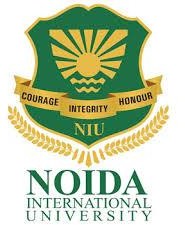
**NOIDA INTERNATIONAL UNIVERSITY**



**DETAILED SYLLABUS**

## For

UNDERGRADUATE DEGREE COURSE IN

**ELECTRONICS & COMMUNICATIONENGINEERING**

## (Effective from the Session: 2021-22)

**DETAILED CURRICULUM CONTENTS**

**Undergraduate Degree In**

**Engineering & Technology**

**BRANCH : Electronics & Communication Engineering**

# SEMESTER -1

**Course Code:** BSC101 **Course Name:** Mathematics-I

## Course Credit Hour: 4hr Total Contact Hour: 40hrs

**Course Objective:**

* The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

## Course Description:

* In this course we apply to differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions and discuss the fallouts of Rolle‘s Theorem that is fundamental to application of analysis to Engineering problems.
* We shall also learn the tool of power series and Fourier series for learning advanced Engineering Mathematics and deal with functions of several variables that are essential in most branches of engineering and the essential tool of matrices and linear algebra in a comprehensive manner

## Course Contents:

Unit 1: Calculus: (6 lectures)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit 2: Calculus: (6 lectures)

Rolle‘s Theorem, Mean value theorems, Taylor‘s and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Unit 3: Sequences and series: (10 lectures)

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval‘s theorem.

Unit 4: Multivariable Calculus (Differentiation): (8 lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Unit 5: Matrices (10 lectures)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew- symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

## Course Learning Outcomes (CLOs):

* + CLO-1: Apply to differential and integral calculus to notions of curvature and to improper

integrals and its applications in engineering problems

* + CLO-2: Fundamental to application of analysis to Engineering problems by mean value theorems.
  + CLO-3: Apply the tool of power series and Fourier series for learning advanced Engineering Mathematics.
  + CLO-4: Discuss problem and application of Multivariable Calculus.
  + CLO-5: Apply tool of matrices and linear algebra in a comprehensive manner

## Text books:

* 1. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
  2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
  3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Edition, Pearson,

## Reference books:

1. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,
2. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

**Online links for study & reference materials:** <https://www.classcentral.com/course/swayam-engineering-mathematics-i-13000> **Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 04% |
| Assignment -2 | - 04% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3 | - 04% |
| Assignment-4 | - 04% |
| Assignment-5 | - 04% |

## Total Internal Assessment - 40%

**Course Code:** BSC102 **Course Name:** Chemistry-I

**Course Credit Hour:** 4hr **Total Contact Hour:** 45hr

## Course Objective:

The objectives of the course are

1. To develop the interest among the students regarding chemistry and their applications in engineering. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the fields such as chemical, mechanical, civil, environmental, electrical and electronics engineering etc.
2. To emphasize on learning microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
3. To understand principles of different spectroscopic techniques and its applications. Bulk properties and processes will be analyzed using thermodynamic considerations.
4. To outline periodic properties, stereochemistry, chemical reactions and synthesis.
5. To teach of experiments illustrating the principles of chemistry that have been learnt so far, as well as others relevant to the study of science and engineering.
6. To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
7. To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.

## Course Description:

* + The course introduces fundamental concepts chemistry including Atomic and molecular structure, Spectroscopic techniques and applications, Intermolecular forces and potential energy surfaces , Use of free energy in chemical equilibrium, Periodic properties, Stereochemistry and Stereochemistry . This subject also laid down the groundwork for subsequent studies in the fields such as chemical, mechanical, civil, environmental, electrical and electronics engineering etc.

**Course Contents:**

**Module 1: Atomic and molecular structure**

Schrodinger equation. Particle in a box solutions and their applications for onjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multi-centre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**Module 2: Spectroscopic techniques and applications**

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules. Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering.

**Module 3: Intermolecular forces and potential energy surfaces**

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

**Module 4: Use of free energy in chemical equilibria**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

**Module 5: Periodic properties**

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity

and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

**Module 6: Stereochemistry**

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

**Module 7: Organic reactions and synthesis of a drug molecule**

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

## Course Learning Outcomes (CLOs):

The course will enable the student to:

* + **CLO-1**: Students will learn to apply concepts from physics and methods from mathematics to derive and understand the properties of chemical systems that arise from quantum mechanical models for the structure of atoms and molecules.
  + **CLO-2**: Student will achieve advanced knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
  + **CLO-3**: Student can explain how intermolecular forces determine physical properties of molecules; especially boiling point, melting point and viscosity.
  + **CLO-4**: Student can answer why chemical reactions occur? the driving force(s) that are responsible for physical and chemical changes.
  + **CLO-5**: Student can apply the knowledge of periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity while planning use of any material for industrial purpose.
  + **CLO-6**: Distinguish between different kinds of isomers, cis/trans or E/Z, superimposable, chiral/achiral, define enantiomers, levorotatory or dextrorotatory, racemic mixture, Distinguish between enantiomers and diastereomers, Understand the relationship between biological properties of pairs of enantiomers or diastereomer.
  + The properties of a compound are not only determined by the functional groups that it contains,
  + but also by the spatial arrangements of the atoms in the molecule. Stereochemistry is the
  + branch of chemistry that is concerned with the three-dimensional structures of molecules.
  + After studying this unit I should be able to:
    - Distinguish between different kinds of isomers
    - Assign cis/trans or E/Z configuration to an alkene
    - Draw the E or Z-isomer of a given alkene rs or
  + diastereomer
  + **CLO-7**: Student can list major chemical reactions that are used in the synthesis of molecules.

## Text books:

* B. H. Mahan, ― University chemistry‖, Addison-Wesley Publishing Company.
* M. J. Sienko and R. A. Plane, ―Chemistry: Principles and Applications‖, McGraw- -ill International.
* C. N. Banwell, ―Fundamentals of Molecular Spectroscopy‖, McGraw Hill Education.

## Reference books:

* B. L. Tembe, Kamaluddin and M. S. Krishnan, ―Engineering Chemistry‖ (NPTEL).
* K. P. C. Volhardt and N. E. Schore, ― Organic Chemistry: Structure and Function‖ Freeman.

**Online links for study & reference materials:** [**https://nptel.ac.in/courses/104/103/104103071/**](https://nptel.ac.in/courses/104/103/104103071/)

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment-1 | - 05% |
| Assignment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assignment-4 | - 05% |
| Assignment-5/Quiz | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: HSMC101 Course Name: English

**Course Credit Hour:** 2 Hr **Total Contact Hours:** 20hr

**Course Objective:**

* + The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

**Course Description:**

* + This course introduces the fundamental of communication skills, writing skills presentation skills and interview skills. Topic includes introduction to Grammar, speaking skills, Writing Skills, Presentation skills, Interview skills.

## Course Contents:

**Unit 1: Vocabulary Building (4 lectures)**

The concept of Word Formation, Root words from foreign languages and their use in English Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

## Unit 2: Basic Writing Skills (4lectures)

Sentence Structures, use of phrases and clauses in sentences Importance of proper punctuation Creating coherence Organizing principles of paragraphs in documents Techniques for writing precisely

**Unit 3: Identifying Common Errors in Writing (4 lectures)**

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions Redundancies Clichés

## Unit 4: Nature and Style of sensible Writing (4 lectures)

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion Writing Practices Comprehension Précis Writing Essay Writing

**Unit 5:** Oral Communication **(4 lectures)**

(This unit involves interactive interaction)

* + - Listening Comprehension
    - Pronunciation, Intonation, Stress and Rhythm
    - Common Everyday Situations: Conversations and Dialogues
    - Communication at Workplace
    - Interviews
    - Formal Presentation.

**Course Learning Outcomes (CLOs):**

* + - * CLO-1: Develop the vocabulary building and basic grammar concepts.
      * CLO-2: Inculcate speaking skills and listening skills.
      * CLO-3: Develop the writing skills.
      * CLO-4: Understand technical writing skills.
      * CLO-5: Demonstrate all skills in presentation and interviews.

## Text books:

* Raman, Singh – Business communication – Oxford Press
* Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.
* Objective English, Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
* Practical English Usage. Michael Swan. OUP. 1995.
* Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

## Reference books:

* English Phonetics & Phonology, P. Roach, Cambridge University Press, London
* Common Errors in English, Abul Hashem, Ramesh Publishing House, new Delhi.
* Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
* Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

## Online links for study & reference materials:

* <https://nptel.ac.in/courses/109/106/109106094/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 05% |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECS101 **Course Name:** Programming for Problem Solving

## Course Credit Hour: 4hr Total Contact Hour: 42hr

**Course Objective:**

* + The course aims to provide exposure to problem –solving through programming. It aims to train the student to the basic concept of the C –programming language. This course involves a lab component which is designed to give the student hands

–on experience with the concept.

## Course Description:

* + This course introduces the fundamental concepts of computer and programming and provides comprehensive introduction to programming in C. Topic includes introduction to programming, Arrays, Basic Algorithms, Functions, Recursion, Structure and Pointers.

## Course Contents:

**Unit 1:** Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) ,Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

**Unit 2:** Arithmetic expressions and precedence

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

**Unit 3:** Arrays

Arrays (1-D, 2-D), Character arrays and Strings.

**Unit 4:** Basic Algorithms

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of Equations, notion of order of complexity through example programs (no formal definition Required)

**Unit 5:** Function

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.

**Unit 6:** Recursion

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

**Unit 7:** Structure

Structures, Defining structures and Array of Structures.

**Unit 8:** Pointers

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

**Unit 9:** File handling (only if time is available, otherwise should be done as part of the lab)

## Course Learning Outcomes (CLOs):

On completion of the course students will be able to:

* **CLO-1**: Formulate simple algorithms for arithmetic and logical problems.
* **CLO-2:** Test and execute the programs and correct syntax and logical errors.
* **CLO-3:** Implement conditional branching, iteration and recursion.
* **CLO-4:** Use arrays, pointers and structures to formulate algorithms and programs.
* **CLO-5:** Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

## Text books:

* 1. Byron Gottfried, Schaum‘s Outline of Programming with C, Third Edition, McGraw-Hill.
  2. E.Balaguruswamy, Programming in ANSI, Tata McGraw- Hill. (vi)Yashavant Kanetkar, Let Us C, BPB Publications.

## Reference books:

* Brian W. Kernighhan and Dennis Ritchie, The C Programming Language, Prentice Hall of India

**Online links for study & reference materials:** [**https://nptel.ac.in/courses/106/104/106104128/**](https://nptel.ac.in/courses/106/104/106104128/)

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 05% |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Lab Code:** ESC101P **Lab Name:** Programming for Problem Solving

## Course Credit Hour: 2hr Total Contact Hour: 04

**List of Experiments:**

**Problems based on if-then-else structure:**

1. If the three sides of the triangle are entered through the keyboard, write a program to check whether the triangle is isosceles or equilateral.
2. In a company an employee is paid under: If his basic salary is less then Rs.1500, then HRA=10% of basic salary and DA=90% of basic salary .If his salary is either equal to or above Rs 1500, then HRA=Rs 500 and DA= 98% of basic salary. If the employee‘s salary is input through the keyboard write a program to find his gross salary.
3. The current year and year in which the employee joined the organization are entered through the keyboard. If the no of years for which the employee has served the organization is greater than 3 then a bonus of Rs.2500/- is given to the employee. If the years of service are not greater than three, then the program should do nothing. Write a program to perform the said task.
4. Write a program to check whether a triangle is valid or not when the three angles of the triangle are entered through the keyboard. A triangle is valid if the sum of all the three angles is equal to 180 degree.
5. If cost price and selling price of item is input through the keyboard, write a program to determine whether the seller gas made profit or incurred loss. Also determine how much profit he made or loss he incurred.
6. In a company worker efficiency is determined on the basis of the time required for a worker to complete a particular job. If the time taken by the worker is between 2-3 hours, then the worker is said to be highly efficient. If the time required by the worker is between 3-4 hours, then the worker is ordered to improve speed. If the time taken is between 4-5 hours, the worker is given training to improve his speed, and if the time taken by the worker is more than 5 hours, then the worker has to leave the company. If time taken by the worker is input through the keyboard, write a program to find the efficiency of the worker.

**Problems based on while loop and for loop:**

1. Write a program to print the cube of any number provided by the user.
2. Make a program to calculate the simple interest for 3 sets of p, n, r using while and for loop.
3. Write a program to print the sum of all the digits from 1 to 10 using while loop.
4. Write a program to print the digit from 1 to100 using while and for loop.
5. Using for loop print the following pattern R=1 c=1 sum=2

R=1 c=2 sum=3 R=2 c=1 sum =3 R=2 c=2 sum=4

1. Write a program to print the following pattern

|  |  |  |
| --- | --- | --- |
| \*\*\*\*\*  \*\*\*\*\*  \*\*\*\*\*  \*\*\*\*\* | \*  \*\*  \*\*\*  \*\*\*\*  \*\*\*\*\* | 1  12  123  1234  12345 |

1. Write a program to print the square and cube of any given number**.**

**Problems based on 1-D Array, Array Manipulation, 2-D Array and String Operations:**

1. Write a program to perform following operations on String(s) using a well-defined library function:
   * Find the length of the string.
   * Concatenate two strings
   * Compare two given strings
   * Copy the content of string to another string
2. Write a program to find average marks obtained by a class of 30 students in a test.
3. Write a program to find the maximum marks obtained by a student in 5 subjects.
4. Write a program to pick up the largest number from any 5 row by 5 column matrix.
5. Twenty five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many of them are negative and how many of them are zeros.
6. Write a program to store n elements in an array and print all elements.
7. Write a program to compute the sum of all elements in an array.
8. Write a program to print the elements of an array in reverse order.

