# B.Tech in Electronics and Communication Engineering
# Course Structure and Syllabus
# (R25 Regulations) Applicable from AY 2025-26

## I Year I Semester

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | A2001 | Matrices and Calculus | 3 | 1 | 0 | 4 |
| 2 | A2004 | Advanced Engineering Physics | 3 | 0 | 0 | 3 |
| 3 | A2501 | Programming for Problem Solving | 3 | 0 | 0 | 3 |
| 4 | A2405 | Introduction to Electrical Engineering | 2 | 0 | 0 | 2 |
| 5 | A2302 | Engineering Drawing and Computer Aided Drafting | 2 | 0 | 2 | 3 |
| 6 | A2006 | English for Skill Enhancement | 3 | 0 | 0 | 3 |
| 7 | A2005 | Advanced Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 8 | A2502 | Programming for Problem Solving Lab | 0 | 0 | 2 | 1 |
| 9 | A2007 | English Language and Communication Skills Lab | 0 | 0 | 2 | 1 |
| 10 | | Induction Programme | | | | |
| | | **Total Credits** | **16** | **1** | **8** | **21** |

## I Year II Semester

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | A2008 | Ordinary Differential Equations and Vector Calculus | 3 | 1 | 0 | 4 |
| 2 | A2002 | Engineering Chemistry | 3 | 0 | 0 | 3 |
| 3 | A2506 | Python Programming | 3 | 0 | 0 | 3 |
| 4 | A2504 | Data Structures | 3 | 0 | 0 | 3 |
| 5 | A2407 | Network Analysis and Synthesis | 3 | 0 | 0 | 3 |
| 6 | A2507 | Python Programming Lab | 0 | 0 | 2 | 1 |
| 7 | A2003 | Engineering Chemistry Lab | 0 | 0 | 2 | 1 |
| 8 | A2505 | Data Structures Lab | 0 | 0 | 2 | 1 |
| 9 | A2406 | Electrical Engineering Lab | 0 | 0 | 2 | 1 |
| 10 | A2301 | Engineering Workshop | 0 | 0 | 2 | 1 |
| | | **Total Credits** | **15** | **1** | **10** | **21** |

**II Year I Semester**

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | A2410 | Probability Theory and Stochastic Processes | 3 | 0 | 0 | 3 |
| 2 | A2411 | Signals and Systems | 3 | 0 | 0 | 3 |
| 3 | A2401 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 |
| 4 | A2413 | Digital Logic Design | 3 | 0 | 0 | 3 |
| 5 | A2415 | Control Systems | 2 | 0 | 0 | 2 |
| 6 | A2015 | Innovation and Entrepreneurship | 2 | 0 | 0 | 2 |
| 7 | A2412 | Modeling and Simulation Lab | 0 | 0 | 2 | 1 |
| 8 | A2402 | Electronic Devices and Circuits Lab | 0 | 0 | 2 | 1 |
| 9 | A2414 | Digital logic Design Lab | 0 | 0 | 2 | 1 |
| 10 | A2416 | Linux and Shell Scripting | 0 | 0 | 2 | 1 |
| | | **Total Credits** | **16** | **0** | **8** | **20** |

**II Year II Semester**

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | A2018 | Numerical Methods and Complex Variables | 3 | 0 | 0 | 3 |
| 2 | A2417 | Electromagnetic Fields and Transmission Lines | 3 | 0 | 0 | 3 |
| 3 | A2418 | Analog and Digital Communications | 3 | 0 | 0 | 3 |
| 4 | A2420 | Linear and Digital IC Applications | 3 | 0 | 0 | 3 |
| 5 | A2422 | Electronic Circuit Analysis | 3 | 0 | 0 | 3 |
| 6 | A2012 | Computational Mathematics Lab | 0 | 0 | 2 | 1 |
| 7 | A2419 | Analog and Digital Communications Lab | 0 | 0 | 2 | 1 |
| 8 | A2421 | Linear and Digital IC Applications Lab | 0 | 0 | 2 | 1 |
| 9 | A2423 | Electronic Circuit Analysis Lab | 0 | 0 | 2 | 1 |
| 10 | A2424 | Web and Mobile Applications | 0 | 0 | 2 | 1 |
| 11 | A2019 | Basics of Environmental Science | 1 | 0 | 0 | 0 |
| | | **Total Credits** | **16** | **0** | **10** | **20** |

**III Year I Semester**

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Digital Signal Processing | 3 | 0 | 0 | 3 |
| 2 | | RISC and Microcontroller Architectures | 3 | 0 | 0 | 3 |
| 3 | | CMOS VLSI Design | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective – I | 3 | 0 | 0 | 3 |
| 5 | | Open Elective - I | 2 | 0 | 0 | 2 |
| 6 | | RISC and Microcontroller Interfacing Lab | 0 | 0 | 2 | 1 |
| 7 | | CMOS VLSI Design Lab | 0 | 0 | 2 | 1 |
| 8 | | Digital Signal Processing Lab | 0 | 0 | 2 | 1 |
| 9 | | Field based Research Project | 0 | 0 | 4 | 2 |
| 10 | | FPGA based System Design | 0 | 0 | 2 | 1 |
| 11 | | Indian Knowledge System | 1 | 0 | 0 | 1 |
| | | **Total Credits** | **15** | **0** | **12** | **21** |

**III Year II Semester**

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Antenna Design and Wave Propagation | 3 | 0 | 0 | 3 |
| 2 | | IoT Architectures and Protocols | 3 | 0 | 0 | 3 |
| 3 | | Business Economics and Financial Analysis | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective – II | 3 | 0 | 0 | 3 |
| 5 | | Open Elective – II | 2 | 0 | 0 | 2 |
| 6 | | Advanced Communications Lab | 0 | 0 | 2 | 1 |
| 7 | | IoT Architectures and Protocols Lab | 0 | 0 | 2 | 1 |
| 8 | | VLSI Design Verification Lab | 0 | 0 | 2 | 1 |
| 9 | | Advanced English Communication Skills Lab | 0 | 0 | 2 | 1 |
| 10 | | 45G Practical Lab / Robotic Lab / Drone lab | 0 | 0 | 2 | 1 |
| 11 | | Gender Sensitization lab / Human Values and Professional Ethics | 1 | 0 | 0 | 1 |
| | | **Total Credits** | **15** | **0** | **10** | **20** |

**Note:** For the courses Gender Sensitization Lab and Human Values and Professional Ethics – one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

**IV Year I Semester**

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Microwave and Optical Communications | 3 | 0 | 0 | 3 |
| 2 | | Embedded System Design | 3 | 0 | 0 | 3 |
| 3 | | Fundamentals of Management for Engineers | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective – III | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective – IV | 3 | 0 | 0 | 3 |
| 6 | | Open Elective – III | 2 | 0 | 0 | 2 |
| 7 | | Microwave and Optical Communications Laboratory | 0 | 0 | 2 | 1 |
| 8 | | Embedded System Design Laboratory | 0 | 0 | 2 | 1 |
| 9 | | Industry Oriented Mini Project / Internship | 0 | 0 | 4 | 2 |
| | | **Total Credits** | **17** | **0** | **8** | **21** |

**IV Year II Semester**

| S.No | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Professional Elective–V | 3 | 0 | 0 | 3 |
| 2 | | Professional Elective–VI | 3 | 0 | 0 | 3 |
| 3 | | Project Work | 0 | 0 | 28 | 14 |
| | | **Total Credits** | **6** | **0** | **28** | **20** |

**Professional Electives**

**Professional Elective-I**

| Course Code | Course Title |
|---|---|
| | Computer Organization & Operating Systems |
| | Data Communications and Computer Networks |
| | Electronic Measurements and Instrumentation |
| | Sustainability for Electronics |

**Professional Elective-II**

| Course Code | Course Title |
|---|---|
| | Digital Image Processing |
| | Low Power VLSI Design |
| | Wireless Communication Networks |
| | Biomedical Instrumentation |

**Professional Elective-III**

| Course Code | Course Title |
|---|---|
| | Fundamentals of Artificial Intelligence |
| | Image and Video Processing |
| | Mobile Communications and Networks |
| | Design for Testability |

**Professional Elective-IV**

| Course Code | Course Title |
|---|---|
| | Deep Learning |
| | Satellite Communications |
| | CMOS Analog IC Design |
| | Real Time Operating Systems |

**Professional Elective-V**

| Course Code | Course Title |
|---|---|
| | DSP Processors and Architectures |
| | Multimedia Database Management Systems |
| | Cloud Computing |
| | 5G and beyond Communication |

**Professional Elective-VI**

| Course Code | Course Title |
|---|---|
| | Block chain Technology |
| | System on Chip Architecture |
| | Wireless sensor Networks |
| | Network Security and Cryptography |

**Open Electives**

**Open Elective-I**

| Course Code | Course Title |
|---|---|
| | Principles of Communication |
| | Fundamentals of Cyber Physical Systems |

**Open Elective-II**

| Course Code | Course Title |
|---|---|
| | Fundamentals of Image Processing |
| | Automotive Electronics |

**Open Elective-III**

| Course Code | Course Title |
|---|---|
| | Introduction to Wireless Communications |
| | Electronics for Health Care |

# A2001: MATRICES AND CALCULUS

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Pre-requisite: Mathematical Knowledge at pre-university level**

**Course Objectives:** To learn

1. Applying basic operations on matrices and their properties.
2. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
3. Concept of Eigen values and Eigen vectors and to reduce the quadratic form to canonical form
4. Geometrical approach to the mean value theorems and their application to the mathematical problems.
5. Finding maxima and minima of functions of two and three variables.
6. Evaluation of multiple integrals and their applications.

**Course Outcomes:** After completion of the course, the student must be able to

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
2. Find the Eigen values and Eigenvectors
3. Reduce the quadratic form to canonical form using orthogonal transformations.
4. Solve the applications of the mean value theorems.
5. Find the extreme values of functions of two variables with/without constraints.
6. Evaluate the multiple integrals and apply the concept to find areas and volumes.

**UNIT – I: Matrices**

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method. System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations. Gauss Jacobi iteration method, Gauss Seidel Iteration Method.

**UNIT – II: Eigen values and Eigen vectors**

Linear Transformation and Orthogonal Transformation: Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof) Finding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical form by Orthogonal Transformation.

**UNIT – III: Single Variable Calculus**

Limit and Continuous of functions and its properties. Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (All the theorems without proof), Maclaurin's series.

**UNIT – IV: Multivariable Calculus (Partial Differentiation and applications)**

Definitions of Limit and continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian–Functional dependence & independence, Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

**UNIT – V: Multivariable Calculus (Integration)**

Evaluation of Double Integrals (Cartesian and polar coordinates), Change of order of integration (only Cartesian form), Change of variables for double integrals (Cartesian to polar).
Evaluation of Triple Integrals.
Applications: Areas by double integrals and volumes by triple integrals.

**TEXT BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36thEdition,2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

**REFERENCE BOOKS:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P.Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited.

# A2004: ADVANCED ENGINEERING PHYSICS

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 10+2 Physics**

**Course Objectives:**

1. To study crystal structures, defects, and material characterization techniques like XRD and SEM.
2. To understand fundamental concepts of quantum mechanics and their applications in solids and nano-materials.
3. To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
4. To learn the properties and applications of magnetic and dielectric materials.
5. To explore the working and applications of lasers and fiber optics in modern technology.

**Course Outcomes:**

1. Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material Characterization.
2. Apply quantum mechanical principles to explain particle behavior and energy band formation in solids.
3. Understand quantum computing concepts, use quantum gates and explain basic quantum algorithms
4. Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
5. Explain the principles of lasers and fibre optics and their applications in communication and sensing.

**UNIT – I: Crystallography & Material Characterization**

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects. Concept of nanomaterials –Surface to volume ratio, X -ray diffraction: Bragg's law, powder method, calculation of average crystallite size using Debye-Scherer's formula, scanning electron microscopy (SEM): block diagram, working principle

**UNIT - II: Quantum Mechanics**

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, Eigen values and Eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, formation of energy bands, origin of band gap, classification of solids, Concept of discrete energy levels and quantum

confinement in nano materials.

**UNIT - III: Quantum Computing**

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, development of of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation, quantum algorithms: Shor, Grover.

**UNIT - IV: Magnetic and Dielectric Materials**

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, synthesis of ferrimagnetic materials using Sol-gel method, Applications: magnetic hyperthermia for cancer treatment, magnets for EV, Giant Magneto Resistance (GMR) device.
Introduction to dielectric materials, types of polarization (qualitative): electronic, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM).

