| **Reference Books:** | |
| 1 | “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press. |
| 2 | “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe, Pearson Education |
| 3 | “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley |

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| **Software Engineering** | | **ECS43104** | **3-0-0** | **3 Credits** | |  | |
| **Module 1:**  **Introduction:** Software - Evolving role of it, a crisis on the Horizon and its Myths | | | | | **[4]** | |  |
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| **Module 2:**  **Software engineering layered technology:** Software process models: linear sequential model, prototyping model, RAD model, evolutionary model, formal methods model; Component based development, Fourth generation techniques | | | | | **[6]** | |  |
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| **Module 3:**  **Project management concepts:** Management spectrum, people, problem, process, project and few Critical approach | | | | | **[6]** | |  |
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| **Module 4:**  **Software Process and project metrics:** Measure, Metrics and Indicators, Process and Project Domain related metrics , Software Measurement, Reconciling of Different Metrics Approaches, Software quality metrics, Validation management  **Software project planning:** Observations on estimation, Objectives of Project planning, Resources: Software project estimation, Empirical models for estimation, Automated estimation tools and Risk management, Software risks: Identification, Risk projection, its refinement, safety risks and hazards; RMMM plans | | | | | **[9]** | |  |
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| **Module 5:**  **Project scheduling and tracking:** Definition of task set and task network, Scheduling, Earned value analysis, Tracking of Errors, Project planning  **Software quality assurance:** Concepts of Software Quality, Quality movement, Review of software quality assurance, Software reliability  S**oftware configuration management:** Object identification in software configuration, Configuring audit-SCM standards  **Analysis concepts and principles:** Requirement analysis, software prototyping, Specification Review Analysis modeling, Data modeling - Functional modeling, Behavioral modeling, Data dictionary | | | | | **[10]** | |  |
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| **Module 6:**  **Design concepts and principles:** Effective modular design, Design heuristics, Design models and documentation  **Software design:** Software architecture, Data designing, Architectural styles, Transform mapping, Transaction mapping, Refining architectural design, User interface design - Component level design  **Software testing techniques:** White box and black box testing, Specialized environment testing - architectures and applications, Software testing strategies - Unit testing, Integrating testing, Software validation technique – System testing and debugging | | | | | **[10]** | |  |
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| **Text Books:** | |
| 1 | Software Engineering: A practitioner's approach, 8th Edition, Roger S. Pressman, McGraw Hill. |
| 2 | An integrated approach to Software Engineering, Springer/Narosa Edition, PankajJalote. |
| **Reference Books:** | |
| 1 | Fundamentals of Software Engineering, 4th Edition, Rajib Mall, Prentice Hall, India. |
| 2 | Software Engineering, 10th Edition, Ian Sommerville, Addison-Wesley. |

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| **Artificial Intelligence** | | **ECS43106** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  Introduction, Agents, Problem formulation, Uninformed search strategies, Heuristics, Informed search strategies, Satisfying constraints | | | | | **[10]** | |
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| **Module 2:**  Logical agents, Propositional logic, Inference rules, First-order logic, Inferences in first order logic, Forward and backward chaining, Unification, Resolution | | | | | **[12]** | |
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| **Module 3:**  Planning with state-space search, Partial-order planning, Planning graphs, Planning and acting in the real world | | | | | **[12]** | |
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| **Module 4:**  Uncertainty, Probability - review, Probabilistic reasoning; Bayesian networks and the inferences rules, Temporal models, Hidden Markov models | | | | | **[14]** | |
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| **Module 5:**  Learning: Learning from observation, Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning | | | | | **[12]** | |
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| **Text Books:** | |
| 1 | Artificial Intelligence – A Modern Approach, Second Edition, S. Russel and P. Norvig Pearson Education, 2003. |
| **Reference Books:** | |
| 1 | Computational Intelligence : a logical approach”, David Poole, Alan Mackworth, Randy Goebel, Firstedition;OxfordUniversityPress, 2004. |
| 2 | Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, G. Luger , Pearson Education, 2002. |

**Elective - II**

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| **Applied Graph Theory** | | **ECS43108** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  **Basics:** Graph – definition; Degree sequences, Different distance measures in graphs, Special types of graphs – complete graph, regular graph, bipartite graph and their properties. | | | | | **[8]** | |
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| **Module 2:**  **Structure and Symmetry:** Cut vertices, bridges and blocks, auto-morphism groups,  reconstruction problem | | | | | **[8]** | |
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| **Module 3:**  **Trees and Connectivity:** Properties of trees, Arboricity, vertex and edge connectivity, Mengers theorem | | | | | **[6]** | |
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| **Module 4:**  **Eulerian and Hamiltonian Graphs:** Characterization of Eulerian graphs, Sufficient  conditions for Hamiltonian graphs. | | | | | **[4]** | |
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| **Module 5:**  **Colouring and Planar Graphs:** Vertex and edge colouring, perfect graphs, planar  graphs, Euler's theorem, Kuratowski's theorem, Colouring of planar graphs, Crossing number and thickness. | | | | | **[10]** | |
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| **Module 6:**  Matching, factors, decomposition and domination | | | | | **[4]** | |
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| **Module 7:**  **External Graph Theory:** Turan's theorem, Ramsay's theorem, Szemeredi's regularity lemma and their applications. | | | | | **[5]** | |
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| **Text Books:** | |
| 1 | “Graph Theory”, J. A. Bondy and U. S. R. Murthy, SringerVerlag, 2008. |
| 2 | “Introduction to Graph Theory”, D. B. West, PHI, 2004. |
| **Reference Books:** | |
| 1 | “Graph Theory”, R. Diestel, SringerVerlag, 2003. |

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| **Cryptography and Cyber Security** | **ECS43110** | **3-0-0** | **3 Credits** |