**Problems based on Structures:**

1. Write a program to enter name, price and page number of three books using structure.
2. Write a program to enter roll number and average marks of 3 students using structure.
3. Create a structure to specify data of customer in a bank. The data to be stored is: Account number, Name, Balance in Account. Assume maximum of 200 customers in the bank. Write a program to print name and account number of each customer with balance below Rs. 100.
4. A record contains name of cricketer, his age, number of test matches that he has played and the average runs that he has scored. Create an array of structures to hold records of 20 such cricketers.
5. There is a structure called employee that holds information like employee code, name, and year of joining. Write a program to create an array of structures and enter some data into it. Then ask the user to enter current year. Display the names of those employees whose tenure is more than 3 years according to given year.

**Problems based on Function, Pointer, Call by Value and Call by Reference**

1. Write function which receives a float and an integer from main (), find the product of these two and returns the product which is printed through main ().
2. Write a function that receives marks received by a student in 3 subjects and returns the average and percentage of these marks. Call this function from main and print the result in main.
3. Find the smallest number in an array.
4. Any year is entered through the keyboard. Write a function to determine whether the year is a leap year or not.
5. Write a function that receives 5 integers and returns the sum, average of these numbers. Call this function from main () and print the result in main ().
6. Write a program to add two numbers using pointers**.**
7. Write a program to store n elements in an array and print all elements using pointer.
8. Write a program to read array elements and print array addresses using pointer.
9. Write a program to compute the sum of all elements in an array using pointer.
10. Write a program to print the elements of an array in reverse order using pointer.

**Problems based on Recursion, recursive functions, file handling operations and numerical method problems:**

1. Write a program to writes records to a file using structure.
2. Write a program for reading a string from the file and display them on screen.
3. Write a program to copy the content of one file to another file.
4. Write a program to display contents of a file on screen.
5. Write a program to count Chars, space, tabs and new lines in a file.
6. Write a program to calculate factorial of any inputted number with recursion and without recursion.
7. Write a program to calculate Fibonacci Series using recursive call.
8. Write a program to calculate Ackerman Function for any two non-negative integers using recursion.

**Lab Code:** BSC104P **Lab Name:** Chemistry Lab

## Course Credit Hour: 1.5 Total Contact Hours: 03

**List of Experiments:**

* Determination of Alkalinity in given water sample.
* Determination of Total hardness, Permanent hardness and Temporary Hardness of given Water Sample by using EDTA as standard solution.
* Determination of available chlorine in Bleaching powder.
* Determination of chloride Contents in given Water sample by using Mohr‘sMethod.
* Determination of Iron Content in the given Ore by using external Indicator.
* pH metric titration.
* Viscosity of an addition polymer like Polyester by Viscometer.
* Determination of heat of neutralization of Hydrochloric acid and Sodiumhydroxide.
* Determination of amount of dissolve Oxygen in water.
* Separation of metal ions by paper chromatography.

# SEMESTER -2

**Course Code:** BSC102 **Course Name:** Physics

## Course Credit Hour: 4hr Total Contact Hour: 42hr

**Course Objective:** At the completion of this course, a student will be able to

1. Know about the development of modern Physics and the theoretical formulation of quantum mechanics.
2. Know the applications of quantum mechanics in solving physical problems.

**Course Description:** This course will analyze the applications of mathematics to the problems in physics & develop suitable mathematical method for such application & for formulation of physical theories.

## Course Contents:

**Unit I: Wave nature of particles and the Schrodinger equation (8 Lectures)**

Introduction to Quantum mechanics Wave nature of particles

Time independent and time dependent Schrodinger equation for wave function Born interpretation

Probability current Expectation values

Free particle wavefunction and wave packets Uncertainty principle

## Unit II: Mathematical Preliminaries for Quantum Mechanics (4 Lectures)

Complex numbers Linear vector spaces Inner product Operators Eigen value problems Hermitian operators Hermite polynomials Legendre`s equation Spherical harmonics

## Unit III: Applying the Schrodinger equation (15 Lectures)

Solution of stationary state Schrodinger equation for one dimensional problem Particle in a box Particle in attractive delta function potential Square well potential Linear harmonic oscillator

Numerical solution of stationary state Schrodinger equation for one dimensional problem for different potentials Scattering from a potential barrier and tunneling Examples like alpha decay, field ionisation and scanning tunnelling microscope Three dimensional problems: particle in three-dimensional box and related examples Angular momentum operator Rigid rotor Hydrogen atom ground state, orbitals, interaction with magnetic field spin Numerical solution stationary state Schrodinger equation for spherically symmetric potentials

## Unit IV: Introduction to Molecular Bonding (4 Lectures)

Particle in double delta function potential Molecules (Hydrogen molecule, valence bond and molecular orbitals picture) Singlet/triplet states Chemical bonding Hybridization

## Unit V: Introduction to Solids (7 Lectures)

Free electron theory of metals Fermi level, density of states Application of white dwarfs and neutron stars Bloch theorem for particles in a periodic potential Kronig-Penney model and origin of energy bands Numerical solution for energy in one dimensional periodic lattice by mixing plane waves

## Course Learning Outcomes (CLOs):

After successful completion of this paper, the student will be well-versed in

* **CLO1.** Concepts of basis and operators
* **CLO2.** Both Schrodinger and Heisenberg formulations of time development and their applications
* **CLO3.** Solution of stationary state Schrodinger equation for one dimensional problem
* **CLO4.** Concepts of Molecules (Hydrogen molecule, valence bond and molecular orbitals picture)
* **CLO5.** Kronig-Penney model and origin of energy bands

## Text Books

* Eisberg and Resnik, Introduction to Quantum Physics

## Reference Books

* D. J. Grriffiths, Quantum Mechanics
* Richard Robinett, Quantum Mechanics
* Daniel McQuarrie, Quantum Chemistry

**Online links for study &amp; reference materials:** [**https://nptel.ac.in/courses/122/106/122106034/**](https://nptel.ac.in/courses/122/106/122106034/)

**Assessment method: (**Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 05% |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| Total Internal Assessment | - 40% |

**Course Code:** BSC103 **Course Name:** Mathematics II

## Course Credit Hour: 4hr Total Contact Hour: 40hrs

**Course Objective:**

* + The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

## Course Description:

* + Applying the mathematical tools for need in evaluating multiple integrals and their usage, solutions of differential equations that model physical processes and the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

## Course Contents:

Unit 1: Multivariable Calculus (Integration): (10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Unit 2: First order ordinary differential equations: (6 lectures)

Exact, linear and Bernoulli‘s equations, Euler‘s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for *x* and Clairaut‘s type.

Unit 3: Ordinary differential equations of higher orders: (8 lectures)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Unit 4: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm)

Unit 5: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville‘s theorem and Maximum-Modulus theorem (without proof); Taylor‘s series, zeros of analytic functions, singularities, Laurent‘s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

## Course Learning Outcomes (CLOs):

* + - CLO-1: Evaluation of areas and volumes, Center of mass and Gravity.
    - CLO-2: Solution of first order ordinary differential equations by various methods.
    - CLO-3: Solution of ordinary differential equations of higher orders.
    - CLO-4: Differentiation of Vector calculus.
    - CLO-5: Integration of Vector Calculus.

## Text books:

* Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
* B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
* G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Edition, Pearson,

## Reference books:

* Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,
* D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
* W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India

## Online links for study & reference materials:

<https://nptel.ac.in/courses/122/107/122107036/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 04% |
| Assignment -2 | - 04% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3 | - 04% |
| Assignment-4 | - 04% |
| Assignment-5 | - 04% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ESC102 **Course Name:** Workshop/Manufacturing Practices

**Course Credit:** 5.5 **Total Contact Hours:** 40hr

**Course Objective:**

* To familiarize with the basic manufacturing processes and to study the various tools and equipment.
* They will get hands-on training is given in different sections. Essentially student should know the labour involved, machinery or equipment necessary.
* To analyze time required to fabricate and also should be able to estimate the cost of the product or job work.

**Course Description:**

* Ability to prepare simple objects using machines and machine tools to make students aware of fundamental operations of manufacturing an engineering component, enhance visualization and motivate them to innovate.

**Course Contents:**

**Module 1**

**Machine Shop:** To make a machined-component using lathe with mild steel round bar or hexagonal bar comprising of common turning operations with reference to drawing given in the manual. Any one of the following jobs Jobs: Hex Bolt, Axle for cycle wheel, Jig Bush, a typical turning specimen.

**Module II**

**Sheet metal Shop:** To make a sheet metal component with galvanized iron sheet as per the drawing provided in the manual having spot welding joint. Any one of the following jobs Jobs: Square tray, Scoop, Funnel.

Fitting Shop To make a joint using fitting tools with mild steel flats, round bars or square bars as per the drawing provided in the manual.

**Module III**

**Carpentry Shop:** To make a wooden joint with soft wood as per the drawing provided in the manual. Any one of the following jobs Jobs: T-Lap joint, Dove tail joint, Mortise & Tendon joint, Bridle joint.

**Module IV**

**Welding Shop- Arc Welding** To prepare a welding joint with mild steel flat using Manual Metal Arc welding machine according to the drawing provided in the manual.

Any one of the following jobs Jobs: Lap joint, Butt joint, Fillet/Corner joint.

**Gas & Spot Welding** To observe the demonstration of making a Lap joint/Butt joint with mild steel sheet using oxyacetylene flame as per the drawing provided in the manual. To perform the spot welding operation

on G.I. Sheet.

**Module V**

**Foundry Shop** Introduction to foundry process like melting of metals, mould making, casting process and use of patterns to prepare of a component and significance of foundry. Demo of mould preparation.

**Course Learning Outcomes (CLOs):**

Upon completion of this course, students will be able to achieve the following:

* Have Capability to identify hand tools and instruments for machining and other workshop practices.
* The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

**Text books:**

* A course in Workshop Technology Vol I and Vol II by Prof. B.S. Raghuwanshi Dhanpat Rai & Co.(P) Ltd.
* Elements of Workshop Technology Vol I and Vol II by S.K. Hajara Choudhury, A.K. Hajara Choudhury & Nirjhar Roy; Media Promoters & Publishers Pvt. Ltd, Mumbai.

**Reference books:**

* Workshop Technology Part 1, Part2 & Part3 by W.A.J. Chapman; CBS Publishers & Distributors, New Delhi
* Kalpak Jian S. And Steven S. Schmid, ―Manufacturing Engineering and Technology‖, 4th edition, Pearson Education India Edition, 2002.
* Gowri P. Hariharan and A. Suresh Babu, ―Manufacturing Technology – I‖ Pearson Education, 2008.
* Roy A. Lindberg, ―Processes and Materials of Manufacture‖, 4th edition, Prentice Hall India, 1998.
* Rao P.N., ―Manufacturing Technology‖, Vol. I and Vol. II, Tata McGrawHill House, 2017.

**Online links for study & reference materials:**

<http://ecoursesonline.iasri.res.in/course/view.php?id=86>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ESC104 **Course Name:** Basic Electrical Engineering

## Course Credit: 5hr Total Contact Hour: 42hr

**Course Objective:**

* + To introduce concept of D.C. circuits and A.C. circuits.
  + To make the students understand and working of machines, transformer and components used for low voltage installation.

**Course Description:**

* + This course introduces the fundamental concepts of circuits, machines and low voltage installation.

## Course Contents:

*Unit 1: DC Circuits*

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

*Unit 2: AC Circuits*

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

*Unit 3: Transformers*

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

*Unit 4: Electrical Machines*

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

*Unit 5: Power Converters*

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

*Unit 6: Electrical Installations (6 hours)*

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

## Course Learning Outcomes (CLOs):

At the end of this course, students will demonstrate the ability

* CLO-1: Analyze basic electric and magnetic circuits.
* CLO- 2: working principles of electrical machines and power converters.
* CLO-3 :Understand the basic concept of components of low-voltage electrical Installations.

## Text books:

* D. P. Kothari and I. J. Nagrath, ― Basic Electrical Engineering‖, Tata McGraw Hill.
* D. C. Kulshreshtha, ―Basic Electrical Engineering‖, McGraw Hill.

## Reference books:

* + L. S. Bobrow, ― Fundamentals of Electrical Engineering‖, Oxford University Press.
  + E. Hughes, ―Electrical and Electronics Technology‖, Pearson.
  + V. D. Toro, ―Electrical Engineering Fundamentals‖, Prentice Hall India.

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/108/108/108108076/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 05% |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** AECCI **Course Name:** Environmental Science

## Course Credit Hour: 2hr Total Contact Hour: 25

**Course Objective:**

* + - The Compulsory course on Environmental Science at Undergraduate level (AECCI) aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology- society-economy.