**UNIT - V: Laser and Fibre Optics**

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, meta stable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, $CO_2$ laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for automatic vehicle.

Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fiber's, losses in optical fibre, applications: optical fibre for communication system, sensor for structural health monitoring.

**TEXT BOOKS:**

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc
3. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

**REFERENCE BOOKS:**

1. Jozef Gruska, *Quantum Computing*, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited

**Useful Links :**

- https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf
- https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
- https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles- Kittel.pdf
- https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf
- https://www.fi.muni.cz/usr/gruska/qbook1.pdf
- https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf

# A2501: PROGRAMMING FOR PROBLEM SOLVING

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: 10+2 Maths

**Course Objectives:** The course aims to

1. Understand problem-solving methodologies using algorithms and flowcharts.
2. Learn fundamentals of C programming language constructs.
3. Implement control structures, functions, and modular programming techniques.
4. Use arrays, strings, structures, pointers, and file handling to solve computational problems.
5. Use pre-processor directives and user-defined data types to enhance code modularity and maintainability

**Course Outcomes:** By the end of the course, students will be able to:

1. Design algorithms and flowcharts to solve problems and Write C programs using appropriate data types, operators, and expressions.
2. Use control flow constructs such as conditional and loop statements to implement logic.
3. Manipulate arrays, strings, and structures to solve real-world problems.
4. Apply modular programming using functions and recursion effectively.
5. Demonstrate effective use of pointers and dynamic memory allocation.
6. Perform file operations and use pre processor directives in C programs.

## UNIT – I: Introduction to C Programming

Problem Solving: Algorithms, Flowcharts, Pseudo code with examples

Structure of a C Program, Compilation and Execution Process, Variables, Constants, Data Types. Operators: Arithmetic, Relational, Logical, Assignment, Bitwise, Unary, Conditional Type Conversion, Expressions and precedence and Expression Evaluation, Input and Output: formatted/unformatted I/O

## UNIT – II: Control Structures and Arrays

Conditional Branching: if, if-else, nested if-else, if else if ladder, switch-case, Iteration: for, while, do-while, Jump Statements: break, continue, go-to

Arrays: Declaration, Initialization and Access, One Dimensional Arrays and Two-Dimensional Arrays, Applications in Problem Solving

## UNIT – III: Strings and Functions

String Handling: Declaration, Initialization, Standard Functions: strlen, strcat, strcpy, strcmp, Manual string manipulation (without string.h)

Functions: Declaration, Definition, Calling, Types /Categories of user defined functions,

Parameter Passing: Call by Value Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Scope and Storage Classes (auto, extern, static,

register)

**UNIT – IV: Structures, Pointers and Dynamic Memory**

Structures and Unions: Declaration, Initialization, Nested Structures, Array of Structures, Passing Structures to Functions, Union

Pointers: Declaration, Initialization, Pointer Arithmetic, Pointers with Arrays, Functions: Call by Reference, Passing Arrays to Functions, Pointers with Structures

Dynamic Memory Allocation: malloc, calloc, realloc, free, Self-referential Structure

**UNIT – V: File Handling and Preprocessor Directives**

Text and Binary Files, File Operations: Opening, reading, writing, closing, File handling functions: fopen, fclose, fread, fwrite, fprintf, fscanf, File Positioning: fseek, ftell, rewind, Preprocessor Directives: #define, #include, #ifdef, #ifndef, Command Line Arguments, User-Defined Data Types: enum, typedef

**TEXT BOOKS:**

1. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition).

**REFERENCE BOOKS:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill.
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB.
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression).
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition.
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

Useful Links

- https://onlinecourses.swayam2.ac.in/imb25_mg71/preview
- https://onlinecourses.nptel.ac.in/noc24_cs02/preview
- https://www.geeksforgeeks.org/c-programming-language/
- https://www.tutorialspoint.com/cprogramming/index.htm

# A2405: INTRODUCTION TO ELECTRICAL ENGINEERING

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Pre-requisite: Mathematics**

**Course Objectives:**

1. To understand DC and Single & Three phase AC circuits
2. To study and understand the different types of DC, AC machines and Transformers
3. To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

**Course Outcomes:**

1. Understand and analyze basic Electrical circuits
2. Study the working principles of Electrical Machines and Transformers
3. Introduce components of Low Voltage Electrical Installations

**UNIT – I: D.C. Circuits**

Introduction to R, L and C elements, independent voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits

**UNIT – II: A.C. Circuits**

Introduction to sinusoidal waveforms, phasor representation, the concept of power and power factor, Analysis of 1-phase RLC series and parallel circuits, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections

**UNIT – III: Transformers**

Principle of operation, equivalent circuit, losses, regulation and efficiency. Introduction to Auto-transformer.

**UNIT – IV: Electrical Machines**

Principle of operation of DC machine, performance characteristics of dc shunt machine. Principle of operation of a 3-phase induction motor, torque-slip characteristics. Principle of operation of synchronous generator.

**UNIT – V: Electrical Installations**

Components of LT Switchgear: SFU, MCB, ELCB, Types of Wires and Cables, Earthing. Types of Batteries, and Characteristics. Elementary calculations for energy consumption, power factor improvement and battery backup.

**TEXT BOOKS:**

1. D.P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, “Basic Electrical Engineering”, Tata McGraw Hill, 2nd Edition, 2008.

**REFERENCE BOOKS:**

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, “Basic Electrical Engineering”, S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, “Basic Electrical and Electronics Engineering”, Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, “Basic Electrical Engineering”, 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011
6. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010
7. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989

# A2302: ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**Course Objectives:**

1. To introduce the fundamentals of engineering drawing and projection systems.
2. To develop skills in constructing orthographic, isometric, and sectional views.
3. To train students in interpreting and creating technical drawings using CAD tools.
4. To familiarize students with dimensioning standards and drafting conventions.
5. To bridge manual drafting techniques with computer-aided drafting practices.

**Course Outcomes:** At the end of the course, the student will be able to:

1. Understand and apply the principles of orthographic and isometric projections.
2. Create sectional views and dimensioned drawings using BIS standards.
3. Use CAD software to generate 2D engineering drawings.
4. Visualize and construct solid models from 2D views.
5. Interpret and produce engineering drawings of mechanical components and assemblies.
6. Demonstrate drafting skills for practical and industrial applications.

**UNIT – I: Introduction to Engineering Graphics (Conventional)**
Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales, Plain and Diagonal, Conic Sections including the Rectangular Hyperbola, General method only. Cycloid, Epicycloid and Hypocycloid.

**UNIT - II: Orthographic Projections (Conventional and Computer Aided)**
Principles of Orthographic Projections, Conventions, Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections, points, lines and planes. Introduction to Computer aided drafting, views, commands and conics.

**UNIT – III: Projections of Regular Solids (Conventional and Computer Aided)**
Auxiliary Views, Sections or Sectional views of Right Regular Solids, Prism, Cylinder, Pyramid, Cone, Auxiliary views, Computer aided projections of solids, sectional views

**UNIT – IV: Development of Surfaces (Conventional)**
Prism, Cylinder, Pyramid and Cone.

**UNIT – V: Isometric Projections (Conventional and Computer Aided)**
Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple and Compound Solids, Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice- versa, Conventions. Conversion of orthographic projection into isometric view.

**Note:**

1. The End Semester Examination will be in conventional mode.
2. CIE – I will be in conventional mode.
3. CIE – II will be using Computer.

**TEXT BOOKS:**

1. Engineering Drawing, N. D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and company Ltd., 3rdEdition,2010.

**REFERENCE BOOKS:**

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc, 3rdEdition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd Edition, 2015.

# A2006: English for Skill Enhancement

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Enhance vocabulary for effective communication
2. Apply suitable sentence structures in both oral and written communication.
3. Strengthen their reading and study skills.
4. Enable students to compose paragraphs, essays, precis, and formal letters
5. Develop proficiency in writing technical reports.

**Course Outcomes: Students will be able to:**

1. Choose appropriate vocabulary in their oral and written communication. (SDG 4,8)
2. Apply the rules of functional grammar and sentence structures effectively. (SDG 4)
3. Develop comprehension skills from known and unknown passages (SDG 4,8)
4. Compose paragraphs, essays, precis and draft letters (SDG 4)
5. Prepare well-structured abstracts and reports in various contexts (SDG 4,8)

**UNIT – I**
**Theme: Perspectives**
**Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan Pvt. Ltd.**
**Vocabulary:** The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms
**Grammar:** Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison
**Reading:** Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning
**Writing:** Sentence Structures and Types -Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

**UNIT – II:**
**Theme: Digital Transformation**
**Lesson on 'Emerging Technologies' from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan Pvt. Ltd.**
**Vocabulary:** Homophones, Homonyms and Homographs
**Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
**Reading:** Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice
**Writing:** Paragraph Writing – Types, Structures and Features of a Paragraph – Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

**UNIT – III:**
**Theme: Attitude and Gratitude**
**Poems on 'Leisure' by William Henry Davies and 'Be Thankful' – Unknown Author from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan Pvt. Ltd.**
**Vocabulary:** Words Often Confused - Words from Foreign Languages and their Use in English

**Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses
**Reading:** Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice
**Writing:** Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette

**UNIT – IV:**
**Theme: Entrepreneurship**
**Lesson on 'Why a Start-Up Needs to Find its Customers First' by Pranav Jain from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan Pvt. Ltd.**
**Vocabulary:** Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.
**Grammar:** Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.
**Reading:** Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice
**Writing**: Writing Practices- Note Making-Précis Writing.

**UNIT – V:**
**Theme: Integrity and Professionalism**
**Lesson on 'Professional Ethics' from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan Pvt. Ltd.**
**Vocabulary:** Technical Vocabulary and their Usage– One Word Substitutes – Collocations.
**Grammar:** Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
**Reading:** Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice
**Writing:** Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Technical Report.

**TEXT BOOKS:**
1. Board of Editors. 2025,*English for the Young in the Digital World,* Orient Black Swan Pvt. Ltd.

**REFERENCE BOOKS:**
1. Swan, Michael. (2016),*Practical English Usage,* Oxford University Press. New Edition.
2. Karal, Rajeevan. 2023,*English Grammar Just for You,* Oxford University Press. New Delhi
3. 2024,*Empowering with Language: Communicative English for Undergraduates,* Cengage Learning India Pvt. Ltd. New Delhi
4. Sanjay Kumar & Pushp Lata. 2022,*Communication Skills – A Workbook,* Oxford University Press. New Delhi
5. Wood, F. T. (2007),*Remedial English Grammar*, Macmillan
6. Vishwamohan, Aysha. (2013),*English for Technical Communication for Engineering Students,* Mc Graw-Hill Education India Pvt. Ltd.

**Useful Links**
- https://hostnezt.com/cssfiles/english/Practical%20English%20Usage%20by%20Michael%20Swan.pdf

- https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/6/__UG_B.A._English_112%2064_Remedial%20English%20Grammar_4066.pdf
- https://aissmschmct.in/wp-content/uploads/2020/07/BOOK-BSc-HS-Sem-III-HS308-Communication-Skills-1.pdf
- https://ebooks.lpude.in/new-scheme/arts/ma_english/sem_1/DEENG539_ACADEMIC_ENGLISH.pdf

# A2005: ADVANCED ENGINEERING PHYSICS LAB

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: 10+2 Physics**

**Course Objectives:**

1. To provide practical exposure to advanced concepts in solid-state and modern physics
2. To synthesize and study the physical properties of materials like semiconductors, ferromagnetic, and ferroelectric substances
3. To perform semiconductor characterization using Hall effect and band gap experiments
4. To explore the working principles of lasers and optical fibers through hands-on experiments
5. To develop skills in data analysis, interpretation, and scientific reporting

**Course Outcomes:**

1. Synthesize and analyze nanomaterials such as magnetite ($Fe_3O_4$) using chemical methods.
2. Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
3. Characterize semiconductors using Hall effect and energy gap measurement techniques.
4. Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.
5. Apply scientific methods for accurate data collection, analysis, and technical report writing.

**List of Experiments:**

1. Synthesis of magnetite ($Fe_3O_4$) powder using sol-gel method.
2. Determination of energy gap of a semiconductor.
3. Determination of Hall coefficient and carrier concentration of a given semiconductor.
4. Determination of magnetic moment of a bar magnet and horizontal earth magnetic field.
5. Study of B-H curve of a ferro magnetic material.
6. Study of P-E loop of a given ferroelectric crystal.
7. Determination of dielectric constant of a given material
8. Determination of Curie's temperature of a given ferroelectric material.
9. A. Determination of wavelength of a laser using diffraction grating.
   B. Study of V-I & L-I characteristics of a given laser diode.
10. A. Determination of numerical aperture of a given optical fibre.
    B. Determination of bending losses of a given optical fibre.

