**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE**

| **I Year - I Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21HST01 | Communicative English | 3 | 0 | 0 | 3 |
| 2 | P21BST01 | Linear Algebra & Differential Equations | 3 | 0 | 0 | 3 |
| 3 | P21BST02 | Applied Physics | 3 | 0 | 0 | 3 |
| 4 | P21EST01 | Engineering Graphics | 3 | 0 | 0 | 3 |
| 5 | P21EST03 | C-Programming for Problem Solving | 3 | 0 | 0 | 3 |
| 6 | P21HSL01 | English Language Communication Skills Lab | 0 | 0 | 3 | 1.5 |
| 7 | P21BSL01 | Applied Physics Lab | 0 | 0 | 3 | 1.5 |
| 8 | P21ESL02 | C-Programming for Problem Solving Lab | 0 | 0 | 3 | 1.5 |
| 9 | P21MCT01 | Induction program | 2 | 0 | 0 | 0 |
| Total Credits | | | | | | 19.5 |

| **I Year - II Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21BST04 | Applied Chemistry | 3 | 0 | 0 | 3 |
| 2 | P21BST06 | Numerical Methods & Vector calculus | 3 | 0 | 0 | 3 |
| 3 | P21EST08 | Network Analysis | 3 | 0 | 0 | 3 |
| 4 | P21EST11 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 |
| 5 | P21EST13 | Data Structures | 3 | 0 | 0 | 3 |
| 6 | P21BSL03 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 7 | P21ESL05 | Electronic Devices and Circuits Lab | 0 | 0 | 3 | 1.5 |
| 8 | P21ESL06 | Data Structure Lab | 0 | 0 | 3 | 1.5 |
| Total Credits | | | | | | 19.5 |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE**

| **II Year - I Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21BST07 | Transformation Techniques and Differential Equations | 3 | 0 | 0 | 3 |
| 2 | P21ECT01 | Signals and Systems | 3 | 0 | 0 | 3 |
| 3 | P21ECT02 | Switching Theory and Logic Design | 3 | 0 | 0 | 3 |
| 4 | P21ECT03 | Electronic Circuit Analysis | 3 | 0 | 0 | 3 |
| 5 | P21EET04 | Pulse and Digital Circuits | 3 | 0 | 0 | 3 |
| 6 | P21ECL01 | Switching Theory and Logic Design Lab | 0 | 0 | 3 | 1.5 |
| 7 | P21ECL02 | Analog Circuit Lab | 0 | 0 | 3 | 1.5 |
| 8 | P21ECL03 | Signals and Systems Lab | 0 | 0 | 3 | 1.5 |
| 9 | P21ECS01 | Certificate course being offered by industries/ professional bodies/ APSSDC or any other accredited bodies. | 1 | 0 | 2 | 2 |
| 10 | P21MCT03 | Environmental Studies | 2 | 0 | 0 | 0 |
| | | | | | Total Credits | 21.5 |

| **II Year - II Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21ECT08 | Random Variables and Stochastic Process | 3 | 0 | 0 | 3 |
| 2 | P21ECT07 | Analog & Digital Communications | 3 | 0 | 0 | 3 |
| 3 | P21ECT05 | Linear and Digital IC Applications | 3 | 0 | 0 | 3 |
| 4 | P21ECT06 | ElectroMagnetic Waves & Transmission Lines | 3 | 0 | 0 | 3 |
| 5 | P21MBT01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 |
| 6 | P21ECL04 | Analog & Digital Communications Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | P21ECL05 | Linear and Digital IC Applications Laboratory | 0 | 0 | 3 | 1.5 |
| 8 | P21ECP01 | Mini Project | 0 | 0 | 2 | 1.5 |
| 9 | P21ECS02 | Certificate course being offered by industries/ professional bodies/ APSSDC or any other accredited bodies. | 1 | 0 | 2 | 2 |
| | | | | | Total Credits | 21.5 |
| Internship 2 Months (Mandatory) during summer vacation | | | | | | |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE**

| **III Year - I Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21ECT10 | MicroProcessor and MicroController | 3 | 0 | 0 | 3 |
| 2 | P21EET09 | Control Systems | 3 | 0 | 0 | 3 |
| 3 | P21ECT09 | Digital Signal Processing | 3 | 0 | 0 | 3 |
| 4 | P21ECEXX | Professional Elective-I | 3 | 0 | 0 | 3 |
| 5 | P21XXXXX | Open Elective-I | 3 | 0 | 0 | 3 |
| 6 | P21ECL07 | MicroProcessor and MicroController Lab | 0 | 0 | 3 | 1.5 |
| 7 | P21ECL06 | Digital Signal Processing Lab | 0 | 0 | 3 | 1.5 |
| 8 | P21ECS03 | Certificate course being offered by industries/ professional bodies/ APSSDC or any other accredited bodies. | 1 | 0 | 2 | 2 |
| 9 | P21XXXXX | Design Thinking for Innovation | 2 | 0 | 0 | 0 |
| 10 | P21ECI01 | Summer Internship 2 Months (Mandatory) after II Year (to be evaluated during III Year I Semester) | 0 | 0 | 0 | 1.5 |
| | | | | | Total Credits | 21.5 |

| **Professional Elective - I** | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| 1 | P21ECE01 | Wired & Wireless Transmission Devices |
| 2 | P21ECE02 | Biomedical Engineering |
| 3 | P21ECE03 | Nano Electronics |

| **Open Elective - I** | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| NPTEL COURSE | | |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE**

| **III Year - II Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21ECT11 | Microwave & Radar Engineering | 3 | 0 | 0 | 3 |
| 2 | P21ECT12 | Internet of Things | 3 | 0 | 0 | 3 |
| 3 | P21ECT13 | VLSI Design | 3 | 0 | 0 | 3 |
| 4 | P21ECEXX | Professional Elective-II | 3 | 0 | 0 | 3 |
| 5 | P21XXXXX | Open Elective-II | 3 | 0 | 0 | 3 |
| 6 | P21ECL08 | Microwave Engineering Lab | 0 | 0 | 3 | 1.5 |
| 7 | P21ECL09 | IOT Lab | 0 | 0 | 3 | 1.5 |
| 8 | P21ECL10 | VLSI Lab | 0 | 0 | 3 | 1.5 |
| 9 | P21ECS04 | Certificate course being offered by industries/ professional bodies/ APSSDC or any other accredited bodies. | 1 | 0 | 2 | 2 |
| 10 | P21XXXXX | Intellectual Property Rights | 2 | 0 | 0 | 0 |
| | | | | | Total Credits | 21.5 |
| Industrial/Research Internship (Mandatory) 2 Months during summer vacation | | | | | | |

| **Professional Elective - II** | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| 1 | P21ECE04 | Digital Image Processing |
| 2 | P21ECE05 | Optical Fiber Communication |
| 3 | P21ECE06 | Analog IC Design |

| **Open Elective - II** | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| NPTEL COURSE | | |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE**

| IV Year - I Semester | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21ECEXX | Professional Elective-III | 3 | 0 | 0 | 3 |
| 2 | P21ECEXX | Professional Elective-IV | 3 | 0 | 0 | 3 |
| 3 | P21ECEXX | Professional Elective-V | 3 | 0 | 0 | 3 |
| 4 | P21XXXXX | Open Elective-III | 3 | 0 | 0 | 3 |
| 5 | P21XXXXX | Open Elective-IV | 3 | 0 | 0 | 3 |
| 6 | P21XXXXX | Universal Human Values-II | 3 | 0 | 0 | 3 |
| 7 | P21ECS04 | Skill Advanced Oriented /Soft Skill Course | 1 | 0 | 2 | 2 |
| 8 | P21ECI02 | Industrial/Research Internship 2 Months (Mandatory) after III Year (to be evaluated during IV Year I Semester) | 0 | 0 | 0 | 3 |
| | | | | | Total Credits | 23 |

| Professional Elective - III | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| 1 | P21ECE07 | Microstrip Antennas |
| 2 | P21ECE08 | Cellular and Mobile Communications |
| 3 | P21ECE09 | Satellite Communications |
| 3 | P21ECE10 | Wireless Sensor Networks |

| Professional Elective - IV | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| 1 | P21ECE11 | Artificial Neural Networks |
| 2 | P21ECE12 | Machine Learning for Signal Processing |
| 3 | P21ECE13 | Electronic Measurements and Instrumentation |
| 3 | P21ECE14 | Speech Processing |

| Professional Elective - V | | |
|---|---|---|
| **S.No** | **Course Code** | **Course Title** |
| 1 | P21ECE15 | Embedded Systems |
| 2 | P21ECE16 | Embedded and Realtime Operating Systems |
| 3 | P21ECE17 | Low Power VLSI Design |
| 3 | P21ECE18 | Digital IC Design |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**R-21 UNDER GRADUATE (B.Tech) COURSE STRUCTURE**

| **IV Year - II Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | P21ECPXX | Project Work, Seminar and Internship in Industry | 0 | 0 | 0 | 12 |
| Internship (6 Months) | | | | | | |
| Total Credits | | | | | | 12 |

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21HST01 | Communicative English | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** The students should have basic knowledge of English grammar and LSRW skills.

**Course Objectives:** The student will be able

1. To enable the engineering students to develop their basic communication skills in English for academic and social purposes.
2. To equip the students with appropriate oral and written communication skills.
3. To inculcate the skills of listening, reading and critical thinking.
4. To integrate English Language learning with employability skills and training.
5. To enhance the students' proficiency in reading skills enabling them to meet the academic demands of their course.

**Course Outcomes:** After going through this course the student will be able to

1. Use English Language effectively in spoken and written forms
2. Interpret the contextual meaning of words
3. Comprehend the given texts and respond appropriately
4. Recall and reproduce the theme in a given context
5. Communicate confidently in formal and informal contexts

**UNIT–I** **(9 Lectures)**

a. Reading Skills: Leela's Friend – R.K. Narayan
b. Vocabulary: Synonyms, Antonyms and Word formation, Root Words
c. Grammar: Parts of Speech, Sentence structure and Types of sentences
d. Writing: Letter Writing, Note Making and Note Taking

**UNIT–II** **(10 Lectures)**

a. Reading Skills: Dr. A.P.J. Abdul Kalam's Biography
b. Vocabulary: Prefixes, Suffixes and Affixes
c. Grammar: Prepositions and Articles
d. Writing: Paragraph Writing and Precis Writing

**UNIT–III** **(9 Lectures)**

a. Reading Skills: Three Days to See – Helen Keller
b. Vocabulary: Collocations, One word substitutes & Idioms
c. Grammar: Tenses, Active voice & Passive voice
d. Writing: Technical Report Writing

**UNIT–IV** **(9 Lectures)**

a. Reading Skills: Satya Nadella's Email to His Employees on His First Day as CEO of Microsoft
b. Vocabulary: Phrasal verbs and Commonly confused words
c. Grammar: Subject–Verb Agreement (Concord) and Question tags
d. Writing: Curriculum vitae, Cover Letter and Resume Writing. (Functional, Chronological and standard Resumes)

**UNIT–V** **(9 Lectures)**

a. Reading Skills: Mokshagundam Visveswaraya
b. Vocabulary: Homonyms, Homophones and Homographs
c. Grammar: Modal Auxiliaries, Degrees of Comparison and Direct speech & Indirect Speech
d. Writing: E- mail Writing and Essay Writing

## Text Books:

1. New Horizons – Pearson Publishers
2. Fluency in English", A Course Book for Engg. Students, Published by Orient Black Swan, Hyderabad, 2016 print.
3. "Technical Communication- Principles and Practice", Third Edition. New Delhi: Oxford University press.
4. Epitome of Wisdom – Maruthi Publications

## Reference Books:

1. Meenakshi raman, Sangeetha, Sharma Fundamentals of technical communication, Pg: 119-153 Oxford University press, 2015
2. Rutherford, Andhrea. J, Communication skills for technology. Pearson, New Delhi.2001
3. Raymond Murphy, Murphy's English Grammar, Cambridge University Press 2004
4. Meenakshi raman, Sangeetha, Sharma,Technical communication: English Skills for Engineers, Oxford University press, 2009
5. Michael Swan, Practical English Usage, Oxford University press, 1996

## Web Resources:

1. www.englishhints.com
2. www.enchantedlearning.com
3. www.learnenglish.de/grammar/prefixtext.html

4. http://www.magickeys.com/books/riddles/words.html
5. http://www.pinnacle.edu.in/campusfiles/1826_campusFile_1.pdf
6. http://www.yourdictionary.com
7. http://www.learnenglish.com
8. http://www.cambridge.org
9. http://www.eslcafe.com
10. http://www.eslgames.com
11. http://www.penguin.co.uk
12. http://www.edufind.com/english/practice
13. www.englishhints.com,www.enchantedlearning.com,
14. www.learnenglish.de/grammar/prefixtext.html
15. http://www.magickeys.com/books/riddles/words.html

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21BST01 | Linear Algebra & Differential Equations | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Basics of Matrix Algebra, Differentiation, Integration

**Course Objectives:** The student will be able to

1. The concept of rank of a matrix which is used to know the consistency of system of linear equations and find the solution by using various analytical and numerical methods.
2. Eigen values and eigenvectors of a given matrix. Cayley-Hamilton theorem to find the inverse and power of a matrix and determine the nature of the quadratic form,
3. Recognize and model differential equations, apply analytical techniques to compute solutions for engineering problems.
4. The general solution to the higher order linear differential equations and applies to calculate the current in electrical circuits.
5. Explore the use of Laplace transform method to solve with initial value problems of ordinary differential equations.

**Course Outcomes:** After going through this course the student will be able to

1. Demonstrate the understanding of rank of a matrix. Analyze the solution of the system of linear equations.
2. Find the Eigen values and Eigenvectors of a matrix, apply Cayley-Hamilton theorem to determine inverse and power of a matrix and identify the nature of the quadratic form.
3. Solve the differential equations of first order and first degree related to various engineering fields.
4. Find the complete solution to the higher order linear differential equations and apply these methods to find the current in complex electrical circuits.
5. Apply the technique of Laplace transform and solve differential equations for analytical solutions with the initial conditions.

**UNIT–I: Solving System of Linear Equations (8 Lectures)**

Rank of a matrix by Echelon form-Normal form- Normal form through PAQ method – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination – Gauss Jordon methods.

**UNIT–II: Eigen values – Eigenvectors, Cayley-Hamilton Theorem and Quadratic forms (10 Lectures)**

Eigen values - Eigenvectors– Properties – Cayley-Hamilton theorem (without proof)– Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form. Quadratic forms: Rank, index, signature and nature of the

quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

**UNIT–III: Differential Equations of First Order and First Degree (10 Lectures)**

Linear differential equation - Bernoulli's differential equation–Exact equations and equations reducible to exact form.

**Applications:** Newton's Law of cooling-Law of natural growth and decay-Orthogonal trajectories-Electrical circuits.

**UNIT–IV: Linear Differential Equations of Higher order (8 Lectures)**

Non-homogeneous equations of higher order with constant coefficients-with RHS term of the type $e^{ax}$, $sinax$, $cosax$, polynomials in $x$, $e^{ax}V(x)$, $x^nV(x)$ and general method - Method of Variation of parameters.

**Applications:** LCR circuit

**UNIT–V: Laplace Transforms (9 Lectures)**

Laplace transforms of standard functions– First shifting Theorem-Change of scale property multiplication by $t^n$–division by $t$, transforms of derivatives and integrals – Second shifting theorem– Laplace transform of Periodic functions.

**Inverse Laplace transforms** – Convolution theorem (without proof)

**Applications:** Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.

## Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, $44^{th}$ Edition, Khanna Publishers
2. B.V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

## Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, $10^{th}$ Edition, Wiley-India.
2. H. K. Das, Advanced Engineering Mathematics, $22^{nd}$ Edition, S. Chand & Company Ltd.
3. David Poole, Linear Algebra- A modern introduction, $4^{th}$ edition, Cengage.
4. Peter O' Neil, Advanced Engineering Mathematics, Cengage
5. Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.

## Web Resources:

1. `http://tutorial.math.lamar.edu/Classes/DE/DE.aspx`
2. `http://mathworld.wolfram.com/topics`
3. `http://www.nptel.ac.in/course.php`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21BST02 | Applied Physics | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** The basics of analytical and conceptual understanding of physics

**Course Objectives:** The student will be able

1. To study the wave nature of light through Interference and diffraction.
2. To learn the basic principles of Lasers and fiber optics.
3. To express the physics of electrostatics and electromagnetic wave concepts through Maxwell's equations.
4. To study the basic concepts of Quantum mechanics.
5. Aware of limits of classical free electron theory and apply band theory of solids.
6. Acquire the knowledge of semiconductor physics.

**Course Outcomes:** After going through this course the student will be able to

1. Understanding the basic concepts of optics and how to apply them for engineering applications.
2. Acquire the knowledge of fundamentals of Lasers and fiber optics enables the students to develop Laser devices to apply them in various systems like communications, Industries and medicine.
3. Set students to be exposed to Electrostatics, Maxwell's equations, electromagnetic waves and fundamental concepts of quantum mechanics.
4. Enable to learn the fundamental concepts of free electron theory and band theory of solids.
5. Develop knowledge of band theory of solids for fundamentals of Semiconductor physics enables the students to apply the knowledge to various systems like communications, solar cell, photo cells and so on.

**UNIT–I: Wave Optics (9 Lectures)**

**Interference:** Introduction, Principle of Superposition of waves, colors in thin films, interference in thin films, Newton's rings: Determination of wavelength and refractive index.