## Course Description:

* + - Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

## Course Contents:

**Unit 1: Introduction to Environmental Studies**

* Multidisciplinary nature of environmental studies
* Scope and importance; Concept of sustainability and sustainable development

## Unit 2: Ecosystem

* Definition and concept of Ecosystem

Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem Physical (energy flow), Biological (food chains, food web, ecological succession) and Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis

* Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration

## Unit 3: Natural Resources

* Land resources and landuse change Land degradation, soil erosion and desertification
* Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
* Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
* Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
* Case studies: National Solar Mission, Cauvery river water conflict etc

## Unit 4: Biodiversity and Conservation

* Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India
* India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots
* Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
* Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity
* Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation

## Unit 5: Environmental pollution

* Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards
* Nuclear hazards and human health risks
* Solid waste management: Control measures of urban and industrial waste
* Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc

## Unit 6: Global Environmental Issues and Policies

* Climate change, Global warming, Ozone layer depletion, Acid rain and impacts on human communities and agriculture
* International agreements: Earth Summit, UNFCCC, Montreal and Kyoto protocols and Convention on Biological Diversity (CBD)
* Sustainable Development Goals and India‘s National Action Plan on ClimateChange Environment legislation in India: Wildlife Protection Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act 1980, Air (Prevention & Control of Pollution) Act, 1981; Environment Protection Act, 1986; Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

## Unit 7: Human Communities and the Environment

* Human population growth: Impacts on environment, human health and welfare
* Resettlement and rehabilitation of project affected persons; case studies
* Disaster management: floods, earthquake, cyclones and landslides
* Environmental movements: Chipko movement, Silent valley movement, Bishnois of Rajasthan, Narmada BachaoAndolan etc
* Environment justice: National Green Tribunal and its importance
* Environmental ethics: Role of Indian and other religions and cultures in environmental conservation
* Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi, Swachh Bharat Abhiyan)

## Field work/ Practicals

* + Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom
  + Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom
  + Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
  + Study of common plants, insects, birds and basic principles of identification
  + Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

## Course Learning Outcomes (CLOs):

The course will empower the undergraduate students by helping them to:

* CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.
* CLO-2: Predict the consequences of human actions on the web of life, global economyand quality of human life.
* CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
* CLO-4: Acquire values and attitudes towards understanding complex environmental- economic social challenges, and participating actively in solving current environmental problems and preventing the future ones..
* CLO-5: Adopt sustainability as a practice in life, society and industry.

## Text books:

* William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003 
* William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
* Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

## Reference books:

* Roosa SA, Sustainable Development Handbook, CRC Press 2008 
* Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014 
* Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

## Online links for study & reference materials:

<https://www.hzu.edu.in/bed/E%20V%20S.pdf>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 05% |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Lab Code:** BSC102P **Lab Name:** Physics Lab

## Course Credit Hour: 1.5hr Total Contact Hour: 03

**List of Experiments:**

* Four Probe Setup
* Stefan`s Law
* Diode Valve Characteristics
* Frequency of A.C Mains
* Band Gap in a Semi-Conductor Diode
* P-N Junction Diode Characteristics
* Zener Diode Characteristics
* Transistor Common-Base Configuration
* Transistor Common-Emitter Configuration

**Lab Code:** ESC102P **Lab Name:** Workshop/Manufacturing Practice

## Course Credit Hour: 2hr Total Contact Hour: 04

**List of Experiments:**

* Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods
* CNC machining, Additive manufacturing
* Fitting operations & power tools
* Electrical &Electronics
* Carpentry
* Plastic molding, glass cutting
* Metal casting
* Welding (arc welding & gas welding), brazing

**Lab Code:** ESC104P **Lab Name:** Electrical Engineering Lab

## Course Credit Hour: 1hr Total Contact Hour: 02

**List of Experiments:**

* + Basic safety precautions. Introduction and use of measuring instruments – poltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
  + To verify KCL and KVL in D.C.circuit
  + To verify Superposition theorem
  + To Verify The venin‘s Theorem
  + To find resonance in series R-L-C circuit.
  + Transformers: Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
  + Demonstration of cut-out sections of machines: dc machine (commutator- brush arrangement).
  + Torque Speed Characteristic of separately excited dc motor.
  + Three-phase induction motors. Direction reversal by change of phase- sequence of connections.
  + Demonstration of Components of LT switchgear.

# SEMESTER -3

**Course Code:** EC01 **Course Name: Electronic Devices**

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective:**

* + To understand basic semiconductor properties and hence improvement in future design consideration.
  + To analyze different types of current in semiconductor.
  + To understand characteristics of Transistor and MOS and other devices.
  + To have an understanding of Integrated circuit fabrication process.

**Course Description:**

This course explores the theory and principles of electronic devices. Special attention is devoted to topics Semiconductor Physics, Generation and recombination, Bipolar Junction Transistor, MOS transistor, Integrated circuit fabrication process.

**Course Contents:**

**UNIT 1**

Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors

**UNIT 2**

Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode

**UNIT 3**

Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell;

**UNIT 4**

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

**Course Learning Outcomes(CLOs) :**

At the end of this course students will demonstrate the ability to

* Understand the principles of semiconductor Physics
* Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

**Text books:**

* G. Streetman, and S. K. Banerjee, ―Solid State Electronic Devices,‖ 7th edition, Pearson,2014.
* D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education.

**Reference books:**

* S. M. Sze and K. N. Kwok, ―Physics of Semiconductor Devices,‖ 3rd edition, John Wiley &Sons, 2006.
* C.T. Sah, ―Fundamentals of solid state electronics,‖ World Scientific Publishing Co. Inc, 1991.
* Y. Tsividis and M. Colin, ―Operation and Modeling of the MOS Transistor,‖ Oxford Univ.Press, 2011.

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/117/103/117103063/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** EC03 **Course Name:** Digital System Design

## Course Credit: 3 Total Contact Hour: 40hr

**Course Objective:**

* + To understand number representation and conversion between different representation in digital electronic circuits.
  + To analyze logic processes and implement logical operations using combinational logic circuits.
  + To understand characteristics of memory and their classification.
  + To understand concepts of sequential circuits and to analyze sequential systems.

## Course Description:

This course emphasizes on the fundamental of digital electronics. The student is first taught about the number system and logic gates before introducing them to digital IC technology. Then they are exposed to both combinational logic network and combinational MSI logic. In concurrence with this, the fundamental of sequential logic, flip-flop, counter and shift register will be taught. The memory devices are introduced. Finally the use of HDL is briefed.

## Course Contents:

**Unit 1**

**Logic Simplification:** Review of Boolean algebra and De Morgan‘s Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

Unit 2

**Combinational Logic Design:** MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

Unit 3

**Sequential Logic Design:** Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

Unit 4

**Logic Families and Semiconductor Memories:** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

Unit 5

**VLSI Design flow:** Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

## Course Learning Outcomes (CLOs) :

At the end of this course students will demonstrate the ability to

* + Understand working of logic families and logic gates.
  + Design and implement Combinational and Sequential logic circuits.
  + Use HDL & appropriate EDA tools for digital logic design and simulation
  + Be able to use PLDs to implement the given logical problem.

## Text books:

* + Moris Mano, ―Digital Logic and Computer Design‖, PHI Publications, 2002
  + R. P. Jain, ―Modern Digital Electronics‖, TMH, 3rd Edition, 2003.

## Reference books:

* + Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
  + R.L. Tokheim, ―Digital Electronics, Principles and Applications‖, Tata McGraw Hill, 1999.
  + W. Gothman, ―Digital electronics‖, PHI.
  + S. Salivahanan & S. Arivyhgan. ―Digital circuits and design‖, Vikas Publication, 2001
  + Malvino Leach, "Digital Principles and Application", TMH, 1999.
  + V. Rajaraman : Computer Fundamentals (PHI)

## Online links for study & reference materials:

https://nptel.ac.in/courses/117/106/117106086/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** EC06 **Course Name:** Network Theory

**Course Credit Hour:** 3hr **Total Contact Hour:** 40hr

**Course Objective:**

* To explain the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
* To analyze circuits in time and frequency domain.
* To explain concepts of driving point and transfer functions, poles and zeroes of network functions and their stability.

**Course Description:**

The course begins with description of circuit elements & sources. Understanding of various interesting network theorems applied to solve linear, time invariant network problems efficiently in time and s-domain is discussed. Steady and transient solution of network problems with various sources including impulse source, representing a circuit in s-domain (Laplace domain).

**Course Contents:**

**UNIT 1**

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin‘s, Norton‘s, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits. Trigonometric and exponential

**UNIT 2**

Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

**UNIT 3**

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

**UNIT 4**

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits,

**UNIT 5**

Introduction to band pass, low pass, high pass and band reject filters.

**Course Learning Outcomes (CLOs):**

* + At the Understand basics electrical circuits with nodal and mesh analysis.
  + Appreciate electrical network theorems.
  + Apply Laplace Transform for steady state and transient analysis.
  + Determine different network functions.

**Text books:**

* Van, Valkenburg.; ―Network analysis‖ ; Prentice hall of India, 2000
* Sudhakar, A., Shyammohan, S. P.―Circuits and Network‖; Tata McGraw-Hill New Delhi, 1994

**Reference books:**

* A William Hayt, ―Engineering Circuit Analysis‖ 8th Edition, McGraw-Hill Education

**Online links for study & reference materials:**

[https://nptel.ac.in/courses/108/105/108105159/#](https://nptel.ac.in/courses/108/105/108105159/)

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Mid exam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** BSC201 **Course Name:** Mathematics-III

## Course Credit Hour: 4hr Total Contact Hour: 40hrs

**Course Objective:**

The main objective of this course is to provide students with the probabilistic and statistical analysis mostly used in varied applications in engineering and sciences and it provide the methods of organising and simplifying data so that their significance is comprehensible.

## Course Description:

This course provides an introduction to probability and statistics with applications. Topics include: random variables, continuous and bivariate probability distributions, Bayesian inference, hypothesis testing, confidence intervals, curve fitting and regression.

## Course Contents:

**Unit 1: Basic Probability (12 hours)**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

## Unit 2: Continuous Probability Distributions (4 hours)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

## Unit 3: Bivariate Distributions (4 hours)

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

## Unit 4: Basic Statistics (8 hours)

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

## Unit 5: Applied Statistics (8 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

## Unit 6: Small samples (4 hours)

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

## Course Learning Outcomes (CLOs):

* + CLO-1: Recognize basic probability theory and its application.
  + CLO-2: calculate Continuous Probability Distributions and their properties.
  + CLO-3: Calculate bivariate distributions and their properties with applications.
  + CLO-4: Basic concept of Statistics, Probability distribution and correlation.
  + CLO-5: Fitting the data and large sample testing.
  + CLO-6: Testing the hypothesis for Small samples

## Text books:

* + Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
  + B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers
  + S. Ross, ―A First Course in Probability‖, Pearson Education India,

## Reference books:

* + Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,
  + W. Feller, ―An Introduction to Probability Theory and its Applications‖, Wiley,

## Online links for study & reference materials:

https://nptel.ac.in/courses/111/105/111105041/

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 04% |
| Assignment -2 | - 04% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3 | - 04% |
| Assignment-4 | - 04% |
| Assignment-5 | - 04% |
| **Total Internal Assessment** | **- 40%** |

**Electronic Devices Lab**

**Teaching Scheme:- 0L:0T:2P Paper Code: EC02**

Credits:1

1. To plot the V-I characteristics of junction tunnel & Schotky diode.
2. To plot the characteristics of P-N junction diode
3. To plot the C-V characteristics of P-N junction diode
4. To plot the halfwave & fullwave rectifier.
5. To plot the V-I Characteristics of zener diode.
6. To Study of zener diode as a voltage regulator.
7. To plot the input output characteristics of BJT in CB, CC, CE configuration.
8. To plot the input output characteristics of FET in CS Configuration.
9. To plot the optical (V-I) Characteristics of Photodiode.
10. To study the depletion mode & Enhancement mode MOSFET.

**Digital System Design Lab**

**Teaching Scheme:- 0L: 0T: 2P Paper Code: EC04 Credits**:1

1. Verification of NAND, NOR, Ex-OR,AND & OR Gates.
2. Implementation of half Adder & Full Adder
3. Implementation of half Subtractor & Full Subtractor.
4. Implementation of Demultiplexer / Decoder operation using IC-74138.
5. Implementation of Seven segment display.
6. Implementation of Binary to gray converter.
7. Implementation of Arithmetic algorithms.
8. Implementation of various flip-flops.
9. Implementation of Counters.
10. Implementation of shift register.
11. Verification of Transfer characteristics of TTL inverters & TTL Schmitt Trigger inverter.

# SEMESTER -4

**Course Code:**EC07 **Course Name:** Analog and Digital Communication

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective:**

* + To understand basic elements of a communication system
  + To conduct analysis of baseband signals in time domain and in frequency domain
  + To demonstrate understanding of various analog and digital modulation and demodulation techniques techniques.
  + To analyse the performance of modulation and demodulation techniques in various transmission environments

**Course Description:**

This course provides a thorough introduction to the basic principles and techniques used in analog and digital communications. The course will introduce analog and digital modulation techniques, communication receiver and transmitter design, baseband and bandpass communication techniques, line coding techniques, noise analysis, and multiplexing techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.