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| **Module 1:**  **Symmetric Ciphers:** Overview of Services, Mechanisms and Attacks; OSI  Security Architecture and Network Security Model  **Classical Encryption Techniques:** Symmetric Cipher - Substitution Techniques, Transposition Techniques; Rotor Machines, Steganography, Block Cipher and Data Encryption Standard (DES), Strength of DES, Cryptanalysis - Differential and Linear model. Symmetric Ciphers - Triple DES, Blowfish; Confidentiality using Conventional Encryption - Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation. | | **[9]** |
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| **Module 2:**  Public Key Encryption, Digital Signatures, Prime Number Format’s and Euler’s Theorems, Primality testing. Public Key Cryptography and RSA - Principles of Public Key Cryptosystems, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange. | | **[10]** |
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| **Module 3:**  Authentication Protocol, Message Authentication, Authentication Requirements,  Authentication Functions, Message Authentication Codes, Message Digest - MD5, Digital Signatures and Authentication Protocols. | | **[10]** |
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| **Module 4:**  **Network Security:** Authentication Applications - Kerberos, X.509 Directory  Authentication Service; Electronic Mail Security: Pretty Good Privacy, IP Security -  Overview, Architecture, Authentication Header, Encapsulation Security Payload  **Web Security:** Basic requirements, Secure Sockets Layer and Transport Layer  Security, Secure Electronic Transaction | | **[10]** |
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| **Module 5:**  **System Security:** Intruders, Malicious Software, Viruses and Related Threats,  Counter Measures, Firewalls and their Design Principles. | | **[6]** |
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| **Text Books:** | |
| 1 | “Cryptography and Network Security”, William Stallings, 4th Edition, Pearson Education/PHI, 2006. |
| **Reference Books:** | |
| 1 | “Network Security: Private Communication in Public World”, Charlie Kaufman, Radia Perman, Mike Speciner, 2nd Edition, Pearson Education, 2011. |
| 2 | “Cryptography and Network Security”, Atulkahate, TMH, 2003. |

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| **Advanced Database System** | | **ECS61104** | **3-0-0** | **3 Credits** | |  |
| **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 Database Limitations 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 database Emergence, 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”, Rini Chkrabarti and Shibhadra Dasgupta, Dreamtech. |
| **Reference Books:** | |
| 1 | “Fundamentals of Database Systems” Ramez Elmasri, Shamkant Navathe, Pearson Education |
| 2 | “Distributed Databases” Ozsu and Valduriez ,Pearson Education |

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| **Cloud Computing** | | **ECS61106** | **3-0-0** | **3 Credits** | |  |
| **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”, Anthony T.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** | |
| **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, Hebbian learing, 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-euclidean domains, Dynamical systems: RNNs.  **Deep Unsupervised Learning:** Autoencoders (standard, Denoising, contractive, etc etc), Variational Autoencoders ,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, Yoshua Bengio, 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** | |  |
| **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 HYPERLINK "https://en.wikipedia.org/wiki/Loop\_unswitching"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 HYPERLINK "https://en.wikipedia.org/wiki/Common\_subexpression\_elimination"subexpressionHYPERLINK "https://en.wikipedia.org/wiki/Common\_subexpression\_elimination" 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 |

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| **Computational Complexity** | | **ECS61116** | **3-0-0** | **3 Credits** | |
| **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”, Sanjeev Arora 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. |

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| **Management -I** | | **MBA43144** | **3-0-0** | **3 Credits** | |
| **Module- 1** INDUSTRIAL MANAGEMENT - Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership. | | | | | **[8]** |
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| **Module 2:** Management Function: Principle of Management – Time and motion study, work simplification – process charts and flow diagrams, Production Planning. Inventory Control: Inventory, Cost, Deterministic Models, Introduction to supply chain management. | | | | | **[12]** |
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| **Module 3:** Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM. | | | | | **[6]** |
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| **Module 4:** Fundamentals of Materials Management; Material cycle; Forecasting; Production Planning and Materials Requirements , Materials Procurement; Tendering; Types of Tenders | | | | | **[7]** |
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| **Module 5:** Storage and warehousing concepts, Receipt, Warehouse type, Layout, issue of materials and updation of records; Manpower and equipment; | | | | | **[6]** |
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| **Module 6:** Material Classification, Need and usage of classification, Single-dimensional classification, Multidimensional classifications; Materials Codification, Usage of codification, Codification types; | | | | | **[6]** |
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| **Text Books:** | |
| 1 | Arnold, Chapman: Introduction to Materials Management: Pearson, 5th edition, 2008 |
| **Reference Books:** | |
| 1 | Gopalkrishnan & Sundarsan: Material Management: An Integrated Approach, Prentice Hall of India Private Limited, New Delhi, 2003 |
| 2 | Industrial Engineering and Management by OP Khanna, Dhanpat Rai Publications, Delhi. |
| 3 | Industrial Management by VK Sharma, OP Harkut. |

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| **Design/Mini Project** | **ECS43402** | **0-0-3** | **2 Credits** |

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| The course encourages students to take project works that are based on current trends and technologies in various subjects, which will augment the theory subjects in a group. To solve some small scale real-life/researched based/industry-oriented problems. |

**Subject Name: Database Management Systems Lab**

**Code: ECS43202**

**Credit: 2**

**Contact Hours: 3**

Familiarization of structured query language, Database Schema Design, Database Creation, SQL Programming and Report Generation using a commercial RDBMS like ORACLE/SYBASE/DB2/SQL-Server/INFORMIX. Students are to be exposed to front end development tools, ODBC and CORBA calls from application Programs, internet based access to databases and database administration.

**Subject Name: Software Engineering Lab**

**Code: ECS43204**

**Credit: 2**

**Contact Hours: 3**

Implementation based on the Requirement Analysis and Prepare SRS (Software Requirement Specification) using COCOMO (Constructive Cost Model) model estimate effort.

Calculate effort using FP (Function point) oriented estimation model.

Analyze the risk related to the project and prepare RMMM (Risk Mitigation, Monitoring, and Management) plan.

Develop time line chart and project table using PERT (Program Evaluation Review Technique) or CPM (critical path method) project scheduling methods.

Use Case diagram, class diagram, Sequence diagram and E-R (Entity Relationship) Diagrams for the projects.

Design of test cases based on requirement and design

Prepare FTR (formal technical reviews)

Prepare Version control and change control for software configuration items

Compute Process and Product Metrics (e.g. Defect Density, Defect Age, Productivity, Cost etc.)

**Subject Name: Applied Graph Theory Lab**

**Code: ECS43208**

**Credit: 2**

**Contact Hours: 3**

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| List of Experiments |
| 1. Write a program to find total number of edges in a complete graph. |
| 2. Write a program to implement graph traversal. |
| 3. Write a program to implement graph using adjacency matrix. |
| 4. Write a program to implement a Heuristic to find the vertex cover of a graph. |
| 5. Write a program to implement Euler’s method. |
| 6. Write a program to implement Hamilton cycle. |
| 7. Write a program to implement graph coloring problem. |

**Subject Name: Cryptography and Cyber Security Lab**

**Code: ECS43210**

**Credit: 2**

**Contact Hours: 3**

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| **S.NO.** | **TOPIC** |
| 1 | Write a Java program to perform encryption and decryption using the following algorithms:   1. **Ceaser Cipher** 2. **Substitution Cipher**   **Hill Cipher** |
| 2 | Write a Java program to implement the DES algorithm logic |
| 3 | Write a C/ JAVA program to implement the BlowFish algorithm logic |
| 4 | Write a C/ JAVA program to implement the Rijndael algorithm logic. |
| 5 | Using Java Cryptography, encrypt the text “Hello world” using BlowFish. Create your own key using Java keytool. |
| 6 | Write a Java program to implement RSA Algoithm |
| 7 | Implement the Diffie -Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob). |
| 8 | Calculate the message digest of a text using the SHA -1 algorithm in JAVA. |
| 9 | Calculate the message digest of a text using the SHA -1 algorithm in JAVA. |

**Subject Name: Advance Database System Lab**

**ECS61204**

**Credit: 2**

**Contact Hours: 3**

Using RDBMS like Oracle, application partitioning , developing applications in distributed environment -front end/back end. 4 GL's Forms management and reports writers

**Subject Name: Cloud Computing Lab**

**Code: ECS61206**

**Credit: 2**

**Contact Hours: 3**

**Experiment 1:**

Installation of various hypervisors and instantiation of VMs with image file using open source hypervisors.

