Major Core Courses (MCC)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
241MA001	Linear Algebra & Calculus	FC	2	1		3	50	50	100	-
241MA002	Differential Equations & Vector Calculus	FC	2	1		3	50	50	100	-
241MA007	Transform Calculus	FC	2	1		3	50	50	100	LAC, DEVC
241CH002	Applied Chemistry	FC	2		1	3	50	50	100	-
241PH002	Modern Physics	FC	2		1	3	50	50	100	-
241CS001	Programming for Problem Solving Using C	FC	2		2	4	50	50	100	-
241IT001	IT & AI Skills	FC			2	2	50	50	100	-
241ME001	Engineering Graphics	FC	1		2	3	50	50	100	-
241ME003	Engineering Workshop	FC			1	1	100	-	100	-
241EE001	Basic Electrical & Electronics Engineering	FC	2		2	4	50	50	100	-
241EC002	Network Analysis	FC	3	1		4	50	50	100	-
241EC001	Digital Electronics & Logic Design	FC	2		2	4	50	50	100	-
241EC003	Electronic Devices & Circuits	FC	2		2	4	50	50	100	BEEE
241EC004	Random Variables & Stochastic Processes	FC	3	1		4	50	50	100	-
241EC014	Signals & Systems	FC	2		2	4	50	50	100	-
241EC005	Electromagnetic Waves &	IC	2	1		3	50	50	100	DEVC

	Transmission Lines									
241EC006	Analog Electronics	IC	2		2	4	50	50	100	EDC
241EC007	Integrated Circuits & Applications	IC	2		2	4	50	50	100	EDC
241EC008	Linear Control Systems	IC	2	1		3	50	50	100	S&S
241EC009	Analog & Digital Communications	IC	2		2	4	50	50	100	S&S
241EC010	Digital Signal Processing	IC	2		1	3	50	50	100	S&S
241EC011	VLSI Design	IC	2		1	3	50	50	100	EDC
241EC012	Microprocessors & Microcontrollers	AC	2		1	3	50	50	100	DELD
241EC013	Antenna & Microwave Engineering	AC	2		2	4	50	50	100	EMTL
Total			**45**	**7**	**28**	**80**				

Linear Algebra & Calculus

(Common to CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT&Min.E)

	L	T	P	C
Course Code: 241MA001	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Solve the system of Linear equations.
CO2: Calculate Eigen values and Eigen vectors.
CO3: Apply differential calculus for one and several variable functions.
CO4: Calculate the Maximum value and Minimum value of a function of several variables.
CO5: Compute areas and volumes using multiple integrals.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									

UNIT – I

System of linear Equations: Vector Space,Linear Independence,Rank of a matrix by echelon form, normal form, Inverse of Non-singular matrices by Gauss-Jordan method, Solutions of Linear Systems: Existence, Uniqueness,Solving the system by Gauss elimination method.

Practice(Using any computational tool)

1. Variables, arithmetic operations, elementary mathematical functions.
2. Defining row vector, column vector, Arithmetic operations on matrices
3. finding transpose of a matrix, inverse of a matrix, determinant of a matrix
4. rank of a matrix, , solving system of linear equations.

UNIT – II

Eigenvalues, Eigenvectors : Eigenvalues and properties(without proof), Eigenvectors, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), Quadratic forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation,Nature of Quadratic forms.

Practice(Using any computational tool):

Computing eigen values and eigen vectors, matrix diagonalization.

UNIT – III

One Variable Calculus:Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.
Several Variable Calculus: Limit, Continuity, partial derivatives and their geometrical interpretation.
Practice(Using any computational tool): Basics of plotting,Plot graphs of single variable functions

UNIT – IV

Functions of several variables: Total differential and differentiability, derivatives of composite and implicit functions, derivatives of higher order and their commutativity,Euler's theorem on homogeneous functions , Taylor's and Maclaurin's expansion of functions of two variables. Jacobians, maxima and minima, constrained maxima/minima problems using Lagrange's method of multipliers.
Practice(Using any computational tool): Plot graphs of various multi variable functions

UNIT – V

Multiple Integrals: Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).
Practice(Using any computational tool): Plotting the region of Integration

Text Books:

1. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 5th Edition (9th reprint), 2021, ISBN: 978-8184875607.
2. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 5th Edition, 2018, ISBN: 978-1292174341.

Reference Books:

1. Advanced Engineering Mathematics, Michael Greenberg, , Pearson publishers, 9th Edition, ISBN: 9788177585469.
2. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, Third Edition, 2023, ISBN: 9788121938907.

Web Links:

1. https://archive.nptel.ac.in/courses/111/104/111104137/
2. https://archive.nptel.ac.in/courses/111/107/111107108/
3. https://www.khanacademy.org/math/linear-algebra/
4. https://www.khanacademy.org/math/multivariable-calculus

Differential Equations & Vector Calculus

(Common to CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT&Min.E)

	L	T	P	C
Course Code:241MA002	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the Course, Student will be able to:

- **CO1:** Solve the linear differential equations of first order and apply in various engineering problems.
- **CO2:** Solve the linear differential equations of higher order and apply in various engineering problems.
- **CO3:** Solve the linear partial differential equations
- **CO4:** Calculate the gradient, divergence and curl.
- **CO5:** Compute work done, flux using vector integration

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									

UNIT – I

Ordinary Differential Equations of First Order and First Degree:

Solution of first order linear differential equations, exact differential equations and equations reducible to exact differential equations, Orthogonal Trajectories, Modelling of RL- circuit.

Practice(Using any computational tool): Solving the first order initial value problems using **odesolver** and plot the solution curves.