**Course Contents:**

**Unit 1**

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

**Unit 2**

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation.

**Unit 3**

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

**Unit 4**

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion, Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

**Unit 5**

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels-Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

**Course Learning Outcomes(CLOs) :**

At the end of this course students will demonstrate the ability to

* + - Analyze and compare different analog modulation schemes for their efficiency and bandwidth
    - Analyze the behavior of a communication system in presence of noise
    - Investigate pulsed modulation system and analyze their system performance
    - Analyze different digital modulation schemes and can compute the bit error performance

**Text books:**

* + Haykin S., "Communications Systems", John Wiley and Sons, 2001.
  + Proakis J. G. and Salehi M.,"Communication Systems Engineering", Pearson Education, 2002.

**Reference books:**

* + Taub H. and Schilling D.L., "Principles of Communication Systems‖, Tata McGraw Hill, 2001.
  + Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.
  + Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.
  + Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

**Online links for study & reference materials:**

https://nptel.ac.in/courses/117/102/117102059/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:**EC09 **Course Name:** Analog Circuits

## Course Credit: 3 Total Contact Hour: 40hr

**Course Objective:**

* + - To Understand the characteristics of diodes and transistors
    - Design and analyze various rectifier and amplifier circuits
    - Design sinusoidal and non-sinusoidal oscillators
    - Understand the functioning of OP-AMP and design OP-AMP based circuits
    - Design ADC and DAC

## Course Description:

This **course** develops a basic understanding of the fundamentals and principles of **analog circuits** and **electronic** devices in electrical and **electronic** engineering. This understanding is a critical step towards being able to design new **electronic circuits** or use them appropriately as part of a larger engineering system.

## Course Contents:

Unit 1

Amplifier models: Voltage amplifier, current amplifier, trans- conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Unit 2

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin. Unit 3

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

Unit 4

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Unit 5

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.Active filters: Low pass, high pass, band pass and band stop, design guidelines.

## Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

* Know about the multistage amplifier using BJT and FET in various configuration to determine frequency response and concept of voltage gain.
* Know about different power amplifier circuits, their design and use in electronics and communication circuits.
* Know the concept of feedback amplifier and their characteristics.
* Design the different oscillator circuits for various frequencies

## Text books:

* + J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
  + A.S. Sedra and K.C. Smith, Microelectronic Circuits, Edition IV**.**

## Reference books:

* + J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
  + P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
  + Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

## Online links for study & reference materials:

https://nptel.ac.in/courses/108/102/108102112/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: EC11 Course Name: Microcontrollers

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

The objectives of the course are to make the students,

* Know the internal organization, addressing modes and instruction sets of 8085 & 8086 processor.
* Know the various functional units of 8051 microcontroller.
* Understand assembly language program by using 8051 Instruction sets and addressing modes.
* Know the various peripheral devices such as 8255, 8279, 8251, 8253, 8259, stepper motor etc.
* Know the various advance microcontroller like ARM processor etc.
* Understand microcontroller based system design for various applications.

## Course Description:

The purpose of this course is to teach students the fundamentals of microprocessor and microcontroller systems. The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a microprocessor/controller implementation. Topics include Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, I/O interface design, I/O peripheral devices, data communications, and data acquisition systems. Several laboratory exercises will be based on both microprocessor (Intel 8086), microcontroller (Intel 8051) and ARM (nuvoTon- Nu-LB-LUC140).

## Course Content:

Unit 1

Overview of microcomputer systems and their building blocks, 8085 and 8086 microprocessor, instruction sets of microprocessors.

Unit 2

Memory interfacing, concepts of interrupts and Direct Memory Access, Interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters.

Unit 3

Arithmetic Coprocessors; System level interfacing design, Concepts of virtual memory, Cache memory,

Unit 4

Advanced coprocessor Architectures- 286, 486, Pentium

Unit 5

Microcontrollers: 8051 systems, Introduction to RISC processors; ARM microcontrollers interface designs.

## Course Learning Outcomes:

At the end of this course students will demonstrate the ability to

* + CO1:- Describe the functionalities of 8085 architectures and Assembly language programming Describe the functionalities of 8086 architectures and Assembly language programming
  + CO2:- Describe the architecture and functional block of 8051 microcontroller.
  + CO3:- Program the functional units of 8051 microcontroller for the given specifications using C/Assembly language.
  + CO4:- Describe various peripheral devices such as 8255, 8279, 8251, 8253, 8259 and 8237.
  + CO5:-Explain various applications using 8051 microcontroller and basic architectures of PIC, ARM and ATMEGA microprocessors and microcontrollers.

## Text Books:

* + Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition, Penram International Publishing.
  + Muhammad Ali Mazidi , Janice Gillispie Mazidi and Rolin D McKinlay, The 8051 microcontroller and embedded systems using assembly and C, second edition Pearson education Asia.
  + Mohamed Rafiquzzaman, Microprocessor and Microcomputer based system design, second edition, CRC press

## Reference Books:

* + Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, third Edition, Penram International Publishers.
  + A.K Ray & K.M. Burchandi, Advanced Microprocessor and peripherals Architectures, Programming and interfacing ―, second edition, Tata McGraw-Hill .
  + Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.

## Online links for study & reference materials :

https:/[/www](http://www.youtube.com/watch?v=liRPtvj7bFU&list=PL0E131A78ABFBFDD0).[youtube.com/watch?v=liRPtvj7bFU&list=PL0E131A78ABFBFDD0](http://www.youtube.com/watch?v=liRPtvj7bFU&list=PL0E131A78ABFBFDD0)

https:/[/www](http://www.youtube.com/watch?v=95uGOJ1Ud2c&list=PLJGA4olwzpArvcdWULcRu).[youtube.com/watch?v=95uGOJ1Ud2c&list=PLJGA4olwzpArvcdWULcRu](http://www.youtube.com/watch?v=95uGOJ1Ud2c&list=PLJGA4olwzpArvcdWULcRu) Mn2495g0n8j

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: EC05 Course Name: Signals and System

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* Understanding the fundamental characteristics of signals and systems.
* Understanding the concepts of vector space, inner product space and orthogonal series.
* Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
* Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

## Course Description:

This course covers the fundamentals of signal and system analysis, focusing on representations of discrete-time and continuous-time signals (singularity functions, complex exponentials and geometrics, Fourier representations, Laplace and Z transforms, sampling) and representations of linear, time-invariant systems (difference and differential equations, block diagrams, system functions, poles and zeros, convolution, impulse and step responses, frequency responses). Applications are drawn broadly from engineering and physics, including feedback and control, communications, and signal processing.

## Course Content:-

Unit 1

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Unit 2

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input- output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response,

Unit 3

Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases,

Unit 4

The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.

Unit 5

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

Unit 6

State-space analysis and multi- input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals.

Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

## Course Learning Outcomes(CLO):-

At the end of this course students will demonstrate the ability to

* CO1: Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
* CO2: Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
* CO3: Classify systems based on their properties and determine the response of LSI system using convolution.
* CO4: Analyze system properties based on impulse response and Fourier analysis.
* CO5: Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.
* CO6: Understand the process of sampling and the effects of under sampling.

## Text books:

* A.Anand Kumar, "Signals and Systems", Second edition, PHI Learning Private Limited,2012.
* A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

## Reference books:

* + R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
  + B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
  + Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
  + Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
  + Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
  + M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
  + J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code: HSMC 202 Course Name:** Human Values

## Course Credit Hour: 3Hr Total Contact Hour: 30hr

**Course Objective:**

* + Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
  + Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
  + Strengthening of self-reflection.
  + Development of commitment and courage to act.

## Course Description:

* + This course introduces the fundamental of human values. It includes important insights about self-exploration, right conduct, ethics and harmony.

## Course Contents:

**Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; ‗Natural Acceptance‘ and Experiential Validation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

**Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!** 1.Understanding human being as a co-existence of the sentient ‗I‘ and the material ‗Body‘. 2.Understanding the needs of Self (‗I‘) and ‗Body‘ - happiness and physical facility.

3.Understanding the Body as an instrument of ‗I‘ (I being the doer, seer and enjoyer). 4.Understanding the characteristics and activities of ‗I‘ and harmony in ‗I‘.

1. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
2. Programs to ensure Sanyam and Health.

## Unit 3: Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students‘ lives.

## Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. 3.Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. 4.Holistic perception of harmony at all levels of existence.

## Unit 5 : Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems

## Course Learning Outcomes (CLOs):

* + CLO-1: Develop the basic concept of human values
  + CLO-2: To understand the importance of self-exploration process
  + CLO-3: To understand harmony at individual levels
  + CLO-4: To understand harmony at nature level
  + CLO-5: Develop professional ethics

## Textbooks:

* Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 Reference Books 1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
* Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

## Reference books:

* Human Values and Professional Ethics: Values and Ethics of Profession, Jay Shree Suresh and B.S Bahgvan, S.Chand

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%) Assignment -1 - 05%

|  |  |
| --- | --- |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** MC-02 **Course Name:** Python

**Course Credit Hour:** 3hr **Total Contact Hour:** 34hr

## Course Objective:

* Master the fundamentals of writing Python programs
* Learn basic Python coding elements such as variables, identifiers and flow control structures.
* Discover how to work with lists and sequence data.
* Write Python functions to facilitate code reuse.
* Work with the Python standard library
* Explore Python's object-oriented features

**Course Description:**

This is an introductory course designed for any student interested in using computation to enhance their problem solving abilities. No prior experience in programming is necessary. Students will use their problem solving abilities to implement programs in Python. This course will develop a basic understanding the Python programming language

## Course Contents: Unit 1

Introduction to Python: - History of python programming language, thrust areas of python, overview of programming in Python, identifiers, variables, Expressions and statements, Operators and Operands, data types, indentation, comments, reading input.

## Unit 2

Control flow Statements:-if statement, if-else statement, if-else-elif control flow statement, nested if statement, the while loops, the for loop, Strings: Creating and storing strings, basic string operations, formatting strings and string operations.

## Unit 3

Functions: Built in functions, function definition and calling the function, default parameters, Lists: Creating list, basic list operations, build in functions used in list, list methods, Dictionaries: Creating dictionaries, built on functions used in dictionaries, dictionary methods.

## Unit 4

Tuples: Creates tuples, basic tuple operations, tuple methods, Sets: set methods, Basics Object –oriented Programming: classes and objects, creating classes and objects in python, classes with multiple objects, class attributes vs. data attributes .

## Course Learning Outcomes (CLOs):

At the end of the course students will demonstrate the ability to

* + Understand python identifiers, variables, Expressions, statements, Operators, operand and data types.
  + Implement Conditionals and Loops for Python Programs.
  + Use functions and represent Compound data using Lists, Tuples, Dictionaries and strings.
  + Implement basics object –oriented components.

## Text books:

* Bill Lubanovic, Introducing Python- Modern Computing in Simple Packages, O‗Reilly Publication.
* Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson Education.

## Reference books:

* Guido Van Russom, Fred L. Drake, An Introduction to Python, Network Theory Limited.
* Magnus Lie Hetland, Beginning Python: From Novice To Professional, Pearson Education.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/106/106/106106212/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%) Assignment -1 -05%

Assignment -2 - 05% Assessment -3(Mid Term-exam)-20% Assignment -3 - 05%

Assessment-4/ Quiz - 05%

## Total Internal Assessment - 40%

**Analog and Digital Communication Lab**

**Teaching Scheme:- 0L:0T:2P Paper Code: EC08 Credits**:1

**List of Experiments:**

1. To study the sampling and reconstruction of a given signal.
2. To study amplitude modulation and demodulation.
3. To study frequency modulation and demodulation.
4. To study time division multiplexing.
5. To study pulse amplitude modulation.
6. To study carrier modulation techniques using binary phase shift keying and differential shift keying.
7. To study pulse code modulation & differential pulse code modulation as well as relevant demodulations.
8. To study quadrature phase shift keying & quadrature amplitude modulation.
9. Study of pulse code modulation and demodulation.
10. Study of delta modulation and demodulation and observe effect of slope overload.
11. Study pulse data coding techniques for various formats.
12. Data decoding techniques for various formats.
13. Study of Amplitude shift keying modulator and demodulator.
14. Study of Frequency shift keying modulator and demodulator.
15. Study of Phase shift keying modulator and demodulator.
16. Error Correction and detection using Hamming code.

**Analog circuits Lab**

**Teaching Scheme:- 0L:0T:2P Paper Code: EC10 Credits**:1

* 1. To find the voltage gain of a CE amplifier and to find its frequency response.
  2. Design a single stage RC coupled amplifier(BJT and FET).
  3. Design a emitter follower circuit using darlington pair.
  4. Design a two stage RC coupled amplifier and plot of frequency v/s gain, estimation of Q factor and bandwidth.
  5. To design a Class A and Class B amplifier.
  6. Design of inverting, non inverting and differential amplifier.
  7. Measurement of common mode gain, Differential mode gain, CMRR, Slew Rate.
  8. Application of Op-Amp as summing amplifier, Difference Amplifier, Integrator, Differentiator.
  9. Oscillator Sinusoidal oscillator (i) Wein bridge (ii) Phase shift (iii) Colpitt's (iv) Hartley. 10.To design and obtain the frequency response of (i) First order low pass Filter,(ii) First order

High Pass Filter , Band Pass Filter.