**Diffraction:** Introduction, differences between interference and diffraction, difference between Fraunhofer and Fresnel's diffraction, Fraunhofer diffraction at single slit, Fraunhofer diffraction due to double slit, Diffraction grating (N-slits qualitative), resolving power of grating.

**UNIT–II: Lasers and Fiber Optics (9 Lectures)**

**Lasers:** Introduction, Characteristics of laser, absorption, spontaneous emission, stimulated emission, Einstein's coefficients, population inversion, pumping, pumping mechanisms, Types of Lasers: Ruby laser, He-Ne laser, diode laser, Applications of Lasers.

**Fiber optics:** Introduction, Total internal reflection-wave propagation in optical fiber, Acceptance angle, numerical aperture, applications of optical fiber.

**UNIT–III: Electrostatics, Maxwell's Equations and Electromagnetic Waves (9 Lectures)**

**Electrostatics:** Coulombs law, electric field, electric field intensity, electric flux density, electrostatic potential, divergence of electric field, Laplace's and Poisson's equations for electrostatic potential, Gauss theorem in electrostatics.

**Maxwell's equations and electromagnetic waves:** Gauss theorem in magneto statics, Faraday's law of electromagnetic induction, Ampere's law, displacement current, Maxwell's equations in vacuum, electromagnetic wave equation in dielectric medium, velocity of propagation of electromagnetic wave, poynting vector and poynting theorem.

**UNIT–IV: Quantum Mechanics, Free Electron Theory and Band Theory (10 Lectures)**

**Quantum Mechanics:** Introduction to quantum physics, de-Broglie's hypothesis and properties of matter waves, Schrodinger's time independent wave equation, Schrodinger's time dependent wave equation, Particle in one dimensional box.

**Free electron theory:** classical free electron theory of metals- assumptions and failures, quantum free electron theory of metals-assumptions and failures, Fermi Dirac distribution function- Fermi level, Femi energy, density of states.

**Band theory of solids:** Introduction, Bloch's theorem, Kronig penny model (qualitative), E-K diagram, Brillouin's zones, classification of solids into metals, semiconductors and insulators, effective mass of electron and concept of hole.

**UNIT–V: Semiconductor Physics (8 Lectures)**

**Semiconductor physics:** Introduction, intrinsic and extrinsic semiconductors, carrier concentration in intrinsic semiconductors, electrical conductivity of intrinsic semiconductor, Fermi energy, carrier concentration in N-type and P-type semiconductors, dependence of Fermi energy on carrier-concentration and temperature, drift and diffusion, Hall effect and its applications, mechanism in LED, solar cell and photo conductor.

## Text Books:

1. A Textbook of Engineering Physics by Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand.
2. Optics by Ajoy Ghatak, Tata McGraw-Hill Publishing company limited
3. Introduction to Electrodynamics by David Griffiths, Cambridge University Press
4. Introduction to Quantum physics by Eisberg and Resnick.

**Reference Books:**

1. Applied physics by Palanisamy (Scitech publications)
2. Optics by Eugene Hecht, Pearson Education.
3. Principle of Lasers by O. Svelto
4. Electricity, magnetism and light by W. Saslow
5. Semiconductor Optoelectronics by J. Singh, Physics and Technology, Mc Graw-Hill inc
6. Engineering Physics by B.K. Pandey, S. Chaturvedi - Cengage Learing.

**Web Resources:**

1. https://nptel.ac.in/courses/115/106/115106066/
2. https://ocw.mit.edu/high-school/physics/exam-prep/electromagnetism/maxwells-equations/#1
3. https://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-solid-state-chemistry-fall-2010/electronic-materials/14-semiconductors/

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21EST01 | Engineering Graphics | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Nill

**Course Objectives:** The student will be able

1. To introduce the students to use drawing instruments and to draw polygons, Engineering Curves and Scales, orthographic projections, projections of points.
2. To introduce the students to use projections of lines.
3. To make the students draw the projections of the planes and the various types of solids.
4. To enable the students to gain the ability to convert the Isometric views in to Orthographic views vice versa and development of surfaces of regular solids.
5. To introduce the students to use the Fusion 360 for creating basic geometric figures.

**Course Outcomes:** After going through this course the student will be able to

1. Construct polygons, scales and engineering curves and Identify the position of points with use of orthographic projections.
2. Identify the position of points and lines with use of orthographic projections.
3. Analyze the location and position of plane figures and solids through orthographic projections.
4. Develop 2D and 3D objects by converting their view.
5. Construct basic geometric figures using Fusion 360.

**UNIT–I** **(9 Lectures)**

**Introduction To Engineering Graphics:** Introduction to Drawing instruments and their uses, construction of regular polygons, Conic sections- ellipse, parabola, hyperbola using general method, Scales- Diagonal scale, Vernier scale.

**Projections of Points:** Principle of orthographic projection-Method of Projection – First and third angle projection methods- Projections of Points.

**UNIT–II** **(9 Lectures)**

**Projections Of Lines:** projection of straight lines- parallel to one plane and inclined to the other plane, projections of straight lines inclined to both the planes, determination of true lengths, angle of inclinations and traces.

**UNIT–III** **(9 Lectures)**

**Projections Of Planes:** projections of plane figures- triangle, square, rectangle, pentagon and hexagon, circle with surfaces inclined to both the reference planes.

**Projections Of Solids:** projections of solids: projections of regular solids with the axis inclined to only one reference plane.

**UNIT–IV** **(9 Lectures)**

**Surface Development:** development of surfaces for basic solids- prisms, pyramids, cylinder and cone.

**Projections of Pictorial Views:** Conversion of isometric views into orthographic views and conversion of orthographic views in to isometric views.

**UNIT–V** **(7 Lectures)**

**Introduction To Autodesk Fusion 360:** fusion 360 fundamentals-Getting Started -The Fusion 360 Interface Design Navigation & Display-Design Units and Origin -Quick Shape Creation.

**Creating Sketched Geometry:** Introduction to the sketching workflow - sketch entities -dimensioning sketch constraint.

## Text Books:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal, Charotar Publications, 2014.
2. Engineering Drawing by Basant Agrawal and C.M. Agrawal, McGraw Hill Education Pvt. Limited, 2013.
3. Engineering Drawing by Prof. K.L. Narayana & Prof. R.K.Kannaiah, Scitech Publications, 2010.
4. Parametric Modeling with Autodesk Fusion 360 By Randy H. Shih SDC publications April 23, 2021

## Reference Books:

1. Engineering Graphics with AutoCAD 2002 by James D. Bethune, PHI, 2011.
2. Engineering Graphics. P I Varghese Tata McGraw Hill Education Pvt. Ltd, 2010.
3. Engineering drawing – P.J. Shah .S.Chand Publishers,2010.
4. Engineering Drawing- Johle/Tata Macgraw Hill Book Publishers, 2010.
5. Autodesk Fusion 360: A Tutorial Approach Kindle Edition by Prof. Sham Tickoo Purdue Univ. and CADCIM Technologies.

## Web Resources:

1. https://lecturenotes.in/subject/436/engineering-drawing-ed.
2. web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf.
3. https://www.smartzworld.com/notes/engineering-drawing-pdf-1st-year-notes-ppts
4. https://www.researchgate.net/305754529_A_Textbook_of_Engineering_Drawing
5. www.academia.edu/32510080/N_d_bhatt_engineering_drawing_pdf

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21EST03 | C - Programming for Problem Solving | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Nill

**Course Objectives:** The student will be able

1. To impart adequate knowledge on the need of programming languages and problem solving techniques.
2. To impart problem solving skills.
3. To enable student to write programs in C and to solve the problems.

**Course Outcomes:** After going through this course the student will be able to

1. Design algorithms and flowchart / Pseudo code for a given problem.
2. Design programs involving decision structures and loops.
3. Implement different operations on arrays and solve problems using functions.
4. Understand pointers and strings.
5. Implement structures, unions and file operations in C programming for a given application problem.

**UNIT–I (8 Lectures)**

**Introduction to Programming:** Computer hardware, Bits and Bytes, programming languages, application and system software, the software development process.

**Idea of algorithm:** steps to solve logical and numerical problems. Representation of algorithm: flowchart/pseudo code with examples, from algorithms to programs.

**UNIT–II (9 Lectures)**

**Introduction to C:** Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing Input and Output. Decision Making - Branching and Looping. Enumerated Data type, Renaming Data type with type def, Type Casting.

**UNIT–III (10 Lectures)**

**Arrays:** Definition, Declaration, Initialization, Assignment, Processing array, Passing array to a function, Two and multi dimensional array. **Functions:** Defining a function, Accessing a function, Passing argument to functions, Function prototypes, Nested function call, Storage classes.

**UNIT–IV (9 Lectures)**

**Pointers:** Definition, initialization, operations on pointers, functions and pointers, arrays and pointers, pointers to pointers, dynamic memory allocation.

**Strings:** C Strings, String Input / Output functions, arrays of strings, string manipulation functions.

**UNIT–V (9 Lectures)**

**Structures:** Definition, declaration, initialization, accessing members, array of structures, arrays within structure, functions and structures, pointers to structures, nested structures, unions.
**File Handling:** Types, operations on files, modes, file I/O functions, Random Access Functions.

**Text Books:**

1. Byron S Gottfried, —Programming with C, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Problem Solving and Program Design in C, $4^{th}$ edition, by jeri R. Hanly and Elli B.Koffman.
3. Balagurusamy. 2011. C Programming. Tata Mc Graw Hills, New Delhi, India.

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Yashavant P. Kanetkar. —Let Us C, BPB Publications, 2011.

**Web Resources:**

1. https://www.studytonight.com/c/
2. https://www.cprogramming.com/tutorial/c-tutorial.html
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.tutorialspoint.com/cprogramming/

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21HSL01 | English Language Communication Skills Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** Basic knowledge of English grammar, Basic understanding of English vocabulary, Ability to speak simple sentences, Have interest to learn the language.

**Course Objectives:** The student will be able

1. To facilitate computer assisted multimedia instructions enabling individualized and independent language learning.
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
3. To bring about a consistence accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
4. To improve the fluency of students in spoken English and neutralize their mother tongue influence.
5. To train students to use language appropriately for public speaking, group discussion and interviews.

**Course Outcomes:** After going through this course the student will be able to

1. Better understanding of nuances of English language through audio visual experience and group activities.
2. Neutralization of accent for intelligibility.
3. Speaking skills with clarity and confidence which in turn enhances their employability skills.
4. Better understanding of the production of sounds of language.
5. Suitable body language for employability.

**EXERCISE–I** **(3 Sessions)**

A. Introduction to Phonetics
   Consonant sounds
   Vowel sounds – Pure Vowels & Diphthongs

B. Greeting, Introducing & taking leave and Ice – Breaking Activity

**EXERCISE–II** **(2 Sessions)**

A. Structure of Syllables - Plural markers & Past tense Markers

B. JAM Session & Situational Dialogues

**EXERCISE–III** **(2 Sessions)**

A. Word Stress & Rules of 'r' pronunciation

B. Role play, Giving Directions & Story Narration

**EXERCISE–IV** **(2 Sessions)**

A. Consonant Cluster, Neutralization of Mother Tongue Influence and Listening Comprehension – Listening for General Details

B. Describing objects, events, places etc. & Presentation Skills – Extempore, Public Speaking.

**EXERCISE–V** **(3 Sessions)**

A. Intonation & Listening Comprehension – Listening for Specific Details

B. Interview Skills & Group Discussion

**Text Books:**


1. Strengthen your Communication Skills - Maruthi Publication, Hyderabad 2013
2. A textbook of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)


**Reference Books:**


1. INFOTECH English (Maruthi Publications).
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)
3. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation
4. Speaking English Effectively $2^{nd}$ Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
5. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill
6. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP
7. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad
8. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP
9. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP
10. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi : Foundation

11. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan

12. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.

13. English Pronouncing Dictionary Daniel Jones Current Edition with CD.

**Web Resources:**

1. http://www.cambridge.org
2. http://www.edufind.com/english/practice
3. http://www.learnenglish.com
4. http://www.penguin.co.uk

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21BSL01 | Applied Physics Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** The basics of analytical and conceptual understanding of physics.

**Course Objectives:**

1. Deploy scientific method of experiments in the laboratory.
2. Develop the procedures and observational skills for appropriate use of simple and complex apparatus.
3. Enable analytical techniques, statistical analysis and graphical analysis.
4. Reinforce ideas and concepts covered in lecture host of experiments.
5. Train to find the radius of curvature of a Plano-convex lens forming Newton's rings.

**Course Outcomes:**

1. Apply the phenomenon of interference and diffraction of light waves.
2. HImplement the concept of resonance in LCR circuit and sonometer.
3. HM toAnalyze the S determine its dependent properties.
4. Evaluate the behavior of electronic components and its characteristics.

**LIST OF EXPERIMENTS:** (any eight of the following to be done)

1. Determination of Radius of Curvature of Plano-Convex lens by forming Newton's Rings.
2. Determination of Wavelengths of various spectral lines using diffraction grating with the normal incidence method.
3. Study of magnetic field along the axis of a current carrying coil and to verify Stewart-Gee's method.
4. Determination of energy gap of PN junction Diode.
5. Determination of hall coefficient and carrier concentration using Hall effect
6. Study of V-I characteristics of Zener diode.
7. Determination of frequency of a vibrating bar or electrical tuning fork using Melde's apparatus.
8. Determination of acceleration due to gravity using compound pendulum
9. Verification of laws of transverse waves by Sonometer.
10. Determination of Velocity of sound by volume resonator.
11. Determination of rigidity modulus by Torsional Pendulum.

**Text Books:**

1. Physics lab manual, department of physics, PACE Institute of Technology and Sciences.

2. Madhusudhanrao, "Engineering Physics lab manual" $1^{st}$ edition, Scietech Publication, 2015.

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ESL02 | C - Programming for Problem Solving Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** Nil

**Course Objectives:** The student will be able

1. To understand the various steps in program development.
2. To understand the basic concepts in C Programming Language.
3. To understand different modules that includes conditional and looping expressions.
4. To understand how to write modular and readable C Programs.
5. To write programs in C to solve problems using arrays, structures and files.

## Experiment Wise Programs

**EXERCISE–I**

a. Write a simple C program to Print "Hello World"

b. Write a simple C Program to Calculate Area and Circumference of Circle

c. Write a simple C program to implement basic arithmetic operations - sum, difference, product, quotient and remainder of given numbers.

**EXERCISE–II:** Write C programs to demonstrate the following operators

a. Assignment Operator.

b. Relational and Logical Operator.

c. Increment and decrement operator.

d. Bitwise operators.

e. Ternary operator.

**EXERCISE–III**

a. Write a C programs - to find the largest and smallest of 2 numbers(if – else), to find the largest and smallest of 3 numbers(Nested if – else), roots of quadratic equation(else – if ladder).

b. The total distance travelled by vehicle in't' seconds is given by distance=ut+1/2 at 2 where 'u' and 'a' are the initial velocity and acceleration.

   Write a c program to find the distance travelled at regular intervals of time given the Values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

c. Write a c program, which takes two integer operands and one operator from the user, performs the operation and the prints the result. (consider the operators $+, -, *, /, \%$ and use switch statement).

**EXERCISE–IV**

a. Write a C program to find the sum of individual digits of a positive integer

b. A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1.Subsequent terms are found by adding the preceding two terms in the sequence .Write a c program to generate the first n terms of the sequence.

c. Write a c program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

**EXERCISE–V**

a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1 + x + x^2 + x^3 + ... + x^n$

b. Write a C program to generate Pascal's triangle.

c. Write a C program to construct a pyramid of numbers

**EXERCISE–VI**

a. Write a c program to find both the largest and smallest number in a list of integers.

b. Write a c program that uses functions to perform the following:

   i. Addition of Two Matrices.

   ii. Multiplication of Two Matrices.

**EXERCISE–VII**

a. Write a programs that use both recursive and non-recursive functions

b. To find the factorial of a given integer.

c. To find the GCD of two given integers.

**EXERCISE–VIII**

a. Write a c program that uses functions to perform the following operations:

   i. To insert a sub-string in given main string from a given position.

   ii. To delete n Characters from a given position in a given string.

b. Write a C program to determine if the given string is a palindrome or not.

**EXERCISE–IX**

a. Write a C program that displays the position or index in the string S Where the string T begins, or - 1 if S doesn't contain T.

b. Write a C program to count the lines, words and characters in a given text .

**EXERCISE–X**

a. Write a program to print the details of a student like(Name, Rollno, marks) using nested structures.

b. Write a C Program to Calculate Difference Between Two Time Period.

**EXERCISE–XI**

a. Write a C program that uses functions to perform the following operations:

   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition of two complex numbers
   iv. Multiplication of two complex numbers
   (Note: represent complex number using a structure.)

**EXERCISE–XII**

a. Write a C program which copies one file to another and display the contents of a file

b. Write a C program to reverse the first n characters in a file.

c. Write a C program to merge two files into a third file ( i.e., the contents of the first file followed by those of the second are put in the third file)

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21BST04 | Applied Chemistry | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Basic Chemistry at Intermediate or equivalent level.
**Course Objectives:** The student will be able

1. To analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers.
2. To utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion.
3. To understand various synthetic methods of nonmaterials for modern advances of engineering technology. Summarize the preparation of semiconductors; analyze the applications of liquid crystals and superconductors
4. To analyze the principles of different analytical instruments and their applications.
5. To Design models for energy by different natural sources.

**Course Outcomes:** After going through this course the student will be able to

1. Analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers.
2. Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion.
3. Understand various synthetic methods of nonmaterials for modern advances of engineering technology. Summarize the preparation of semiconductors; analyze the applications of liquid crystals and superconductors
4. Analyze the principles of different analytical instruments and their applications.
5. Design models for energy by different natural sources.