# A2502: PROGRAMMING FOR PROBLEM SOLVING LAB

**I Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:** 10+2 Maths

**Course Objectives:** The course aims to

1. Develop proficiency in C programming by understanding syntax, semantics, and program structure.
2. Enhance problem-solving abilities using control structures, arrays, strings, functions, recursion, pointers, and structures.
3. Apply modular programming concepts to implement efficient and reusable code.
4. Utilize dynamic memory allocation, file handling, and command-line arguments for real-world programming scenarios.
5. Strengthen analytical thinking through implementation of numerical, pattern generation, and data processing problems.

**Course Outcomes:** By the end of the course, students will be able to:

1. Write and execute C programs using fundamental programming constructs such as input/output, operators, and control structures.
2. Implement problem solutions involving arrays, strings, and matrices for data processing applications.
3. Apply functions (including recursion) for modular and structured program development.
4. Use pointers and structures effectively for efficient data manipulation and storage.
5. Implement file operations and command-line arguments to handle persistent data storage and program flexibility.
6. Analyze, design, and test C programs for numerical, logical, and pattern-based problems with proper documentation and coding style.

**Practice session:**

1) Demonstration Programs on printf( ),scanf( )
2) Write a simple C program that prints the results of all the operators available in C. Read required operand values from standard input

**Programs on numbers using control structures**

1) Write a C program for find the max and min from the three numbers.
2) Write a C program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.
3) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).
4) Write a program that finds if a given number is a prime number.
5) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
6) Write a C program that finds if a given number is a Armstrong number or not
7) Write a C program that finds if a given number is strong number or not
8) Write a C program that finds if a given number is a Automorphic number or not

9) Write a C program to generate all the prime numbers between 1 and n.

**Programs on Pyramid of stars and numbers**

Write a C program to construct as follows:

1)
```
    *
   ***
  *****
 *******
```

2)
```
*
1
**
23
***
456
****
78910
*****
****
***
**
*
```

3)
```
    *
   ***
  *****
 * ******
*****
 ***
  *
```

4)
```
1111
2222
3333
4444
```

5)
```
1
22
333
4444
```

6)

**Programs using Arrays and Strings**

1) Write a C program to find the minimum, maximum and average in an array of integers.
2) Write a C program to Finding the frequency of elements in an array
3) Write a C program to Counting Distinct Elements in an Array
4) Write a C program to Remove Duplicate elements from an array
5) Write a C program to find addition of two matrices of order m x n ,p x q
6) Write a C program to find multiplication of two matrices of order m x n ,p x q
7) Write a C program for Spiral traversal on a Matrix
8) Write a C program to rotate matrix by 90 degrees
9) Write a C program to Count the number of vowels in a given string.
10) Write a C program to check if two strings are anagrams or not.
11) Write a C program to insert a sub-string in to a given main string from a given position.
12) Write a C program to delete n Characters from a given position in a given string.
13) Write a C program to determine if the given string is a palindrome or not (Spelled Same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

14)Write a C program to count the lines, words and characters in a given text.
15)Write a C program to Count common sub-sequence in two strings

**Programs using functions and Recursion**

1. Write a C program to swap to numbers using call by value.
2. Write a C program that uses both non recursive and recursive functions for the following
   a) To find the factorial of a given integer.
   b) To find the GCD (greatest common divisor) of two given integers.
   c) To find X^n
   d) Find Nth term of a Fibonacci sequence

**Programs using Pointers and Structures**

1. Write a C program to swap two numbers using call by reference
2. Write a C program for reading elements into array using pointer and display them
3. Write a C program to create an one dimensional array dynamically using malloc() to store n elements and find sum, average of array elements
4. Write a C program to reverse the string using character pointer
5. Write a C program to create a student record with fields roll number, name and mobile number of the student using structures concept
6. Write a C program to manage student records, where each record contains a student's name, roll number, and marks using array of structures concept.
7. Write a C Program to display the date using nested structures concept

**Programs using Files**

1. Write a C Program to read the data from a standard input device, store it in a file and then display the content of a file to standard output device
2. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
3. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).
4. Write a C Program to reverse the contents of a File
5. Write a C program to demonstrate the concept of command line arguments
6. Write a C program to find the reverse of a number provided as a command line argument.

**TEXT BOOKS:**

1. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition).

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill.
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB.
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression).
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition.

7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

**Useful Links**

- https://www.hackerrank.com/domains/c
- https://leetcode.com/problemset/all/?difficulty=EASY
- https://www.codechef.com/practice?end_rating=999

# A2007: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

| I Year I Sem | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Course Objectives:**

**Listening Skills**
1. To enable students, develop their active listening skills.
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds.

**Speaking Skills**
3. To improve their pronunciation and neutralize accent.
4. To enable students express themselves fluently and appropriately
5. To practice speaking in social and professional contexts

**Learning Outcomes: Students will be able to:**
1. Listen actively and identify important information in spoken texts. (SDG4)
2. Interpret the speech and infer the intention of the speaker. (SDG4)
3. Improve their accent for intelligibility. (SDG4, 8, 10)
4. Speak fluently with clarity and confidence. (SDG4, 8, 10)
5. Use the language in real life situations. (SDG4, 8)

**Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:**
a. **Computer Assisted Language Learning (CALL) Lab which focuses on listening skills**
b. **Interactive communication Skills (ICS) Lab which focuses on speaking skills**

**Exercise – I**
**CALL Lab:**
Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - Testing Exercises
**ICS Lab:**
Diagnostic Test – Activity titled 'Express Your View'
Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing
Oneself and Others
Practice: Any Ice-Breaking Activity

**Exercise – II:**
**CALL Lab:**
Instruction: Listening vs. Hearing - Barriers to Listening
Practice: Listening for General Information - Multiple Choice Questions - Listening Comprehension
Exercises (It is essential to identify a suitable passage with exercises for practice.)
**ICS Lab:**
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations – Making
Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

**Exercise – III:**
**CALL Lab:**
Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)
Practice: Differences between British and American Pronunciation –Listening Comprehension Exercises
**ICS Lab:**
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events (A wide range of Materials / Handouts are to be made available in the lab.)

**Exercise: IV**
**CALL Lab:**
Instruction: Techniques for Effective Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - Listening Comprehension
Exercises. (It is essential to identify a suitable passage with exercises for practice.)
**ICS Lab:**
Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity
Practice: Activity on Telling and Retelling Stories - Collage

**Exercise: V**
**CALL Lab:**
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)
**ICS Lab:**
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity

- ❖ Post-Assessment Test on 'Express Your View'

**Minimum Requirement of infrastructural facilities for ELCS Lab:**
1. **Computer Assisted Language Learning (CALL) Lab:**
The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self-study by students.
**System Requirement (Hardware component):**
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:
i) Computers with Suitable Configuration
ii) High Fidelity Headphones

**2. Interactive Communication Skills (ICS) Lab:**
The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.
**Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.**
**Suggested Software**

- Cambridge Advanced Learners' English Dictionary with CD.

- Grammar Made Easy by Darling Kindersley
- Punctuation Made Easy by Darling Kindersley
- Oxford Advanced Learner's Compass, 10th Edition
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

**REFERENCE BOOKS:**

1) Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
2) Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient BlackSwan Pvt. Ltd
3) Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press(2022).
4) English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd
5) Ur, Penny and Wright, Andrew. 2022. Five Minute Activities – A Resource Book for Language Teachers. Cambridge University Press

# A2008: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Pre-requisite: Mathematical Knowledge at pre-university level**

**Course Objectives:** To learn

1. Methods of solving the differential equations of first and higher order.
2. Concept, properties of Laplace transforms.
3. Solving ordinary differential equations using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions
5. The basic properties of vector valued functions and their applications to line, surface, and volume integrals

**Course Outcomes:** After completion of the course, the student must be able to

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equation and apply the concept of differential equation to real world problems.
3. Use the Laplace Transforms techniques for solving Ordinary Differential Equations.
4. Evaluate the Line, Surface and Volume integrals and converting them from one to another

**UNIT – I: First Order Ordinary Differential Equations**

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates).
Applications: Newton's law of cooling, Law of natural growth and decay.

**UNIT – II: Ordinary Differential Equations of Higher Order**

Higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type $e^{ax}$, $\sin ax$, $\cos ax$, polynomials in $x$, $e^{ax}V(x)$ and $x^k V(x)$, Method of variation of parameters.

**UNIT – III: Laplace Transforms**

Laplace Transforms: Laplace Transform of standard functions, first shifting theorem, Laplace transforms of functions multiplied by 't' and divided by 't' Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof).
Applications: solving Initial value problems by Laplace Transform method.

**UNIT – IV**: **Vector Differentiation**

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Solenoidal and Irrotational vectors, Directional derivatives, Scalar potential functions, Vector Identities.

**UNIT – V: Vector Integration**

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

**TEXT BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

**REFERENCE BOOKS:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008. 4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

# A2002: ENGINEERING CHEMISTRY

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: Pre-university knowledge**

**Course Objectives:**

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

**Course Outcomes:**

1. To analyze the quality of water samples and their fitness for steam generation in industries and suitability for human consumption.
2. To understand the various causes, affects and control techniques of corrosion.
3. To categorized the different types of batteries and fuel cells for their advanced applications. To calculate the calorific values and learn usage of different fuels.
4. To compare the general properties and applications of different polymeric materials like plastics, rubber, conducting polymers and biodegradable polymers.
5. TO illustrate various applications of advanced functional materials like smart material, biosensors and interpretative UV-VIS, IR spectroscopy.

**UNIT – I: Water and its treatment**

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps
involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination. Defluoridation - Nalgonda technique.

**Boiler troubles**: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water -Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods -Softening of water by ion- exchange processes. Desalination of brackish water – Reverse osmosis.

**UNIT – II: Electrochemistry and Corrosion:**

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode.

**Corrosion:** Introduction- Definition, causes and effects of corrosion – Theories of corrosion,

chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

**UNIT – III: Energy sources**

**Batteries:** Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

**Fuels:** Introduction and characteristics of a good fuel, Calorific value – Units - HCV, LCV- Dulongs formula - Numerical problems.

**Fossil fuels:** Introduction, Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking- Moving bed catalytic cracking. LPG and CNG composition and uses.

**Synthetic Fuels:** Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

**UNIT – IV: Polymers**

Definition - Classification of polymers: Based on origin and tacticity with examples – Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization. Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6). Differences between themoplastics and thermo setting plastics.

**Conducting polymers:** Definition and Classification with examples - Mechanism of conduction in transpoly-acetylene and applications of conducting polymers.

**Biodegradable polymers:** Poly lactic acid and its applications.

**UNIT – V: Advanced Functional Materials:**

**Smart materials**: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications.

**Biosensor** - Definition, Amperometric Glucose monitor sensor.

**Interpretative spectroscopic applications** of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Monitoring- CO sensor (Passive Infrared detection).

**TEXT BOOKS:**

1) *Engineering Chemistry* by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2) *Engineering Chemistry* by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

**REFERENCE BOOKS:**

1. *Engineering Chemistry:* by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
2. *Engineering Chemistry* by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.

3. *Engineering Chemistry* by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. *Engineering Analysis of Smart Material Systems* by Donald J. Leo, Wiley, 2007.
5. *Challenges and Opportunities in Green Hydrogen* by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.

**Useful Links**

1. https://doi.org/10.1142/13094 | October 2023
2. https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2u

# A2506: PYTHON PROGRAMMING

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PPS, JAVA

**Course Objectives:**

1. Understand the fundamentals and syntax of Python programming.
2. Develop applications using control structures, functions, and modules.
3. Learn data structures such as lists, tuples, dictionaries, and sets.
4. Gain practical experience with file handling, exceptions, and object-oriented concepts.
5. Develop and debug Python programs for real-time applications.

**Course Outcomes:**

1. Understand basic syntax, keywords, and control structures in Python.
2. Design Python programs using functions, recursion, and modules.
3. Implement data structures such as lists, tuples, sets, and dictionaries.
4. Perform file operations and handle exceptions effectively.
5. Apply object-oriented programming principles and develop modular code.
6. Solve complex real-time problems using Python programming skills.