1. To construct a 3-bit R-2-R ladder type D/A converter using op-amp IC 741.

**Microcontroller Lab**

**Teaching Scheme:- 0L:0T:2P Paper Code: EC12 Credits**: 1

**List of Experiments for microcontroller:**

* 1. Write a program to add starting five natural number, odd number and even number using microcontroller.
  2. Write a program to multiply and divide two number using microcontrollers.
  3. Write a program to find largest and smallest number using microcontroller.
  4. Write a program to interface Stepper motor using 8051 Microcontroller.
  5. Write a program to interface a DC Motor using 8051 microcontroller.

**List of experiment of 8085/8086 micrporocessor.**

1. Using 8085/86 Write two different programs for 16 bit addition, one using instruction DAD and another without using instruction DAD.
2. Using 8085/86 Write assembly language program for 8 bit multiplication and division.
3. Using 8085/86 write an ALP to sum two largest number & smallest number.
4. Using 8085/86 write an ALP to count negative numbers from a given list of 10 numbers.
5. Using 8085/86 write an ALP to add odd & even number & Square of a given no.
6. To obtain interfacing of keyboard controller .
7. To obtain interfacing of DMA controller .
8. To perform microprocessor based traffic light control.

# SEMESTER -5

**Course Code:** EC13 **Course Name:** Electronic Measurement & Instrumentation

## Course Credit Hour: 3hr Total Contact Hour: 40hr

**Course Objective:**

* To understand operation of different instruments.
* To describe different terminology related to measurements.
* To understand the principles of various types of transducers and sensors.

## Course Description:

Electronic measuring instruments are widely used for measuring the electrical charge quantity and amount of flow of electricity through different electronic appliances The course deals with topics such as Principle of measurements, Errors, Accuracy, Units of measurements and electrical standards, , introduction to the design of electronic equipment‘s for temperature, pressure, level, flow measurement, speed etc.

## Course Contents:

**Unit 1**

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohmmeter. **Unit 2**

Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes Digital voltmeter systems, digital multimeters, digital frequency meter system.

## Unit 3

Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

**Unit 4** CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications.

## Unit 5

Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters.

## Course Learning Outcomes (CLOs):

* + Employ appropriate instruments to measure given sets of parameters.
  + Practice the construction of testing and measuring set up for electronic systems.
  + To have a deep understanding about instrumentation concepts this can be applied to Control systems.

## Text books:

* David A. Bel, ―Electronic Instrumentation and Measurements‖, 2nd Ed., PHI, New Delhi 2008.
* Oliver and Cage, ―Electronic Measurements and Instrumentation‖, TMH, 2009.

## Reference books:

* Alan S. Moris, ―Measurement and Instrumentation Principles‖, Elsevier (Buterworth Heinman), 2008.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/108/105/108105153/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |  |
| --- | --- | --- |
| Assessment -1 |  | - 05% |
| Assessment-2 | - 05% |  |
| Assessment-3(Mid exam) | - 20% |  |
| Assessment-3 | - 05% |  |
| Assessment-4 | - 05% |  |
| **Total Internal Assessment** | **- 40%** |  |

## Course Code: EC15 Course Name: Computer Architecture

**Course Credit Hour:** 3hr **Total Contact Hour:** 42hr

## Course Objective:

* + How Computer Systems work & the basic principles
  + Instruction Level Architecture and Instruction Execution
  + The current state of art in memory system design
  + How I/O devices are accessed and its principles.
  + To provide the knowledge on Instruction Level Parallelism
  + To impart the knowledge on microprogramming
  + Concepts of advanced pipelining techniques.

## Course Description:

* + This course provides students with a solid understanding of fundamental architectural techniques used to build today's high-performance processors and systems.
  + Course topics include pipelining, superscalar, out of order execution, multithreading, caches, virtual memory, and multiprocessors.

## Course Contents:

**Module 1: Introduction to computer organization (6 hours)**

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

**Module 2: Memory organization (6 hours)**

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

**Module 3: Input – output Organization (8 hours)**

Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

**Module 4: 16 and 32 microprocessors (8 hours)**

80x86 Architecture, IA **–** 32 and IA **–** 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

**Module 5: Pipelining(8 hours)**

Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

**Module 6: Different Architectures (8 hours)**

VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

**Course learning outcomes:**

Understand the concepts of microprocessors, their principles and practices.

* + - Write efficient programs in assembly language of the 8086 family of microprocessors.
    - Organize a modern computer system and be able to relate it to real examples.
    - Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.
    - Implement embedded applications using ATOM processor.

**Text Books:**

* + ―Computer Architecture and Organization‖, 3rd Edition by John P. Hayes, WCB/McGraw-Hill

**Reference Books:**

* + ―Computer Organization and Architecture: Designing for Performance‖, 10th Edition by William Stallings, Pearson Education.
  + ―Computer System Design and Architecture‖, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

## Online links for study & reference materials:

NPTEL

**Assessment method :**(Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: EC16 Course Name: Probability and Stochastic Processes

**Course Credit Hour:** 3hr **Total Contact Hour:** 30hrs

## Course Objective:

The main objective of this course is to provide students uunderstand representation of random signals and application in different areas, analysis characteristics of any random processes, make use of theorems related to random signals and understand propagation of random signals in LTI systems.

## Course Description:

This course provides an introduction to Probability and Stochastic Processes with applications. Topics include: basic probability, conditional probability, random variables, probability distributions, Markov, Chebyshev and Chernoff bounds , Random sequences and modes of convergence, Transmission of random process.

## Course Contents: Unit-1

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.

## Unit 2

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions.

## Unit-3

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds.

## Unit-4

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem. Random process, Stationary processes, Mean and covariance functions. Ergodicity, Transmission of random process through LTI. Power spectral density.

## Course Learning Outcomes (CLOs):

* + - CLO-1: Understand representation of random signals.
    - CLO-2: Investigate characteristics of random processes
    - CLO-3: Make use of theorems related to random signals
    - CLO-4: To understand propagation of random signals in LTI systems.

## Text books:

* H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education.
* Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes, McGraw Hill.
* P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
* P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers.

## Reference books:

* K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International.
* W. Feller, ―An Introduction to Probability Theory and its Applications‖, Wiley.

## Online links for study & reference materials:

https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ma19/

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 04% |
| Assignment -2 | - 04% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3 | - 04% |
| Assignment-4 | - 04% |
| Assignment-5 | - 04% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: EC17 Course Name: Digital Signal Processing

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* + To develop a thorough understanding of the central elements of discrete time signal processing theory and the ability to apply this theory to real-world signal processing applications.
  + Use z-transforms and discrete time Fourier transforms to analyze a digital system.
  + Understand the discrete Fourier transform (DFT), its applications and its implementation by FFT techniques.
  + Design and understand finite & infinite impulse response filters for various applications.

## Course Description:

The course covers theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. Review of discrete-time linear, time-invariant systems, Fourier transforms and z- transforms. Topics include sampling, impulse response, frequency response, finite and infinite impulse response systems, linear phase systems, digital filter design and implementation, discrete-time Fourier transforms, discrete Fourier transform, and the fast Fourier transform algorithms.

## Course Contents:

Unit 1

Discrete time signals: Sequences; representation of signals on orthogonal basis; Samplingand reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequencyAnalysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Unit 2

Designof FIR Digital filters: Windowmethod,Park-McClellan's method.Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations;Lowpass, Bandpass, Bandstop and High pass filters.

Unit 3

Effect of finite register length in FIR filter design.Parametric and non-parametric spectral estimation.

Unit 4

Introduction to multirate signalprocessing, Application of DSP.

## Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

* Represent signals mathematically in continuous and discrete time and frequency domain
* Get the response of an LSI system to different signals
* Design of different types of digital filters for various applications

## Text books:

* + S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
  + A.S. Sedra and K.C. Smith, Microelectronic Circuits, Edition IV**.**

## Reference books:

* + A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
  + John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
  + L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

## Online links for study & reference materials:

https://nptel.ac.in/courses/108/105/108105055/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code : ECEL1 Course Name: Bio-Medical Electronics

**Course Credit:** 4 **Total Contact Hour:** 40hr

## Course Objective :

To study the working of different medical equipments

## Course Description :

Bio medical electronics (**BME**) is the application of engineering principles and design concepts to medicine and biology for healthcare purposes (e.g. diagnostic or therapeutic). This field seeks to close the gap between engineering and medicine, combining the design and problem solving skills of engineering with medical and biological sciences to advance health care treatment, including diagnosis, monitoring, and therapy.

## Course Contents : Unit 1

Introduction to the physiology of cardiac, nervous & muscular and respiratory systems. Transducers and Electrodes: Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes such as, Ag – Ag Cl, pH, etc.

## Unit 2

Cardiovascular measurement: The heart & the other cardiovascular systems. Measurement of Blood pressure-direct and indirect method, Cardiac output and cardiac rate. Electrocardiography-waveform-standard lead systems typical ECG amplifier, phonocardiography, Ballisto cardiography, Cardiac pacemaker –defibrillator –different types and its selection.

## Unit 3

EEG Instrumentation requirements –EEG electrode –frequency bands – recording systems EMG basic principle-block diagram of a recorder –pre amplifier. Bed side monitor –block diagram- measuring parameters-cardiac tachometer-Alarms-Lead fault indicator-central monitoring. Telemetry – modulation systems – choice of carrier frequency – single channel telemetry systems.

## Unit 4

Instrumentation for clinical laboratory: Bio electric amplifiers-instrumentation amplifiers isolation amplifiers-chopper stabilized amplifiers –input guarding – Measurement of pH value of Blood-blood cell counting, blood flow, Respiratory transducers and instruments.

**Mode of Evaluation:** The theory and lab performance of students are evaluated separately.

## Course Learning Outcomes (CLOs) :

On completion of this course, the students will be able to

* Introduce the student to the electronic devices and theory of operation in the medical area.
* Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronic test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report.
* Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.
* Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.

## Text Books

* J J Carr, ―Introduction to Biomedical Equipment Technology‖ : Pearson Education 4th e/d.

## Reference Books

* K S Kandpur, ―Hand book of Biomedical instrumentation‖, Tata McGraw Hill 2nd e/d.
* John G Webster, ―Medical Instrumentation application and design‖, John Wiley 3rd e/d.
* Richard Aston, ―Principle of Biomedical Instrumentation and Measurement

**Online links for study & reference materials :** [**https://www.slideshare.net/CHINTTANPUBLICATIONS/biomedical-electronics-**](https://www.slideshare.net/CHINTTANPUBLICATIONS/biomedical-electronics-by-j-f-khan-pdf)[**by-j-f-khan-pdf**](https://www.slideshare.net/CHINTTANPUBLICATIONS/biomedical-electronics-by-j-f-khan-pdf)

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: ECEL2 Course Name: CMOS Design

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective :

The objectives of the course is to enable students to:

* Impart knowledge of MOS transistor theory and CMOS technologies.
* Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
* Cultivate the concepts of subsystem design processes.

## Course Description :

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. In this course, we will study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation

## Course Contents :

Unit 1

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. VLSI Fabrication, Oxidation, Lithography, Diffusion, Ion Implantation, Metallization, Integrated Resistors and Capacitors.

Unit 2

MOS Theory Analysis: Basic Electrical Properties of MOS Circuits: Ids-Vds Relationships,MOS Transistor Threshold Voltage Vth, Gradual channel approximation, MOS Capacitance, Short Channel and Narrow Channel Width Effects, Scaling of CMOS Circuits.

Unit 3

Inverter characteristics:- NMOS Inverter, Various Pull-ups, CMOS Inverter Analysis and Design, Bi-CMOS Inverters, Latch up in CMOS Circuits.

Unit 4

Parasitics. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.

Unit 5

CMOS Circuits and Logic Design Rules:, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm, 1.2 µm Design Rules, Rules for Vias and Contacts, Stick Diagrams and Simple Symbolic Encodings for NMOS, PMOS, CMOS and BiCMOS Logic Gates.

Unit 6

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic. Sequential Circuit Design: Static circuits. Design of latches and Flip-flops. Pass Transistor, Transmission Gate

## Course Learning Outcomes (CLOs) :

At the end of the course, the students will be able to:

* + **CO1 & CO2**: be able to use mathematical methods and circuit analysis models in analysis of CMOS , CMOS fabrication flow and technology scaling.
  + **CO3**: Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
  + **CO4:** Estimate and optimize combinational circuit delay using RC delay models and logical effort,and optimize interconnect delay and noise
  + **CO5:** be able to use the physical design aspects to draw the basic gates using the stick and layout diagrams.
  + **CO6**: Be able to design static CMOS combinational and sequential logic at the transistor level, including mask layout.

## Text books :

* Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw-Hill, 1998.
* Neil H.E.Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Addison Wesley, 1998.
* J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.