**UNIT–I: Polymer Technology (9 Lectures)**

**Polymerization:** Introduction, classification, methods of polymerization (Emulsion and Suspension), mechanical properties.

**Plastics:** Compounding, fabrication (compression, injection, blown film and extrusion), preparation, properties and applications (Poly ethylene, PVC, Polycarbonates and Bakelite).

**Elastomers:** Introduction, preparation, properties and applications (Buna S, Thiokol and Polyurethanes).

**Composite materials:** Fiber reinforced plastics, conducting polymers, biodegradable polymers,

**UNIT–II: Electrochemical Cells and Corrosion (10 Lectures)**

Galvanic Cells, Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, construction of glass electrode, batteries (Dry cell, Li ion battery, Lead Acid battery and Ni-Cd cells).

**Corrosion:** Definition, theories of corrosion (Chemical and Electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, corrosion control (Proper designing and cathodic protection), protective coatings (Surface preparation, Cathodic coatings, Anodic coatings, Electroplating and Electroless plating).

**UNIT–III: Chemistry of Advanced Materials (10 Lectures)**

**Nano materials:** Introduction, sol-gel method, characterization by (Brunauer Emmet Teller (BET), and transmission electron microscopy (TEM) with example (TiO2), applications of fullerenes, carbon nanotubes (types, preparation and applications).

**Liquid crystals:** Introduction-types-applications.

**Super conductors:** Type –I, Type II-characteristics and applications

**Non-elemental semiconducting materials:** Stoichiometric, controlled valency & chalcogen photo/ semiconductors preparation of semiconductors (zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation)– semiconductor devices (p-n junction diode as rectifier, junction transistor).

**UNIT–IV: Spectroscopic Techniques & Synthesis Of Essential Drug Molecules (9 Lectures)**

**Spectroscopic Techniques:** Electromagnetic spectrum-types of molecular spectra and their absorption criteria ,UV-visible spectroscopy (electronic spectroscopy), Beer-Lambert's law and its limitations ,– applications of UV visible spectroscopy ,IR spectroscopy principle, Molecular vibrations – stretching and bending vibrations – applications of IR, NMR (Nuclear magnetic resonance)–working principle and instrumentation of NMR, chemical shift($\delta$) – applications of NMR

**Synthesis of essential drug molecules:** Preparation, properties and uses of Paracetamol , Aspirin, Ibuprofen

**UNIT–V: Non-Conventional Energy Sources (7 Lectures)**

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, tidal and wave power, ocean thermal energy conversion.

## Text Books:

1. P.C. Jain and M. Jain "Engineering Chemistry", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, "Engineering Chemistry", Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, "A Textbook of Engineering Chemistry", S.Chand & Co, (2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).

**Reference Books:**

1. K. SeshaMaheshwaramma and MridulaChugh, "Engineering Chemistry", Pearson India Edition.
2. O.G. Palana, "Engineering Chemistry", Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) "Preparation and characterization of materials" Academic press, New York (latest edition).
4. B. S. Murthy, P. Shankar, "Textbook of Nanoscience and Nanotechnology", University press (latest edition).

**Web Resources:**

1. http://jntuk-coeerd.in/
2. http://en.wikipedia.org/wiki/title
3. http://nptel.ac.in/coures/105106/.com
4. https://en.wikipedia.org/wiki/Electrochemistry
5. https://www.youtube.com/watch?v=WLyaZbT97EI&list=PLzW3l18TEXrpqo3jRarGr9ao-61tB2184
6. https://encyclopedia.che.engin.umich.edu/
7. http://encyclopedia.che.engin.umich.edu/Pages/ProcessParameters/Spectrometers/Spectrometers.html

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21BST06 | Numerical Methods & Vector Calculus | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Differentiation, Partial differentiation, Integration, Differential Equations

**Course Objectives:** The student will be able to

1. The different numerical techniques to solve algebraic and transcendental equations and evaluate the polynomials from the numerical data.
2. The approximate solutions using numerical methods in the absence of analytical solutions of various systems of ordinary differential equations and integrations.
3. Enhance the knowledge level to visualize integrals in higher dimensional coordinate systems, possible representation and evaluation of geometrical and physical quantities in terms of multiple integrals.
4. Interpret concepts of vector functions, vector fields, differential calculus of vector functions in Cartesian coordinates and apply them for various engineering problems.
5. Evaluate line, surface and volume integrals and construct relation between line, surface and volume integrals using vector integral theorems.

**Course Outcomes:** After going through this course the student will be able to

1. Evaluate approximate roots of the polynomial and transcendental equations by different algorithms and apply Newton's forward, backward interpolation and Lagrange's formulae for equal and unequal intervals.
2. Apply different algorithms for approximating the integrals of numerical data and solutions of ordinary differential equations to its analytical computations.
3. S Evaluate the multiple integrals by using change of variables and change of order of integration. Also apply double and triple integration techniques in evaluating areas and volumes bounded by regions and solids.
4. nterpret the physical meaning of different operators such as gradient, curl and divergence.
5. Determine line, surface and volume integrals. Apply Green's, Stoke's and Gauss divergence theorems to calculate line, surface and volume integrals.

**UNIT–I: Iterative Methods, Finite differences and Interpolation (10 Lectures)**

Introduction-Solution of algebraic and transcendental equations-Bisection method -Method of false position-Newton-Raphson method (Single variable only)

**Interpolation:** Introduction-Errors in polynomial interpolation-Finite differences – Forward differences-Backward differences-Relations between operators-Newton's forward and backward formulae for interpolation -Interpolation with unequal intervals -Lagrange's interpolation formula.

**UNIT–II: Numerical integration, Solution of ordinary differential equations with initial** **(9 Lectures)**

Trapezoidal rule – Simpson's 1/3rd and 3/8th rule– Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Modified Euler's method-Runge-Kutta method (second and fourth order).

**UNIT–III:Multiple Integrals:** **(9 Lectures)**

Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar coordinates) –Triple integrals- Change of variables (Cartesian to Cylindrical and Spherical coordinates).

**Applications:** Areas by double integrals and Volumes by triple integrals.

**UNIT–IV: Vector Differentiation:** **(8 Lectures)**

Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives – Divergence – Curl – Laplacian second order operator- Vector identities- Applications: Scalar Potential function.

**UNIT–V: Vector Integration:** **(9 Lectures)**

Line integral – Work done – Circulation- Surface integral- Volume integral

**Vector Integral Theorems (without proof):** Application of Green's theorem in a plane- Stoke's theorem- Gauss Divergence theorem.

## Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, $44^{th}$ Edition, Khanna Publishers.
2. B.V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

## Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, $10^{th}$ Edition, Wiley-India.
2. H. K. Das, Advanced Engineering Mathematics, $22^{nd}$ Edition,S. Chand & Company Ltd.
3. David Poole, Linear Algebra- A modern introduction, $4^{th}$ edition, Cengage.
4. Peter O' Neil, Advanced Engineering Mathematics, Cengage
5. Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.

## Web Resources:

1. `http://tutorial.math.lamar.edu/Classes/DE/DE.aspx`
2. `http://mathworld.wolfram.com/topics`
3. `http://www.nptel.ac.in/course.php`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21EST08 | Network Analysis | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Applied Physics

**Course Objectives:** The student will be able

1. To understand the basic concepts on R,L, C circuits and Network topology
2. To analyze the behavior of AC circuits and steady state analysis in RLC circuits.
3. To understand the concept of coupled circuits & resonance
4. To understand the network theorems for analysis of networks
5. To analyze the performance of two port networks

**Course Outcomes:** After going through this course the student will be able to

1. Gain the knowledge on basic network elements andnetwork topology concepts.
2. Analyze the behavior of AC circuits and steady stateanalysis in RLC circuits.
3. Explain the magnetic circuits with dot rule and different types of resonance
4. Understand to minimize of electrical networks by using different network theorems.
5. Analyze the different types of two port network parameters

**UNIT–I: (9 Lectures)**

**Introduction to Electrical Circuits:** Basic Definitions, Types of Network elements, Ohms Law, R-L-C Parameters - Types of energy sources, Source transformation, Kirchhoff's laws, series, parallel, Star-Delta conversion, Mesh analysis and Nodal analysis, Numerical Problems

**Network Topology:** Network Topology: Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, Principal of Duality with examples, basic tie set schedule, basic cut set schedule. Numerical- problems.

**UNIT–II: (9 Lectures)**

**A.C Fundamentals:** Average Values, R.M.S, Form Factor, Peak Factor for different Periodic Wave Forms, Types of powers, power factor, Significance of J operator.

**Steady State Analysis of A.C Circuits:** Response to sinusoidal excitation - pure resistance, pure inductance, pure capacitance, impedance concept, series R-L, R-C, R-L-C circuits, Star-Delta conversion, numerical problems.

**UNIT–III: (9 Lectures)**

**COUPLED CIRCUITS:** Basic Definitions, Faradays laws of electromagnetic induction, Self inductance, Mutual inductance, Coefficient of coupling, Analogy between electrical and magnetic circuits, analysis of coupled circuits, Dot rule.

**RESONANCE:** Introduction, Definition of Q, Series and parallel resonance, tank circuit, bandwidth of series and Parallel resonance, comparison between series and parallel circuits, numerical problems.

**UNIT–IV: (9 Lectures)**

**NETWORK THEOREMS:** Superposition theorem, Thevinin's theorem, Norton's theorem, Maximum PowerTransfer theorem, Milliman's theorem, Reciprocity theorem, Compensation theorem.

**UNIT–V: (9 Lectures)**

**TWO PORT NETWORKS:** Two port network parameters, Z-parameters, Y-parameters, Transmission parameters, h-parameters, Inverse h-parameters, Inverse Transmission parameters, Relationship between parameter sets, series and Parallel connection of two port networks, Cascading of two port networks

**Text Books:**

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, $3^{rd}$ Edition, 2000.
2. Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
3. Electric Circuit Analysis by Hayt and Kimmarle, TMH

**Reference Books:**

1. Network lines and Fields by John. D. Ryder $2^{nd}$ edition, Asia publishing house.
2. Basic Circuit Analysis by Dr.Cunninghan, Jaico Publishers.
3. Network Analysis and Filter Design by Chadha, Umesh Publications.
4. Circuit Theory (Analysis and Synthesis) by A.chakrabarthi, Dhanpat Rai&co.

**Web Resources:**

1. `www.allaboutcircuits.com/textbook/`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21EST11 | Elctronic Devices and Circuits | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Applied Physics

**Course Objectives:** The student will be able

1. The basic concepts of semiconductor devices will be reviewed.
2. Study the physical phenomenon such as conduction, transport mechanism and electrical characteristics of P-N diode and Study the physical phenomena such as basic principle of operation of different diodes.
3. The application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
4. The principal of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics are explained.
5. To learn and understand the purpose of transistor biasing and its significance.

**Course Outcomes:** After going through this course the student will be able to

1. Analyze the basic concepts of semiconductor physics.
2. Design and formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation and Analyze the basic concepts of special purpose diodes.
3. Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
4. Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
5. Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.

**UNIT–I: (9 Lectures)**

**Review of Semi Conductor Physics:** Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

**Junction Diode :** energy band diagram of PN junction Diode, Open circuited p- n junction, Biased p-n junction.

**UNIT–II: Special Semiconductor Devices: (9 Lectures)**

p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PN-PN Diode, Construction, operation and V-I characteristics

**UNIT–III: (9 Lectures)**

**Rectifiers:** Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms.

**Filters:** Inductor filter(Series inductor), Capacitor filter(Stunt inductor), $\pi$- Filter, comparison of various filter circuits in terms of ripple factors.

**UNIT–IV: Transistor Characteristics (9 Lectures)**

**BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

**FET:** FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

**UNIT–V: (9 Lectures)**

**Transistor Biasing and Thermal Stabilization :** Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in VBE, Ic, and $\beta$, Stability factors, (S,S',S"), Bias compensation, Thermal runaway, Thermal stability.

**FET Biasing-** methods and stabilization.

## Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, satyabrata jit Tata Mc-Graw Hill,$4^{th}$ Edition, 2015.
2. Electronic Devices and Circuits- S Salivahanan, N Suresh kumar- Tata Mc-Graw Hill, 2012

## Reference Books:

1. Electronic Devices and Circuits-K. Satya Prasad, VGS Book Links, $2^{nd}$ Edition, 2014.
2. Electronic Devices and Circuits – Bell, Oxford, $5^{th}$ Edition, 2010.

## Web Resources:

1. physics.info/semiconductors/
2. www.allaboutcircuits.com/technical-articles/characteristics-of-junction-diodes/
3. www.academia.edu/8160398/Transistor_Biasing_and_Stabilisation
4. http://203.202.233.187/moodle/course/view.php?id=1074

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21EST13 | Data Structures | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** C Programming

**Course Objectives:** The student will be able to

1. Comprehensive knowledge of data structures and ability to implement the same in software applications.
2. Exposure to algorithmic complexities, recursive algorithms, searching techniques.
3. Exposure to sorting technique, Applying stack techniques for logical operations.
4. Applying queue techniques for logical operations, Exposure to list representation models in various types of applications.
5. Implementation of tree in various forms, Advanced understanding of other variants of trees and their operations.
6. Orientation on graphs, representation of graphs, graph traversals, spanning trees Graphs.

**Course Outcomes:** After going through this course the student will be able to

1. Student will be able to choose appropriate data structure as applied to specified problem definition.
2. Implement appropriate sorting/searching technique for given problem
3. Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.
4. Students will be able to implement Linear and Non-Linear data structures

**UNIT–I: (9 Lectures)**

**Data Structure, Recursion & Searching:** Preliminaries of algorithm, Algorithm analysis and complexity. Data Structure: Definition, types of data structures. **Recursion:** Definition, Design Methodology and Implementation of recursive algorithms, Types of recursion (Linear, binary and Tail), recursive algorithms for factorial function, GCD Computation, Fibonacci sequence.

**Searching:** List Searches using Linear Search, Binary Search.

**UNIT–II: (10 Lectures)**

**Sorting Techniques:** Basic Concepts, Sorting by: Insertion (Insertion Sort), Selection (heap sort), Exchange(Bubble sort, Quick Sort) Merging(Merge sort) Algorithms.

**Stacks:** Basic Stack operations, Representation of a stack using arrays, Stack Applications: Reversing list, Infix to postfix transformation.

**UNIT–III: (10 Lectures)**

**Queues:** Introduction, Representation of a Queue using arrays, Queue Operations, Applications of queues- Round Robin Algorithm, Circular Queues, Priority Queues.
**Linked List:** Introduction, single linked list, representation of a linked list in memory, Operations on a single linked list, Reversing a single linked list, Applications: single linked list to represent polynomial expressions, Double linked list. , Circular linked list

**UNIT–IV: (9 Lectures)**

**Trees:** Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays, operations on a Binary tree, Binary Tree Traversals (recursive).
**Advanced Tree Concepts:** Binary search tree, Basic concepts, BST operations: Searching, insertion, deletion, Balanced search trees-AVL Trees.

**UNIT–V: (7 Lectures)**

**Graphs:** Basic concepts, Graph Representations- Adjacency matrix, Adjacency lists, Graph algorithms: Graph Traversals (BFS & DFS), applications: Dijkstra's shortest path, Minimum Spanning Tree using Prim's & Kruskal's Algorithm.

### Text Books:

1. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage,2007.
2. Data Structures and Algorithms, G.A.V.Pai, TMH, 2008
3. Data Structures and Algorithms Made Easy, Narasimha Karumanchi , Second Edition, 2011.

### Reference Books:

1. Data Structure with C, Seymour Lipschutz, TMH,2010.
2. Classic Data Structures, 2/e, Debasis ,Samanta,PHI,2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz, Sahni, Anderson Freed, University Press.

### Web Resources:

1. `www.geeksforgeeks.org`
2. `www.hackr.io.`
3. `www.letsfindcourse.com`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21BSL03 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** Basic Chemistry at Intermediate or equivalent level.

**Course Objectives:** The purpose of this course to provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

**Course Outcomes:** After going through this course the student will be able to

1. Carrying out different types of titrations for estimation of concerned in materials using comparatively more quantities of materials involved for good results.
2. Handling different types of instruments for analysis of materials using small quantities of materials involved for quick and accurate results.

**LIST OF EXPERIMENTS:** Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis.

1. Determination of HCl using standard $Na_2CO_3$ solution.
2. Determination of alkalinity of water sample containing $Na_2CO_3$ and NaOH.
3. Determination of $Mn^{+2}$ using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of $Cu^{+2}$ using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of $Fe^{+3}$ by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide ($p^Hmetry$ method).
9. Determination of isoelectric point of amino acids using $p^Hmetry$ method (or) conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conductometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Estimation of Vitamin C.
13. Preparation of Nylon-6, 6 and Bakelite (demonstration only).

**Reference Books:**

1. Dr. Jyotsna Cherukuris (2012) Laboratory Manual of engineering chemistry-II,
2. VGS Techno Series 3. Chemistry Practical Manual, Lorven Publications

**Web Resources:**

1. https://vlab.amrita.edu/index.php?sub=2&brch=193.

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ESL05 | Electronic Devices and Circuits Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** Engineering Physics

**Course Objectives:** The objective of this lab is

1. To study basic electronic components.
2. To observe characteristics of electronic devices

**Course Outcomes:** At the end of the course student can able to

1. Measure voltage, frequency and phase of any waveform using CRO.
2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Analyze the characteristics of different electronic devices such as diodes, transistors etc., and simple circuits like rectifiers etc.