**UNIT – I: Python Basics**

Introduction to Python, features, applications, Python interpreter and IDEs, Variables, data types, and operators, Input/output functions, Control structures: if, if-else, nested if, loops (for, while), break and continue

**UNIT – II: Functions and Modules**

Defining and calling functions, Function arguments and return values, Recursive functions, Lambda functions, Modules and packages, built-in and user-defined modules, Introduction to Python Standard Library

**UNIT – III: Data Structures in Python**

Lists: operations, list comprehensions, Tuples: accessing, slicing, and unpacking, Sets and its operations, Dictionaries: creation, operations, and methods, Iterating through data structures

**UNIT – IV: File Handling, Exception Handling, and Regular Expressions**

Reading and writing text/binary files, File methods and context manager, Handling exceptions using try, except, finally, Raising exceptions, Regular expressions: match, search, findall, sub

**UNIT – V: Object-Oriented Programming (OOP) in Python& Extended Modules**

Classes and objects, Constructors and destructors, Inheritance and polymorphism, Encapsulation and data hiding, Method overloading and overriding, Introduction to decorators and iterators Numpy, pandas, matplotlib, seaborn, Scikit-learn

**Text Books:**

1. Reema Thareja, “Python Programming: Using Problem Solving Approach,” Oxford University Press.

2. Dr. R. Nageswara Rao, “Core Python Programming,” Dreamtech Press.
3. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist,” O’Reilly

**Reference Books:**

1. Mark Lutz, “Learning Python,” O’Reilly Media.
2. Wesley J. Chun, “Core Python Applications Programming,” Pearson.
3. Charles Dierbach, “Introduction to Computer Science Using Python,” Wiley.
4. Zed A. Shaw, “Learn Python the Hard Way,” Addison-Wesley

**Useful Links**

- https://www.w3schools.com/python
- https://onlinecourses.nptel.ac.in/noc22_cs26/preview
- https://www.javatpoint.com/python-tutorial
- https://www.tutorialspoint.com/python
- https://www.programiz.com/python-programming
- https://www.geeksforgeeks.org/python-programming-language/

# A2504: DATA STRUCTURES

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PPS

**Course Objectives:** The course aims to

1. Understand fundamental concepts, classifications, and operations of data structures.
2. Implement and analyze searching and sorting algorithms for efficient data processing
3. Learn linear and non-linear data structures and their applications.
4. Apply suitable data structures for problem-solving and algorithm optimization
5. Gain proficiency in advanced concepts like balanced search trees, hashing, and collision resolution.

**Course Outcomes:** By the end of the course, students will be able to:

1. Select appropriate searching and sorting techniques for given application.
2. Understand Linear data structures operations
3. Perform Various Linked List operations and its types
4. Implement Linear data structures Applications
5. Solve the given Problem using Non Linear data structures
6. Apply the concepts of Graph Traversals and Hashing for efficient Searching.

**UNIT – I: Searching and Sorting**

**Introduction to Data Structures:** Introduction, Classification of Data Structures, Operations on Data Structures

**Searching and Sorting:** linear search, jump search, binary search, interpolation search, bubble sort, selection sort, insertion sort, shell sort, Radix sort

**UNIT – II: Stacks and Queues**

**Stacks:** Introduction, Array Representation of Stack, Operations on Stack.

**Application of Stacks:** Infix-to- Postfix conversion, evaluating Postfix expressions.

**Queues:** Introduction, Array representation of Queue, Operations on a Queue, Circular Queue, Operations on a Circular Queue, Double Ended Queue, Operations on Double Ended Queue

**UNIT – III: Linked Lists**

**Linked Lists:** Introduction, Singly Linked List: Representation of a Singly Linked List, Operations on a Single Linked List (Create, insert, delete, reverse, traverse and count), and Operations on a Double linked list (Create, insert, delete, reverse, traverse and count), Circular Linked Lists.

**Applications of Linked Lists:** Implementation of Stack using Linked List, Implementation of Queue using linked list

**UNIT – IV: Trees**

**Trees:** Definition, Basic Terminologies, Binary Trees: Properties, Types, Representation of a Binary Tree using Array and Linked List and Tree Traversals: Pre order, In order and Post order, HEAPS: Binary Heap.

**Search Trees:** Binary Search Trees: Definition, Operations: Insertion, searching, find Minimum, find Maximum and Deletion, BALANCED SEARCH TREES: AVL Trees: Definition,

Rotations, Operations – Insertion, deletion and Searching, B Trees, B+ Trees

**UNIT – V: Graphs and Hashing**

GRAPHS: Definition, Basic Terminologies and Representation, Graph Traversals- Breadth First Search (BFS) and Depth First Search (DFS).

HASHING: Hash table representation, hash functions, collision resolution Techniques: separate chaining, open addressing-linear probing, quadratic probing, double hashing, and rehashing.

**Text Books:**

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A.Forouzan, Cengage Learning.
2. Data Structure using C– Reema Thareja, 3rd Edition, Oxford University Press.

**Reference Books:**

1. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.
2. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan , Fundamentals of Data Structure in C, 2nd Edition, University Press, India
3. Samanta Debasis , Classic Data Structures, 2nd Edition, Prentice Hall of India

**Useful Links**

- https://onlinecourses.swayam2.ac.in/cec24_cs17/preview
- https://onlinecourses.swayam2.ac.in/cec21_cs02
- https://www.geeksforgeeks.org/data-structures/
- https://www.programiz.com/dsa

# A2407: NETWORK ANALYSIS AND SYNTHESIS

| I Year II Sem | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Pre-requisite: Basic Electrical Engineering**

**Course Objectives:**
1. To understand the basic concepts on RLC circuits
2. To know the behavior of the steady state and transient states in RLC circuits
3. To understand the two port network parameters
4. Learn the design concepts of various filters and attenuators

**Course Outcomes:**
1. Gain the knowledge on basic RLC circuits behavior
2. Analyze the Steady state and transient analysis of RLC Circuits.
3. Characterization of two port network parameters.
4. Analyze the Design aspect of various filters and attenuators

**UNIT – I: Network Topology**
Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

**UNIT – II: Transient and Steady state analysis**
RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

**UNIT – III: Two port network parameters**
Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T,π , L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network

**UNIT – IV: Filters & Attenuators**
**Filters:** Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and π filters- Low pass, high pass
**Attenuators:** Types – T, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers-Types- Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

**UNIT – V: Network Synthesis**

Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non ladder networks, Poles, Zeros analysis of network functions, Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and causer methods

**TEXT BOOKS:**

1. Van Valkenburg -Network Analysis, 3rd Ed., Pearson, 216
2. JD Ryder - Networks, Lines and Fields, 2nd Ed., PHI, 1999

**REFERENCE BOOKS:**

1. J. Edminister and M. Nahvi - Electric Circuits, Schaum's Outlines, Mc Graw Hills Education, 1999
2. A. Sudhakar and Shyammohan S Palli - Networks & Circuits, 4th Ed., Tata McGraw- Hill Publications
3. William Hayt and Jack E. Kimmerley - Engineering Circuit Analysis, 6th Ed., William Hayt and Jack E. Kimmerley, McGraw Hill Company

# A2507: PYTHON PROGRAMMING LAB

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: PPS, JAVA

**Course Objectives:**

1. Understand the fundamentals and syntax of Python programming.
2. Develop applications using control structures, functions, and modules.
3. Learn data structures such as lists, tuples, dictionaries, and sets.
4. Gain practical experience with file handling, exceptions, and object-oriented concepts.
5. Develop and debug Python programs for real-time applications.

**Course Outcomes:**

1. Understand basic syntax, keywords, and control structures in Python.
2. Design Python programs using functions, recursion, and modules.
3. Implement data structures such as lists, tuples, sets, and dictionaries.
4. Perform file operations and handle exceptions effectively
5. Apply object-oriented programming principles and develop modular code.
6. Solve complex real-time problems using Python programming skills.

**Week-1**

1. Calculate the total and average of marks scored in five subjects.
2. Determine if a year is a leap year.
3. Accept a string and count vowels, consonants, digits, and special characters.
4. Accept a number and determine if it is prime.
5. Create a calculator using functions.
6. Simulate ATM transactions (withdrawal, balance check).
7. Generate Fibonacci series up to N terms using recursion.
8. Convert temperature from Celsius to Fahrenheit and vice versa.

**Week-2**

1. Accept a string and reverse it using a function.
2. Display multiplication tables from 1 to N using nested loops.
3. Accept a string and count the frequency of each character.
4. Perform matrix addition and multiplication.
5. Find the factorial of a number using recursion.

**Week-3**

1. Store and display student details using dictionaries.
2. Validate a user-defined password policy.
3. Accept a sentence and count the number of words.
4. Create a login authentication system.
5. Create a contact book using dictionary and functions.
6. Write a program to simulate a library management system.
7. Accept a list of numbers and remove duplicates.

**Week-4**

1. Implement a simple voting system.
2. Accept a list and sort it in ascending and descending order.
3. Accept N names and display them in alphabetical order.
4. Accept N email addresses and validate them using regex.
5. Implement a pattern printing program.
6. Read a text file and count the number of lines and words.
7. Convert binary number to decimal and vice versa.
8. Create a mini-billing system.

**Week-5**

1. Accept a list of tuples and sort them based on the second element.
2. Implement a marks analysis system for N students.
3. Develop a simple calculator using lambda expressions.
4. Create a quiz application using dictionaries.
5. Create a dictionary with product details and implement search.
6. Accept date input and validate it using regex.
7. Implement a string compression and decompression tool.
8. Accept file name and display contents in reverse order.
9. Track attendance of students using sets.

**Week-6**

1. Accept two matrices and perform transpose.
2. Merge two sorted lists into a single sorted list.
3. Develop a mini hospital appointment booking system.
4. Accept a file and replace all spaces with underscores.
5. Simulate a digital clock.
6. Create a bank account class with deposit, withdraw, and balance.
7. Accept a number and check if it is an Armstrong number.
8. Create a basic weather report display using dictionaries.
9. Create a bus ticket booking application.
10. Simulate a parking system using OOP.

**Week-7**

1. Develop a mini email sender simulator (mock only).
2. Manage employee records using file handling.
3. Find common elements in two lists using set operations.
4. Create a menu-driven grocery store billing application.
5. Convert a paragraph to title case.

6. Accept a mobile number and validate its format using regex.
7. Create a dictionary of employees and find the one with max salary.
8. Implement stack and queue using lists.
9. Read and write CSV files.
10. Accept coordinates and calculate distance between two points.
11. Simulate a random OTP generator.
12. Create a grade calculator with dynamic marks entry.

**Text Books:**

1. Reema Thareja, “Python Programming: Using Problem Solving Approach,” Oxford University Press.
2. Dr. R. Nageswara Rao, “Core Python Programming,” Dreamtech Press.
3. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist,” O’Reilly

**Reference Books:**

1. Mark Lutz, “Learning Python,” O’Reilly Media.
2. Wesley J. Chun, “Core Python Applications Programming,” Pearson.
3. Charles Dierbach, “Introduction to Computer Science Using Python,” Wiley.
4. Zed A. Shaw, “Learn Python the Hard Way,” Addison-Wesley

**Useful Links**

- https://www.w3schools.com/python
- https://onlinecourses.nptel.ac.in/noc22_cs26/preview
- https://www.javatpoint.com/python-tutorial
- https://www.tutorialspoint.com/python
- https://www.programiz.com/python-programming
- https://www.geeksforgeeks.org/python-programming-language/

# A2003: ENGINEERING CHEMISTRY LABORATORY

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: Pre-university knowledge**

**Course Objectives:**

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate (KMnO4) using a calibration curve.

**Course Outcomes:**

1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering.
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions.
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6.
5. Students will understand the working principle of colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law).

**UNIT – I: Volumetric Analysis:**

Estimation of Hardness of water by EDTA Complexometry method.

**UNIT – II: Conductometry:**

1. Estimation of the concentration of strong acid by Conductometry..
2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry

**UNIT – III: Potentiometry:**

Estimation of concentration of Fe+2ion by Potentiometry using KMnO4.