## Reference books :

* C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
* L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.
* K. Martin, Digital Integrated circuit design, Oxford University press, 2001.
* A.Mukherji, Introduction to nMOS and CMOS VLSI system design, Prentice Hall Inc., 1986.
* C.Mead and L.Conway, Introduction to VLSI systems, Addison Wesley, 1986.

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: ECEL3 Course Name: Information Theory and Coding

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* + Understand the basics of information theory and coding theories.
  + Introduce the concept of amount of information, entropy, channel capacity, errordetection and error-correction codes, block coding, convolution coding, and Viterbi decoding algorithm.
  + Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
  + Describe the real life applications based on the fundamental theory.

## Course Description:

This course comprises of the concepts of entropy, mutual information, the Asymptotic Equipartition property, applications to source coding (data compression), applications to channel capacity (channel coding), differential entropy and its application to waveform channel capacities, and a subset of advanced topics such as Kolmogorov complexity, timing (covert) communications, or rate-distortion theory, as time permits. The second half of the course comprises Hamming codes, cyclic codes (CRC and BCH codes), a brief introduction to Reed-Solomon codes, and perhaps universal codes (Lempel-Ziv coding). Students will be encouraged to choose non-traditional applications of information theory or coding for the course research project.

## Course Contents:

Unit 1

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless codingtheorem; Encoding of discrete sources.Different types of optical fibers, Modal analysis of a step index fiber.

Unit 2

Markov sources; Shannon's noisy coding theorem and converse for discrete channels;Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

Unit 3

Techniques of coding and decoding; Huffman codes and uniquely detectable codes Unit 4

Cyclic codes, convolutional arithmetic codes.

## Course Learning Outcomes(CLOs) :

* + - Understand the concept of information and entropy
    - Understand Shannon‘s theorem for coding
    - Calculation of channel capacity
    - Apply coding techniques

## Text books:

* + N. Abramson, Information and Coding, McGraw Hill, 1963.
  + M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

## Reference books:

* + R.B. Ash, Information Theory, Prentice Hall, 1970.
  + Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/108/102/108102117/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code: HSMC 501 Course Name:** Organization Behavior

## Course Credit Hour: 3Hr Total Contact Hour: 30hr

**Course Objective:**

* + - The student will acquire knowledge of organizational behavior including workplace environment, leadership skills, and organization management.
    - To enhance the understanding of the dynamics of interactions between individuals and the organization. To facilitate a clear perspective to diagnose and effectively handle human behavior issues in Organization and to develop greater insight into their behavior in interpersonal and groups and team.

**Course Description:**

* + - This course introduces the fundamental of organizational behavior includes important insights about motivation, leadership, perception, and learning theories.

## Course Contents:

**Unit 1: Introduction of OB:** (6 lectures)

The concept and nature of OB, need to understand human behavior, Its significance, and impact, Challenges, and opportunities.

**Unit 2: Individual dimensions of behavior**:( 8 lectures)

Individual characteristics, Ability, Values, Attitudes, Formation, Organization related attitude, Relationship between attitude and behavior, Personality, Types, Determinants and traits, learning and Learning theories, Motivation and Motivation theories.

## Unit 3: Group behavior and team development: (8 lectures)

Concept of groups and group dynamics, Types of groups, Formal and Informal group, Stages of group development, Group cohesiveness, Group decision making, Concept of team vs group, Types of teams, Managing teams.

## Unit 4: Organizational culture and conflict management: (8 lectures)

Organizational culture, Leadership: What is leadership, types of leaders and leadership styles, traits and qualities of an effective leader, managing conflicts, resolution of conflicts, Change management.

**Course Learning Outcomes (CLOs):**

CLO-1: Develop the basic concept of organization and types. CLO-2: Inculcate skills and understand behavior.

CLO-3: To understand group behavior and emotional development. CLO-4: To understand organization culture and management.

## Textbooks:

1. Fred Luthans, ―Organizational Behavior‖, 12th Edition, McGraw Hill International Edition
2. Stephen P. Robbins, ―Organizational Behavior‖, 12th Edition, Prentice Hall
3. Aswathappa K, ―Organizational Behavior (Text, Cases, and Games)‖, Himalaya Publication

## Reference books:

Udai Pareek, ―Organizational Behavior‖, Oxford University Press

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment -1 | - 05% |
| Assignment -2 | - 05% |
| Assessment-3(Mid-Exam) | - 20% |
| Assignment-3/Quiz-1 | - 05% |
| Assignment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**EC18: Digital Signal Processing Laboratory [0L:0T:2P 1 credit]**

Hands-on experiments related to the course contents EC17

**EC22: EMI Laboratory [0L:0T:2P 1 credit]**

Hands-on experiments related to the course contents EC13

# SEMESTER -6

**Course Code:** EC19 **Course Name:** Control Systems

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective :**

* To understand fundamental concepts of Control systems and mathematical modelling of the system.
* To understand concept of time response and frequency response of the system.
* To understand basics of stability analysis of the system.

**Course Description:**

This course provides an introduction to linear systems, transfer functions, and Laplace transforms. It covers stability and feedback, and provides basic design tools for specifications of transient response. It also briefly covers frequency-domain techniques.

**Course Contents:**

## Unit 1

Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.

## Unit 2

Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems.

~~Feed-forward and multi-loop control configurations, stability concept, relative stability,~~ Routh stability criterion.

## Unit 3

Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.

## Unit 4

Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency- domain. Frequency-domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution

## Unit 5

State variable Analysis- Concepts of state, state variable, state model, state modelsfor linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

Introduction to Optimal control & Nonlinear control, Optimal Control problem,Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.

**Course Learning Outcomes(CLOs) :**

At the end of this course students will demonstrate the ability to

* + Characterize a system and find its study state behavior
  + Investigate stability of a system using different tests
  + Design various controllers
  + Solve liner, non-liner and optimal control problems

**Text books:**

* Gopal. M., ―Control Systems: Principles and Design‖, Tata McGraw-Hill, 1997.
* Kuo, B.C., ―Automatic Control System‖, Prentice Hall, sixth edition, 1993.

**Reference books:**

* Ogata, K., ―Modern Control Engineering‖, Prentice Hall, second edition, 1991.
* Nagrath & Gopal, ―Modern Control Engineering‖, New Age International, New Delhi

**Online links for study & reference materials:**

https://nptel.ac.in/courses/107/106/107106081/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** EC20 **Course Name:** Computer Networks

## Course Credit Hour: 3hr Total Contact Hour: 35hr

**Course Objective:**

* To develop an understanding of modern network architectures from a design and performance perspective.
* To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
* To provide an opportunity to do network programming
* To provide a WLAN measurement ideas.

## Course Description:

The course covers the basic and advanced concepts and techniques of Computer Networks from both theoretical and practical perspective. The material includes Data communication Components, Data Link Layer and Medium Access Sub Layer, Network Layer, Transport Layer and Application Layer. The students will be able to understand almost all algorithms required to understand real world network issues.

## Course Contents:

**Unit-1**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

**Unit-2**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

**Unit-3**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routingprotocols.

**Unit-4**

**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**Unit-5:**

**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

## Course Learning Outcomes (CLOs):

* **CLO-1**: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
* **CLO-2:** For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.
* **CLO-3**: For a given problem related TCP/IP protocol developed the network

programming.

* **CLO-4**: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

## Text books:

* BehrouzA. Frozen, Data Communication and Networking, 4th Edition, McGraw- Hill.
* William Stallings, Data and Computer Communication, 8th Edition, , Pearson Prentice Hall India.

## Reference books:

* Andrew S. Tanenbaum , Computer Networks, 8th Edition, , Pearson New International Edition.
* Douglas Comer , Internetworking with TCP/IP, Volume 1, 6th Edition , Prentice Hall of India.
* Richard Stevens , TCP/IP Illustrated, Addison-Wesley, United States o f America.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/106/105/106105183/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assignment-1 | - 05% |
| Assignment-2 | - 05% |
| Assessment-3(Mid-Term Exam) | - 20% |
| Assignment-3 | - 05% |
| Assignment-1/Quiz | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code : ECEL04 Course Name : Introduction to MEMS

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective :** The goal of this course is to introduce students to MEMS devices, microsystems and their applications as follows

* To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
* To educate on the rudiments of Micro fabrication techniques.
* To introduce various sensors and actuators
* To introduce different materials used for MEMS
* To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

**Course Description :** Micro-electro-mechanical is one of the emerging fields.. The course will start with an introduction on the mechanical and electrical properties of materials commonly used in MEMS. The micro-fabrication processes, including bulk and surface micromachining processes for realization of these micro/nano transducers will be discussed, along with integration of MEMS with CMOS electronics. Some representative sensors and actuators, including capacitive & piezoelectric pressure sensors, mechanical resonators and filters, minimally invasive implantable medical devices, and biomedical lab-on-a-chip will be used to illustrate the capabilities & advantages of these miniaturized devices. This course designs for the give the knowledge of the fabrication of different micro electronics system. It covers the different topic related with the micro system, fabrication technology at micro level.

## Course Contents :

Unit1

INTRODUCTION Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes

– New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Unit2

SENSORS AND ACTUATORS-I Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

Unit3

SENSORS AND ACTUATORS-II Piezoresistive sensors – Piezoresistive sensor materials

- Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Uint4

MICROMACHINING Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies –Basic surface micro machining processes –

Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

Unit 5

POLYMER AND OPTICAL MEMS Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

## Text Books:

* Chang Liu, ‗Foundations of MEMS‘, Pearson Education Inc., 2012.
* Stephen D Senturia, ‗Microsystem Design‘, Springer Publication, 2000.
* Tai Ran Hsu, ―MEMS & Micro systems Design and Manufacture‖ Tata McGraw Hill, New Delhi, 2002.

## References Books:

* Nadim Maluf,― An Introduction to Micro Electro Mechanical System Design‖, Artech House, 2000.
* Mohamed Gad-el-Hak, editor, ― The MEMS Handbook‖, CRC press Baco Raton, 2001.
* Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
* James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
* Thomas M.Adams and Richard A.Layton, ―Introduction MEMS, Fabrication and Application,‖ Springer, 2010.

## Course Learning Outcomes(CLOs) :

* **CLO1** : Ability to understand the operation of micro devices, micro systems and their applications.
* **CLO2 &CLO3** : able to understand the concept of sensors and actuators, their uses& application
* **CLO4** : Ability to design the micro devices, micro systems using the MEMS fabrication process
* **CO5:-Able to understand about the** polymer and optical mems

## Online links for study & reference materials :

https://nptel.ac.in/courses/117/105/117105082/

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL5 **Course Name:** Electromagnetic Waves

**Course Credit:3 Total Contact Hour:** 40hr

## Course Objective:

* To introduce students with different coordinate systems.
* To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
* To expose the students to the ideas of electromagnetic waves and structure of transmission line.

## Course Description:

This course includes the knowledge of Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields. It distinguishes between the static and time- varying fields establish the corresponding sets of Maxwell‘s Equations and Boundary Conditions. It analyzes the Wave Equations for good conductors, good dielectrics and evaluate the UPW Characteristics for several practical media of interest.

## Course Contents: Unit 1

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmitssion line sections as circuit elements.

## Unit 2

Maxwell‘s Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

## Unit 3

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Poincare‘s Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

## Unit 4

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

## Unit 5

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

## Unit 6

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

## Course Learning Outcomes (CLOs):

* Understand characteristics and wave propagation on high frequency transmission lines.
* Use sections of transmission line sections for realizing circuit elements.
* Characterize uniform plane wave.
* Calculate reflection and transmission of waves at media interface
* Understand principle of radiation and radiation characteristics of an antenna

## Text books:

* E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
* Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

## Reference books:

* R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

## Online links for study & reference materials:

<https://nptel.ac.in/courses/117/101/117101056/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Mid exam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: ECEL06 Course Name: Speech and Audio Processing

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* + To introduce the models of speech and audio production and acoustic phonetics
  + To teach time and frequency domain techniques for estimating speech parameters
  + To teach predictive techniques for speech coding
  + To introduce speech recognition and speech synthesis applications

## Course Description:

This course covers the basic principles of digital speech processing, fundamentals of speech production and perception with basic techniques for digital speech processing: like short – time energy, magnitude, autocorrelation ,short – time Fourier analysis

,homomorphic (convolutional) methods, linear predictive methods – Speech estimation methods ,speech/non-speech detection , voiced/unvoiced/non-speech segmentation/classification , Applications of speech signal processing , Speech coding , Speech synthesis, Speech recognition/natural language processing

## Course Contents:

Unit 1

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Unit 2

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit 3

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

Unit 4

Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Unit 5

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

## Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

* + - Mathematically model the speech signal
    - Analyze the quality and properties of speech signal.
    - Modify and enhance the speech and audio signals.

## Text books:

* ―Digital Speech‖ by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.

## Reference books:

* ―Speech Coding Algorithms: Foundation and Evolution of Standardized Coders‖, W.C. Chu, WileyInter science, 2003.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/117/105/117105145/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**EC21: Computer Networks Laboratory [0L:0T:4P 2 credit]**

Hands-on experiments related to the course contents EC20

**Course Code : EC23 Course Name :** Mini Project/Electronic Design Workshop

## Course Credit: 2 Total Contact Hour: 20hr

**Guidelines:**

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

## Course Outcomes:

At the end of the course, students will demonstrate the ability to:

* + Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
  + Design, implement and test the prototype/algorithm in order to solve the conceived problem.
  + Write comprehensive report on mini project work.