**PART-A ELECTRONIC WORKSHOP PRACTICE (2 lab sessions)**

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of Active Devices, Diodes, BJTs, Lowpower JFETs, MOSFETs, Power Transistors, LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs, TRIACs, Linear and Digital ICs.
3. Soldering practice – Simple Circuits using active and passive components.
4. Study and operation of

   a) Multimeters (Analog and Digital)

   b) Function Generator

   c) Regulated Power Supplies.

   d) CRO

**PART-B List of Experiments: (Minimum of Ten Experiments has to be performed) (in 8 lab sessions)**

1. P-N Junction Diode Characteristics :forward and reverse bias
2. Zener Diode V-I Characteristics.
3. Zener Diode as Voltage Regulator.
4. Half wave Rectifier with & without filters
5. Full wave Rectifier with & without filters

6. Full wave Rectifier with & without filters BJT Characteristics (CE Configuration) : Input &Output
7. BJT Characteristics (CB Configuration) : Input &Output
8. FET Characteristics (CS Configuration) : Drain & Transfer Characteristics
9. FET Characteristics (CG Configuration) : Drain & Transfer Characteristics
10. Transistor as an inverter.
11. UJT Characteristics
12. CRO Operation and its Measurements

**Equipement Required:**

1. Regulated Power supplies
2. Analog /Digital Storage Oscilloscopes
3. Analog /Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| P21ESL06 | Data Structures Lab | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** C- Programming

**Course Objectives:** The objective of this lab is

1. To choose the appropriate data structure and algorithm design method for a specified application.
2. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps binary search trees, and graphs and writing programs for these solutions.

**Course Outcomes:** At the end of the course student can able to

1. Analyze worst-case running times of algorithms using asymptotic analysis and implement various data structures like linked lists.
2. Understand and implement stacks and queues using arrays and linked lists.
3. Analyze and implement various searching and sorting algorithms.
4. Design and implement appropriate hash function and collision-resolution algorithms

**List of Experiments:**

**Exercise 1:**

Write recursive program for the following

a. Write recursive C program for calculation of Factorial of an integer
b. Write recursive C program for calculation of GCD (n, m)
c. Write recursive program which computes the $n^{th}$ Fibonacci number

**Exercise 2:**

a. Write recursive C program for functions to perform Linear search for a Key value in a given list.
b. Write recursive C program for functions to perform Binary search for a Key value in a given list.

**Exercise 3:**

a. Write C program that implement Bubble sort, to sort a given list of integers in ascending order.
b. Write C program that implement Quick sort, to sort a given list of integers in ascending order

**Exercise 4:**

a. Write C program that implement Insertion sort, to sort a given list of integers in ascending order
b. Write C program that implement merge sort, to sort a given list of integers in ascending order

**Exercise 5:**

a. Write C program that implement stack (its operations) using arrays
b. Write C program that implement stack (its operations) using Linked list

**Exercise 6:**

a. Write a C program that uses Stack operations to Convert infix expression into postfix expression
b. Write C program that implement Queue (its operations) using arrays.
c. Write C program that implement Queue (its operations) using linked lists

**Exercise 7:**

a. Write a C program that uses functions to create a singly linked list
b. Write a C program that uses functions to perform insertion operation on a singly linked list
c. Write a C program that uses functions to perform deletion operation on a singly linked list.

**Exercise 8:**

a. Write a C program to Create a Binary Tree of integers
b. Write a recursive C program for Traversing a binary tree in preorder, inorder and postorder.

**Exercise 9:**

Write a C program for BST operations (insertion, deletion)

**Exercise 10:**

a. Write a C program for finding minimum spanning tree in a graph by using Prim's algorithm.
b. Write a C program for finding minimum spanning tree in a graph by using Kruskal's algorithm.

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| P21BST08 | Transformation Techniques and Differential Equations | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:**

1) Differentiation
2) Integration

**Course Objectives:** The student will be able

1. To understand Fourier series representation of Periodic signals.
2. To The Fourier transform can be used to interpolate functions and to smooth signals.
3. To solve finite difference equations using Z-transforms.
4. To enlighten the learners in the concept of differential equations and multivariable calculus.
5. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

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

1. Find or compute the Fourier series of periodic signals.
2. Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms.
3. Solving methods for finite difference equations using Z-transforms.
4. Familiarize with functions of several variables which is useful in optimization.
5. Identify the solution methods for partial differential equation related to various engineering fields.

**UNIT–I: Fourier series (8 Lectures)**

Fourier series: Introduction – Periodic functions – Fourier series of periodic function –Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

**UNIT–II: Fourier Transforms (10 Lectures)**

Fourier Transforms: Fourier integral theorem (without proof) –Fourier sine and cosine integrals– Sine and cosine transforms –Properties–inverse transforms –Finite Fourier transforms.

**UNIT–III: Z-TRANSFORMS (8 Lectures)**

Introduction-properties-Damping rule-Shifting rule-Initial and Final value theorems – Inverse Z transform-Convolution theorem-Solution of difference equation by Z-transform

**UNIT–IV: Partial differentiation (10 Lectures)**

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain

rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

**UNIT–V: PDE of first order & Second order and Applications (10 Lectures)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.
Second order PDE: Solutions of linear partial differential equations with constant coefficient – RHS term of the type $e^{ax+by}$ , sin(ax+ by) , cos(ax+ by), $x^m\ y^n$
**Applications of PDE:** Method of separation of Variables

## Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, $44^{th}$ Edition, Khanna Publishers.
2. B.V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

## Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, $10^{th}$ Edition, Wiley-India.
2. H. K. Das, Advanced Engineering Mathematics, $22^{nd}$ Edition, S. Chand & Company Ltd.
3. David Poole, Linear Algebra- A modern introduction, $4^{th}$ edition, Cengage.
4. Peter O' Neil, Advanced Engineering Mathematics, Cengage
5. Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.

## text Web Resources:

1. `http://tutorial.math.lamar.edu/Classes/DE/DE.aspx`
2. `http://mathworld.wolfram.com/topics`
3. `http://www.nptel.ac.in/course.php`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT01 | Signals and Systems | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Basic knowledge of Vectors, Integration, Differentiation, Complex Numbers

**Course Objectives:** The student will be able

1. To explain about signals and perform various operations on it and to summarize the sampling.
2. To build Trigonometric and Exponential Fourier series of various signals.
3. To develop Fourier transforms for various signals.
4. To analyze the linear systems in time and frequency domains.
5. To solve Laplace transforms and z-transforms for various signals.

**Course Outcomes:** After going through this course the student will be able to

1. Characterize the signals and systems and principles of vector spaces, Concept of orthgonality.
2. Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
3. Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.
4. Understand the relationships among the various representations of LTI systems
5. Understand the Concepts of convolution, correlation, Energy and Power density spectrum and their relationships.
6. Apply z-transform to analyze discrete-time signals and systems.

**UNIT–I: (9 Lectures)**

**Introduction:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: Time-shifting, Time-scaling, Amplitude-shifting, Amplitude- scaling. Problems on classification and characteristics of signals and systems. Complex, Exponential and sinusoidal signals, Singularity functions and related functions: Impulse function, Step function signum function and ramp function.

**UNIT–II: (9 Lectures)**

**Orthogonal Functions:** Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions.

**Fourier Series:** Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum; Applications of Fourier series.

**UNIT–III: (9 Lectures)**

**Fourier Transform:** Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, Fourier transforms involving impulse function, Introduction to Hilbert Transform; Applications of Fourier Transform.

**Sampling Techniques:** Sampling theorem, Graphical and analytical proof for Band Limited Signals, Types-impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing.

**UNIT–IV: (9 Lectures)**

**Analysis of Linear Systems:** Linear system, Impulse response, Response of a linear system, Linear time invariant (LTI) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system. Filter characteristics of linear systems. Cross-correlation and auto-correlation of functions, Properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation.

**UNIT–V: (9 Lectures)**

**Laplace Transforms:** Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, Constraints on ROC for various classes of signals, Properties of L. T's, Relation between L. T's, and F.T. of a signal.

**Z–Transforms:** Fundamental difference between continuous-time and discrete-time signals, Discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

## Text Books:

1. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, $2^{nd}$ Edition, 1997
2. Signals, Systems & Communications - B.P. Lathi, BS Publications, $2^{nd}$ Edition, 2003.
3. Signals and Systems- Sanjay Sarma, 2013

## Reference Books:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, $2^{nd}$ Edition, 2011
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, $2^{nd}$ Edition, 2015

3. Signals and Systems – K Raja Rajeswari, B Visweswara Rao, PHI, $2^{nd}$ Edition, 2014

4. Signals and Systems – A. Anand Kumar, PHI, $1^{st}$ Edition, 2011

**Web Resources:**

1. nptel.ac.in/courses/108101039/mathematics/node3.html

2. www.tutorialspoint.com/signals_and_systems/signals_sampling_theorem

3. www.dspguide.com/ch3/2.htm

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT02 | Switching Theory and Logic Design | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** The Pre-requisites for this Course is Basic Mathematics.
**Course Objectives:** The student will be able

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To Theorems and functions of Boolean algebra and behavior of logic gates.
3. To understand concepts of combinational circuits.
4. To implement simple logical operations using combinational logic circuits
5. To develop advanced sequential circuits.

**Course Outcomes:** After going through this course the student will be able to

1. Classify different number systems and apply to generate various codes.
2. Use the concept of Boolean algebra in minimization of switching functions
3. Design different types of combinational logic circuits.
4. Apply knowledge of flip-flops in designing of Registers and counters
5. The operation and design methodology for synchronous sequential circuits and algorithmic state machines.

**UNIT–I: (9 Lectures)**

**NUMBER SYSTEMS AND BOOLEAN CODES:** Decimal, Binary, Dettol and Hexadecimal number systems and their arithmetic operations, Conversion of one number system to another number system. Boolean codes: Binary, BCD, Gray and Ex-3 codes and their arithmetic operations; ASCII code; 1's and 2's complement of a binary number and their arithmetic operations. Error Detecting and Correcting Codes- Parity code, Hamming code.

**BOOLEAN FUNCTIONS:** Boolean algebra, Theorems, Properties; Boolean Functions-Representation in SOP and POS forms; Conversion from one to another form; Standard and canonical forms of representation of functions; Minimization of Boolean functions using Boolean Properties and K-maps (Up to 5-variable) both in SOP and POS forms.

**UNIT–II: (9 Lectures)**

**LOGIC GATES:** Types of basic logic gates and their truth tables; Realization of basic gates using Discrete components; Universal Gates, XOR and XNOR gates, Functions realization using Multilevel NAND-NOR gates; Positive and Negative logic Systems.

**COMBINATIONAL CIRCUITS-I:** Definition, Half Adder, Half Subtractor, Full Adder, Full Subtractor; N-bit Binary Parallel Adder, Subtractors, Adder/ Subtractor; BCD Adder/Subtractor, Carry look-ahead adder..

**UNIT–III:** **(9 Lectures)**

**COMBINATIONAL CIRCUITS-II:** Design of encoder, Decoder, Multiplexer and Demultiplexers; Design of higher order circuits using lower order ones; Priority encoder, Comparator (up to 4-bit); BCD to seven segment decoder.

**INTRODUCTION OF PLD's:** Design of PLA, PAL, PROM.

**UNIT–IV:** **(9 Lectures)**

**SEQUENTIAL CIRCUITS I:** Definition; Types of Sequential circuits (Synchronous and Asynchronous), Basic memory element; Types of Clock Signals; Clocked Latch; Types of Flip- flops- R-S; D, T, J-K and Master-Slave JK flip-flops with their circuits, Truth table and Excitation tables; Conversion of one flip-flop to another flip-flop.

**SEQUENTIAL CIRCUITS II:** Counters- Asynchronous, Synchronous and Ripple counters; Special Counters- Ring and Johnson Counters, Shift registers- Buffer register, 4-bit Shift register, Bi-directional shift register, Universal shift register.

**UNIT–V:** **(9 Lectures)**

**FINITE STATE MACHINES**: State table, State diagrams, Trees, Reduction of state table; Design of Synchronous circuits using state tables; Sequential Machines-Moore and Mealy; Sequence generator and detector.

## Text Books:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha $3^{rd}$ Edition, Cambridge UniversityPress,2009
2. Digital Design by M.MorrisMano,Michael D Ciletti, $4^{th}$ editionPHIpublication,2008
3. Switching theory and logic design by Hill and Peterson,Mc-Graw Hill TMH edition, 2012.
4. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.

## Reference Books:

1. Fundamentalsof Logic Design by Charles H. Roth Jr,JaicoPublishers, 2006
2. Digital electronics by R S Sedha.S.Chand & company limited, 2010
3. Switching Theory and Logic Design by A. Anand Kumar, PHI Learningpvtltd, 2016.
4. Digital logic applications and design by John M Yarbough, Cengagelearning, 2006

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT03 | Electronic Circuit Analysis | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Electronic Devices and Circuits

**Course Objectives:** The student will be able to

1. Familiarize the student with the analysis and design of different amplifier circuits (single atage) using BJTs.
2. Understand the analysis multistage amplifier circuits using BJTs and analysis of MOS amplifier circuits.
3. Understand the concepts of feed back in amplifiers and emphasis on feedback amplifiers (ckts of different implementing different topologies) and oscillators.
4. Familiarize with different power amplifier circuits using BJT and designing the power amplifier.
5. Learn about various tuned amplifiers and their frequency responses.

**Course Outcomes:** After going through this course the student will be able to

1. Analysis of various transistor amplifier circuits using h-parameters
2. Analysis of various multi stage transistor amplifier circuits using h-parameters at low frequencies and at high frequencies.
3. Analysis of concepts of both positive and negative feedback in electronic circuits and construct & analysis of oscillator circuits to generate signals in various frequency ranges.
4. Analysis of different types of power amplifiers for practical applications of desired specifications.
5. Analysis of different tuned amplifiers circuits.

**UNIT–I: (8 Lectures)**

**Single Stage Amplifiers:** Transistor hybrid model, determination of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CE, CB and CC amplifiers using exact hybrid model and Analysis of CE, CB and CC amplifiers using simplified hybridmodel, Analysis of CE amplifier with emitter resistance using simplified hybrid model, Miller's theorem.

**UNIT–II: (12 Lectures)**

**Multistage Amplifiers:** Analysis of Cascaded RC coupled BJT amplifiers, Cascode Amplifier, Darlington Pair, Different Coupling Schemes used in Amplifiers – RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier.

**BJT Amplifiers-Frequency Response:** The Hybrid pi model –Common Emitter Transistor Model, CE Short Circuit current gain, current gain with resistive load. MOS Amplifiers: Basic Concepts, MOS Small signal model, Common source amplifier with resistive load.

**UNIT–III:** **(9 Lectures)**

**Feedback Amplifiers:** Concepts of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations, Illustrative examples.

**Oscillators:** Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge and crystal Oscillators, Stability of Oscillators

**UNIT–IV:** **(8 Lectures)**

**Large Signal Amplifiers:** Classification of amplifiers, Class A Large signal amplifiers, Transformer Coupled Class A Audio Power amplifier, Efficiency of class A amplifier, Class B amplifier, Efficiency of class B Amplifier, class B Push pull Amplifier, Complementary Symmetry Class B Push Pull Amplifier, Distortion of Power Amplifiers, Thermal Stability and Heat sinks

**UNIT–V:** **(8 Lectures)**

**TUNED AMPLIFIERS:** Introduction, Q Factor, Small signal Tuned Amplifiers, Effect of Cascading Single tuned Amplifiers on bandwidth, Effect of Cascading Double Tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers, Stability of tuned amplifiers.

## Text Books:

1. Integrated Electronics – by J. Millman and C.C. Halkias, -1991 ed 2008 TMH
2. Electronic Devices and Circuits – by G K Mithal, Kanna Publications, $23^{rd}$ Edition, 1988.
3. Electronic Devices and Circuits – by B.P. Singh, Rekha Singh, Pearson, $2^{nd}$ Edition, 2013.

## Reference Books:

1. Electronic Devices and Circuits Theory- Robert L. Boylestad and Louis Nashelsky, PHI, $9^{th}$ Edition, 2008
2. Micro Electronic Circuits – by Sedra A.S. and K.C. Smith, Oxford University Press, $5^{th}$ Edition, 2013
3. Electronic Circuit Analysis-– by K. Lal Kishore, BS Publications/BSP Books; $4^{th}$ Edition, 2016

## Web Resources:

1. `electronicspost.com/single-stage-transistor-amplifier/`
2. `www.niu.edu/remotelab/samplegui/tunedamp.shtml`
3. `www.npteliitm.ac.in`

4. www.modernelectronics.org

5. www.electronicsforyou.com

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT04 | Pulse and Digital Circuits | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Electronic Devices and Circuits, Network Analysis.

**Course Objectives:** The student will be able

1. To understand the Complete Response of R-C and R-L-C transient circuits.
2. To Understand the concepts of wave shaping it's for any application.
3. To design various Multivibrators using Transistors and Sampling Gates.
4. To Introduce to Time-base Generators in sweep signal generation.
5. To discuss and realize the Logic Gates using Diodes and Transistors.

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

1. Explain the Complete Response of R-C and R-L-circuit.
2. Analyze the responses of sinusoidal and non-sinusoidal signals to various responses.
3. Demonstrate the concept of switching characteristics of diodes and transistors.
4. Construct the various Multivibrators Using Transistors and demonstrate time base generators.
5. Discuss and realize the Logic Gates using Diodes and Transistors.