**Experiment 2:**

Client server communication between two virtual machine instances, execution of chat application.

**Experiment 3:**

Creation of simple network topology using open source network virtualization tools.

**Experiment 4:**

Implementation of simple network protocols using open source network controllers .

**Experiment 5:**

Implementation of various scheduling mechanisms using open source cloud simulator

**Experiment 6:**

Familiarization and usage of the following cloud services with open source cloud tools.

**Experiment 7:**

Familiarization and usage of collaborative applications (SaaS).

**Experiment 8:**

Implementing applications using Google App Engine (PaaS).

**Experiment 9:**

Develop MapReduce application using Hadoop cluster set up

**Subject Name: Neural Network and Deep Learning Lab**

**Code: ECS61208**

**Credit: 2**

**Contact Hours: 3**

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| **Exp No.** | **Title of Experiment** |
| 1 | To Write a program to implement Perceptron. |
| 2 | To write a program to implement AND OR gates using Perceptron. |
| 3 | To implement Crab Classification using pattern net |
| 4 | To write a program to implement Wine Classification using Back propagation. |
| 5 | To write a MatLab Script containing four functions Addition, Subtraction, Multiply and Divide functions |
| 6 | Write a program to implement classification of linearly separable Data with a perceptron |
| 7 | To study Long Short Term Memory for Time Series Prediction |
| 8 | To study Convolutional Neural Network and Recurrent Neural Network |
| 9 | To study ImageNet, GoogleNet, ResNet convolutional Neural Networks |
| 10 | To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historic data |

**Subject Name: Advances in Compiler Design Lab**

**Code: ECS61210**

**Credit: 2**

**Contact Hours: 3**

* Automata Concepts
  + Program to find epsilon-closure of all states of any given NFA with  epsilon transition
  + Program to convert NFA with epsilon transition to NFA without epsilon transition
  + Program to convert NFA to DFA
  + Program to minimize any given DFA
* Lex and Yacc
  + Implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and new line
* Parser Implementation
  + Implement a operator precedence parser for a given language
  + Program to find First and Follow of any given grammar
  + Implement a recursive decent parser for an expression
  + Implement a Shift-Reduce parser for an expression
* Code Generation and Interpretation
  + Construct a compiler-interpreter for a simple imperative programming language.

**Subject Name: Computational Complexity Lab**

**Code: ECS61216**

**Credit: 2**

**Contact Hours: 3**

**List of Experiment:**

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| 1. Write C programs for reduction of NP problems to NP -complete problems. |
| 1. Write C programs for converting  any Boolean CNF formula to 3 CNF formula. |
| 1. Write C programs for converting any 3 CNF formula to K-clique. |
| 1. Write C programs for converting any 3 CNF formula to Vertex cover. |
| 1. Write C programs for converting any 3 CNF to Hampath. |
| 1. Write C programs for converting any PSPACE problem to PSPACE-complete problems |



**ADAMAS UNIVERSITY**

**B.Tech in Computer Science and Engineering**

**SEMESTER – VII**

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| **Embedded Systems Design** | | **EEC44101** | **3-0-0** | **3 Credits** | |
| **Module 1:Overview of Embedded system**  Introduction to embedded systems, Differences between Microprocessor and Microcontroller, General computing systems Vs Embedded system, Classification of embedded systems, embedded processor in system, purpose of Embedded systems | | | | | **[5]** |
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| **Module 2: Hardware of Embedded System**  Input: Sensors, Sample-and-hold circuits, A/D converters; Communication: Requirements Electrical robustness, Real-time behavior, Examples; Processing Unit: Application-Specific Circuits (ASICs), Processors, Reconfigurable Logic; Output: D/A-converters, Actuators ; Memories: Memory organization; | | | | | **[10]** |
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| **Module 3: Communication Buses and Devices:**  I/O types, Serial Parallel communication port, Timer and Counting devices, Watchdog timers, real time clock ,Brown out reset,, Serial bus communication protocol-I2C, CAN, Parallel communication protocol-ISA | | | | | **[8]** |
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| **Module 4:Interrupt Service Mechanism**  Interrupt sources, Interrupt handling mechanism,Fast interrupts, Interrupt controller, Interrupt latency, Interrupt programming, Device driver | | | | | **[8]** |
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| **Module 5:Embedded software development and Program Modeling Concepts**  Assambly language programming (ALP), High level language-C, Processor directives, functions and macros and other programming elements, primary issues in Hardware software co-design, Unified Modeling Language(UML), DFG model, state machine programming model, Hardware Software trade-offs. | | | | | **[6]** |
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| **Module 6: Real time operating system (RTOS)**  RTOS overview, types of Real-time tasks, Basic design rule using RTOS, Task swapping methods ,Scheduler algorithms, Priority inversion, process, thread, Choice of RTOS, Overview of embedded RTOS, Programming in RTOS. | | | | | **[5]** |
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| **Module 7:Case study of different types of embedded system**  System design using ARM Processor 7 or 9, Development of protocol converter, Case studies digital camera, Robotics, Popular microcontrollers used in embedded systems | | | | | **[3]** |

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| **Text Books:** | |
| 1 | Steve heath, ―Embedded system design , 2nd edition 2003,elsevier |
| 2 | Rajkmal, Embedded system, 2nd edition. |
| 3 | Santanu Chattopadhyay,-- Embedded System Design,2nd edition,PHI Learning |
| **Reference Books:** | |
| 1 | Shibu. K.V , ―Introduction to Embedded systems‖, mcgraw hill 2009 |
| 2 | *Frank Vahid* , Embedded systems. |