# SEMESTER -7

**Course Code:** ECEL07 **Course Name:** Power Electronics

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective:**

* + - To understand and acquire knowledge about various power semiconductor devices.
    - To prepare the students to analyze and design different power converter circuits.

**Course Description:**

The course focuses on presenting concepts for conversion, control and monitoring of electric energy using power semiconductor devices.Methods for analyzing power electronic converters suitable for AC/DC, DC/DC and DC/AC electrical energy conversions including resonance converters are presented. Additionally, principles for designing power electronic converters, including their power semiconductors and passive elements are established. Computer-aided analysis and simulations of the electrical and thermal performance of power electronic converters is also among the course objectives.

**Course Contents:**

**Unit 1**

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

**Unit 2**

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

**Unit 3**

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

**Unit 4**

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

**Unit 5**

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters-need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

**Course Learning Outcomes(CLOs) :**

At the end of this course students will demonstrate the ability to

* + - Build and test circuits using power devices such as SCR
    - Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
    - Learn how to analyze these inverters and some basic applications.

**Text books:**

* + - Muhammad H. Rashid, ―Power electronics‖ Prentice Hall of India.
    - Ned Mohan, Robbins, ―Power electronics‖, edition III, John Wiley and sons.

**Reference books:**

* + - P.C. Sen., ―Modern Power Electronics‖, edition II, Chand& Co.
    - V.R.Moorthi, ―Power Electronics‖, Oxford University Press.
    - Cyril W., Lander,‖ Power Electronics‖, edition III, McGraw Hill.
    - G K Dubey S R Doradla,: Thyristorised Power Controllers‖, New Age International Publishers. SCR manual from GE, USA.

**Online links for study & reference materials:**

https://nptel.ac.in/courses/108/102/108102145/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code : ECEL8 Course Name :** Nano electronics

## Course Credit: 3 Total Contact Hour: 40hr

**Course Objective :**

Students undergoing this course are exposed to:

* Know the types of nanotechnology, atomic structure, molecular technology and preparation of nano materials.
* Understand the fundamentals of nano electronics and its properties.
* Know the Silicon MOSFET‘s, QTD and carbon nano tubes.
* Understand the fundamentals of molecular electronics.

## Course Description :

The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of nanoelectronics. The course will cover electrical and optical properties of materials and nanostructures, fabrication of nanostructures, nanoelectronic devices including resonant-tunneling devices, transistors, and single-electron transfer devices, as well as applications of nanotechnologies in molecular biology and medicine.

## Course Contents :

Unit 1

Introduction To Nanotechnology:- Introduction: Discussion of the International Technology Roadmap characteristics: Need for new concepts in electronics From microelectronics towards biomolecule electronics Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up. Molecular Nanotechnology: Electron Microscope – Scanning Electron Microscope – Atomic Force Microscope –Scanning Tunneling Microscope. Nanomaterials: Preparation –Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position

– Ball Milling –Applications Of Nanomaterials. Unit 2

Fundamentals Of Nanoelectronics:-Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation:- power dissipation limit – dissipation in reversible computation – the ultimate computer.

Unit 3

Silicon MOSFET & Quantum Transport Devices:-Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling: Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applicationssingle electron devices – applications of single electron devices to logic circuits.

Unit 4

Carbon Nanotubes:-Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube fets – Nanotube for memory applications – prospects of all carbon nanotube nanoelectronics.

Unit 5

Molecular Electronics:-Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS

* robots – random access memory – mass storage devices

## Course Learning Outcomes(CLOs) :

Upon the successful completion of the course, students will be able to:

* + CLO1: Discuss the types of nanotechnology, molecular technology and the preparation of nano materials.
  + CLO2: Explains the fundamental of the devices such as logic devices, field effect devices, and spintronics
  + CLO3: Describe the concepts of silicon MOSFET and Quantum Transport Devices.
  + CLO4: Summarize the types, synthesis, interconnects and applications of carbon nano tubes.
  + CLO 5: Explain the concepts, functions, fabrications and applications of molecular electronics.

## Text books :

* Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and Burkhard 2. Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002.
* Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003.
* T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007.

## Reference books :

* M.Ziese and M.J Thornton(Eds.)‖Spin Electronics ―, Springer-verlag 2001.
* M.Dutta and M.A Stroscio Edited by ―Quantum Based Electronic Devices and systems‖, world Scientific, 2000.
* K.E. Drexler, Nanosystems, Wiley, 1992.
* J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
* C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

## Online links for study & reference materials :

https:/[/www.edx.org/course/fundamentals](http://www.edx.org/course/fundamentals-nanoelectronics-part-b-purduex-nano521x)-[nanoelectronics-part-b-purduex-nano521x](http://www.edx.org/course/fundamentals-nanoelectronics-part-b-purduex-nano521x)

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL9 **Course Name:** Scientific Computing

**Course Credit Hour:** 3hr **Total Contact Hour:** 40hr

## Course Objective:

* To make students familiar with the concepts of programming and the get they accustomed with high-level languages like MATLAB etc.
* To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration, differential equations and simulation.

## Course Description:

After this course the student should be able to understand simple mathematical models and scientific problems (such as finite capacity growth models, plotting a line through data points, etc.) and implement a solution in an adequate scientific programming language (such as MATLAB).

## Course Contents:

**UNIT-1**

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

## UNIT-2

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

## UNIT-3

Eigen-values and singular values: Eigen-values and Eigenvectors, Methods for Computing All Eigen-values, Jacobi Method, Methods for Computing Selected Eigen-values, Singular Values Decomposition, Application of SVD

## UNIT-4

Nonlinear equations: Fixed Point Iteration, Newton‘s Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation **UNIT-5**

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences.

## Course Learning Outcomes (CLOs):

* Exploring the properties for numerical methods and mathematical models by using the analysis methods covered in the course.
* Understanding the results when running a MATLAB program, and describe a problem with an algorithm or a programming code in MATLAB (which might include self-written MATLAB functions);
* Structure and divide a computational problem into sub-problems, formulate an algorithm and implement the algorithm in MATLAB;

## Text books:

* Heath Michael T., ―Scientific Computing: An Introductory Survey‖ , McGraw-Hill, 2nd Ed., 2002
* Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery,

―Numerical Recipes: The Art of Scientific Computing‖, Cambridge University Press, 3rd Ed., 2007

## Reference books :

* Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, ―Scientific Computing With MATLAB And Octave‖, Springer, 3rd Ed., 2010

## Online links for study & reference materials :

<https://nptel.ac.in/courses/111/102/111102137/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Mid exam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code: ECEL10 Course Name: Adaptive Signal Processing

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* + To understand multirate DSP and design efficient digital filters.
  + To construct multi-channel filter banks.
  + To select linear filtering techniques to engineering problems.
  + To describe the most important adaptive filter generic problems and various adaptive filter algorithms.

## Course Description:

This **course** develops the concepts, key issues and motivating examples for adaptive filters; Discrete time linear systems and filters; Random variables and random processes, covariance matrices; Z transforms of stationary random processes. Optimum Linear Systems - Error surfaces and minimum mean square error; Optimum discrete time Wiener filter; Principle of orthogonality and canonical forms; Constrained optimisation; Method of steepest descent - convergence issues; Stochastic gradient descent LMS - convergence in the mean and misadjustment Case study. Least squares and recursive least squares. Linear Prediction - Forward and backward linear prediction; Levinson Durbin; Lattice filters.

## Course Contents:

Unit1

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment

Unit 2

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit 3

Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank andnullity, innerp roduce space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Unit 4

Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit 5

Introduction to recursive least squares (RLS), vector space formulation of RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

## Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

* + - Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.
    - Mathematically represent the ‗adaptability requirement‘.
    - Understand the mathematical treatment for the modeling and design of the signal processing systems.

## Text books:

* + S. Haykin, Adaptive filter theory, Prentice Hall, 1986.

## Reference books:

* + C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/117/105/117105075/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL11 **Course Name:** Antenna & Propagation

**Course Credit Hour:** 3hr **Total Contact Hour:** 40hr

**Course Objective:**

* + - To introduce the student to antennas, covering their principles of radiation, their basic parameters, (radiation resistance, radiation pattern, polarization, reciprocity, effective radiated power), their general types, and those commonly used in wireless systems.
    - Concept of radiation mechanism of various antennas.
    - Mechanism and models for radio-wave propagation.

**Course Description:**

Antenna and Wave Propagation is to introduce to the students the basics of radiating elements and effect of propagation of radio waves in actual environment. This course provides students with comprehensive coverage of a wide variety of antennas and propagation topics related to numerous communication systems with a particular emphasis on military applications.

**Course Contents:**

**UNIT-1**

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

**UNIT-2**

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

**UNIT-3**

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

**UNIT-4**

Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, and synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

**UNIT-5**

Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice.

**Course Learning Outcomes (CLOs):**

* Understand the properties and various types of antennas.
* Analyze the properties of different types of antennas and their design.
* Operate antenna design software tools and come up with the design of the antenna of required specifications.

**Text books:**

* J.D. Kraus, Antennas, McGraw Hill, 1988.
* C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.

**Reference books :**

* + R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.

**Online links for study & reference materials :**

<https://nptel.ac.in/courses/108/101/108101092/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Mid exam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code ECEL12 Course Name: Digital Image & Video Processing**

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* To understand the need for image transforms different types of image transforms and their properties.
* To develop any image processing application.
* To understand the rapid advances in Machine vision.
* To learn different techniques employed for the enhancement of images.

## Course Description:

This course will cover the fundamentals of image and video processing. We will provide a mathematical framework to describe and analyze images and videos as two- and three- dimensional signals in the spatial, spatio-temporal, and frequency domains. In this class not only will you learn the theory behind fundamental processing tasks including image/video enhancement, recovery, and compression – but you will also learn how to perform these key processing tasks in practice using state-of-the-art techniques and tools. We will introduce and use a wide variety of such tools – from optimization toolboxes to statistical techniques.

## Course Contents:

UNIT 1

Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

UNIT 2

Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

UNIT 3

Image Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

UNIY 4

Image Compression-Redundancy–inter-pixel and psycho-visual; Losslesscompression – predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards–JPEG and JPEG-2000.

UNIT 5

Fundamentals of Video Coding-Inter-frame redundancy, motion estimationtechniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy–Group of pictures, frames, slices,

macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Video Segmentation-Temporal segmentation–shot boundary detection, hard-cutsand soft- cuts; spatial segmentation–motion-based; Video object detection and tracking.

## Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

* Mathematically represent the various types of images and analyze them.
  + Process these images for the enhancement of certain properties or for optimized use of the resources.
  + Develop algorithms for image compression and coding

## Text books:

* R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
* Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004

## Reference books:

* + Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

## Online links for study & reference materials:

https://nptel.ac.in/courses/117/105/117105079/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code: ECEL13 Course Name: Mobile Communication and Networks**

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective:**

* To study the concept of Mobile radio propagation, cellular system design
* To understand mobile technologies like GSM and CDMA.
* To know the mobile communication evolution of 2G, 3G and 3 GPP in detail.
* To have overview of immerging technologies for 4 G standards.

**Course Description:**

This Course is to expose the students to the most recent technological developments in Mobile communication systems.. The Course considers the basic concepts of cellular system. Following this, various propagation effects and propagation models used in mobile communication are included in the course.This course deals with various methodologies to improve the received signal quality in mobile communication.The Course provides various multiple access techniques and Standards in Cellular mobile Communication.

**Course Contents:**

Unit 1

Cellular concepts-Cell structure, frequency reuse, cell splitting, channelassignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Unit 2

Signal propagation**-**Propagation mechanism- reflection, refraction, diffraction andscattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

Unit 3

Capacity of flat and frequency selective channels. Antennas-Antennas for mobileterminal- monopole antennas, PIFA, base station antennas and arrays.

Unit 4

Multiple access schemes**-** FDMA, TDMA, CDMA and SDMA. Modulationschemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Receiver structure- Diversity receivers- selection and MRC receivers, RAKEreceiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

Unit 5

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

**Course Learning Outcomes(CLOs) :**

At the end of this course students will demonstrate the ability to

* + Understand the working principles of the mobile communication systems.
  + Understand the relation between the user features and underlying technology.
  + Analyze mobile communication systems for improved performance

**Text books:**

* WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
* WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.

**Reference books:**

* Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
* AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
* VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

**Online links for study & reference materials:**

<http://www.nptelvideos.in/2012/12/wireless-communication.html>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL14 **Course Name:** Mixed Signal Design

## Course Credit Hour: 3hr Total Contact Hour: 40hr

**Course Objective:**

* Study the mixed signal of submicron CMOS circuits
* Understand the various integrated based filters and topologies
* Learn the data converters architecture, modeling and signal to noise ratio
* Study the integrated circuit of oscillators and PLLs

## Course Description:

This course provides the understanding of the practical situations where mixed signal analysis is required and analyze to handle the inter-conversions between signals. It includes the concepts of design systems involving mixed signals.