**UNIT–I: (9 Lectures)**

**Linear Wave Shaping:** High pass, low pass RC circuits, their Response for Sinusoidal, Step, Pulse, Square, and Ramp inputs. High pass RC Network as Differentiator and Low pass RC circuit as an integrator, Attenuators and its application as a CRO, RL and RLC circuits and their response for step input.

**UNIT–II: (9 Lectures)**

**Non-Linear Wave Shaping:** Diode as a switch, Piece Wise Linear Diode Characteristics, Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, applications of voltage comparators, Clamping operation, clamping circuits taking source and diode resistances taking into account, Clamping circuit theorem.

**UNIT–III: (9 Lectures)**

**Multivibrators:** Transistor as a switch, break down voltages, Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger circuit using BJT.

**Sampling Gates:** Basic Operating Principles of Sampling Gates, Diode Unidirectional Sampling Gate and Two-Diode Bi-Directional Sampling Gate, Four- Diode gates, Six-Diode Gates, Applications of Sampling Gates.

**UNIT–IV:** **(9 Lectures)**

**Time Base Generators:** General features of a time base signal, Methods of generating time base waveform, Sweep generation by UJT, basic principles in Miller and Bootstrap time base generators, Transistor Miller time base generator, Transistor Bootstrap time base generator, Transistor current time base generators.

**UNIT–V:** **(9 Lectures)**

**Logic Families:** Realization of digital logic gates with Diode Logic, Transistor Logic, Diode- Transistor Logic, Resistor Transistor Logic Transistor-Transistor Logic, Emitter Coupled Logic, CMOS logic, Comparison of Digital Logic Families.

## Text Books:

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, Mothiki S Prakash Rao McGraw-Hill, $2^{nd}$ Edition, 2007.
2. Solid State Pulse circuits - David A. Bell, PHI, $4^{th}$ Edition, 2002..

## Reference Books:

1. Integrated electronics, Jacob Miman, Christos, C. Halkias, $2^{nd}$ Edition, Tata McGraw Hill Publication, 2017.
2. Pulse and Digital Circuits, A. Anand Kumar, $2^{nd}$ Edition, PHI, 2005
3. Fundamentals of Pulse and Digital Circuits, Ronald J. Tocci, $3^{rd}$ Edition, PHI, 2008.

## Web Resources:

1. `www.npteliitm.ac.in`
2. `www.modernelectronics.org`
3. `www.electronicsforyou.com`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL01 | Switching Theory and Logic Design Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**List of Experiments: (Minimum of Ten Experiments has to be performed)**

1. Verification of Logic gates
2. Implementation all individual gates with Universal gates NAND & NOR.
3. Design a circuit for the given canonical form, draw the circuit diagram & Verify the De- Morgan laws.
4. Construct Half adder & full adder using half adder and verify truth table.
5. Design and study the Half Subtractor and verify the truth table.
6. Design a combinational logic circuit for 4x1 MUX and verify the truth table.
7. Design a combinational logic circuit for 1x4 DE-MUX and verify the truth table.
8. Design and implementation of BCD to excess-3 code converter and vice versa using logic gates.
9. Design and implementation of binary to gray code converter and vice versa using logic gates
10. Verification of the truth table of basic flipflops with synchronous & a synchronous modes.
11. Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.
12. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| P21ECL02 | Analog Circuit Lab | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** Electronic Devices and Circuits

**Course Objectives:** The objective of this lab is

1. Frequency response of single stage amplifier.
2. How frequency response varies by applying negative feedback on amplifiers.
3. Different frequency sinusoidal signal generation.
4. Generation and processing of sinusoidal signals.
5. Generation of waveforms using various multivibrator circuits.

**Course Outcomes:** At the end of the course student can able to

1. Simulate and evaluate single-stage and two-stage amplifiers
2. Realize the given performance using feedback amplifiers
3. Design and test Oscillator circuits using BJT.
4. Implement and simulate the performance of power amplifiers
5. Design and analyze various multivibrator circuits

**Part A:(Simulation)**

List of Experiments :( Minimum of Ten Experiments has to be performed)

1. Single stage CE Amplifier.
2. Voltage-Series Feedback Amplifier
3. RC Phase Shift/Wien Bridge Oscillator
4. Hartley/Colpitt's Oscillator
5. Two Stage RC Coupled Amplifier
6. Complementary Symmetry Class B Push-Pull Power Amplifier

**Part B:(Hardware)**

1. Non-Linear wave shaping – Clippers.
2. Non-Linear wave shaping – Clampers.
3. Astable Multivibrator.
4. Monostable Multivibrator.
5. Schmitt Trigger.
6. Sampling Gates.

**Equipement Required:**

**Hardware:**

1. Regulated Power supplies
2. Analog /Digital Storage Oscilloscopes
3. Analog /Digital Function Generators
4. Active & Passive Electronic Components

**Software:**

1. Multisim/ Equivalent Industrial Standard Licensed simulation software tool.
2. Computer Systems with required specifications

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL03 | Signals and Systems Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Objectives:** The objective of this lab is

1. To learn in MATLAB software.
2. To perform some basic operations on signals
3. To analyze the given siven signal in both time and frequency domain
4. To implement cross-correlation, convolution and autocorrelation functions on the system.
5. To develop the given LTI system and finding the output response and stability of system.

**Course Outcomes:** At the end of the course student can able to

1. Generation of some basic signals and able to do some basic operations on signals.
2. Analysis of signals both in time and frequency domain
3. Calculation of system response to the given input signal.
4. Observation of system stability using transform theory.

**List of Experiments: (Minimum of Ten Experiments has to be performed)**

1. Write a MATLAB code to perform basic operations on matrices using MATLAB
2. Write a MATLAB program to generate various signals & sequences (periodic & aperiodic) such as unit impulse, unit step, square, sawtooth, triangular, sinusoidal, ramp and sinc using MATLAB
3. Write a MATLAB program to perform operations on signals & sequences such as addition, multiplication, scaling, shifting, computation of energy and average power using MATLAB
4. Write a MATLAB program to find even & odd parts of signal/sequence and real & imaginary parts of signal using MATLAB
5. Write a MATLAB program to perform convolution between signals and sequences using MATLAB
6. Write a MATLAB program to perform autocorrelation and cross correlation between signals and sequences using MATLAB
7. Write a MATLAB program to find the fourier transform of a given signal and plot its magnitude and phase spectrum using MATLAB

8. Locating the zeros and poles and plotting the pole-zero maps in S-plane and Z-plane for the given transfer function
9. Write a MATLAB program to verify Sampling theorem for a given continuous signal using MATLAB
10. Write a MATLAB program to verify Linearity and Time Invariance properties of a given system using MATLAB
11. Write a MATLAB program to compute unit sample, unit step and sinusoidal responses of the given LTI system and verify its physical reliability and stability using MATLAB

**Equipement Required:**

1. PC
2. MATLAB

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21MCT03 | Environmental Science | 2 | 0 | 0 | 0 |

Internal Marks: 100

**Course Prerequisite:**Basic knowledge about sciences up to intermediate or equivalent level.

**Course Objectives:** The student will be able to

1. Overall understanding of the natural resources
2. Basic understanding of the ecosystem and its diversity
3. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities
4. An understanding of the environmental impact of developmental activities
5. Awareness on the social issues, environmental legislation and global treaties

**Course Outcomes:** After going through this course the student will be able to acquire

1. The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
2. The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources
3. Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
4. The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
5. Social issues both rural and urban environment and the possible means to combat the challenges and environmental assessment stages involved in EIA and the environmental audit.

**UNIT–I: (9 Lectures)**

**MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:** Definition, Scope and Importance– Need for Public Awareness. Renewable energy Resources, Solar energy-solar cells, solar batteries, wind energy, wind mills, ocean energy, tidal energy and nonrenewable energy resources: LPG, water gas, producer gas. World food problems, degradation and Soil erosion - overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging and salinity.

**UNIT–II: (8 Lectures)**

**ECOSYSTEMS:** Concept of an ecosystem. – Structure, Components and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Ecological pyramids - Food chains, food webs and Introduction, types, characteristic features, structure and function of

the following ecosystem: a. Forest ecosystem. b. Grassland ecosystem c. Desert ecosystem d. Aquatic – River and Lake Ecosystems.

**UNIT–III: (8 Lectures)**

**BIODIVERSITY AND ITS CONSERVATION:** Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India –Value of biodiversity: consumptive use, Productive use, social, ethical and aesthetic values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT–IV: (9 Lectures)**

**ENVIRONMENTAL POLLUTION:** Definition, Cause, Effects and Control measures of : a. Air Pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Nuclear hazards.

**Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes

**Disaster management:** floods, earthquake, cyclone and landslides.

**UNIT–V: (8 Lectures)**

**SOCIAL ISSUES AND THE ENVIRONMENT:** From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management –Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Population growth – Impacts on society, variation among nations. Environmental Impact Assessment (EIA) and Environmental Protection Acts.

**Text Books:**

1. Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi, 2008.

**Reference Books:**

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2. Perspectives in Environmental Studies, Second edition, AnubhaKoushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.

**Online References:**

1. Environmental Science - Oxford Research Encyclopedia
2. Environmental Science - Museum of Science and Industry
3. Collegesat.du.ac.in/UG/Envinromental%20Studies_ebook.pdf

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT08 | Random Variables and Stochastic Processes | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Simple geometry theory, Multiple integration and differentiation

**Course Objectives:** The objective of this course is

1. To give students an introduction to elementary probability theory, in preparation for courses on statistical analysis, random variables and stochastic processes.
2. To mathematically model the random phenomena with the help of probability theory concepts.
3. To introduce the important concepts of random variables and stochastic processes.

**Course Outcomes:** After going through this course the student will be able to

1. Apply the specialized knowledge in probability theory and random processes to solve practical engineering problems.
2. Gain some knowledge in various probability distribution and density functions and solve the major noise removal problems in communication systems.
3. Apply the theory of stochastic processes student will able to determine the temporal and spectral characteristics of random signals response of a given linear system.
4. Describe the concept of random processes and determine mean and correlation of random processes.
5. Understand the concept of random processes in frequency domain and determine the relation between correlation and power spectral density function.

**UNIT–I: (9 Lectures)**

**Random Variables:** Introduction to Random Variable, Types of Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

**UNIT–II: (9 Lectures)**

**Operations on One Random Variable:** Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function.

**UNIT–III: (9 Lectures)**

**Multiple Random Variables:** Vector Random Variables, Joint Distribution Function, Properties Joint Distribution, Marginal Distribution Functions, Conditional

Distribution and Density,Statistical Independence, Sum of Two Random Variables. Central Limit Theorem: Unequal Distribution, Equal Distributions.

**Operations on Multiple Random Variables:** Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties.

**UNIT–IV: (9 Lectures)**

**Random Processes – Temporal Characteristics:** The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes.

**UNIT–V: (9 Lectures)**

**Random Processes – Spectral Characteristics:** The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross- Correlation Function.

## Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, $4^{th}$ Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, $4^{th}$ Edition, 2002.

## Reference Books:

1. Probability Theory and Stochastic Processes – B. Prabhakara Rao, BS Publications, $1^{st}$ Edition, 2012.
2. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, $3^{rd}$ Edition, 2002.
3. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, $1^{st}$ Edition, 1968.
4. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, $1^{st}$ Edition, 2014.

## Web References:

1. `ewww.ee.iitb.ac.in`
2. `nptel.ac.in`
3. `ocw.usu.edu`
4. `www.smartzworld.com`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT07 | Analog & Digital Communications | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Signals and Systems, Probability Theory

**Course Objectives:** The objective of this course is to

1. Familiarize with various techniques for analog modulation and demodulation of signals distinguish the figure of merits of various analog modulation methods
2. Develop the ability to classify and understand various Angle Modulation techniques
3. Gain the knowledge on noise and its impact on the performance of communication systems
4. Familiarize with various digital modulation techniques and calculation of their error probabilities
5. Compute and analyze Block codes, cyclic codes and convolution codes.

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

1. Explain the spectral characteristics, generation and detection Techniques of Amplitude modulation techniques
2. Explain the spectral characteristics, generation and detection Techniques of Angle modulation techniques
3. Illustrate different types of noise and predict its effect on Analog communication Systems
4. Describe the generation and detection methods of various digital Modulation schemes
5. Analyze the concepts of error control coding

**UNIT–I: (9 Lectures)**

**Analog Modulation** – Introduction to Analog communication systems, Need of modulation, Types- AM, SSB, DSB-SC, VSB - Time domain and frequency domain description, Single tone modulation, Power relations, Generation & Detection techniques, AM Transmitters, AM Receivers-Super-heterodyne receiver, AGC. Illustrative problems.

**UNIT–II: (9 Lectures)**

**Angle Modulation:** Phase and Frequency Modulation, Narrow band and Wideband FM, Carson's rule, Indirect and direct method of FM generation, Detection of FM, PM generation and detection. Phase locked loop, Comparison of FM and AM, FM Transmitters, FM Super-heterodyne receiver. Illustrative problems.

**UNIT–III: (9 Lectures)**

**Noise in Analog Communication system:** Noise in AM system, Noise in SSB & DSB system, Noise in Angle Modulation system, Pre-emphasis and de-emphasis techniques. Illustrative problems.
Pulse Modulation: Types of Pulse modulations- PAM, PWM, PPM-Generation & Detection of signals.

**UNIT–IV: (9 Lectures)**

**Digital Modulation Systems:** Introduction to digital communication system, Base-band and Bandpass signals. Sampling process; Quantization Process; Quantization Noise; Pulse-Code Modulation; Noise Considerations in PCM Systems; Differential Pulse-Code Modulation, Delta modulation, Adaptive delta modulation, Amplitude, Phase and frequency shift keying schemes (ASK, FSK, PSK, QPSK). Introduction to M-array modulation schemes, Matched filter receiver and optimum receiver. Illustrative problems.

**UNIT–V: (9 Lectures)**

**Information theory and Error control Coding:** Measure of information, Entropy, Information rate, Source coding theorem, Channel capacity, Shannon-Hartley law, Error control Codes–Linear codes, Cyclic codes, Convolution Coding-encoder, decoder-Exhaustive search and sequential method. Illustrative problems.

## Text Books:

1. Simon Haykin and Michael Moher, "An Introduction to Analog & Digital Communications", $2^{nd}$ Ed., Wiley, (2007).
2. Tomasi, Wayne, "Electronics Communication Systems Fundamentals through advanced", $5^{th}$ Edition, Pearson Education, 2009.
3. B.P. Lathi, "Modern Digital & Analog Communications Systems", 2e, Oxford University Press
4. Communication Systems (Analog and Digital) by Dr. Sanjay Sharma.

## Reference Books:

1. Bruce Carlson, Paul B. Crilly and Janet C. Rutledge, "Communication Systems: An Introduction to Signals and Noise in Electrical Communications", $4^{th}$ Edition, McGraw- Hill, (2002).
2. Simon Haykin, "Communication Systems", $4^{th}$ Edition, John Wiley & Sons, (2001)
3. Nevio Benvenuto, Roberto Corvaja, Tomaso Erseghe, and Nicola Laurenti, "Communication Systems: Fundamentals and Design Methods", John Wiley & Sons, (2006).
4. Sam Shanmugam, K, "Digital and Analog Communication Systems", Wiley publisher (2006).

5. R. P. Singh, S. Sapre, "Communication Systems: Analog and Digital", Tata McGraw-Hill, $2^{nd}$ edition.

**Web References:**

1. analogcommunication4u.blogspot.com/p/lesson-plan.html
2. www.electronics-notes.com
3. https://swayam.gov.in/nd1_noc20_ee17/preview
4. https://www.tutorialspoint.com/digital_communication/digital_communication_quadrature_phase_shift_keying.htm

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT05 | Linear and Digital IC Applications | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Electronic Devices and Circuits, Switching Theory and Logic Design

**Course Objectives:** The student will be able to

1. Understand the basic features of Operational Amplifier and its applications.
2. Analyze the design of Op-Amp based Active Filters, Waveform generators, Functionality of 555 Timer and 565 ICs and their applications.
3. Design of various types of ADCs and DACs.
4. Explain digital IC's and its applications.
5. Learn about different Sequential Logic IC's and Memories.

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

1. Explain the concepts of Operational Amplifier and its features and apply the concepts of Op- Amps in the design of Summing Amplifier, Subtractors, Comparators, differentiators, Integrators and Voltage Regulators.
2. Analyze and design Op-Amp based circuits namely Active Filters, Waveform generators; Design and apply Astable and Mono-stable multi vibrator modes using 555 Timer IC; Conceptualize Phase Locked Loop using 565 IC and explain its applications.
3. Analyze and design DACs and ADCs using various methods of implementation.
4. Explain the structure digital integrated circuits and their applications.
5. Analysis of Sequential logic IC's and Memories.

**UNIT–I: (11 Lectures)**

OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, DC and AC Characteristics, Definitions of Input and Output Off-set voltage and currents slow rate, CMRR, PSRR. Features of 741 Op-Amp, General Linear Applications of Op-Amp: Adder, Subtractor - Modes of operation Inverting, Non- Inverting, Differential, Instrumentation Amplifier, Differentiators and Integrators, Nonlinear Applications- Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Design of Voltage Regulator using IC723.

**UNIT–II: (7 Lectures)**

**Applications of OPAMP IC741, IC-555 & IC 565:** Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis and Design of 1st order and 2nd order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram,

Monostable and Astable Operations, Applications, IC565 PLL – Block Schematic, Description of Individual Blocks, Applications.