**UNIT – IV: pH Metry:**

Determination of an acid concentration using pH meter

**UNIT – V: Preparations:**
Preparation of Bakelite.

**UNIT – VI: Corrosion:**
Determination of rate of corrosion of mild steel in the presence and absence of inhibitor

**UNIT – VII: Virtual lab experiments:**

1. Construction of Fuel cell and it's working
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

# A2505: DATA STRUCTURES LABORATORY

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: Programming for Problem Solving

Course Objectives:

1. Implement basic searching and sorting algorithms..
2. Design linear and non-linear data structures using arrays and linked lists..
3. Solve expression conversion, evaluation, and traversal problems.
4. Apply advanced structures like balanced trees and hashing.
5. Build modular C programs for real-world problem-solving

Course Outcomes:

1. Apply various searching and sorting techniques
2. Implement all operations on different linear data structures
3. Develop all operations on different Non- linear data structures
4. Understand the complexity analysis of linear and nonlinear data structures
5. Implement Various Hashing Techniques
6. Use appropriate data structure for any given problem

List of Experiments:

1. Write a Program to implement
   a) Linear Search b) Jump search c)Binary search d) Interpolation search
2. Write a Program that implements the following sorting methods to sort a given list of integers in ascending order
   i ) Bubble Sort ii) Selection sort iii) Insertion sort iv) Shell Sort v) Radix sort
3. Write a Program that implement stack (its operations) using Arrays
4. Write a Program that uses Stack to
   a) Convert the infix expression to postfix expression
   b) Evaluate the postfix expression
5. Write a Program that implements the following with its operations using Arrays
   a) Queue b) Circular Queue c) Double Ended Queue
6. Write a Program that uses functions to perform the following operations on singly linked list :
   a) Creation b) Insertion c) Deletion d) Traversal
7. Write a Program that uses functions to perform the following operations on doubly linked list :
   a) Creation b) Insertion c) Deletion d) Traversal
8. Write a Program that uses functions to perform the following operations on Circular linked list :
   a) Creation b) Insertion c) Deletion d) Traversal
9. Write a Program that implements the following with its operations using Linked List
   a) Stack b) Queue
10. Write a Program to implement the Binary tree traversal methods
11. Write a Program to implement the following with its operations
    a) Binary Search tree b) AVL tree
12. Write a Program to implement the graph traversal methods
13. Write a Program to implement Separate Chaining, Linear Probing collision

resolution techniques

**Text Books:**

1. *Fundamentals of Data Structures in C*, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press
2. *Data Structures using C* – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

**Reference Books**:

1. *Data Structures: A Pseudocode Approach with C*, 2nd Edition, R. F. Gilberg and B. A. Forouzan, Cengage Learning..

**Useful Links**

- https://onlinecourses.swayam2.ac.in/cec24_cs17/preview
- https://onlinecourses.swayam2.ac.in/cec21_cs02
- https://www.geeksforgeeks.org/data-structures/
- https://www.programiz.com/dsa

# A2406: ELECTRICAL ENGINEERING LABORATORY

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: Introduction to Electrical Engineering**

**Course Objectives:**

1. To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
2. To study the transient response of various R, L and C circuits using different excitations.
3. To determine the performance of different types of DC, AC machines and Transformers.

**Course Outcomes:** After learning, the student must be able to

1. Verify the basic Electrical circuits through different experiments.
2. Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
3. Analyze the transient responses of R, L and C circuits for different input conditions.

**PART – A** (compulsory)

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RLC series and Parallel AC circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

**PART – B** (Any Two)

1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. No-Load Characteristics of a Three-phase Alternator

# A2301: ENGINEERING WORKSHOP

**I Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: Practical Skills**

**Course Objectives:**

1. To introduce students to basic manufacturing processes and workshop practices.
2. To provide hands-on training in carpentry, fitting, welding, sheet metal, and machining
3. To develop skills in using hand tools and measuring instruments.
4. To enhance safety awareness and proper handling of workshop equipment.
5. To build a foundational understanding of industrial production and fabrication.

**Course Outcomes:** At the end of the course, the student will be able to:

1. Understand the basic manufacturing processes and operations.
2. Use hand tools and equipment safely and efficiently.
3. Perform basic operations in carpentry, fitting, welding, sheet metal work, and machining
4. Read and interpret workshop drawings
5. Develop teamwork, time management, and quality awareness in a workshop environment

**1. TRADES FOR EXERCISES:**

**At least two exercises from each trade:**

i. Carpentry: T- Lap Joint, Dovetail Joint, Mortise and Tenon Joint
ii. Fitting: V- Fit, Dovetail Fit and Semi- circular fit
iii. Tin Smithy: Square Tin, Rectangular Tray and Conical Funnel
iv. Foundry: Preparation of Green Sand Mould using Single Piece and Split Pattern
v. Welding Practice: Arc Welding and Gas Welding
vi. House wiring: Parallel and Series, Two-way Switch and Tube Light
vii. Black Smithy: Round to Square, Fan Hook and S- Hook

**2. TRADES FOR DEMONSTRATION AND EXPOSURE:**

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

**Text Books:**

1. Workshop Practice, B. L. Juneja, Cengage Learning India, 1st edition, 2015.
2. Workshop Practice Manual, K. Venkata Reddy, BS Publication,6th Edition, Rpt.2025.

**Reference Books:**

1. Workshop Manual, K. Venugopal, Anuradha Publications, 2012th edition, 2012.

# A2410: PROBABILITY THEORY AND STOCHASTIC PROCESSES

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: Mathematics**

**Course Objectives:**

1. This gives basic understanding of random variables and operations that can be performed on them
2. To know the Spectral and temporal characteristics of Random Process
3. To Learn the Basic concepts of Information theory Noise sources and its representation for understanding its characteristics.

**Course Outcomes:**

1. Perform operations on single and multiple Random variables
2. Determine the Spectral and temporal characteristics of Random Signals
3. Characterize LTI systems driven by stationary random process by using ACFs and PSDs
4. Understand the concepts of Noise and Information theory in Communication systems

**UNIT – I: Probability and Radom Variables**

**Probability**: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events.

**Random Variables**: Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

**UNIT – II: Operations on single Random Variable**

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Computer generation of a Random Variable of a given PDF/CDF.

**UNIT – III: Multiple random variables and Operations on Multiple random variables**

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution (Proof not expected).

Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

**UNIT – IV: Random processes – Temporal characteristics**

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-Order and Wide- Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean- Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross- Correlation Function and Its Properties, Covariance Functions, Gaussian
Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output

**UNIT – V: Random processes – Spectral characteristics**

**The Power Spectrum**: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

**Noise sources**: Resistive / Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

**TEXT BOOKS:**

1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles - TMH, 4th Edition
2. Murray R Spiegel, John Schiller, R Alu Srinivasan. – Probability and Statistics – Schaum's Outlines, 2nd Edition, TMH

**REFERENCE BOOKS:**

1. P Ramesh Babu - Probability Theory and Random Processes – McGraw Hill Education
2. Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes – McGraw Hill Education, 4th Edition
3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly - Probability Theory and Stochastic Processes for Engineers - Pearson, 1st Edition, 2011
4. Taub and Schilling - Principles of Communication systems by (TMH), 2008
5. Y Mallikarjuna Reddy - Probability Theory and Stochastic Processes, 4th Edition, University Press

# A2411: SIGNALS AND SYSTEMS

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: Mathematics**

**Course Objectives:**

1. Classify signals and systems and their analysis in time and frequency domains
2. Study the concepts of distortion less transmission through LTI Systems, convolution and correlation properties
3. Understand Laplace and Z-transforms their properties for analysis of signals and systems
4. Identify the need for sampling of CT signals, types and merits and demerits of each type

**Course Outcomes:**

1. Characterize various signals, systems and their time and frequency domain analysis, using transform techniques
2. Identify the conditions for transmission of signals through systems and conditions for physical realization of systems.
3. Understand the significance of sampling theorem for baseband and band pass signals for various types of sampling and for different duty cycles
4. Understand the concept of correlation and PSD functions and their applications

**UNIT – I: Signal Analysis**

Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function

**UNIT – II: Fourier Series and Transforms**

**Fourier series**: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms**: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

**UNIT – III: Signal Transmission through Linear Systems**

System & Types of System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time.

**UNIT – IV: Laplace Transforms and Correlation**

**Laplace Transforms:** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Correlation:** Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Parseval's Theorem

**UNIT – V: Z-Transforms & Sampling Theorem**

**Z–Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

**Sampling theorem:** Graphical and analytical proof of Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing

**TEXT BOOKS:**

1. Signals, Systems & Communications -B.P. Lathi, BS Publications
2. Signals and Systems – Allan. V. Oppenheim, Allan. S. Willsky with S. Hamid. Nawab, 2nd Ed. Pearson.

**REFERENCE BOOKS:**

1. Signals and Systems–Simon Haykin, Barry Van Veen, 2nd Ed., Wiley
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH
3. Fundamentals of Signals and Systems – Michel J. Roberts, Govind Sharma, 2nd Ed., MGH
4. Signals, Systems and Transforms - Charles. L. Philips, John M. Parr and Eve A. Riskin, 4th Ed., 2004, Pearson, Prentice Hall

# A2401: ELECTRONIC DEVICES AND CIRCUITS

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 10+2 Physics**

**Course Objectives:**

1. To impart knowledge of semiconductor diodes, their electrical characteristics, and practical applications such as rectifiers, regulators, clippers, and clampers in electronic circuits.
2. To explain the structure, working principles, and characteristics of Bipolar Junction Transistors (BJT) in different configurations and enable students to analyze their input-output behavior using h-parameters.
3. To develop an understanding of BJT biasing techniques and the importance of stabilization, load line, and thermal considerations in ensuring reliable transistor operation.
4. To introduce the concept of transistor amplifiers and equip students with analytical skills to evaluate small-signal models and performance parameters of CE, CB, and CC amplifiers.
5. To familiarize students with special-purpose diodes, FETs, MOSFETs, and advanced nanoelectronic devices (such as FinFETs and CNTFETs), highlighting their structures, operations, and comparative advantages in modern VLSI applications.

**Course Outcomes:**

1. Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits
2. Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics
3. Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications
4. Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations
5. Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations

**UNIT – I: Diode Characteristics and Applications**

PN junction diode – I-V characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piecewise Linear), Rectifiers – Half-wave, Full-wave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode – I-V characteristics and voltage regulation

**UNIT – II: Bipolar Junction Transistor (BJT)**

Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics

**UNIT – III: BJT Biasing**

Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed

bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

**UNIT – IV: Transistor Amplifiers**
Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor.

**UNIT – V: Special Devices**
**Special Purpose Diodes**: Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode
**Field Effect Transistors and Advanced Devices:** JFET: Structure, operation, and characteristics
**MOSFET:** Enhancement and Depletion modes – Structure, operation, and characteristics
**Advanced Devices**: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET

**TEXT BOOKS:**

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. Tata McGraw-Hill, 1991.
2. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. Pearson, 11th ed., 2013.
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. Oxford University Press, 7th ed., 2014.

**REFERENCE BOOKS:**

1. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 5th ed., 2008
2. Neamen, Donald A. Electronic Circuit Analysis and Design. McGraw-Hill, 2nd ed., 2001.
3. Salivahanan, S., and N. Suresh Kumar. Electronic Devices and Circuits. McGraw-Hill Education, 4th ed., 2017.
4. Razavi, Behzad. Fundamentals of Microelectronics. Wiley, 2nd ed., 2013.
5. Taur, Yuan, and Tak H. Ning. Fundamentals of Modern VLSI Devices. Cambridge University Press, 2nd ed., 2009.

# A2413: DIGITAL LOGIC DESIGN

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: Mathematics**

**Course Objectives:**

1. To introduce the fundamentals of number systems, binary arithmetic, and error detection/correction techniques for reliable digital system design.
2. To develop the ability to apply Boolean algebra and gate-level minimization techniques for the simplification and efficient implementation of logic functions.
3. To provide knowledge of combinational logic circuit design and analysis, including arithmetic circuits, comparators, decoders, encoders, multiplexers, and demultiplexers.
4. To impart understanding of sequential logic circuits and their design methodologies, covering latches, flip-flops, counters, and shift registers with practical applications.
5. To familiarize students with synchronous sequential logic, state machine modeling, and programmable logic devices (PLA, PAL, ROM, RAM) for the design of real-world digital systems.