**Elective –III**

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| **Mobile Computing** | | **EEC44119** | **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) | | | | | |
| **Number Theory** | | | **SMA44101** | **3-0-0** | **3 Credits** | |
| **Module 1:** The integers:  Divisibility, Prime numbers, Greatest common divisor, Euclidean algorithm, Unique factorization. | | | | | |  |
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| **Module 2** Congruences: Basic properties, Modular arithmetic, Euler's phi function, Fermat's, Euler's and Wilson's theorems Chinese remainder theorem**,** some properties of Euler’s phi-function. | | | | | |  |
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| **Module 3:** Quadratic Reciprocity: Quadratic residues, Legendre and Jacobi symbols, Law of quadratic reciprocity. | | | | | |  |
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| **Module 4: Data delivery models in wireless channel**: Diophantine equations: Pythagoras, Fermat, Pell  Primitive roots: Lagrange's Theorem Primality testing, Factoring RSA Algorithm, Arithmetic functions, Moebius inversion formula, Mersenne primes. | | | | | |  |
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| **Text Books:** |
| David M. Burton, Elementary Number Theory, 6th Ed., Tata McGraw Hill, Indian reprint,  2007. |
| **Reference Books:** |
| Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd.,  Delhi, 2007. |

**Elective – IV**

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| **VLSI System Design** | | **EEC43102** | **3-0-0** | **3 Credits** | |
| **Module 1: :** Introduction to VLSI Design: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structu12L); | | | | | **[6]** |
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| **Module 2:** Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processig, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion (1L), Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist; Basic CMOS Technology – (Steps in fabricating CMOS ), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator; Layout Design Rule: Stick diagram with examples, Layout rules. | | | | | **[10]** |
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| **Module 3:** CMOS for Digital VLSI Circuits: Recapitulation of MOS; CMOS, CMOS inverter characteristics; CMOS logic circuits, NAND & NOR Gates, Complex logic circuits, CMOS Full Adder, CMOS Transmission GATE, Advanced CMOS Logic circuits; Sequential CMOS logic circuits; SR Latch circuit, clocked JK Latch/ Master-Slave JK, CMOS D-latch & Edge triggered flip-flop; | | | | | **[10]** |
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| **Module 4:** Analog VLSI Circuits: Analog VLSI design steps; Basic building blocks of Analog VLSI chips; MOS switch; Active load / resistors; Voltage dividers; CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only]; CMOS Differential amplifier; Output amplifiers [Basic circuits only]; CMOS OPAMP; Switched capacitor filter | | | | | **[8]** |
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| **Text Books:** | |
| 1 | Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education. |
| 2 | CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH. |
| 3 | Modern VLSI Design, Wayne Wolf, Pearson Education. |
| **Reference Books:** | |
| 1 | Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons . |
| 2 | Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher. |

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| **Control System** | | **EEE43115** | **3-0-0** | **3 Credits** | |
| **Module 1: Introduction to Control Systems:**  Concept of feedback and automatic control, effects of feedback, objectives of control system, definition of linear and nonlinear systems, elementary concepts of sensitivity and robustness, types of control systems, servomechanisms and regulators, examples of feedback control systems, transfer function concept, poles and zeroes of a transfer function, properties of transfer function. | | | | | **[4]** |
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| **Module 2: Mathematical Modeling of Dynamic Systems:**  Translational systems, rotational systems, gear-train arrangement, electrical analogy of Spring-Mass-Dashpot system, block diagram representation of control systems, block diagram algebra, signal flow graph, Mason’s gain formula. | | | | | **[8]** |
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| **Module 3: Time Domain Analysis:**  Time domain analysis of a standard second order closed loop system, concept of undamped natural frequency, damping, overshoot, rise time and settling time, dependence of time domain performance parameters on natural frequency and damping ratio, step and impulse response of first and second order systems, effects of poles and zeros on transient response, stability by pole location, Routh-Hurwitz criteria and applications. | | | | | **[8]** |
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| **Module 4: Error Analysis:**  Steady state errors in control systems due to step, ramp and parabolic inputs, concepts of system types and error constants. | | | | | **[6]** |
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| **Module 5: Stability Analysis:**  Root locus techniques, construction of Root Loci for different systems, changes of gain on the movement of pole and zeros. | | | | | **[8]** |
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| **Module 6: Frequency Domain Analysis of Linear System:**  Bode plots, Polar plots, Nyquist criteria, measure of relative stability, phase and gain margin, determination of stability margins in Bode plot. | | | | | **[11]** |

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| **Text Books:** | |
| 1 | Kastuhiko Ogata, *Modern Control Engineering*, 5th Ed., Pearson Education, 2015. |
| 2 | FaridGolnaraghi and Bengamin C. Kuo, *Automatic Control Systems*, 9thEd., Wiley, 2014. |
| 3 | Norman S. Nise, *Nise’s Control Systems Engineering*, Wiley India Edition, Wiley, 2018. |
| **Reference Books:** | |
| 1 | Richard C. Dorf and Robert H. Bishop, *Modern Control Systems*, 12th Ed., Pearson Education India, 2013. |
| 2 | Naresh K. Sinha, *Control Systems*, 4th Ed., New Age InternationalPvt. Ltd., 2013. |

**Elective – V**

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| **Compiler Design** | | **ECS44101** | **3-0-0** | **3 Credits** | | |  |
| **Module 1:**  **Introduction:** Overview of Compiler and phases of compilation | | | | | **[4]** |  |  |
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| **Module 2:**  **Lexical Analysis:** Regular language, finite automata, regular expression, Designing Finite Automata from regular expression, scanner generator (lex, flex). | | | | | **[8]** |  |  |
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| **Module 3:**  **Syntax Analysis (Parser):** Context-free Grammar and Language, Push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison) | | | | | **[10]** |  |  |
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| **Module 4:**  **Semantic Analysis:** Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.  **Symbol table:**  Structure, symbol attributes and management. | | | | | **[7]** |  |  |
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| **Module 5:**  **Run-time environment:** Procedure activation, parameter passing, value return, memory allocation, and scope.  **Intermediate Code Generation:** Translation of different language features, different types of intermediate forms.  **Code Improvement (optimization):** Analysis of control-flow, data-flow dependence; Code improvement - local optimization, global optimization, loop optimization, peep-hole optimization; Architecture dependent code improvement - instruction scheduling (for pipeline), loop optimization (for cache memory) | | | | | **[8]** |  |  |
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| **Module 6:**  Register allocation and Generation of target codes  **Advanced topics:** Type systems, data abstraction, compilation of object oriented features and non-imperative programming languages. | | | | | **[8]** |  |  |
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| **Text Books:** | |
| 1 | Compilers: Principles, Techniques and Tools, 2nd Edition, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Addison-Wesley. |
| **Reference Books:** | |
| 1 | Modern Compiler Implementation in Java, 2nd Edition, Andrew W. Appel , Cambridge University Press. |
| 2 | Compiler Design in C, Allen I. Holub , Prentice-Hall. |
| 3 | Optimizing Compilers for Modern Architectures, 1st Edition, Randy Allen and Ken Kennedy, Elsevier. |