**UNIT–III: (6 Lectures)**

**Data Converters:** Introduction- Basic DAC techniques- weighted resistor DAC, R-2R ladder DAC, Different types of ADCs - Flash type ADC, Successive approximation ADC and dual slope ADC, DAC and ADC Specifications

**UNIT–IV: (15 Lectures)**

**Digital Integrated Circuits:** Classification of Integrated Circuits, Comparison of Various Logic Families, Combinational Logic ICs - Specifications and Applications of Binary Parallel Binary adder -Subtractor (74x181), Look Ahead Carry Generator (IC74x182), Decoders (IC74x138), encoders (IC74x148), multiplexers (IC74x151) and demultiplexers (IC74x155), parity circuits (IC74x280), Magnitude comparators (IC74x682).

**UNIT–V: (9 Lectures)**

**Sequential Logic IC's and Memories:** Latches (IC74x373) and flip flops IC74x175), Ring Counter (IC74x163), Johnson Counter (IC74LS164.), Design of Modulus N Synchronous Counters (74x102), Shift Registers (IC74x194), LFSR counter (IC74HC164). Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

## Text Books:


1. Op-Amps & Linear Integrated Circuits, Ramakanth A. Gayakwad, $4^{th}$ Edition, PHI, 2003.
2. Digital Design Principles & Practices, John F. Wakerly, $3^{rd}$ Edition., PHI/ Pearson Education Asia, 2005.
3. VHDL Primer , J. Bhasker, $3^{rd}$ Edition, Pearson Education/ PHI. 2015.
4. Operational Amplifiers & Linear Integrated Circuits, Sanjay Sharma, 2nd Edition, SK Kataria & Sons, 2010.
5. Linear Integrated Circuits, D. Roy Chowdhury, 2nd Edition., New Age International (p) Ltd, 2003.


## Reference Books:


1. Linear Integrated Circuits and Applications – Salivahana, TMH.
2. Fundamentals of Digital Logic with VHDL Design- Stephen Brown, ZvonkoVranesic, McGrawHill, $3^{rd}$ Edition.


## Web References:

1. `https://swayam.gov.in/nd1_noc20_ee55/preview`
2. `https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.htm`

3. https://nptel.ac.in/courses/108/108/108108111/

4. https://nptel.ac.in/courses/117/108/117108040/

5. https://nptel.ac.in/courses/117/106/117106088/

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| P21ECT06 | Electromagnetic Waves and Transmission Lines | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Three-Dimensional Coordinate Systems, Vector Calculus

**Course Objectives:** The student will be able to

1. Recognize and classify the basic Electrostatic theorems and laws.
2. Classify the basic Magneto static theorems and laws.
3. Establish the proof and estimate the polarization features, reflection and transmission coefficients for UPW propagation
4. Explain the characteristics of transmission lines and its losses
5. Analyze the transmission lines and their parameters using the Smith Chart and learn about striplines

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

1. Display an understanding of fundamental electromagnetic laws and concepts
2. Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning.
3. Analyze the Wave Equations for good conductors and good dielectrics
4. Derive the expressions for input impedance of transmission lines.
5. Analyze impedance matching by stubs using smith charts also analyze the planar striplines.

**UNIT–I: (9 Lectures)**

**Electrostatics:** Review of Co-ordinate Systems, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

**UNIT–II: (9 Lectures)**

**Magneto Statics :** Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar andVector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy. Illustrative Problems.

**Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric- Dielectric and Dielectric-Conductor Interfaces. Illustrative Problems.

**UNIT–III:** **(9 Lectures)**

**EM Wave Characteristics:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics–Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Skin depth, Illustrative Problems.

**UNIT–IV:** **(9 Lectures)**

Transmission Lines - I : Types, Parameters, T&$\pi$ Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Loading - Types of Loading. Illustrative Problems.

**UNIT–V:** **(9 Lectures)**

**Transmission Lines – II :** Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements; Impedance Transformations $\frac{\lambda}{4}, \frac{\lambda}{2}, \frac{\lambda}{8}$ Lines –. Smith Chart – Construction and Applications, Quarter wave transformer, Stub Matching-single & double, Illustrative Problems.

**Planar Transmission Lines:** Electromagnetic fields in striplines, microstriplines, and co-planar waveguides.

## Text Books:


1. Electromagnetic Waves and Radiating Systems– E. C. Jordan and K.G. Balmain, PHI, $2^{nd}$ Edition, 2000.
2. Principles of Electromagnetics – Matthew N.O. sadiku and S.V. Kulkarni, Oxford University Press, Asian $6^{th}$ Edition, 2015.
3. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan, Tech. India Publications, New Delhi, $1^{st}$ Edition, 2001.
4. Electromagnetic Fields And Waves- K. D. Prasad, 2001


## Reference Books:


1. Engineering Electromagnetics – Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, $2^{nd}$ Edition, 2005.
2. Networks, Lines and Fields – John D. Ryder, PHI, $2^{nd}$ Edition, 1999.
3. Engineering Electromagnetics– William H. Hayt Jr. and John A. Buck, TMH, $7^{th}$ Edition, 2006.
4. Electromagnetic Field Theory and Transmission Lines – G.S.N. Raju, Pearson Education, $3^{rd}$ Edition, 2009.


## Web References:

1. science.nasa.gov/ems/
2. physics.info/em-waves
3. nptel.ac.in/courses/117101056

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| P21MBT01 | Managerial Economics and Financial Analysis | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Nill

**Course Objectives:** The student will be able to

1. The Learning objective of this Unit is to understand the concept and nature of Managerial Economic s and its relationship with other disciplines, Concept of Demand and Demand forecasting.
2. The Learning objective of this Unit is to understand the concept of Production function, Input Output relationship, different Cost Concepts and Concept of Cost-Volume-Profit Analysis.
3. The Learning Objective of this Unit is to understand the Nature of Competition, Characteristics of Pricing in the different market structure and significance of various pricing methods and to know the different forms of Business organization
4. The Learning objective of this Unit is to understand the different Accounting Systems preparation of Financial Statements and uses of different tools for performance evaluation
5. The Learning objective of this Unit is to understand the concept of Capital, Capitalization, Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods

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

1. The Learner is equipped with the knowledge of estimating the Demand for a product and the relationship between Price and Demand.
2. One should understand the Cost Concepts for decision making and to estimate the least cost combination of inputs.
3. One has to understand the nature of different markets and Price Output determination under various market conditions and with the knowledge of different Business Units.
4. The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
5. The Learner is able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

**UNIT–I: (8 Lectures)**

**Introduction to Managerial Economics and demand Analysis:** Definition of Managerial Economics-Scope of Managerial Economics and its relationship with other subjects-Concept of Demand, Types of Demand, Determinants of Demand-Demand Schedule, Demand Curve, Law ofDemand and its limitations-Elasticity

of Demand-Types of Elasticity of Demand and Measurement-Demand forecasting and its Methods.

**UNIT–II: (10 Lectures)**

**Production and Cost Analyses:** Concept of Production function-Cobb-Douglas Production Function – Law of one Variable proportions-Isoquants and Isocosts and choice of Least cost factor combination-Concepts of Returns to Scale and Economics of Scale-Different Cost Concepts: Opportunity Costs, Explicit Costs and Implicit Costs -Fixed Costs, Variable Costs and Total Costs - Cost Volume Profit analysis - Determination of Break-Even Point (Simple Problem) Managerial Significance and limitations of Breakeven point.

**UNIT–III: (8 Lectures)**

**Introduction to Markets and Types of Business Organization:** Market Structures: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price and Output Determination– Other Methods of Pricing: Average Cost Pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company –Private Public Partnership - State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle.

**UNIT–IV: (10 Lectures)**

**Introduction to Accounting & Financing Analysis:** Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements (Simple Problems) GST basic concepts and Slab rates.

**UNIT–V: (10 Lectures)**

**Capital and Capital Budgeting:** Capital Budgeting: Meaning of Capital-Meaning of Capital Budgeting-Time value of Money-Methods of appraising Project profitability: Traditional methods (pay back period, accounting rate of return) and Modern Methods (Discounted cash flow method, Net present value method, internal rate of return method and profitability index).

## Text Books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.
2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011.
3. Prof. J.V.Prabhakara rao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.
4. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.

## Reference Books:

1. V. Maheswari : Managerial Economics, Sultan Chand.
2. Suma Damodaran : Managerial Economics, Oxford 2011.

3. Dr. B. Kuberudu and Dr. T. V. Ramana : Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.

4. Sanjay Dhameja : Financial Accounting for Managers, Pearson.

5. Maheswari : Financial Accounting, Vikas Publications.

6. S. A. Siddiqui & A. S. Siddiqui : Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

**Web References:**

1. https://lecturenotes.in/subject/566/managerial-economics-and-financial-analysis-mefa

2. https://nptel.ac.in/courses/110101005/

3. https://www.crectirupati.com/sites/default/files/.../MEFA%20lecture%20notes.pdf

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL05 | Analog & Digital Communication Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**List of Experiments (Twelve experiments to be done)**

**The objective of this lab is to Develop and Analyze the output signal of Part A: Analog Communications**

1. Amplitude Modulation and Demodulation.
2. DSB SC - Modulation and Demodulation.
3. Spectrum Analysis of Modulated signal using Spectrum Analyzer
4. Pre-emphasis & De-emphasis circuits.
5. Frequency Modulation - Modulation and Demodulation.
6. By Implementation of Sampling Theorem
7. PAM, PWM, PPM- Modulation and Demodulation.

**Part B: Digital Communications**

1. Pulse code modulation, Differential pulse code modulation.
2. Delta modulation.
3. ASK, FSK, PSK.
4. Differential phase shift keying.
5. Source Encoder and Decoder
6. Channel coding-
   (a) Linear Block Code-Encoder and Decoder
   (b) Binary Cyclic Code – Encoder and Decoder
   (c) Convolution Code – Encoder and Decoder

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL04 | Linear and Digital IC Applications Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**PART – A (minimum 6 experiments) Design and Verify the functionality of the following:**

1. Study of OP AMPs - IC 741, IC 555, IC 565, IC 566, - functioning, parameters and Specifications.
2. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
3. Integrator and Differentiator Circuits using IC 741.
4. Active Filter Applications – LPF, HPF (first order)
5. Function Generator using OP AMPs.
6. (a) IC 555 Timer - Monostable Operation Circuit.
   (b) IC 555 Timer - Astable Operation Circuit.
7. Schmitt Trigger Circuits – using IC 741
8. Design of Frequency Multiplier using PLL IC 565
9. Voltage Regulator using IC 723.

**PART – B (minimum 6 experiments using VHDL)**

1. Design of all gates using VHDL. -74XX.
2. Write VHDL programs for the following circuits, check the waveforms and the hardware generated
   (a) Half adder, Half Subtractor
   (b) Full adder , Full Subtractor
3. Write VHDL programs for the following circuits, check the waveforms and the hardware generated- multiplexer -74X151 and 2x4 Demultiplexer-74X155.
4. Write VHDL programs for the following circuits, check the wave forms and the hardware generated -3-8 Decoder -74138 & 8-3 Encoder- 74X148
5. Write a VHDL program for a 4-bit comparator (74x85))and check the wave forms and the hardware generated
6. Write a VHDL program for D FLIP-FLOP and check the wave forms and the hardware generated
7. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
   (a) register
   (b) shift register
8. Write a VHDL program for a Decade counter –IC 7490 and check the wave-forms and the hardware generated

9. Write a VHDL program for a parity generator/Checker and check the wave forms and the hardware generated.

**Additional Experiments:**

1. OPAMP characteristics and parameter measurement
2. Weighted resistor 4-bit DAC using IC 741
3. Priority Encoder using 74XX Series.
4. Simulation of Synchronous up-down counter.

**Equipment Required:**
**For Part - A**

1. Regulated Power Supply (0-30V)
2. Cathode Ray Oscilloscope (20MHz)
3. Multimeters
4. Kits for the above experiments or the following components
   (a) ICs- 741, 555, 723, 7805, 7809, 7912.
   (b) Resistors, Capacitors.
   (c) Breadboards

**For Part - B**

1. Computer with Xilinx software,ISE 14.7
2. Note: Minimum 12 experiments are to be conducted (Minimum 6 experiments from each part are to be conducted)

**For Software Simulation**

1. Computer Systems
2. LAN Connections (Optional)
3. Operating Systems
4. VHDL/ VERILOG
5. FPGAS/CPLDS (Download Tools)

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT10 | Microprocessors and Microcontrollers | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:**Semiconductor Devices and Circuits, Switching Theory and Logic Design

**Course Objectives:** The student will be able to

1. To acquire knowledge on microprocessors and microcontrollers.
2. Understand Interfacing of 8086, With memory and other peripherals
3. Understand Interfacing of 8086, With memory and other peripherals
4. Study the features 8051 microcontroller and programming.
5. Study the features of ARM cortex-M3 and its programming.

**Course Outcomes:** After going through this course the student will be able to

1. Describe the microprocessor capability in general and explore the evaluation of microprocessors.
2. 2. Demonstrate programming skills in assembly language for processors.
3. Describe 8086 interfacing with different peripherals and implement programs.
4. Describe hardware concepts, development of programs for 8051 microcontroller and interfacing.
5. Describe hardware concepts and program develop for ARM cortex-M3.

**UNIT–I: (10 Lectures)**

**Introduction:** Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, CISC and RISC architectures.

**8086 ARCHITECTURE:** Main features, Register Organization, Pin diagram/ description, 8086 microprocessor family, internal architecture, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration. and a d v a n c e d microprocessors.

**UNIT–II: (8 Lectures)**

**8086 PROGRAMMING:** Program development steps, Instructions, addressing modes, assembler directives, writing Simple Programs with an assembler, assembly language program development tools.

**UNIT–III: (9 Lectures)**

**8086 Interfacing:** Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, stepper motor, A/D and D/A converters, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, Need for 8259 programmable interrupt controllers.

**UNIT–IV:** **(9 Lectures)**

**Intel 8051 MICROCONTROLLER:**

Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LED and & 7-segment display, LCD Interfacing, Traffic light controls.

**UNIT–V:** **(9 Lectures)**

**ARM Architectures and Processors:**

ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces, Programmers Models, ARM Cortext- M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model.

## Text Books:

1. "Advanced Microprocessor and Peripherals" by A.K Ray, K.M.Bhurchandhi, , Tata McGraw Hill Publications, 2nd Ed., 2006.
2. "The 8051 Microcontrollers and Embedded systems Using Assembly and C" by Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2-Edition, 2011.
3. "The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors" by JosephYou.

## Reference Books:

1. "Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English" by Dr. Alexander G. Dean, Published by Arm Education Media, 2017.
2. "Microprocessors and Interfacing – Programming and Hardware" by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
3. Cortex -M3 Technical Reference Manual.

## Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ee42/preview
2. https://ict.iitk.ac.in/courses/microprocessors-and-microcontrollers/

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21EET09 | Control Systems | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Engineering Mathematics

**Course Objectives:** The student will be able

1. To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function.
2. To analyze the time response of first and second order systems and improvement of performance using PI, PD, PID controllers. To investigate the stability of closed loop systems using Routh's stability criterion and root locus method.
3. To understand basic aspects of design and compensation of LTI systems using Bode diagrams.
4. To learn Frequency Response approaches for the analysis of LTI systems using Bode plots, polar plots and Nyquist stability criterion.
5. To learn state space approach for analysis of LTI systems and understand the concepts of controllability and observability.

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

1. Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
2. Determine time response specifications of second order systems and absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.
3. Analyze the stability of LTI systems using frequency response methods.
4. Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode diagrams.
5. Represent physical systems as state models and determine the response. Understand the concepts of controllability and observability.

**UNIT–I: (10 Lectures)**

M**athematical Modelling of Control Systems:** Classification of control systems- open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks translational and rotational mechanical systems - transfer function of DC servo motor- AC servo motor - Mathematical Modelling of synchro transmitter and receiver -block diagram algebra - signal flow graph – reduction using Mason's gain formula.

**UNIT–II: (10 Lectures)**

**Time Response Analysis and Controllers:** Time response of first and second order systems – time domain specifications - steady state errors and error constants

- effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) - proportional integral derivative (PID) systems.

**Stability Assessment Techniques :**The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function

**UNIT–III: (8 Lectures)**

**Frequency Response Analysis:** Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin

**UNIT–IV: (7 Lectures)**

**Classical Control Design Techniques:** Lag, lead, lag-lead compensators - physical realisation - design of compensators using Bode plots.

**UNIT–V: (10 Lectures)**

**State Space Analysis of Linear Time Invariant (LTI) Systems:** Concepts of state - state variables and state model - state space representation of transfer function -Transfer function from state space representation, solving the time invariant state equations - State Transition Matrix and its properties- concepts of controllability and observability.

## Text Books:

1. Control Systems Engineering, I. J. Nagrath, M. Gopal, 5th Edition, New Age International (P) Ltd., 2007.
2. Modern Control Engineering, Katsuhiko Ogata, 5 th edition, Prenties-Hall India Pvt. Ltd., 2010.

## Reference Books:

1. Control Systems Principles & Design, M.Gopal, 4th Edition, McGraw-Hill, 2012.
2. Automatic Control Systems, B. C. Kuo, Farid Golnaraghi, 8th Edition, John wiley & sons, 2003

## text Web Resources:

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

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT09 | Digital Signal Processing | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Signals and Systems

**Course Objectives:** The student will be able

1. Impart the knowledge of key discrete-time signals & systems.
2. Introduce the methods of time domain and frequency domain implementation.
3. Understand the characteristics of digital filters and the design of digital IIR and FIR filters.
4. Demonstrate an understanding of multi-rate signal processing.
5. Introduce the concepts of DSP in real-time applications.