**Course Outcomes:**

1. Apply Boolean algebra and minimization techniques to simplify Boolean functions
2. Design combinational circuits using logic gates.
3. Analyze latches and flip-flops to design sequential logic circuits
4. Construct synchronous sequential circuits combining flip-flops and logic gates
5. Utilize programmable logic devices in digital system design

**UNIT – I: Number Systems and Boolean Algebra**

**Number Systems**: Binary, Octal, Decimal, Hexadecimal, Fixed-point and Floating-point Number Representations, Complements of Numbers: 1's and 2's Complement, Error Detection and Correction

**Codes**: Parity Check, Hamming Code.

**Boolean Algebra and Logic Gates**: Axiomatic definitions, basic theorems and properties,

**Boolean Functions**: Canonical and standard forms, Digital Logic Gates Overview.

**UNIT – II: Gate-Level Minimization Techniques**

**Karnaugh maps:** 2, 3, and 4 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, Don't care conditions, Implementation using NAND and NOR gates

**UNIT – III: Combinational Logic Circuits**

Analysis and design procedures, Binary adder-subtractor and BCD adder, magnitude comparator, decoders, encoders, multiplexers and demultiplexers

**UNIT – IV: Sequential Logic Circuits - I**

Gated latches, Flip-flops: Clocked S-R, D, T, JK, Master-Slave JK, Design of synchronous and asynchronous counters, Shift registers: types and applications

**UNIT – V: Sequential Logic Circuits – II**

**Synchronous Sequential Logic**: Moore and Mealy state machines, State diagrams, state tables, and state reduction, Case studies: sequence detector, traffic light controller, vending

machine.

**Programmable Logic Devices:** Memory devices - RAM, ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

**TEXT BOOKS:**

1. M. Morris Mano, Michael D. Ciletti, Digital Design with an Introduction to the Verilog HDL, 6th Edition, Pearson Education/PHI, 2017

**REFERENCE BOOKS:**

1. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital Systems: Principles and Applications, 10th Edition, Pearson Education.
2. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, 6th Edition, Cengage Learning.

# A2415: CONTROL SYSTEMS

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Pre-requisite: Mathematics, Network Analysis & Synthesis**

**Course Objectives:**

1. To introduce the fundamental concepts, classifications, and mathematical modeling of control systems for mechanical and electrical domains
2. To analyze control system behaviour in time and frequency domains and stability criteria using root locus, Bode plot, Nyquist plot, etc.
3. Design and evaluate compensators and controllers to improve system performance
4. Explain state-space representation, solution of state equations, and assess system controllability and observability.

**Course Outcomes:**

1. Describe open- and closed-loop systems, and develop mathematical models using block diagrams and signal flow graphs
2. Analyze time response of second-order systems using time-domain specifications, and assess stability using Routh-Hurwitz criterion and root locus techniques.
3. Analyse frequency response plots including Bode, Polar, and Nyquist plots, and investigate system stability
4. Design compensators and controllers to meet specific performance criteria in control systems
5. Apply the state-variable approach and analyze controllability and observability

**UNIT – I: Control System fundamentals**

Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs

**UNIT – II: Time response Analysis**

**Time response Analysis:** Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability.

**Root locus techniques:** Analysis of typical systems using root locus techniques. Effect of location of roots on system response

**UNIT – III: Frequency response Analysis**

Frequency domain specifications, bode plots, Gain margin and Phase Margin. Polar plot, Nyquist plot, and Nyquist criterion for stability

**UNIT – IV: Compensators and Controllers**

Introduction to compensators, Lag compensator, Lead compensator, Lag- Lead compensator, Design of compensators using bode plot. Introduction to controllers, P, I, D, PI, PD, PID controllers

**UNIT – V: State space representation**

Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability

**TEXT BOOKS:**

1. I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009
2. Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010

**REFERENCE BOOKS:**

1. K. Ogata, Modern Control Engineering, 2ed. Prentice Hall, 2010.
2. M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997
3. Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007
4. A.K. Jairath, Solutions and Problems of Control Systems, CBS Publishers, 2013.
5. A. Nagoor Kani, Control Systems, 2ed., RBA Publications, 2007

# A2015: INNOVATION AND ENTREPRENEURSHIP

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Pre-requisite: Nil**

**Course Objectives:**

1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies

**Course Outcomes:**

1. Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
2. Assess the problem from an industry perspective and generate solutions using the design thinking principles.
3. Assess market competition, estimate market size, and develop a prototype.

**UNIT I: Fundamentals of Innovation and Entrepreneurship**

**Innovation:** Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.

**Entrepreneurship:** Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.

**Core Teaching Tool:** Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

**UNIT II: Problem and Customer Identification**

Identification of gap, problem, analyzing the problem from an industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Idea generation,

**Ideation techniques:** Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.

**Core Teaching Tool:** Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

**UNIT - III: Opportunity assessment and Prototype development**

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.

Understanding prototyping and Minimum Viable Product (MVP).
**Developing a prototype:** Testing, and validation.
**Core Teaching Tool:** Venture Activity, no-code Innovation tools, Class activity.

**UNIT – IV: Business & Financial Models**
Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup.
**Business planning:** components of Business plan- Sales plan, People plan and financial plan,
**Financial Planning:** Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.
**Core Teaching Tool:** Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

**UNIT – V: Startups and IPR**
Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.
Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property.
**Patent Rights:** Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.
**Core Teaching Tool:** Expert talks; Cases; Class activity and discussions; Venture Activities.

**Suggested Readings:**

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Stratup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
6. 6. NISP -Brochure inside pages - startup policy 2019.pdf

# A2412: MODELING AND SIMULATION LAB

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: Signals & Systems, Probability Theory and Stochastic Processes**

**Course Objectives:**

1. To develop practical skills in signal generation, transformation, and analysis (both continuous and discrete) using MATLAB/Simulink or equivalent tools.
2. To provide hands-on experience in system characterization and response analysis, including linearity, time invariance, stability, frequency response, Fourier/Laplace/Z-transforms, and pole-zero analysis.
3. To apply probability theory and stochastic processes in simulating and analyzing random variables, Gaussian noise, sampling theorem verification, and noise removal techniques.
4. To introduce the modeling and simulation of control systems (such as DC motors and PID controllers) and to analyze their controllability and observability using modern computational tools.

**Course Outcomes:** After learning the contents of this paper the student must be able to

1. Use a simulation tool for generating, analyzing and performing various operations on Signals / Sequences both in time and Frequency domain.
2. Use a simulation tool for generating, analyzing and performing various operations on Signals / Sequences both in time and Frequency domain
3. Use a simulation tool for generating different Random Signals; analyze their Characteristics by finding different higher order Moments and noise removal applications
4. use a simulink for Control System applications

**PART – A** (Signals & Systems) – Minimum 7 Experiments

1. Write the code / script for generating various standard viz: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using Waveform synthesis. Also for perform different operations viz: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them
2. Write the code / script for finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal.
3. Write the code / script for finding the output of a System for a given input and Impulse Response and finding Auto Correlation and Cross Correlation of Signals / sequences
4. Write the code / script for Verifying whether a given Continuous/Discrete System is Linear, Time Invariant, Stable and Physically Realizable
5. Write the code / script for obtaining Sinusoidal response and Impulse response of a given Continuous / Discrete LTI System. a) Plot the Real and Imaginary part and b) Magnitude and Phase Plot of the response
6. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Fourier Transform by using the properties where ever required.
7. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any

given Signal by finding its Laplace Transform by using the properties where ever required. Also plot pole-zero diagram in S-plane

8. Write the code/ script for finding and plotting the Magnitude and Phase Spectrum of any given Sequence by finding its Z-Transform by using the properties wherever required. Also plot pole – zero diagram in Z-plane
9. Design a Simulink or equivalent model for a) Solving Differential Equations b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses
10. Gibbs Phenomenon and waveform synthesis

**PART – B** (Probability Theory & Stochastic Processes) – Minimum 3 Experiments

11. Write the code / script for generating various Random Variables with different CDFs/ PDFs
12. Write the code / script for generating Gaussian noise and for finding its mean, Skewness, Kurtosis, PDF and PSD.
13. Write the code / script for Verifying Sampling theorem for different sampling rates, Sampling types and Duty Cycles and for plotting the sampled and reconstructed Signals
14. Write the code / script for Removal of noise from the signal using Cross correlation.
15. Write the code / script for Extraction of Periodic Signal masked by noise using Auto Correlation

**PART – C** (Control Systems) – Minimum 2 Experiments

16. Build and Simulate a DC Motor using Simulink
17. Implementation of a PID Controller from equations using Simulink
18. Controllability and Observability

**Application on Real Time Signals**

1. Application of Autocorrelation: GPS Synchronization Satellite communication toolbox is required for this experiment. Generate the GPS signal. Visualize the GPS signal. Plot of autocorrelation of C/A code and visualize the spectrum of GPS signals. For exact steps, go through the following page: https://www.mathworks.com/help/satcom/ug/gps-waveform-generation.html
2. Sampling of Speech Signals Record and play speech in MATLAB. For steps, go through the following page: https://in.mathworks.com/help/matlab/import_export/record-and-play-audio.html Change the sampling rate of the recorded speech signal and play back to see the effect of aliasing. For steps, go through the following page: https://in.mathworks.com/help/signal/ug/changing-signal-sample-rate.html

Note: For the experiments with code/scripts written in SCILAB / MATLAB or equivalent (1-8, 11-15), the student can design a user interface or app using SCILAB / MATLAB App Designer or equivalent

# A2402: ELECTRONIC DEVICES AND CIRCUITS LAB

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: Electronic Devices and Circuits**

**Course Objectives:**

1. To understand the fundamental characteristics of semiconductor devices such as diodes, BJTs, JFETs, and MOSFETs through experimental analysis in different biasing and circuit configurations.
2. To design, implement, and analyze basic electronic circuits including rectifiers, regulators, amplifiers, clippers, clampers, and digital inverters using both hardware and simulation tools.
3. To develop proficiency in the use of laboratory equipment and simulation software (e.g., CRO/DSO, function generator, LTSpice, Multisim, Proteus, PSPICE) for testing, measurement, and verification of electronic circuits.
4. To enhance problem-solving and circuit-level design skills by correlating theoretical concepts with practical implementation, thereby preparing students for advanced courses in analog and digital electronics.

**Course Outcomes:** After learning the contents of this subject the student must be able to

1. Analyze the I–V characteristics of semiconductor devices such as diodes, BJTs, and FETs
2. Design and evaluate basic rectifier, clipper, clamper, and voltage regulation circuits.
3. Demonstrate biasing techniques for BJTs and determine their operating point using DC load line analysis.
4. Design and analyze transistor amplifier circuits in various configurations using h-parameter models
5. Simulate and interpret electronic circuits using appropriate simulation tools.

**PART – A** (Hardware Based)

1. Study the I–V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
5. Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance and current gain.
6. Design and test fixed bias and voltage divider bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior
7. Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain (α) and input/output resistance

**PART – B** (Software Based)

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
3. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification
4. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
5. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and transconductance.
6. Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
7. Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

**Hardware Requirements:**

1. Regulated DC Power Supply (0–30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

**Software Requirements (Any one of the listed tools or equivalent):**

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

# A2414: DIGITAL LOGIC DESIGN LAB

**II Year I Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: Digital Logic Design**

**Course Objectives:**

1. To understand the fundamentals of digital logic design by realizing basic combinational and sequential circuits using standard logic ICs in the hardware laboratory.
2. To develop the ability to design and implement combinational and sequential circuits such as adders, subtractors, code converters, multiplexers, decoders, shift registers, and counters using both gates and HDL.
3. To acquire proficiency in Verilog HDL programming by applying different modeling styles (dataflow, behavioral, and structural) for the simulation and verification of digital systems.
4. To strengthen problem-solving and design skills in digital electronics by bridging theory, hardware realization, and HDL simulation, thereby preparing students for advanced courses in VLSI and digital system design.

**Course Outcomes:** After learning the contents of this paper the student must be able to

1. Analyze and simplify Boolean expressions and implement them using logic gates and ICs
2. Design and realize combinational and sequential logic circuits using logic gate hardware.
3. Model digital systems in Verilog HDL using dataflow, behavioral, and structural styles.
4. Simulate and verify digital designs using industry-standard EDA tools and testbenches.
5. Build modular and hierarchical designs such as counters, FSMs, and shift registers.

**PART – A** (Hardware Based)

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.
3. Construct and analyze basic logic gates (AND, OR, NOT, XOR, XNOR) using only NAND and NOR gates.
4. Design and implement parity bit generators (even and odd) and a 4-input majority logic circuit.
5. Design and implement code converters such as Binary to Gray, Gray to Binary, and BCD to Excess-3 using gates.
6. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7-segment decoder logic

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.

**PART – B** (Software Based)

1. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7-segment decoder logic
2. Implement a 2:1 multiplexer using dataflow modeling and design an 8:1 multiplexer using structural modeling.
3. Design a 2-to-4 decoder using dataflow modeling and realize a 3-to-8 decoder using structural modeling.
4. Implement a given Boolean function using a decoder-based approach in behavioural modeling.
5. Design and simulate a universal n-bit shift register (left, right, hold, parallel load) using behavioural modeling
6. Design a synchronous MOD-n counter using behavioural modeling with D or JK flip-flops
7. Design and simulate an asynchronous (ripple) counter for a custom sequence using structural modeling.
8. Implement a sequence detector for a given binary pattern using FSM (Moore/Mealy) in behavioural modeling.