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| **Computer Vision** | | **ECS44103** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  Overview of Computer Vision, Computer imaging systems, lenses, Image formation and sensing, CVIPlab, CIE color space, Image analysis, Pre-processing, Binary image analysis, Edge detection, Hough transform, corner detection, Segmentation, Morphological filtering, Fourier and Wavelet transform**.** | | | | | **[14]** | |
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| **Module 2:**  Feature extraction through shape, histogram, color, spectral information, texture and using CVIP tools; Feature analysis through feature vectors, distance /similarity measures, data pre-processing; Pattern classification | | | | | **[10]** | |
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| **Module 3:**  Image Structure - Linear filters, Finding Lines - from detection to model fitting, clustering and segmentation, pixel grouping methods; Camera Models – Epi polar Geometry, Stereo and multi-view Reconstruction | | | | | **[11]** | |
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| **Module 4:**  Recognition Building blocks - Detectors and Descriptors, SIFT and Single Object Recognition, Optical flow and Tracking. Recognition - Object Scenes, Activities - Object classification and detection, Object in scenes, Human Motion Detection | | | | | **[10]** | |
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| **Text Books:** | |
| 1 | Computer Vision: A Modern Approach *Second Edition*, David Forsyth and Jean Ponce ,Pearson, 2003***.*** |
| 2 | Computer Vision, First edition, D.H. Ballard, C.M. Brown; Prentice-Hall Inc New Jersey, 1982, |
| **Reference Books:** | |
| 1 | Machine Vision, First edition , R. Jain, R. Kasturi, B.G. Schunck; McGraw-Hill, 1995, |
| 2 | Computer Vision and Action Recognition, Second Edition, M. A. R Ahad; Springer, 2011, |
| 3 | Digital Image Processing, Second edition, B. Jahne; Springer Verlag, 2005 |

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| **Cryptography & Cryptosystems** | | | **ECS62101** | **3-0-0** | **3 Credits** | |  |
| **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, Solovay Strassen Primality 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 HYPERLINK "https://en.wikipedia.org/wiki/Elliptic\_curve\_Diffie%E2%80%93Hellman"DiffieHYPERLINK "https://en.wikipedia.org/wiki/Elliptic\_curve\_Diffie%E2%80%93Hellman"–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]** | |
| **Text Books:** | | | | | | | |
| 1 | "Cryptography Theory and Practice", Douglas Stinson, 2nd Edition, Chapman & Hall/CRC. | | | | | | |
| 2 | "Cryptography & Network Security", B. A. Forouzan, Tata Mc Graw 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 Mc Graw Hill. | | | | | | |

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| **Cyber Security** | | | **ECS62105** | **3-0-0** | **3 Credits** | |
| **Module 1:**  **Systems Vulnerability Scanning:** Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, Open VAS, 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 HYPERLINK "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"andHYPERLINK "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" 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, PW dump, 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, Key loggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks | | | | | | **[7]** |
| **Text Books:** | | | | | | |
| 1 | “Anti-Hacker Tool Kit (Indian Edition)”, Mike Shema, Publication Mc Graw Hill | | | | | |
| 2 | " Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Nina Godbole and Sunit Belpure, Publication Wiley | | | | | |

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| **HSS - VI (Basics of Organizational Behaviors)** | | | **HPS44101** | **3-0-0** | **3 Credits** | |
| **Module 1:**  Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. | | | | | | **[4]** |
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| **Module 2:**  Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. Motivation: Definition, Theories of Motivation - Maslow’s Hierarchy of Needs Theory, McGregor’s Theory X & Y, Herzberg’s Motivation-Hygiene Theory, Alderfer’s ERG Theory, McClelland’s Theory of Needs, Vroom’s Expectancy Theory. | | | | | | **[10]** |
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| **Module 3:**  Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.  Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. | | | | | | **[4]** |
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| **Module 4:**  Leadership: Definition, Importance, Theories of Leadership Styles.  Organizational Politics: Definition, Factors contributing to Political Behaviour | | | | | | **[4]** |
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| **Module 5:**  Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.  Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. | | | | | | **[6]** |
| **Text Books:** | | | | | | |
| 1 | Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn. | | | | | |
| 2 | Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn | | | | | |

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| **Project –I** | **ECS44401** | **0-0-6** | **4 Credits** |

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| The course encourages students to take project works that are based on current trends and technologies in various subjects, which will augment the theory subjects. The students will form a group to do their project work. This teaming is to encourage team spirit and to insist the importance of team work. The students typically undergo group formation, finalization of area of work, testing, generation and verification of results, and possible research publication procedure. |

**Subject Name: Embedded Systems Lab**

**Code: EEC44201**

**Credit: 2**

**Contact Hours: 3**

**List of experiments:**

1. Write an ALP to generate 10 khz square wave

2. Write an ALP to generate 10 khz freq. Using interrupts.

3. Write an ALP to interface one microcontroller with other serial/parallel communication.

4. Write an ALP for temperature measurement to display on intelligent LCD display.

5. Write an ALP for temperature measurement to display on intelligent LCD display.

6. Develop an embedded system for traffic light controller using microcontroller.

7. Develop an embedded system for automatic motion of a car & subsequent display on LCD using microcontroller.

8. Write an ALP to add two numbers & display the result on LED

9. Write an ALP to add two numbers & display the result on LCD

10. Write an ALP to multiply two numbers & display the result on LED

11. Write an ALP to multiply two numbers & display the result on LCD

12. Study of ARM evaluation system

13. Interfacing ADC and DAC.

14. Interfacing LED and PWM.

15. Interfacing real time clock and serial port.

16. Interfacing keyboard and LCD.

17. Interfacing EPROM and interrupt.

**Subject Name: VLSI System Design Lab**

**Code: EEC43202**

**Credit: 2**

**Contact Hours: 3**

Experiments Part I:

Digital System Design using HDL and FPGA

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA

Compare pre synthesis and post synthesis simulation for experiments 1 to 6.

Experiments Part II:

Digital Circuit Design

1. Design and simulate a CMOS inverter using digital flow
2. Design and simulate a CMOS Basic Gates and Flip-Flops
3. Design and simulate a 4-bit synchronous counter using a Flip-Flops

Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9  
Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.