**Course Outcomes:** After going through this course the student will be able to

1. Illustrate digital signals, systems and their significance.
2. Apply the transformation tools to signals and analyze their significance and applications.
3. Design various digital filters and analyze their frequency response.
4. Apply the Multi-rate Processing concepts in sampling rate conversions.
5. Apply the signal processing algorithms for real-time applications.

**UNIT–I: (9 Lectures)**

**Introduction:** Introduction to Digital Signal Processing: Discrete-time signals & sequences, Classification of Discrete-time systems, stability, the causality of LTI systems, Invertibility, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete-time signals and systems.

**UNIT–II: (9 Lectures)**

**Discrete Fourier Series & Fourier Transforms:** Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, computation of DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

**Stability Assessment Techniques :**The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function

**UNIT–III: (9 Lectures)**

**Design Of IIR & FIR Digital Filters & Realizations:** Review of Z-transforms, Basic structures of IIR systems, Transposed forms, Basic structures of FIR systems, System function. Analog filter approximations – Butter worth and Chebyshev,

Design of IIR Digital filters from analog filters, Analog and Digital frequency transformations, Design of FIR Digital Filters using Window Techniques, Comparison of IIR & FIR filters.

**UNIT–IV: (9 Lectures)**

**Multi-rate Digital Signal Processing:** Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion, Multistage Implementation of Sampling Rate Conversion

**UNIT–V: (9 Lectures)**

**Application of Digital Signal Processing:** Role of Digital Signal Processing in Speech Processing, Radar Communications, medical field, Sonar.

**Text Books:**

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, DimitrisG.Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V. Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processors-Architecture, Programming and Applications, B.Venkataramani, M. Bhaskar, TATA McGraw Hill, 2002

**Reference Books:**

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.

**Web Resources:**

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://www.tutorialspoint.com/digital_signal_processing/digital_signal_processing_pdf_version.html

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE01 | Wired & Wireless Transmission Devices | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Electromagnetic Waves and Transmission Lines

**Course Objectives:**

1. To Understand the transmission of EM waves through rectangular waveguides.
2. To Analyze the concepts of antenna radiation parameters.
3. To Evaluate the field components of wire antennas. And to understand Design antenna array Configurations.
4. Design non-resonant radiators and Design VHF, UHF and microwave antennas.
5. Distinguish the characteristics of radio wave propagation.

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

1. To understand about rectangular wave guide and its propagation through fields and mode analysis
2. To know basic understanding about antenna fundamentals and its parameters
3. To understand different types of array antennas and their configuration
4. To design analyze different types of VHF,UHF and microwave antennas
5. To know characteristics of radio wave propagations

**UNIT–I: (9 Lectures)**

**MICROWAVE TRANSMISSION LINES:** Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides– TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths, and Impedance Relations; power Transmission and power Losses in Rectangular Guide, Impossibility of TEM mode. Related Problems.

**MICROSTRIP LINES**– Introduction, Z0 Relations, Effective Dielectric Constant, Losses, Q factor

**UNIT–II: (9 Lectures)**

**ANTENNA FUNDAMENTALS:** Introduction, Radiation Mechanism – single wire, 2 wires, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Polarization, Radiation Intensity, Directivity, Gain Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.

**UNIT–III: (9 Lectures)**

**THIN LINEAR WIRE ANTENNAS:** Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half Wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Beam widths, Directivity, Effective Area and Effective Height, Antenna Theorems – Applicability and Proofs for equivalence of directional characteristics, Loop Antennas: Small Loops - Field Components, Concept of short magnetic dipole, D and Rr relations for small loops.

**ANTENNA ARRAYS:** Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, Binomial Arrays, Arrays with Parasitic Elements. Yagi-Uda Arrays, Folded Dipoles and their characteristic.

**UNIT–IV: (9 Lectures)**

**NON-RESONANT RADIATORS:** Introduction, Traveling wave radiators, long wire antennas, Rectangular Patch Antennas –Geometry and Parameters, Impact of different parameters on characteristics. Helical Antennas, Geometry, basic properties

**VHF, UHF AND MICROWAVE ANTENNAS:** Reflector Antennas: Corner Reflectors. Parabolic Reflectors – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Cassegrain Feeds. Horn Antennas – Types, Optimum Horns, Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications

**UNIT–V: (9 Lectures)**

**WAVE PROPAGATION:** Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation–Characteristics, Fundamental Equation for Free Space Propagation, Basic Transmission Loss Calculations, Space Wave Propagation–Mechanism, LOS and Radio Horizon, Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations.

**ANTENNA MEASUREMENTS** – Patterns, Set Up, Distance Criterion, Directivity, VSWR, Impedance and Gain Measurements (Comparison, Absolute and 3-Antenna Methods)

### Text Books:

1. Balanis, Constantine A. Antenna theory: analysis and design. John wiley & sons, 2016.
2. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
3. Pozar, David M. Microwave engineering. John wiley & sons, 2011.

### Reference Books:

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.

2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.

**Web Resources:**

1. https://archive.nptel.ac.in/courses/108/101/108101092/

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE02 | Bio Medical Engineering | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Engineering Physics, Biological sciences and Electronicdevices & Circuits

**Course Objectives:**

1. Study the principles of electronics used in designing various diagnostic equipment and recordings of ECG, EEG and EMG.
2. Learn the principles of bio-electrodes and transducers.
3. Explain the activities and measurement of Cardiovascular and Respiratory system.
4. Explore different patient care and monitoring equipment and the technical details withexposure to the hospitals and health care industry.
5. Gain the Knowledge on health care equipment and advanced technologies.

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

1. Demonstrate the principles of electronics used in designing various diagnostic equipment and analyze ECG, EEG and EMG recordings for disorder identification.
2. Understand principles of bio-electrodes and transducers.
3. Acquire the knowledge on activities and measurement of Cardiovascular and Respiratory system.
4. Understand about different streams in Biomedical Engineering with greater emphasis on health care equipment's and the advanced technologies such as Telemedicine, Telemetry, Medical Imaging, etc.
5. Examine different patient care and monitoring equipment and provide a better technical support & usage with exposure to the hospitals and health care industry.

**UNIT–I: (9 Lectures)**

**INTRODUCTION TO BIOMEDICAL INSTRUMENTATION:** Age of Biomedical Engineering, Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG, Evoked Responses.

**UNIT–II: (9 Lectures)**

**ELECTRODES AND TRANSDUCERS:** Introduction, Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer Principles, Biochemi-

cal Transducers, The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output.

**UNIT–III: (9 Lectures)**

**CARDIOVASCULAR SYSTEM AND MEASUREMENTS :** The Heart and Cardiovascular System, Electro Cardiograph, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sound, Plethysmography. X-RAY AND RADIOISOTOPE INSTRUMENTATION: Generation of Ionizing radiation, instrumentation for diagnostic X-rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy.

**UNIT–IV: (9 Lectures)**

**DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY:** Principles of Ultrasonic Measurement, Ultrasonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring.

**UNIT–V: (9 Lectures)**

**PATIENT CARE AND MONITORING:** Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Pacemakers, Defibrillators, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring.

**MEASUREMENTS IN THE RESPIRATORY SYSTEM:** The Physiology of the Respiratory System, Tests and Instrumentation for the Mechanics of Breathing, Respiratory Therapy Equipment.

### Text Books:

1. “Bio-Medical Electronics and Instrumentation”, Onkar N. Pandey, Rakesh Kumar, Katson Books.
2. “Bio-Medical Instrumentation”, Cromewell, Wiebell, Pfeiffer.

### Reference Books:

1. “Introduction to Bio-Medical Equipment Technology”, 4th Edition, Joseph J. Carr, John M.Brown, Pearson Publications.
2. ”Hand Book of Bio-Medical Instrumentation”, Khandapur. McGrawHill.

### Web Resources:

1. www.embs.org/about-biomedical-engineering/
2. www.biomedicaltechnology.eu/
3. https://biomedical-engineering-online.biomedcentral.com/
4. https://bmes.org/biomedicalengineeringsociety

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE03 | Nano Electronics | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Engineering Physics, Electronic devices & Circuits.
**Course Objectives:** Students undergoing this course are exposed to:

1. Study the types of nanotechnology, atomic structure, molecular technology and preparation of nano materials.
2. Understand the fundamentals of nano electronics and its properties.
3. Demonstrate the quantum transport devices.
4. Familiarize the students with the concepts of carbon nano tubes.
5. Gain knowledge for studying molecular electronics and fundamentals.

**Course Outcomes:** The students will be able to

1. Obtain the skills in nanotechnology, molecular technology and the preparation of nano materials.
2. Understand the fundamental concepts of Nanoelectronics.
3. Analyze the principles of silicon MOSFET and Quantum Transport Devices.
4. Demonstrate the working principle of carbon nano tubes.
5. Explore the knowledge of molecular electronics.

**UNIT–I: (9 Lectures)**

**INTRODUCTION TO NANOTECHNOLOGY:** Discussion of the International Technology Roadmap characteristics: Need for new concepts in electronics from microelectronics towards bio-molecule electronics. **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–II: (9 Lectures)**

**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–III: (9 Lectures)**

**SILICON MOSFETs & 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 applications- Single electron devices – applications of single electron devices to logic circuits.

**UNIT–IV: (9 Lectures)**

**CARBON NANOTUBES:** 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–V: (9 Lectures)**

**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.

### Text Books:

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

### Reference Books:

1. M.Ziese and M.J Thornton(Eds.)"Spin Electronics ", Springer-verlag 2001.
2. M.Dutta and M.A Stroscio Edited by "Quantum Based Electronic Devices and systems", world Scientific, 2000.

### Web Resources:

1. `https://www.edx.org/course/fundamentals-nanoelectronics-part-b-purduex-nano521x.`

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL07 | Microprocessor and Microcontrollers Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**List of the Experiments / Programs**

**Part A:** (Minimum of 5 Experiments has to be performed)
**8086 ASSEMBLY LANGUAGE PROGRAMMING AND INTERFACING.**

1. Introduction to MASM/TASM, KEIL
2. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
   (a) Addition of n-BCD numbers.
   (b) Multiplication and Division operations.
3. Program for sorting an array.
4. Program for Factorial of given n-numbers.
5. Interfacing ADC to8086
6. Interfacing DAC to8086.
7. Interfacing stepper motor to 8086.

**Part B:** (Minimum of 5 Experiments has to be performed)
**8051 ASSEMBLY LANGUAGE PROGRAMMING AND INTERFACING.**

1. Finding number of 1's and number of 0's in a given 8-bit number
2. Average of n-numbers.
3. Program and verify Timer/ Counter in8051.
4. Interfacing of Switches and LEDs
5. Interfacing Traffic Light Controller to8051.
6. UART operation in8051
7. Interfacing LCD to8051.

**Part C:** (Minimum of 2 Experiments has to be performed)
Conduct the following experiments using
**ARM CORTEX M3 PROCESSOR USING KEIL MDK ARM**

1. Write an assembly program to multiply of 2 16-bit binary numbers.
2. Write an assembly program to find the sum of first 10 integers numbers.

3. Write a program to toggle LED every second using timer interrupt

**Equipment Required:**

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module, DAC module
6. Stepper motor module
7. Key board module
8. LED, 7-SegemtUnits
9. Digital Multi-meters
10. ROM/RAM Interface module
11. Bread Board etc.
12. ARM CORTEX M3
13. KEIL MDKARM, Digital Multi-meters

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL06 | Digital Signal Processing Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Prerequisite:** Signals and Systems Lab

**Course Objectives:** The student will be able to

1. Revise MATLAB software & basic operations.
2. Implement Linear and Circular Convolution
3. Obtain frequency domain information.
4. Apply FIR and IIR filters.
5. Apply multi-rate concepts toreal-time applications.

**Course Outcomes:** At the end of the course student can able to

1. Calculate linear and circular convolution of discrete signals.
2. Sketch the magnitude and phase response of the discrete time signal's DFT, IDFT and FFT.
3. Develop algorithms for designing and implementing FIR and IIR filters with standard techniques.
4. Analyze the Multi-rate signal processing algorithms.

**List of Experiments: (Minimum of Ten Experiments has to be performed)**

1. Write a MATLAB program to obtain the Linear Convolution of two finite-length sequences.
2. Write a MATLAB program to obtain the Circular Convolution of two finite-length sequences.
3. Write a MATLAB program to find the Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT) of a given Discrete-Time signal.
4. Write a MATLAB program to obtain the N-Point FFT of a sequence.
5. Write a MATLAB program to compute the power density spectrum of a sequence.
6. Write a MATLAB program to design the following Butterworth filters
   (a) Low Pass Filter
   (b) Band Pass Filter
7. Write a MATLAB program to design the following Chebyshev filters
   (a) Low Pass Filter

(b) Band Pass Filter

8. Write a MATLAB program to design an FIR filter using the following Rectangular window.
   (a) Low Pass Filter
   (b) Band Pass Filter
9. Write a MATLAB program to design an FIR filter using the following Triangular window.
   (a) Low Pass Filter
   (b) Band Pass Filter
10. Write a MATLAB program to perform decimation and interpolation of a given signal.
11. Write a MATLAB program to verify Sampling theorem for a given continuous signal
12. Write a MATLAB program to convert the sampling rate of a given signal by using decimation and interpolation.
13. Write a MATLAB program to perform audio processing using simple signal processing algorithms.

**Equipement Required:**

1. PC
2. MATLAB

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21XXXXX | Design Thinking for Innovation | 2 | 0 | 0 | 0 |

Internal Marks: 30 External Marks: 70

**UNIT–I: Design thinking Evolution**

Definitions and stories. Design thinking Importance, and Impact-History and Evolution of Design Thinking, - Three Space of Innovation in Design Thinking- knowledge funnel - Design Thinking Process, -Design thinking mindset for innovation

**UNIT–II: Building confidence, Mindset and Building Team**

Myths of Innovation- Myths of Creativity-Creative Confidence-Innovators DNA - 5 forces of growth (SEPIA),- 5 frictional forces (DCAFE),- 3 capacity levers (VAL)-Building Design Teams.

**UNIT–III: Empathy-Define**

Initial Problem Description - beginner's mindset-5whys,- persona development-Empathy mapping-interview with empathy and stories collection-Question the critical assumptions -Reframe Problem Definition – (PoV) point of view- how might we

**UNIT–IV: Ideation**

Ideation and Visualization- Brainstorming-SCAMPER-Mind mapping-sketch –structure idea-Storyboard-Customer Co-Creation-Provocation-Role-play

**UNIT–V: Prototyping -Testing**

Step-by-step prototyping & low fidelity prototyping -Testing Prototyping -feedback capturing grid, conduct A/B Testing-Experiment grid, user retrospective board-Create a Pitch of the prototype

## Text Books:

1. An AVA Book, "Design Thinking", AVA Publishing, 2010
2. Dr.BalaRamaduri, "Karmic Design Thinking", 2020, ISBN:978-9354190100

## Reference Books:

1. proach", 3rd edition, Springer, 2007
2. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006
3. Liedtka, Jeanne and Ogilvie, Timothy, Ten Tools for Design Thinking
4. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses, and Ecosystems by Michael Lewrick
5. The Myths of Innovation by Scott Berkun, Publisher(s): O'Reilly Media, IncISBN: 9781449389628

6. The Myths of Creativity: The Truth About How Innovative Companies and People Generate Great Ideas, D BurkusJossey-Bass, San Francisco, CA (2014), 214 pp, ISBN: 978-1-118-61114-2
7. Creative Confidence: Unleashing the Creative Potential within Us All by (Author), David Kelley(Author)
8. The innovator's DNA: mastering the five skills of disruptive innovators Author: Dyer, JeffGregersen, Hal B, 1958-Christensen, Clayton MPublished: Boston, Mass: Harvard Business Press, [2011]
9. Collective Genius: The Art and Practice of Leading Innovation, Authors: Linda A Hill, Greg Brandeau, Emily Truelove, Kent Lineback
10. Change by Design, by Tim Brown
11. Unmukt-Science and Art of Design Thinking Authors Arun Jain School of Design Thinking 2019
12. The Design Thinking Play Book by Michael Lewrick, Patrick Link& Larry Leifer, Wiley Press,2018
13. The Design of Business: Why Design Thinking Is the Next Competitive Advantage. Martin, R. (2009). Boston, MA: Harvard Business Press.

**Online Resources:**

1. https://www.interaction-design.org/literature/topics/design-thinking
2. https://www.interaction-design.org/literature/article/how-to-develop-an-empathic-approach-in-design-thinking
3. https://medium.com/dc-design/what-is-human-centered-design-6711c09e2779
4. https://think.design/user-design-research/user-testing/
5. Mentor-DesignThinking.pdf (aim.gov.in)
6. Mentor-DesignThinking.pdf (aim.gov.in)

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE11 | Microwave and Radar Engineering | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Electromagnetic Waves and Transmission Lines, Wired and Wireless Transmission Devices

**Course Objectives:** The Course should enable the students to:

1. Understand the transmission Through Microwave Tubes.
2. Analyze the concepts of wave guides and its application
3. Understand different types of radars and its applications.
4. Design concept of tracking and different tracking techniques
5. Distinguish about various components of radar receivers and their performances

**Course Outcomes:** The student will be able to

1. understand about Microwave tubes and Helix TWTS and Microwave Solid state Devices
2. Know basic understanding about waveguides and its application
3. Understand the different types of radars and its applications.
4. Understand the concept of tracking and different tracking techniques.
5. Understand the various components of radar receiver and its performance.

**UNIT–I: (10 Lectures)**

**Microwave tubes (qualitative treatment only):** Microwave Tubes (qualitative treatment only): cavities, re-entrant cavities, two cavity klystrons-structure, velocity modulation and bunching process, reflex klystrons-structure, principle of working.