**Required Hardware (for Hardware Lab Experiments)**

| Component | Description |
|---|---|
| Digital Trainer Kit | Breadboard with power supply and clock generator |
| Logic ICs | 7400 (NAND), 7402 (NOR), 7408 (AND), 7432 (OR), 7486 (XOR), 7404 (NOT), etc |
| Flip-Flop ICs | 7474 (D Flip-Flop), 7476 (JK Flip-Flop) |
| MUX/Decoder ICs | 74153, 74138, 74139 |
| LEDs, switches, connecting wires | For I/O interface and testing |

**Required Software Tools (for Verilog HDL Experiments) (Any one of the tool below)**

| Software | Purpose |
|---|---|
| Xilinx ISE | For Simulation and FPGA design |
| ModelSim | Verilog simulation and waveform analysis |
| Xilinx Vivado | HDL simulation and synthesis |

# MA401BS: NUMERICAL METHODS AND COMPLEX VARIABLES

**II Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: Mathematics Courses of First Year of Study**

**Course Objectives:** To learn

1. Expressing periodic function by Fourier series and anon-periodic function by Fourier transforms
2. Various numerical methods to find roots of polynomial and transcendental equations.
3. Concept of finite differences and to estimate the value for the given data using interpolation.
4. Evaluation of integrals using numerical techniques.
5. Solving ordinary differential equations of first order using numerical techniques.
6. Differentiation and integration of complex valued functions.
7. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
8. Expansion of complex functions using Taylor's and Laurent's series.

**Course Outcomes:** After learning the contents of this paper, the student must be able to

1. Express any periodic function in terms of sine and cosine.
2. Find the root of a given polynomial and transcendental equations.
3. Estimate the value for the given data using interpolation
4. Find the numerical solutions for a given first order ODE's
5. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
6. Taylor's and Laurent's series expansions in complex function.

**UNIT – I: Fourier Series & Fourier Transforms**

Fourier series–Dirichlet's Conditions–Half-range Fourier series–Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

**UNIT – II: Numerical Methods-I**

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton – Raphson method and Regula-Falsi method.

Finite differences: forward differences –backward differences –Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

**UNIT – III: Numerical Methods-II**

Numerical integration: Trapezoidal rule-Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Ordinary differential equations: Taylor's series, Euler's method, Runge-Kutta method of fourth order for first order ODE.

**UNIT – IV: Complex Differentiation**

Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), Harmonic Functions , Finding harmonic conjugate , Milne-Thomson method,

Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

**UNIT – V: Complex Integration**

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series. Residues, Cauchy Residue theorem (All theorems without Proof).

**TEXT BOOKS:**

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,36th Edition,2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition,2005.

**REFERENCE BOOKS:**

1. MurrayR.Spiegel,Ph.D.,SeymourLipschutz,Ph.D.,JohnJ.Schiller,Ph.D.,Dennis Spellman, Ph.D., Complex Variables (Schaum's outline).
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley &Sons, 2006
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

# A2417: ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

**II Year II Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: Mathematics**

**Course Objectives:**

1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields and apply them to solve physics and engineering problems
2. To distinguish between static and time-varying fields and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems
3. To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media
4. To analyze the propagation of waves in transmission line and able to solve transmission line problem using Smith Chart.

**Course Outcomes:**

1. Acquire knowledge of Basic Laws, Concepts and solve problems related to Electrostatic Fields and Magnetostatics Fields
2. Differentiate the static and time-varying EM fields and apply Maxwell's Equations at different Boundaries.
3. Able to classify conductors and dielectric materials and analyze the Wave Propagations in those mediums.
4. To solve transmission line problems numerically and using smith charts

**UNIT – I: Electrostatics**

Review of Coordinate Systems & Vector Calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its applications, Electric Potential, Relation between E and V, Maxwell's Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors–Parallel Plate, Coaxial, Spherical.

**UNIT – II: Magnetostatics**

Biot-Savart's Law, Ampere's Circuit Law and its applications, Magnetic Flux Density, Maxwell's equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

**UNIT – III: Maxwell's Equations (Time Varying Fields)**

Faraday's Law, Transformer and Motional EMF, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations in Differential, Integral and Phasor form. Electric and magnetic Boundary Conditions (Dielectric – Dielectric, Conductor–Dielectric, Conductor–Free Space interfaces).

**UNIT – IV: EM Wave Characteristics**

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves–Definitions, Relation between E&H, Wave Propagation in Lossless and Conducting Media,

Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin Depth, Surface Impedance, Wave Polarization. Poynting Vector and Poynting Theorem. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection

**UNIT – V: Transmission Lines**

Types, Parameters, Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless Lines, Types of Distortions, condition for Distortion less transmission lines, Minimum Attenuation, Loading – Types of Loading, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Impedance Transformations - $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Smith Chart-Configuration and Applications, Single Stub Matching.

**TEXT BOOKS:**

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck,8th Ed., McGrawHill,2014
2. Principles of Electromagnetics –Matthew N.O. Sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Asian Edition, 2015.

**REFERENCE BOOKS:**

1. Electromagnetic Waves and Radiating Systems–E.C. Jordan and K.G. Balmain,2nd Ed., PHI,2000.
2. Engineering Electromagnetics – NathanIda, 2ndEd., Springer (India) Pvt. Ltd., New Delhi,2005
3. Electromagnetic Field Theory Fundamentals –Bhag Singh Guru and Husey in R. Hiziroglu, Cambridge University Press, 2nd Ed., 2006

# A2418: ANALOG AND DIGITAL COMMUNICATIONS

**II Year II Sem**

| L | T | P | C |
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**Pre-requisite: Signals & Systems**

**Course Objectives:**

1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers
4. To understand the concepts of baseband transmissions

**Course Outcomes:**

1. Design and analyze various Analog and digital Modulation and Demodulation techniques
2. Understand the effect of noise present in continuous wave Modulation techniques
3. Understand the concept of Super heterodyne Receiver and Pulse Modulation Techniques
4. Analyze and design the various coding techniques and Base band Transmission

**UNIT – I: Modulation Techniques – I**

**Amplitude Modulation**: Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation – Switching modulator, Detection - Envelope detector, DSB-SC Modulation: Generation – Balanced Modulator, Detection- Synchronous detector, COSTAS Loop, SSB Modulation: Time and frequency domain description, Generation – Phase discrimination Method and Demodulation – coherent detection, Vestigial side band modulation and demodulation.

**Angle Modulation**: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson's Rule, Generation of FM Waves- Armstrong Method, Detection of FM Waves - Phase locked loop, Comparison of FM and AM

**UNIT – II: Modulation Techniques – II**

**Transmitters & Receivers:** Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Stereo FM multiplex reception, Comparison of AM and FM Receiver. Noise analysis in AM, DSB, SSB and FM Modulation System, Threshold effect in Angle Modulation System, Pre- emphasis, and de-emphasis

**Pulse Modulation**: Types of Pulse modulation-PAM, PWM and PPM, Comparison of FDM and TDM

**UNIT – III: Detection, Estimation and Transmission**

**Detection and Estimation:** Model of Digital Communication Systems, Geometric

Interpretation of Signals, Gram-Schmidt Orthogonalization, Response of Bank of correlators to Noisy Input, Detection of Known Signals in Noise, Probability of error, Optimum Receivers Using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Detection of signals with unknown Phase in Noise

**Base Band Shaping for Data Transmission:** Requirements of a line encoding format, various line encoding formats- Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist's criterion, Correlation coding: Duobinary signaling, Modified Duobinary technique, generalized form of correlation coding, Eye pattern.

**UNIT – IV: Digital Modulation Techniques**

PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM. Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Coherent quadrature modulation techniques (QPSK), Non-Coherent binary modulation techniques (BFSK, DPSK), QAM, M-ary modulation techniques (PSK, FSK, QAM), Comparison of M-ary digital modulation techniques, power spectra, bandwidth efficiency, constellation diagrams

**UNIT – V: Information theory and Source Coding**

**Information theory:** Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR.

**Source coding**: Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.

**TEXT BOOKS:**

1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, PHI, 2009.
2. Digital and Analog Communication System – K. Sam Shanmugam, Wiley, 2019
3. Principles of Communication Systems - Herbert Taub, Donald L Schiling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.

**REFERENCE BOOKS:**

1. Electronic Communications – Dennis Roddy and John Coolean, 4th Edition, PEA, 2004
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH, 2004
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5th edition, 2022

# A2420: LINEAR AND DIGITAL IC APPLICATIONS

**II Year II Sem**

| L | T | P | C |
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**Pre-requisite: Digital Logic Design**

**Course Objectives:**

1. To introduce the basic building blocks of linear integrated circuits
2. To introduce the theory and applications of analog multipliers and PLL
3. To introduce the concepts of waveform generation and introduce some special function ICs.
4. To understand and implement the working of basic digital circuits

**Course Outcomes:**

1. A thorough understanding of operational amplifiers with linear integrated circuits.
2. Attain the knowledge of functional diagrams and design applications of IC555andIC565
3. Acquire the knowledge and design the Data converters
4. Understanding of the different families of digital integrated circuits and their characteristic

**UNIT – I: Operational Amplifier**

Ideal and Practical Op-Amp Characteristics, Features of 741 Op- Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators

**UNIT – II: Op-Amp, IC-555 & IC565 Applications**

Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, principle and Applications

**UNIT – III: Data Converters**

Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2Rladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications

**UNIT – IV: Combinational Logic ICs**

Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators

**UNIT – V: Sequential Logic IC's and Memories**

Familiarity with commonly available 74XX & CMOS40XX Series ICs– All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

**TEXT BOOKS:**

1. Op-Amps & Linear ICs– Ramakanth A. Gayakwad, PHI, 2003
2. Digital Fundamentals – Floydand Jain, Pearson Education, 8th Ed., 2005.

**REFERENCE BOOKS:**

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003
2. Digital Design Principles and Practices–John. F. Wakerly, Pearson 3rd Ed., 2009.
3. Linear Integrated Circuits and Applications – Salivahana, TMH, 2008
4. Operational Amplifiers with Linear Integrated Circuits, 4th Ed., William D. Stanley, Pearson Education India, 2009.

# A2422: ELECTRONIC CIRCUIT ANALYSIS

**II Year II Sem**

| L | T | P | C |
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**Pre-requisite: Electronic Devices and Circuits**

**Course Objectives:**

1. To provide an understanding of multistage amplifiers and high-frequency transistor models with emphasis on frequency response, bandwidth, and distortion analysis.
2. To explain the principles of feedback in amplifiers and analyze the effects of various feedback configurations on gain stability, bandwidth, noise, and distortion.
3. To impart knowledge of oscillator design and operation, including LC, RC, and crystal oscillators, based on positive feedback and Barkhausen's criterion.
4. To develop the ability to analyze and design different classes of power amplifiers with considerations of efficiency, distortion, and practical applications.
5. To familiarize students with transistor-based multivibrators and time base generators and their role in waveform generation and timing applications.

**Course Outcomes:**

1. Analyze and classify multistage amplifier configurations and determine the impact of coupling schemes on amplifier performance and frequency response.
2. Apply the hybrid-π transistor model to evaluate high-frequency behavior of common-emitter amplifiers and calculate gain-bandwidth product.
3. Examine feedback amplifier types and assess the influence of negative feedback on gain stability, bandwidth, and distortion.
4. Design and analyze LC, RC, and crystal oscillators based on the Barkhausen criterion to generate sinusoidal waveforms.
5. Design power amplifiers and multivibrator circuits, and evaluate their performance in terms of efficiency, distortion, and waveform generation

**UNIT – I: Multistage Amplifiers and High Frequency Transistor Model**

**Multistage Amplifiers**: Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of multistage amplifiers, Transistor configuration choice in cascade amplifiers, Cascade and Cascode amplifiers, Darlington pair amplifier.