**Subject Name: Control System Lab**

**Code: EEE43215**

**Credit: 2**

**Contact Hours: 3**

**List of Experiments:**

1. Familiarization with MATLAB, Simulink tool box and m-file.
2. Determination of overall transfer function from the block diagram of a system.
3. Determination of impulse response and step response of 1st order and 2nd order systems. From the step response of a 2nd order system, determine time-domain specifications like rise time, peak time, settling time, peak overshoot etc. with/without MATLAB.
4. Determination of steady state errors of Type-0, Type-1 and Type-2 systems for step, ramp and parabolic inputs using MATLAB.
5. Determination of Root Locus of different types of systemsusing MATLAB, and their time domain specifications with/without MATLAB.
6. To plot root locus diagram of an open loop transfer function and determine range of gain *K* for stability.
7. Determination of Bode plot for different systemsusing MATLAB, and their frequency domain specifications with/without MATLAB.
8. Determination of Nyquist plot for different systemsusing MATLAB, and their frequency domain specifications with/without MATLAB.
9. To draw a Nyquist plot of an open loop transfer function and examine the stability of the closed loop system.
10. Determinations of approximate transfer function from Bode plot.

**Subject Name: Compiler Design Lab**

**Code: ECS44201**

**Credit: 2**

**Contact Hours: 3**

Implement lexical analyzer using JLex, flex or other lexical analyzer generating tools. Practice of Lex/Yacc of Compiler writing.

Implement syntax analysis using context free grammar, Pushdown automata.

Demonstrate different types of parsing technique for example LL (1), LALR, operator precedence parsing and recursive descent parsing.

**Subject Name: Computer Vision Lab**

**Code: ECS44203**

**Credit: 2**

**Contact Hours: 3**

**Experiments:**

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| 1 | Implement the noise reduction for various types of noise |
| 2 | Implement the histogram equalization method |
| 3 | Restore the original images from the inputs given in lab |
| 4 | Extract the gradient parts from the input image. |
| 5 | Extract the rice objects from the input image. |
| 6 | Separate the two types of blobs in the input image. |
| 7 | Detecting a Cell Using Image Segmentation |
| 8 | Cell counting |
| 9 | Detecting Cars in a Video of Traffic |
| 10 | Edge detection: Sobel, Prewitt, Canny and Laplacian |

**Subject Name: Cryptography & Cryptosystems Lab**

**Code: ECS62201**

**Credit: 2**

**Contact Hours: 3**

**List of Experiments:**

1. Implement the encryption and decryption of 8-bit data using Simplified DES Algorithm (created by Prof. Edward Schaefer) in C

2. Write a program to break the above DES coding

3. Implement Linear Congruential Algorithm to generate 5 pseudorandom numbers in C

4. Implement Rabin-Miller Primality Testing Algorithm in C

5. Implement the Euclid Algorithm to generate the GCD of an array of 10 integers in C

6. a) Implement RSA algorithm for encryption and decryption in C

b) In an RSA System, the public key of a given user is e=31, n=3599. Write a program to find private key of the User.

7. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters.

8. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.

**Subject Name: Cyber Security Lab**

**Code: ECS62205**

**Credit: 2**

**Contact Hours: 3**

**List of Experiment:**

1. Perform Buffer Overflow operation.
2. Perform DNS Spoofing Attack.
3. Perform ARP Spoofing Attack.
4. Perform Data Packet filtering using Wireshark.
5. Perform Cross Site Scripting Attack.
6. Perform SQL Injection attack.
7. Perform Session Hijacking Attack.



**ADAMAS UNIVERSITY**

**B.Tech in Computer Science and Engineering**

**SEMESTER – VIII**

**Elective – VI**

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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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| **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. Ovidiu Vermesan, Dr. Peter Friess, River Publishers |
|  | 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 , Arshdeep Bahga |
|  | Data and Computer Communications; By: Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition |

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| **Quantum Computing** | | **SPH44102** | **3-0-0** | **3 Credits** | |
| **Module 1:** Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit, multiple qubits | | | | | **[2]** |
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| **Module 2:** Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. | | | | | **[8]** |
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| **Module 3:** Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits. | | | | | **[6]** |
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| **Module 4:** Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem. | | | | | **[6]** |
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| **Module 5:** Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch’s algorithm, Deutsch’s-Jozsa algorithm, Shor factorization, Grover search. | | | | | **[10]** |
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| **Module 6:** Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation | | | | | **[10]** |

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| **Text Books:** | |
| 1 | Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press. |
| 2 | Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. |
| **Reference Books:** | |
| 1 | Pittenger A. O., An Introduction to Quantum Computing Algorithms |

**Elective – VII**

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| **Distributed Computing** | | **ECS44102** | **3-0-0** | **3 Credits** | |  |
| **Module 1:**  **Characterization of Distributed Systems:** Introduction, Examples of distributed  Systems, Issues in Distributes Operating 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.  **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. | | | | | **[12]** | |
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| **Module 2:**  **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.  **Agreement Protocols:** Introduction, System models, classification of Agreement Problem-Interactive consistency Problem, Applications of Agreement algorithms. | | | | | **[8]** | |
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| **Module 3:**  **Distributed Objects and Remote Invocation:** Communication between distributed  objects, Remote procedure call, Events and notifications, Java RMI case study. **Transactions and Concurrency Control:** Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control | | | | | **[8]** | |
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| **Module 4:**  **Distributed Transactions:** Introduction, Flat and nested distributed transactions,  Atomic commit protocols, concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Distributed shared memory – Design and Implementation issues, PAXOS algorithm, consistency models, CORBA Case Study: CORBA RMI, CORBA services. | | | | | **[10]** | |
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| **Module 5:**  File service components, design issues, interfaces, implementation techniques, Sun  Network File System – architecture and implementation, other distributed file systems – AFS, CODA. Name services – SNS name service model. Review Results. – Evaluating software quality – defect prevention – testing maturity model | | | | | **[7]** | |
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| **Text Books:** | |
| 1 | “Advanced Concepts in Operating Systems” ,MukeshSinghal and Niranjan G. Shivaratri, Tata McGraw Hill, 2001. |
| 2 | “Distributed System: Concepts and Design”, Coulouris, Dollimore, Kindberg, Pearson Education, 2006. |
| **Reference Books:** | |
| 1 | “Distributed Operating Systems”, S. Tanenbaum, Pearson Education, 2005. |
| 2 | “Distributed System: Concepts and Design”, P. K. Sinha, PHI, 2004. |