**HELIX TWTS:** Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT.M-TYPE TUBES Introduction, Cross-field effects, Magnetrons – 8-Cavity Cylindrical Travelling WaveMagnetron.

**Microwave Solid State Devices:** introduction, classification, applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, LSA Mode of operation.

**UNIT–II: (8 Lectures)**

**Waveguided Components and Its Applications:** Waveguide attenuators – resistive card, rotary vane types, scattering matrix parameters: definition, properties, salient features -s- parameters of two port, three port, and four port networks. 2 Hole, Bethe Holotypes

**UNIT–III: (9 Lectures)**

**Basics of Radar:** Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Receiver Noise, Illustrative Problems

**CW AND FMCW Radar:** Doppler Effect, CW Radar – Block Diagram, Non-zero IF Receiver, Applications of CW radar. Range and Doppler Measurement, Block Diagram and characteristics, FM-CWaltimeter.

**MTI and Pulse Dopper Radar:** Introduction, Principle, MTI Radar with – Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers, Blind Speeds.

**UNIT–IV: (9 Lectures)**

**Tracking Radar:** tracking with radar, sequential lobing, conical scan, mono pulse tracking radar-amplitude comparison mono pulse (one- and two- coordinates), phase comparison mono pulse, tracking in range, acquisition and scanning patterns, comparison of trackers.

**UNIT–V: (9 Lectures)**

**Radar Receivers** –Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width Changes, Series versus parallel feeds, Applications, Advantages and Limitations.

## Text Books:

1. Introduction to Radar Systems, $3^{rd}$ edition – M.I. Skolnik, TMH Ed., 2005
2. Radar Engineering – GSN Raju, IK International
3. Pozar, David M.Microwave engineering. Johnwiley & sons,2011.

## Reference Books:

1. Antenna Theory-C.A.Balanis, John Wiley & Sons, $3^{rd}$ Ed.,2005.
2. Antennas and Wave Propagation–K. D. Prasad, Satya Prakashan, Tech India Publications, New Delhi,2001.

## Web References:

1. https://archive.nptel.ac.in/courses/108/101/108101092/

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| P21ECT12 | Internet of Things | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Computer Architecture & Organization , Microprocessors &Micro controllers, Python programming.

**Course Objectives:** The Course should enable the students to:

1. Learn the basic design of Internet of Things.
2. Understand the Programming concepts with Arduino.
3. Describe the IoT and Machine –to–Machine similarity.
4. Understand the design and development concepts of Internet of things.
5. Learn about connecting IoT physical devices and end points.

**Course Outcomes:** The student will be able to

1. Able to understand the applications of Internet of Things and Able to understand building blocks of Internet of Things and characteristics
2. Design some Arduino based prototypes.
3. Discriminate the similarity between IoT and M2M
4. Develop design methodology for IoT system design.
5. Illustrate how to connect IoT physical devices and end points.

**UNIT–I: (9 Lectures)**

**Introduction to IoT:** Introduction to Internet of Things ,Physical Design of IOT ,Logical Design of IOT,IOT Levels .Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Health & Life Style.

**UNIT–II: (9 Lectures)**

**Programming with Arduino :**Introduction to Arduino, Arduino UNO-Architecture, Arduino IDE Fundamentals of Arduino Programming, Arduino Interfacing –LED, Displays and sensors.

**UNIT–III: (9 Lectures)**

**IoT AND M2M:** Introduction to M2M,difference between IoT and M2M,software defined networking (SDN) and network function virtualization (NFV)for IoT. IoT system

**management:** Need for IOT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements.

**UNIT–IV: (9 Lectures)**

**Developing Internet of Things:** Introduction ,IOT Design Methodology, case study on IoT Systems for weather monitoring. Logical Design using Python : Introduction ,Python Data , Types & Data Structures ,Control Flow, Functions ,Modules, Packages, File Handling ,Data/Time operations ,Classes, Python Packages for IOT.

**UNIT–V:** **(9 Lectures)**

**IOT Physical Devices & Endpoints:** What is an IOT Device ,Exemplary Device: Raspberry Pi— About the Board ,Interfaces-serial,SPI,I2C,and Programming Raspberry Pi, Other IOT Devices

## Text Books:

1. Matt Richardson , Shawn Wallace,—Getting Started with Raspberry Pi, O'Reilly (SPD), 3RD Edition,2014.
2. Simon Monk—Programming Arduino : Getting Started with Sketches ,Second Edition (ELECRONICS),2016.

## Reference Books:

1. Ardian McEwen, Hakim Cassimally,–Designing the Internet of Things, Jhon Wiley and Sons 2014.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things : Enabling Technologies, Platforms, and Use Cases", CRC Press ,2017.3.'Beginning Arduino "Michal Mc Roberts, Second Edition.

## Web References:

1. https://www.coursera.org/specializations/iot
2. https://spoken-tutorial.org/tutorial-saerch/?_foss=Arduino&search_language=English
3. https://onlinecourse.swayam2.ac.in/aic20_sp40/preview
4. https://online.stanford.edu/course/ee284a-ntroduction-internet-things
5. https://onlinecourses.nptl.ac.in/noc20_cs66/preview

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECT13 | VLSI Design | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Semiconductor Devices and Circuits, Switching Theory and Logic Design, Linear and Digital IC Applications.

**Course Objectives:** The Course should enable the students to:

1. Basic characteristics of MOS transistor and examines various possibilities for configuring inverter circuits and aspects of latch-up are considered.
2. Design processes are aided by simple concepts such as stick and symbolic diagrams but the key element is a set of design rules, which are explained clearly.
3. Basic circuit concepts are introduced for MOS processes we can set out approximate circuit parameters which greatly ease the design process.
4. CMOS combinational and Data path subsystem
5. FPGA architectures and various structures explained and

**Course Outcomes:** The student will be able to

1. Explain various MOS transistor characteristics and fabrication process techniques.
2. Develop stick diagrams for various MOS circuits and distinguish design rules.
3. Design basic MOS circuits with circuit concepts along with scaling concepts.
4. Explain CMOS combinational and sequential logic circuit design.
5. Distinguish various FPGA architectures and logic synthesis

**UNIT–I: (9 Lectures)**

**Introduction and Basic Electrical Properties of MOS Circuits:** Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology.

**UNIT–II: (9 Lectures)**

**MOS and Bi-CMOS Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout, $2\mu m$ Double Metal, Double Poly, CMOS/BiCMOS rules, $1.2\mu m$ Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form.

**UNIT–III: (9 Lectures)**

**Basic Circuit Concepts:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, Some area Capacitance Calculations, The Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.

**Scaling of MOS Circuits:** Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Switch logic, Gate logic.

**UNIT–IV: CMOS Combinational and Data Path Subsystem: (9 Lectures)**

**Static CMOS Design:** Complementary CMOS, Rationed Logic, Pass-Transistor Logic. Dynamic

**CMOS Design:** Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates.

**Data Path Subsystem:** Subsystem Design, Barrel Shifters, Adders, ALUs, Multipliers, Parity Generators, Comparators, Zero/one Detectors, Counters.

**Memory Array Subsystem:** SRAM, DRAM, ROM, Seral acces Memory

**UNIT–V: (9 Lectures)**

**FPGA Design:** FPGA design flow, Basic FPGA architecture, FPGA Technologies, FPGA families- Altera Flex 8000FPGA, Altera Flex 10FPGA, Xilinx XC4000 series FPGA, Xilinx Spartan XL FPGA, Xilinx Spartan II FPGAs, Xilinx Vertex FPGA. Case studies: FPGA Implementation of Half adder and full adder. Introduction to Synthesis: Logic Synthesis, RTL Synthesis, High Level Synthesis

### Text Books:

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition
2. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata McGraw-Hill Education, 2003.
3. CMOS VLSI DESIGN: ACircuit and system Perspective, Neil H.E WASTE David Harris,Ayan, Benerjee, 3rd ED,Pearson 2009.

### Reference Books:

1. Advanced Digital Design with the Verilog HDL, Michael D.Ciletti, Xilinx Design Series, Pearson Education
2. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology, 3'rd edition, David Hodges.

### Web References:

1. https://nptel.ac.in/courses/117/101/117101058/
2. https://www.tutorialspoint.com/vlsi_design/index.htm

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE05 | Optical Fiber Communication | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Objectives:** The Course should enable the students to:

1. To realize the significance of optical fiber communications.
2. To understand the construction and characteristics of optical fiber cable.
3. To develop the knowledge of optical signal sources and power launching.
4. To identify and understand the operation of various optical detectors.
5. To under the design of optical systems and WDM.

**Course Outcomes:** The student will be able to

1. Understand and analyze the constructional parameters of optical fibers.
2. be able to design the optical system.
3. Estimate the losses due to attenuation, absorption, scattering and bending.
4. Compare various optical detectors and choose suitable one for different applications.
5. Able to demonstrate the design of WDM

**UNIT–I: (10 Lectures)**

**OPTICAL FIBER COMMUNICATIONS:** Historical development, the general system, advantages of Optical fiber communications. Optical fiber wave guides- Ray theory transmission, Modes in Planar guide, phase and group velocity, cylindrical Fiber -Modes. Fiber materials, Fiber Fabrication techniques, fiber optic cables, Classification of Optical Fibers: Single mode fibers, Graded Index fibers.

**UNIT–II: (10 Lectures)**

**SIGNAL DISTORTION IN OPTICAL FIBERS:** -Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity determination, Group delay,Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode Dispersion, Intermodal dispersion, pulse broadening. Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return Loss, Optical Fiber Splicing.

**UNIT–III: (10 Lectures)**

**OPTICAL SOURCES:** Intrinsic and extrinsic material-direct and indirect band gaps-LED - LED structures-surface emitting LED-Edge emitting LED-quantum efficiency and LED Power- light source materials-modulation of LED. LASER diodes - modes and threshold conditions-Rate equations-external quantum Efficiency-resonant frequencies-structures and radiation patterns- single mode laser-external Modulation-temperature effects.

**UNIT–IV:** **(9 Lectures)**

**SOURCE TO FIBER POWER LAUNCHING:** Source to fiber power launching, Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling,Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers

**UNIT–V:** **(9 Lectures)**

**OPTICAL SYSTEM DESIGN:** Considerations, Component choice, Multiplexing, Point-topoint links, System considerations, Link power budget with examples. Rise time budget withexamples. WDM –Passive DWDM Components-Elements of optical networks.

**Text Books:**

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

**Reference Books:**

1. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
2. Fiber Optic Communication Systems – Govind P. Agarwal, John Wiley, 3rd Ediition, 2004.

**Web References:**

1. https://archive.nptel.ac.in/courses/108/106/108106167/
2. https://www.trumpf.com/en_INT/solutions/applications/optical-communication
3. https://www.youtube.com/watch?v=OQUupuqT-GI

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE04 | Digital Image Processing | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Course Prerequisite:** Signals and Systems, Digital Signal Processing

**Course Objectives:** The Course should enable the students to:

1. Study the image fundamentals and mathematical transforms necessary for image processing.
2. Acquire knowledge about simple image enhancement techniques in the Spatial and Frequency domain.
3. Understanding of color models, type of image representations and related statistics.
4. Study image segmentation and compression techniques.
5. Introduce wavelets and multi-resolution techniques for image processing.

**Course Outcomes:** The student will be able to

1. Demonstrate knowledge about the fundamentals of digital image and its processing.
2. Apply image enhancement techniques for improving the quality of images.
3. Analyze pseudo and full-color image processing techniques.
4. Elucidate the mathematical modelling of image segmentation and compression.
5. Apply multi-resolution techniques for image processing.

**UNIT–I: (10 Lectures)**

**Digital Image Fundamentals:** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, an introduction to the mathematical tools used in Digital Image Processing.

**UNIT–II: (9 Lectures)**

**Image Enhancements and Filtering:** Gray level transformations, histogram equalization and specifications, Fundamentals of Spatial Filters, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Two-dimensional DFT and its inverse, The basics of filtering in the Frequency Domain, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters, Selective filtering.

**UNIT–III: (9 Lectures)**

**Color Image Processing:** Color fundamentals, Color models: RGB, YUV, HSI; Pseudo color Image Processing Color transformations, Color image smoothing and sharpening, Image segmentation based on color.

**UNIT–IV:** **(9 Lectures)**

**Image Segmentation:** Fundamentals, point, line, edge detection, thresholding, region –based segmentation.

**Image Compression:** Fundamentals, Some basic compression Methods, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Block transform coding.

**UNIT–V:** **(9 Lectures)**

Wavelets and Multi-resolution Processing: Image pyramids, subband coding, Multi-resolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

**Applications:** Image Processing applications in satellite, sonar, radar and medical areas

**Text Books:**

1. R.C.Gonzalez and R.E. Woods, "Digital Image Processing", Second Edition, Pearson Education.
2. Anil Kumar Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India.

**Reference Books:**

1. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, MC-GRAW HILL Publications, 2010.
2. S.Sridhar, Digital Image Processing, Oxford University Press, 2016.
3. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision,Thomson learning, Second Edition, 2001.

**Web References:**

1. https://nptel.ac.in/courses/117105079
2. https://nptel.ac.in/courses/117105135

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECE06 | Analog IC Design | 3 | 0 | 0 | 3 |

Internal Marks: 30 External Marks: 70

**Prerequisites:** Electronics Devices and Circuits, Integrated Circuits & Applications

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

1. Understand the concepts of electrical MOS transistor.
2. Analyze different types of current mirrors
3. Demonstrate one stage and two stage CMOS operational amplifiers.
4. Demonstrate on MOS design circuits.
5. Demonstrate of dynamic logic circuits.

**UNIT–I: Basic introduction about MOS Circuits (10 Lectures)**

Basic electrical properties of MOS and CMOS circuits, MOS and CMOS circuit design processes, Basic circuit concepts, scaling of MOS circuits-qualitatitive and quantitative analysis with proper illustrations and necessary derivations of expressions

**UNIT–II: (10 Lectures)**

**Analog CMOS Sub-Circuits:** Basic current mirrors, Cascode current mirrors, Active current mirrors, Current mirror with Beta Helper, Degeneration, Cascade current, Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures. Design of CMOS Op Amps

**UNIT–III: (10 Lectures)**

**MOS Design:** Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic

**UNIT–IV: (5 Lectures)**

**Operational Amplifiers** General considerations, One-stage op-amps, Cascode op-amps, Folded cascode op-amp topology, two-stage op-amps, gain boosting, comparison.

**UNIT–V: (9 Lectures)**

**Dynamic Logic Circuits:** Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

**Text Books:**

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd Edition, TMH, 2007.
2. D. A. John, Ken Martin, Analog Integrated Circuit Design, 2nd Edition,John Wiley, 1997.

**Reference Books:**

1. 1. Paul R Gray, Robert G Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, John Wiley and Sons, 2009.
2. Gregolian, Temes, Analog MOS Integrated Circuits, 1st Edition, John Wiley, 1986.

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL09 | Internet of Things Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Course Objectives:** The student will be able to

1. Develop an IOT enabled technologies which are cost effective and socially relevant.
2. Study the field of IOT based application development

**Course Outcomes:** At the end of the Lab student can able to

1. Design the IOT simple projects for basic application with sensors.
2. Develop of IoT module using hardware and software components.
3. Understand the IOT tested which is an open and developing ecosystem of edge devices, Communication protocols ,cloud-based platforms
4. Implement control devices and data monitoring in real-time and take necessary actions.

**MINIMUM TWELVE EXPERIMENTS TO BE CONDUCTED:**

**PART-A (Any 6 Experiments)**

**ARDUINO BASED EXPERIMENTS :**

1. LED Blink and pattern
2. 7 Segment Display
3. LM35 Temperature sensor
4. Controlling Two Actuators Using Arduino
5. Iot Based Air Pollution Control System
6. Ultrasonic Distance measurement
7. IR Sensor Based Security System.

**PART-B (Any 6 Experiments)**

**RASPBERRY Pi BASED EXPERIMENT**

1. Think Speak Based DHT Sensor Monitoring
2. Node Red Based IOT Configuration
3. AWS IOT Basic Configuration
4. Alexa based Home Automation System

5. Dht11sensor Data To Cloud
6. A Heart Rate Monitoring System
7. AWS Based DHT Sensor

**Equipement Required:**

**For Part-A**

1. Arduino Uno
2. 9/12V Battery
3. Computer with Arduino IDE software
4. Jumper cables
5. Center tapped transformer (230/6-0-6V)(As required)

**For Part-B**

1. Raspberry Pi
2. 9/12V Battery
3. Computer with Raspberry Pi IDE software
4. Jumper cables
5. Center tapped transformer (230/6-0-6V)(As required)
6. 16 x2 LCD display

| Course Code | Course Name | Course Structure | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| P21ECL10 | VLSI Design Lab | 0 | 0 | 3 | 1.5 |

Internal Marks: 15 External Marks: 35

**Note** The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using 130nm technology with the Industry standard EDA Tools.

**List of Experiments:**

1. Design and Implementation of an Inverter
2. Design and Implementation of an Universal Gates
3. Design and Implementation of Full Adder
4. Design and Implementation of Full Subtractor
5. Design and Implementation of Encoder
6. Design and Implementation of Decoder
7. Design and Implementation of SR-Latch
8. Design and Implementation of D-Latch
9. Design and Implementation asynchronous counter
10. Design and Implementation of static RAM cell
11. Design and Implementation of 8 bit DAC using R-2R latter network

**Software Required:**

1. Mentor Graphics Software / Equivalent Industry Standard Software.
2. Personal computer system with necessary software to run the programs and to implement.