**High-Frequency Transistor Model**: Hybrid-π model, Hybrid-π parameters: Conductances and capacitances, CE short-circuit current gain, Gain with resistive load and gain-bandwidth product

**UNIT – II: Feedback Amplifiers**

Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, Characteristics of negative feedback: Gain stability, bandwidth, noise, distortion, Voltage series, Voltage shunt, Current series, Current shunt configurations

**UNIT – III: Oscillators**

Principle of positive feedback, Barkhausen Criterion for oscillations, LC Oscillators: Generalized analysis, Hartley, Colpitts, RC Oscillators: RC phase shift, Wien bridge, Crystal oscillator: Working and advantages

**UNIT – IV: Power Amplifiers**

**Classification:** Class A, B, AB, C, Series-fed Class A amplifier, **Transformer**- coupled Class A amplifier, Class B amplifier: Push-pull, Complementary symmetry, Efficiency calculations and Crossover distortion

**UNIT – V: Multivibrators & Time Base Generators**

**Multivibrators**: Analysis and design of Bistable, Monostable and Astable multivibrators and Schmitt Trigger using transistors.

**Time Base Generators:** General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Linearity improvement techniques

**TEXT BOOKS:**

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. McGraw-Hill Education, 2008.
2. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 2008
3. Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. 7th ed., Oxford University Press, 2015

**REFERENCE BOOKS:**

1. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2013.
2. Millman, Jacob, and Arvin Grabel. Microelectronics. 2nd ed., McGraw-Hill, 1987
3. Malvino, Albert Paul. Electronic Principles. 7th ed., McGraw-Hill Education, 2007
4. Millman, Jacob, and Herbert Taub. Pulse, Digital, and Switching Waveforms. McGraw-Hill Education, 1991

# A2012: COMPUTATIONAL MATHEMATICS LAB

**II Year II Sem**

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**Pre-requisite: Matrices, Iterative Methods and Ordinary Differential Equations**

**Course Objectives:**

1. Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
2. Solution of Algebraic and Transcendental Equations using Python/MATLAB
3. Solve problems of Linear system of equations
4. Solve problems of First-Order ODEs Higher order linear differential equations with constant

**Course Outcomes:**

1. Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
3. Write the code to solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients

**UNIT - I: Eigen values and Eigenvectors:**

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

**UNIT – II: Solution of Algebraic and Transcendental Equations**

Bisection method, Newton Raphson Method Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

**UNIT-III: Linear system of equations:**

Jacobi's iteration method and Gauss-Seidal iteration method Programs:

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidal method

**UNIT-IV: First-Order ODEs**

Exact and non-exact equations, Applications: exponential growth/decay, Newton law of cooling.

Programs:

- Solving exact and non-exact equations
- Solving exponential growth/decay and Newton law of cooling problems

**UNIT-V: Higher order linear differential equations with constant coefficients**

Programs:

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

**TEXT BOOKS:**

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

**REFERENCE BOOKS:**

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

# A2419: ANALOG AND DIGITAL COMMUNICATIONS LAB

**II Year II Sem**

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**Pre-requisite: Analog and Digital Communications**

**Course Objectives:**

1. To understand and analyze fundamental analog and digital modulation techniques (AM, FM, PM, DSB-SC, SSB-SC, FSK, PSK, QPSK, DPSK) and their demodulation through hardware implementation and simulation.
2. To design and implement multiplexing, sampling, and pulse modulation schemes (PAM, PWM, PPM, PCM, Delta modulation) and study their practical performance through waveform, spectrum, and reconstruction analysis.
3. To gain proficiency in advanced communication system analysis tools by simulating eye diagrams, constellation diagrams, raised cosine, duobinary signals, and matched filters under noisy environments.
4. To develop problem-solving and design skills in digital communication systems by applying coding techniques (Shannon–Fano, Huffman) and performance evaluation methods, bridging theoretical knowledge with practical implementation.

**Course Outcomes:** After learning the contents of this paper the student must be able to

1. Design and implement various Analog modulation and demodulation Techniques and observe the time and frequency domain characteristics of these modulated Signals
2. Design and implement various Pulse modulation and demodulation Techniques and observe the time and frequency domain characteristics of these modulated Signals
3. Understand the concept of aliasing and different types of Sampling with various Sampling rates and duty Cycles by implementing practically
4. Design and implement various Digital modulation and demodulation Techniques and observe the waveforms of these modulated Signals practically

**List of Experiments**

**Minimum 12 Experiments to be conducted**

**All the experiments are to be simulated first using SCILAB/MATLAB/COMMSIM or any other simulation package and then realized in hardware**

1. Generate Amplitude modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
2. Generate Frequency modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index
3. Generate modulated and demodulate DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically
4. Generate and demodulate SSB-SC modulated Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate

theoretically and practically the modulation index in each case
5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting at least 4 different signals simultaneously with respect to time and recovering without distortion.
6. Verify Sampling theorem for different sampling rates, Sampling types and Duty Cycles and Plot the sampled and reconstructed Signals. Write the conclusions, based on practical observations
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
8. Design and implement a Pulse Width Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
9. Design and implement a Pulse Position Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
10. Generate PCM Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations
11. Generate Delta Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations
12. Generate FSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
13. Generate practically Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate practically DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate practically QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot Signal Constellation for BPSK, BFSK and QPSK
17. Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram
18. Demonstrate ISI through eye diagram
19. Simulate raised cosine signal and duo binary signals
20. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
21. Analyze the performance of a Matched filter.

# A2421: LINEAR AND DIGITAL IC APPLICATIONS LAB

**II Year II Sem**

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**Pre-requisite: Linear and Digital IC Applications**

**Course Objectives:**

1. To understand the applications of analog integrated circuits by designing and analyzing amplifiers, filters, oscillators, waveform generators, voltage regulators, and modulation/demodulation circuits.
2. To design and implement combinational and sequential digital circuits such as adders, subtractors, encoders, decoders, multiplexers, counters, registers, and memory using standard logic ICs.
3. To develop practical skills in interfacing analog and digital systems by constructing DACs, ADCs, and code converters, and verifying their functionality through truth tables, waveforms, and performance analysis.
4. To enhance circuit design, problem-solving, and experimental verification skills by correlating theoretical concepts with hardware implementation for real-world electronic system design.

**Course Outcomes:** After learning the contents of this paper the student must be able to

1. Design and implementation of various analog circuits using 741 ICs
2. Design and implementation of various Multivibrators using 555 timer
3. Design and implement various circuits using digital ICs
4. Design and implement ADC, DAC and voltage regulators.

**Minimum 12 Experiments to be conducted**
**Verify the functionality of the IC in the given application.**
**List of Experiments**

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op-Amp and draw the comparison results of A=B, A<B, A>B
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHz and find the roll off of it.
6. Design a Circuit using IC741 to generate sine / square / triangular wave with period of 1KHz and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct Astable Multivibrator using IC 555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Frequency modulator and demodulator circuit and draw the respective waveforms.
11. Design Voltage Regulator using IC723, IC 7805 / 7809 / 7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type / counter type / successive approximation ADC and find

its efficiency.

14. Design a Gray code converter and verify its truth table.
15. Design an even priority encoder using IC74xx and verify its truth table.
16. Design a 8x1multiplexer using digital ICs.
17. Design a 4-bit Adder / Subtractor using digital ICs and Add / Sub the following bits.
(i) 1010 (ii) 0101 (iii) 1011
0100 0010 1001.
18. Design a Decade counter and verify its truth table and draw respective waveforms.
19. Design a Up/downcounterusingIC74163anddrawread/write waveforms.
20. Design a Universal shift register using IC74194 / 195and verify its shifting operation.
21. Design a 16x4 RAM using 74189 and draw its read /write operation.
22. Design a 8x3 encoder / 3x8 decoder and verify its truth table.

# A2423: ELECTRONIC CIRCUIT ANALYSIS LAB

**II Year II Sem**

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**Pre-requisite: Electronic Circuit Analysis**

**Course Objectives:**

1. To understand and analyze the operation of transistor-based amplifier and oscillator circuits by designing, implementing, and studying their gain, frequency stability, and waveform characteristics.
2. To design and evaluate power amplifier stages (Class A, Class B, push-pull, transformer-coupled) for efficiency, harmonic distortion, and practical limitations in real-world applications.
3. To implement and analyze multivibrator circuits (bistable, astable, monostable, Schmitt trigger, time-base generators) for waveform generation and switching applications.
4. To utilize circuit simulation tools (LTSpice, Multisim, PSpice, Proteus) for virtual experimentation, frequency response analysis, and verification of theoretical concepts.
5. To strengthen circuit design, problem-solving, and analytical skills by correlating hardware measurements with simulation results, preparing students for advanced courses in analog/digital electronics and VLSI circuit design.

**Course Outcomes:** After learning the contents of this subject the student must be able to

1. Design and analyze multistage and power amplifiers and evaluate their frequency response and efficiency.
2. Implement and examine feedback and oscillator circuits and validate theoretical conditions for sustained oscillations.
3. 3. Develop and interpret waveform generation circuits such as multivibrators and time base generators.
4. 4. Perform simulations to validate analog circuit performance using industry-standard software tools.
5. 5. Correlate practical results with theoretical predictions and identify deviations due to real-world constraints

**List of Experiments**

**A. Hardware Experiments (7):**

Perform practical design, implementation, and waveform analysis of amplifiers, oscillators, power stages, and multivibrators to validate theoretical concepts and observe real-world circuit behavior

1. Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement and study coupling capacitance effects
2. Design Hartley and Colpitts oscillators for a specified frequency and observe their output waveforms.
3. Design an RC phase shift oscillator and derive the practical gain condition for oscillations at a given frequency.
4. Design a transformer-coupled class A power amplifier, observe input/output waveforms, and calculate efficiency

5. Design a class B power amplifier, analyze input/output waveforms, and evaluate harmonic distortion.
6. Design a bistable multivibrator, analyze commutating capacitor effects, and record transistor waveforms.
7. Design an astable multivibrator and observe transistor base and collector waveforms.

**B. Software Simulations (7):**
Use circuit simulation software to design, analyze, and verify the performance of feedback amplifiers, waveform generators, and power amplifier circuits through virtual experimentation and frequency response evaluation.
1. Simulate four feedback amplifier topologies and compare their frequency responses with and without feedback
2. Simulate a monostable multivibrator and analyze its input/output waveforms
3. Simulate a Schmitt trigger for gain values greater than and less than one and analyze response behavior
4. Simulate a bootstrap time base generator using BJT and observe the output sweep waveform
5. Simulate a Miller sweep circuit using BJT and observe the time base output waveform.
6. Simulate a complementary symmetry push-pull amplifier and verify elimination of crossover distortion.
7. Simulate a single tuned amplifier and determine the quality factor (Q) of its tuned circuit

**Software Requirements:**

**Simulation Tools:** LTspice / Multisim / PSpice / Proteus / NI Multisim Live or equivalent

**Operating System:** Windows 10/11 or Linux (Ubuntu preferred)

**Hardware Requirements:**

1. Dual Power Supply (±15V, 0–30V)
2. Function Generator (up to 1 MHz)
3. CRO / DSO (Dual Channel, 20 MHz or more)
4. Digital Multimeters
5. Breadboards and Connecting Wires
6. BJTs: BC107, BC547, BC557, 2N2222, etc.
7. Resistors, Capacitors (Wide range of values)
8. Transformers (for power amplifiers)
9. Inductors, Crystals (1 MHz, 4 MHz, etc.)
10. Heat sinks, transistors for power stages (e.g., TIP41, TIP42 etc.)

# A2420: BASICS OF ENVIRONMENTAL SCIENCE

**II Year II Sem**

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**Pre-requisite: Chemistry**

**Course Objectives:**

1. Understand the components, structure, and functions of ecosystems and their relevance to human society.
2. Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
3. Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
4. Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
5. Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

**Course Outcomes:**

1. Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges, protocols and EIA.

**UNIT – I: Ecosystems**

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles (nitrogen cycle).

**UNIT – II: Natural Resources: Classification of Resources**

Living and Non-Living resources, Dams: Benefits and Problems. **Mineral Resources:** Use and Exploitation, environmental effects of extracting and using mineral resources, **Energy Resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

**UNIT – III: Biodiversity and Biotic Resources**

Introduction, Definition, genetic, species and ecosystem diversity. India as a mega diversity nation, Hot spots of biodiversity. Forest Act, Wild Life Act, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. National Biodiversity act

**UNIT – IV: Environmental Pollution and Control Technologies**

**Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and

secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards, **Solid waste:** Composition and characteristics of e-Waste, Plastic Waste, Hazardous Waste and their management.

**Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

**UNIT – V: Environmental Policy, Legislation & EIA**

Environmental Protection act, Legal aspects Air Act-1981, Water Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules. EIA: Definition, Scope and Applications, Environmental Management Plan(EMP). Sustainable development goals (SDGs); Global environmental challenges.

**TEXT BOOKS:**

1. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission
3. Environmental Studies by R. Rajagopalan, Oxford University Press

**REFERENCE BOOKS:**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.