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| **Information Retrieval** | | | **ECS44104** | **3-0-0** | **3 Credits** | |  |  |
| **Module 1:**  **Introduction:** Basics of Information Retrieval and Introduction to Search Engines; Boolean Retrieval: Boolean queries, Building simple indexes, Processing Boolean  Queries | | | | | | **[6]** | |  |
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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 Kgramindexes, Spelling correction, Phonetic correction. | | | | | | **[8]** | |  |
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| **Module 3:**  Index Construction – Singlepass 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. | | | | | | **[6]** | |  |
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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-idf functions. | | | | | | **[5]** | |  |
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| **Module 5:**  Computing Scores in a Complete Search System – Efficient scoring Inexact retrieval, Champion lists, Impact ordering, Cluster pruning, Tiered indexes, Query term proximity, Vector space scoring and query operations. | | | | | | **[4]** | |  |
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| **Module 6:**  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. | | | | | | **[6]** | |  |
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| **Module 7:**  Probabilistic Information Retrieval – Review of basic probability theory, Probability ranking principle, Binary independence model, Probability estimates, probabilistic approaches to relevance feedback. Text Classification – Rocchio classifier, K-Nearest  neighbor classifier, Linear and nonlinear classifiers, Bias-variance tradeoff, Naïve  Bayes and Support Vector machine based classifiers. | | | | | | **[6]** | |  |
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| **Module 8:**  Text Clustering – Clustering in information retrieval, Evaluation of clustering, K-Means  and Hierarchical clustering. Introduction to Linear Algebra, Latent Semantic Indexing. | | | | | | **[4]** | |  |
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| **Text Books:** | | | | | | | | |
| 1 | “An Introduction to Information Retrieval”, C. D. Manning, P. Raghavan, H. Schutze, Cambridge University Press, 2009. | | | | | | | |
| **Reference Books:** | | | | | | | | |
| 1 | “Modern Information Retrieval”, R. Baeza and B. Ribeiro-Neto, Pearson Education, 1999. | | | | | | | |

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| **Formal Systems** | | **ECS61118** | **3-0-0** | **3 Credits** | |  | |
| **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** | |
| **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 Haskell ML. | | | | | **[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** | |
| **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. | | | | | |  |
| **Natural language processing** | | | **ECS61124** | **3-0-0** | **3 Credits** | | |
| **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); [CoreferenceHYPERLINK "https://en.wikipedia.org/wiki/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. |

**Elective-VIII**

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| **Numerical Analysis** | **SMA44102** | **3-0-0** | **3 Credits** |

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| **Module 1:**  Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. | | **[4]** |
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| **Module 2:**  Interpolation: Newton forward/backward interpolation, Lagrange’s and Newton’s divided difference Interpolation. Numerical integration: Trapezoidal rule, Simpson’s 1/3 rule, Expression for corresponding error terms. | | **[8]** |
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| **Module 3:**  Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. | | **[10]** |
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| **Module 4:**  Numerical solution of ordinary differential equation: Euler’s method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. | | **[4]** |

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| **Text Books:** | |
| 1 | C.Xavier: C Language and Numerical Methods. |
| 2 | J.B.Scarborough: Numerical Mathematical Analysis |
| **Reference Books:** | |
| 1 | Balagurusamy: Numerical Methods, Scitech. |
| 2 | N. Dutta: Computer Programming & Numerical Analysis, Universities Press. |

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| **Operation Research** | **SMA44104** | **3-0-0** | **3 Credits** |

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| **Module 1:**  Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples. 5L Solution of LPP by Simplex Method; Charnes’ Big-M Method; Duality Theory. Transportation Problems and Assignment Problems. | | **[17]** |
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| **Module 2:**  Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock. | | **[9]** |
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| **Module 3:**  Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance. | | **[5]** |
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| Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems. | | **[5]** |

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| **Text Books:** | |
| 1 | H. A. Taha, “Operations Research”, Pearson |
| 2 | P. M. Karak – “Linear Programming and Theory of Games”, ABS Publishing House |
| **Reference Books:** | |
| 1 | Kanti Swaroop — “Operations Research”, Sultan Chand & Sons |
| 2 | . Rathindra P. Sen—“Operations Research: Algorithms and Applications”, PHI. |

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| **Medical Electronics** | **SPH44104** | **3-0-0** | **3 Credits** |

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| **Module 1:**  Anatomy and physiology, Elementary ideas of cell structure, Heart and circulatory system., Central nervous system, Muscle action, Respiratory system, Body temperature and reproduction system | | **[6]** |
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| **Module 2:**  Overview of Medical Electronics Equipments, classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments, Bioelectric signals, Bio electrodes, Electrode, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG , EEG | | **[12]** |
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| **Module 3:**  Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor. | | **[8]** |
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| **Module 4:**  Block diagram description and application of following instruments , ECG Machine ,EEG Machine, EMG Machine | | **[12]** |
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| **Module 5:**  Patient Monitoring Systems , Heart rate measurement , Pulse rate measurement , Respiration rate measurement, Blood pressure measurement , Principle of defibrillator and pace mark ,Use of Microprocessor in patent monitoring. | | **[12]** |
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| **Module 6:**  Safety Aspects of Medical Instruments ,Gross current shock , Micro current shock ,-Special design from safety consideration ,Safety standards. | | **[6]** |

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| **Text Books:** | |
| 1 | Handbook of biomedical Instrumentation by RS Khandpur |
| 2 | Biomedical Instrumentation by Cromwell |
| **Reference Books:** | |
| 1 | Modern Electronics Equipment by RS Khandpur, TMMH, New Delhi |
| 2 | Introduction to BioMedical Electronics by Edward J. Perkstein; Howard Bj, USA |

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| **Entrepreneurship Development** | **MBA44142** | **3-0-0** | **3 Credits** |

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| **Module 1:** Introduction - Understanding the meaning of Entrepreneurial ship - Characteristics of an Entrepreneur - Classification of the Entrepreneurs - Entrepreneurial Scene in India - Factors influencing Entrepreneurship | | **[5]** |
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| **Module 2:** Early Career Dilemmas of an Entrepreneur   * The Entrepreneur’s Role, Task and personality * A typology of Entrepreneurs: Defining Survival and success * Entrepreneurship as a Style of Management | | **[7]** |
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| **Module 3:** Entrepreneurial growth - Role played by government and Non-Government agencies - EDP’s, TIIC, SIDBI, PIPDIC, IDBI, IFCI, ETC. , Rural Entrepreneurs - Small scale entrepreneurs and Export Entrepreneurs . | | **[5]** |
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| **Module 4:** Business plan, Business idea generation Techniques - Identification of Business Opportunities - Marketing Feasibility - Financial Feasibility - Technical - Legal - Managerial and Location Feasibility. | | **[7]** |
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| **Module 5:** Project Appraisal - Methods - Techniques - Preparation of Business Plan - Content of a Business Plan - Project Report. | | **[8]** |
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| **Module 6:** Start an enterprise - Franchising and Acquisition - Product Strategies - Pricing Strategies - Distribution Strategies - Promotional Strategies.  How to be a successful Entrepreneur? - Learning to be Successful - Successful entrepreneurs | | **[7]** |

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| **Text Books:** | |
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| 1 | Vasant Desai - Dynamics of Entrepreneurial Development and Management. HPH |
| 2 | Khanka - Entrepreneurial Development. S CHAND |
| **Reference Books:** | |
| 1 | Jayshree Suresh - Entrepreneurial Development |
| 2 | Saini - Entrepreneurship : Theory & Practice. |