## Course Contents:

**UNIT-1**

Analog and discrete-time signal processing, introduction to sampling theory; Analog

continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

## UNIT-2

Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

## UNIT-3

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

## UNIT-4

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

## UNIT-5

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

## Course Learning Outcomes (CLOs):

* + Apply the concepts for mixed signal MOS circuit.
  + Analyze the characteristics of IC based CMOS filters.
  + Design of various data converter architecture circuits.
  + Design of oscillators and phase lock loop circuit.

## Text books:

* CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint 2008.

## Reference books :

* Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33rd Reprint, 2016.

## Online links for study & reference materials :

<https://nptel.ac.in/content/storage2/courses/117101105>/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Mid exam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL15 **Course Name:** Microwave Theory & Techniques

## Course Credit Hour: 3hr Total Contact Hour: 40hr

**Course Objective:**

* To understand the microwave waveguides, passive & active devices, tubes and network analysis.
* To design microwave matching networks.
* To perform microwave measurements.

## Course Description:

Microwaves are everywhere in current technology, especially in the most popular television industries. Microwaves is very much applicable between local and national security channels. For instance, microwaves are used missile guidance infrastructures to control the speed of their missiles as well as parameters.

## Course Contents:

**UNIT-1**

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;

Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

## UNIT-2

Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

## UNIT-3

Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes,

Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

## UNIT-4

Microwave Design Principles- Impedance transformation, Impedance Matching, Microwave

Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave

## UNIT-5

General measurement setup, Microwave bench, Power measurement – low, Medium & high, Attenuation measurement, Measurement of VSWR, Measurement of dielectric constant, Measurement of Impedance: using Smith Chart, Measurement with spectrum analyzer, Scalar & vector network analyzer operation.

## Course Learning Outcomes (CLOs):

* + Understand about different modes of wave propagation (TE, TM and TEM) and waveguide structure.
  + Knowledge about different microwave components
  + Understanding about devices used in microwave generation
  + Microwave measurement theory and technology

## Text books:

* + R.E. Collins, Microwave Circuits, McGraw Hill
  + K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

## Reference books:

* Liao, S.Y., Microwave Devices & Circuits, Tata McGraw Hill (2006) 2nd edition.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/108/101/108101112/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Mid exam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

Open Elective-3for 7th SEM

**Course Code:** ECP1 **Course Name:** Project Stage-I

## Course Credit: 5

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

# SEMESTER -8

**Course Code: ECEL16 Course Name: Fiber Optic Communication**

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective:

* + To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
  + To understand the different kind of losses, signal distortion, SM fibers
  + To learn the various optical sources, materials and fiber splicing
  + To learn the fiber optical receivers and noise performance in photo detector.

## Course Description:

The course is aimed at equipping the undergraduate Engineering and Physics students with the basic understanding of optical fibers and optical fiber communication. The course provides knowledge of optical fiber waveguide at fundamental level, essentials of an optical fiber communication system and understanding of various components of an optical fiber telecommunication system.

## Course Contents:

Unit 1

Introduction to vector nature of light, propagation of light, propagation of light ina cylindrical dielectric rod, Ray model, wave model.Different types of optical fibers, Modal analysis of a step index fiber.

Unit 2

Signaldegradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.Optical sources - LEDs and Lasers, Photo- detectors - pin-diodes, APDs, detectorresponsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Unit 3

Optical switches - coupled mode analysis of directional couplers, electro-opticswitches. Unit 4

Optical amplifiers - EDFA, Raman amplifier.WDM and DWDM systems. Principles of WDM networks.

Unit 5

Nonlinear effects in fiber optic links. Concept of self-phase modulation, groupvelocity dispersion and solition based communication.

## Course Learning Outcomes(CLOs) :

* Understand the principles fiber-optic communication, the components and the bandwidth advantages.
* Understand the properties of the optical fibers and optical components.
* Understand operation of lasers, LEDs, and detectors
* Analyze system performance of optical communication systems
* Design optical networks and understand non-linear effects in optical fibers

## Text books:

* + J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
  + T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

## Reference books:

* + J. Gowar, Optical communication systems, Prentice Hall India, 1987.
  + S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.

## Online links for study & reference materials:

<https://nptel.ac.in/courses/108/106/108106167/>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL17 **Course Name:** Radar & Satellite Communication

## Course Credit: 3 Total Contact Hour: 40hr

**Course Objective:**

* + To become familiar with satellites and satellite services.
  + Study of satellite orbits and launching.
  + Study of earth segment and space segment components
  + Study of satellite access by various users.

## Course Description:

The course introduces the students to the basic concept in the field of satellite communication. This will enable the students to know how to place a satellite in an orbit and about the earth & space segment. The satellite services like broadcasting are also studied thoroughly.

## Course Contents:

**Unit-1**

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

## Unit-2

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

## Unit-3

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub- systems etc.

## Unit-4

Typical Phenomena in Satellite Communication:Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

## Unit-5

Satellite link budget, flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Modulation and Multiple Access Schemes:Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA**.**

## Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

* Visualize the architecture of satellite systems as a means of high speed, high range communication system.
* State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
* Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

## Text books:

* Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002

## Reference books:

* Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
* Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

## Online links for study & reference materials:

https://nptel.ac.in/courses/117/105/117105131/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40** |

## Course Code : ECEL18 Course Name : High Speed Electronics

**Course Credit:** 3 **Total Contact Hour:** 40hr

## Course Objective :

Aim of this subject is to understand significance and the areas of application of high-speed electronics circuits

## Course Description :

Important parameters governing the high speed performance of devices and circuits are described, mainly emphases on transmission line, Noise analysis, RF amplifier design, mixer circuit,oscillators and understanding of PCB Designing is given.

## Course Contents :

Unit 1

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency powerdelivery, methodologies for design of high speed buses, radiated emissions and minimizing system noise.

Unit 2

Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation,Cross-modulation, Dynamic range.

Devices: Passive and active, Lumped passive devices (models), Active (models,low vs highfrequency)

Unit 3

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages

Unit 4

Mixers –Upconversion Downconversion, Conversion gain and spurious response.Oscillators Principles.PLL Transceiver architectures

Unit 5

Printed Circuit BoardAnatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

## Course Learning Outcomes(CLOs) :

At the end of the course, students will demonstrate the ability to:

* + CLO1 : Understand significance and the areas of application of high-speed electronics circuits.
  + CLO2& CLO3: Understand the properties of various components used in high speed electronics
  + CLO4 : Design High-speed electronic system using appropriate components.
  + CLO5: Understand about CAD tools for PCB Design

## Text books :

* Stephen H. Hall, Garrett W. Hall, James A. McCall ―High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices‖, August 2000, Wiley-IEEE Press
* Thomas H. Lee, ―The Design of CMOS Radio-Frequency Integrated Circuits‖, CambridgeUniversity Press, 2004, ISBN 0521835399.

## Reference books :

* Behzad Razavi, ―RF Microelectronics‖, Prentice-Hall 1998, ISBN 0-13-887571-5.
* Guillermo Gonzalez, ―Microwave Transistor Amplifiers‖, 2nd Edition, Prentice Hall.
* Kai Chang, ―RF and Microwave Wireless systems‖, Wiley.
* R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

**Online links for study & reference materials :** <https://nptel.ac.in/courses/117/106/117106089/> <https://nptel.ac.in/courses/117/104/117104071/>

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL19 **Course Name:** Wavelets

**Course Credit:** 3 **Total Contact Hour:** 40hr

**Course Objective:**

* + To expose to the basics of wavelet theory
  + To illustrate the use of wavelet processing for data compression
  + To understand denoising and noise suppression.

## Course Description:

This course focus on the concepts, methodologies and tools of signal processing using wavelets. We will discuss the basics of wavelets, and aim at the appropriate balance of theory and applications. Topics of interest include multiresolution analysis, wavelet packets, and selected applications to data compression, denoising and signal and image processing.

## Course Contents: Unit 1

Introduction to time frequency analysis; the how, what and why about wavelets, Short-time Fourier transform,

## Unit 2

Wigner-Ville transform.;Continuous time wavelet transform, Discrete wavelet transform, tiling of the time-frequency plane and wave packet analysis,

## Unit 3

Construction of wavelets. Multiresolution analysis. Introduction to frames and biorthogonal wavelets, Multirate signal processing and filter bank theory,

## Unit 4

Application of wavelet theory to signal denoising, image and video compression, multi- tone digital communication, transient detection.

## Course Learning Outcomes(CLOs) :

At the end of the course, students will demonstrate the ability to:

* + Understand time-frequency nature of the signals.
  + Apply the concept of wavelets to practical problems.
  + Mathematically analyze the systems or process the signals using appropriate wavelet functions.

## Text books:

* Stephen H. Hall, Garrett W. Hall, James A. McCall ―High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices‖, August 2000, Wiley-IEEE Press
* Thomas H. Lee, ―The Design of CMOS Radio-Frequency Integrated Circuits‖, CambridgeUniversity Press, 2004, ISBN 0521835399.

## Reference books:

* Behzad Razavi, ―RF Microelectronics‖, Prentice-Hall 1998, ISBN 0-13-887571-5.
* Guillermo Gonzalez, ―Microwave Transistor Amplifiers‖, 2nd Edition, Prentice Hall.
* Kai Chang, ―RF and Microwave Wireless systems‖, Wiley.
* R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

## Online links for study & reference materials:

https://nptel.ac.in/courses/117/101/117101001/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

**Course Code:** ECEL20 **Course Name:** Wireless Sensor Network

## Course Credit: 3 Total Contact Hour: 40hr

**Course Objective:**

* + To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology
  + Understand the medium access control protocols and address physical layer issues
  + Learn key routing protocols for sensor networks and main design issues
  + Learn transport layer protocols for sensor networks, and design requirements
  + Understand the Sensor management ,sensor network middleware, operating systems.

## Course Description:

This course will cover the latest research in the area of Wireless Sensor Networks. We will cover all aspects of these unique and important systems, from the hardware and radio architecture through protocols and software to applications. Topics will include sensor network architectures, hardware platforms, physical layer techniques, medium access control, routing, topology control, quality of service (QoS) management, localization, time synchronization, security, storage, and other advanced topics. Each student must complete a semester-long course project related to wireless sensor networks.

## Course Contents:

**Unit 1**

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

## Unit 2

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

## Unit 3

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

## Unit 4

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. **Unit 5**

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

## Course Learning Outcomes(CLOs) :

At the end of the course the students will be able to

* + - Design wireless sensor networks for a given application
    - Understand emerging research areas in the field of sensor networks
    - Understand MAC protocols used for different communication standards used in WSN
    - Explore new protocols for WSN

## Text books:

* + Waltenegus Dargie , Christian Poellabauer, ―Fundamentals Of Wireless Sensor Networks Theory And Practice‖, By John Wiley & Sons Publications ,2011
  + Sabrie Soloman, ―Sensors Handbook" by McGraw Hill publication. 2009

## Reference books:

* + Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks‖, Elsevier Publications,2004
  + Kazem Sohrby, Daniel Minoli, ―Wireless Sensor Networks‖: Technology, Protocols and Applications, Wiley-Inter science
  + Philip Levis, And David Gay "TinyOS Programming‖ by Cambridge University Press 2009

## Online links for study & reference materials:

https://nptel.ac.in/courses/106/105/106105160/

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

## Course Code : ECEL21 Course Name : Embedded Systems

**Course Credit:**3 **Total Contact Hour:** 40hr

## Course Objective :

* + To provide an overview of Design Principles of Embedded System.
  + To provide clear understanding about the role of firmware , operating systems in correlation with hardware systems.

## Course Description :

In this course you will learn the basics of designing, interfacing, configuring, and programming embedded systems. By the end of the course you will have mastered the basics of embedded system design and programming. This course will help to prepare you for cutting edge careers in industry and research.

## Course Contents :

Unit 1

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit 2

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Unit 3

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

Unit 4

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Unit 5

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

## Course Learning Outcomes(CLOs) :

* + CLO1 : Expected to understand the selection procedure of Processors in the Embedded domain.
  + CLO2: Design Procedure for Embedded Firmware.
  + CLO 3: Expected to visualize the role of Real time Operating Systems in Embedded Systems
  + CLO 4. Expected to evaluate the Correlation between task synchronization and latency issues

## Text books :

* + Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

## Reference books :

* + Embedded Systems - Raj Kamal, TMH.
  + Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
  + Embedded Systems – Lyla, Pearson, 2013
  + An Embedded Software Primer - David E. Simon, Pearson Education.

**Online links for study & reference materials :** <https://nptel.ac.in/courses/108/102/108102045/> <https://nptel.ac.in/courses/106/105/106105193/>

**Assessment method :** (Continuous Internal Assessment = 40% , Final Examination = 60%)

|  |  |
| --- | --- |
| Assessment -1 | - 05% |
| Assessment-2 | - 05% |
| Assessment-3(Midexam) | - 20% |
| Assessment-3 | - 05% |
| Assessment-4 | - 05% |
| **Total Internal Assessment** | **- 40%** |

Open Elective-4 for 8th sem

**Course Code: ECP2 Course Name:** Project Stage -II

## Course Credit: 9

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.