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| **Project –II** | **ECS44402** | **0-0-12** | **8 Credits** |

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| The course encourages students to take project works that are based on current trends and technologies in various subjects, which will augment the theory subjects. The students will form a group to do their project work. This teaming is to encourage team spirit and to insist the importance of team work. The students typically undergo group formation, finalization of area of work, testing, generation and verification of results, and possible research publication procedure. |

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| **Comprehensive Viva** | **ECS44502** | **0-2-0** | **2 Credits** |

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| 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. |

**Subject Name: Distributed Computing Lab**

**Code: ECS44202**

**Credit: 2**

**Contact Hours: 3**

**List of Experiments:**

1. Program to implement non token based algorithm for Mutual Exclusion

2. Program to implement Lamport’s Logical Clock

3. Program to implement edge chasing distributed deadlock detection algorithm.

4. Program to implement locking algorithm.

5. Program to implement Remote Method Invocation.

6. Program to implement Remote Procedure Call.

7. Program to implement Chat Server.

8. Program to implement termination detection

**Subject Name: Information Retrieval Lab**

**Code: ECS44204**

**Credit: 2**

**Contact Hours: 3**

**List of Experiments**

1. Prepare and build a model to extract keywords from any documents.
2. Prepare and build a search engine.
3. Build a sentiment classification model for user reviews Pizza Hut. Each user review should be classified as positive or negative.
4. Build a Twitter tweets classifier model for Sports or Entertainment. Train the classifier and predict the category of incoming tweets.
5. Build a model to detect summarized points from a huge or multiple paragraphs. The model will extract keywords which occur often and will detect summarized point from a collection of documents.

**Subject Name: Formal Systems Lab**

**Code: ECS61218**

**Credit: 2**

**Contact Hours: 3**

Design a machine model to verify the syntactic structure of a C program.

Design a machine to recognize CFL from a given string.

Ackermann’s Function,

Write a program to compute the complexity for recognizing CFL of a given string.

**Subject Name: Principles of Programming Languages Lab**

**Code: ECS61220**

**Credit: 2**

**Contact Hours: 3**

**List of Programs**:

Write a program in Python/Java to:

1. Demonstrate Decision Making, Branching and Looping, Use of break and continue statement etc.
2. Implementation involving the use of Arrays with subscript, String operations and pointers.
3. Implementation involving the use Functions and Recursion.
4. Implementation involving the use Structures and Files.

**Subject Name: High Performance Computer Architecture Lab**

**Code: ECS61222**

**Credit: 2**

**Contact Hours: 3**

**Experiment 1:**

Implementation based on basic Logic Gates (AND, OR, NOT, NAND, NOR, XOR, XNOR)

**Experiment 2:**

Implementation based on Half adder and Full adder (using data flow, behavioral, structural modeling)

**Experiment 3:**

Implementation based on Half subtractor and Full subtractor (using data flow, behavioral, structural modeling)

**Experiment 4:**

Implementation based on Full adder using two half adders and Full subtractor using two half subtractors

**Experiment 5:**

Implementation based on multiplexer, demultiplexer, Encoder and Decoder

**Experiment 6:**

Implementation based on D Flip Flop, SR Flip Flop, JK Flip Flop, T Flip Flop

**Experiment 7:**

Implementation based on 4 Bit Register (using Structural modeling)

**Experiment 8:**Implementation based on 4 Bit Comparator (using Behavioral modeling)

**Experiment 9:**

Implementation based on 4 Bit ALU

**Subject Name: Natural Language Processing Lab**

**Code: ECS61224**

**Credit: 2**

**Contact Hours: 3**

1. [Word Analysis](https://nlp-iiith.vlabs.ac.in/exp1/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
2. [Word Generation](https://nlp-iiith.vlabs.ac.in/exp2/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
3. [Morphology](https://nlp-iiith.vlabs.ac.in/exp3/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
4. [N-Grams](https://nlp-iiith.vlabs.ac.in/exp4/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
5. [N-Grams Smoothing](https://nlp-iiith.vlabs.ac.in/exp5/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
6. [POS Tagging: Hidden Markov Model](https://nlp-iiith.vlabs.ac.in/exp6/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
7. [POS Tagging: Viterbi Decoding](https://nlp-iiith.vlabs.ac.in/exp7/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
8. [Building POS Tagger](https://nlp-iiith.vlabs.ac.in/exp8/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
9. [Chunking](https://nlp-iiith.vlabs.ac.in/exp9/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)
10. [Building Chunker](https://nlp-iiith.vlabs.ac.in/exp10/Introduction.html?domain=Computer%20Science&lab=Natural%20Language%20Processing%20Lab)

**Subject Name: Numerical Analysis Lab**

**Code: SMA44202**

**Credit: 2**

**Contact Hours: 3**

* + - 1. Assignments on Newton forward /backward, Lagrange’s interpolation.
      2. Assignments on numerical integration using Trapezoidal rule, Simpson’s 1/3 rule, Weddle’s rule.
      3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
      4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
      5. Assignments on ordinary differential equation: Euler’s and Runga-Kutta methods.
      6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

**Subject Name: Operation Research Lab**

**Code: SMA44204**

**Credit: 2**

**Contact Hours: 3**

**Use any programming language C / C++ / Python / RStudio to write the programmes.**

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| **Module 1:**  Solution of different optimization problems using generic packages (Viz. TORA, LINDO, LINGO etc.).  Write a program to find out:  i)The determinant of a matrix A and matrix B  ii)Multiplication of matrix A and matrix B | | **[2]** |
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| **Module 2:**  Write a program to solve a given LPP. | | **[5]** |
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| **Module 3:**  Write a program to solve a given transportation problem. | | **[5]** |
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| **Module 4:**  Write a program to solve a given Assignment problem. | | **[4]** |
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| **Module 5:**  Write a program to solve a given sequencing problem. | | **[4]** |
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| **Module 6:**  Write a program to implement pure and mixed strategy game problem. | | **[5]** |
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| **Module 7:**  Write programs to find Economic order quantity for different types of inventory problem. | | **[5]** |

**Subject Name: Medical Electronics Lab**

**Code: SPH44204**

**Credit: 2**

**Contact Hours: 3**

**LIST OF EXPERIMENTS:**

1. Design and analysis of biological preamplifiers

2. Recording of ECG signal and analysis

3. Recording of EMG-Signal

4. Recording of EEG-Signal

5. Recording of various physiological parameters using patient monitoring system and telemetry units.

6. Measurement of pH and conductivity.

7. Measurement and recording of peripheral blood flow

8. Measurement of visually evoked potential.

9. Study of characteristics of optical Isolation amplifier

10. Galvanic skin resistance (GSR) measurement