UNIT – II

Linear Differential Equations of Higher Order:

Solution of linear differential equations with constant coefficients, method of variation of parameters, solution of simultaneous linear differential equations.

Equations reducible to Linear differential equations with constant coefficients: Cauchy's homogeneous Linear Equations, Legendre's Linear Equations. Study of oscillations arising in LCR circuit (free oscillations and forced oscillations).

Practice(Using any computational tool): Solving the second order initial value problems using **odesolver** and plot the solution curves

UNIT – III

Partial Differential Equations:
Solution of linear PDE of first order by Lagrange's method, solution of homogeneous linear PDE of higher order with constant coefficients.

UNIT – IV

Vector Differentiation:
Gradient of a scalar field, finding angle between two surfaces, directional derivative. Divergence and solenoidal fields. Curl and irrotational fields, Finding Scalar Potential.
Practice(Using any computational tool): Plotting of surfaces, 3D-plots, plotting vector fields

UNIT – V

Vector Integration:
Line integrals, work done by a force, conservative force field, surface integral, flux, volume integral. Green's theorem, Stoke's theorem and Gauss divergence theorem.

Text Books:

1. Advanced Engineering Mathematics, E. Kreyszig, John Willey & Sons,10th Edition, 2018, ISBN 978-0470458365.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 44th Edition 2021, ISBN 978-9383214204.

Reference Books:

1. Advanced Engineering Mathematics, Dennis G. Zill, Jones & Bartlett Learning, 2018, 6th Edition.ISBN 978-1284105902.
2. Higher Engineering Mathematics, B.V. Ramana, McGraw-Hill Education, 11th Edition, ISBN 978-9339216016.

Web Links:
1. https://www.classcentral.com/course/differential-equations-engineers-13258
2. https://archive.nptel.ac.in/courses/111/106/111106100/
3. https://www.khanacademy.org/math/differential-equations
4. https://archive.nptel.ac.in/courses/111/101/111101153/
5. https://archive.nptel.ac.in/courses/111/105/111105122/

Transform Calculus

	L	T	P	C
Course Code: 241MA007	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the Course, Student will be able to:

- **CO1:** Calculate the Fourier series of a given function and examine the convergence of the series.
- **CO2:** Calculate Laplace transform of standard functions and examine the properties of Laplace transform.
- **CO3:** Apply Laplace transform to solve Initial value problems.
- **CO4:** Calculate the Fourier transform for certain functions.
- **CO5:** Compute Z- transform of various functions and apply to solve difference equations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									

UNIT – I

Fourier Series: Fourier series of periodic function, Half-range series, Change of interval and Fourier series in complex form, Parseval's formula and R.M.S Value.

Practice(Using any computational tool): Generating Fourier Series of functions .

UNIT – II

Laplace Transforms: Laplace transforms of standard functions, Shifting theorems, Change of scale property, Multiplication with t, Division by t, Transforms of derivatives and integrals, Unit step function, Dirac delta function, Periodic function, Evaluating improper integrals of the type $\int_0^\infty f(t)\,dt$ using Laplace Transforms.

Practice(Using any computational tool): Find Laplace transform of elementary functions.

UNIT – III

Inverse Laplace Transforms : Inverse Laplace transforms of functions, First shifting theorem, Convolution theorem (without proof), Method of partial fractions, Second shifting theorem, Solving initial value problems and integro-differential equations using Laplace transforms.

UNIT – IV

Fourier Transforms: Fourier integral theorem (without proof), Fourier sine and cosine integral, Fourier Transform, Properties, Fourier sine and cosine transforms and Finite Fourier transforms.

UNIT – V

Z-Transforms: Definition of Z-transform, Properties, Damping rule, Shifting rule, Initial and final value theorems, Inverse Z-transform, Convolution theorem (without proof), Solution of Difference equation by using Z-transforms.

Text Books:

1. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 5th Edition (9th reprint), 2021· ISBN978-8184875607.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 44'th Edition (2021).ISBN 978-9383214204.

Reference Books:

1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2016.ISBN 978-8131808320.
2. Higher Engineering Mathematics, H. K. Dass, Er. R. Verma, S-Chand publishers, 3rd edition 2023.ISBN 9788121938907.

Web Links:

1. https://nptel.ac.in/courses/117105134/13
2. https://nptel.ac.in/courses/108106075/23
3. https://tutorial.math.lamar.edu/Classes/DE/LaplaceTransforms.aspx
4. https://archive.nptel.ac.in/courses/111/106/111106111/

Applied Chemistry

(Common to EEE, ECE, CSE, IT, CSE(DS) &AIML)

	L	T	P	C
Course Code: 241CH002	**2**	**0**	**1**	**3**

Course Outcomes:

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

CO1: Interpret the essence of polymers and explore engineering applications.
CO2: Exemplify the principles and applications of electrochemical cells.
CO3: Summarize the preliminaries of Computational Chemistry and its applications.
CO4: Infer the preliminaries of Nano, smart materials and their applications.
CO5: Apply the knowledge of water treatment and E-waste management.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3		1			1		1	1		
CO2	3							1	1		
CO3	2							1	1		
CO4	2					1		1	1		
CO5	3					2		1	1		

UNIT-I

Polymer Chemistry:
Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and methods of polymerization (Suspension polymerization and Emulsion Polymerization) Difference between thermoplastics and thermosetting plastics; Engineering application of plastics - PTFE and Bakelite.
Polymer composites: Composites as structural material; Synthesis and applications of Kevlar and Carbon Fibers.
Conducting polymers: Polyacetylene- Mechanism of conduction – applications (polymers in sensors, Self-Cleaning windows), Biodegradable polymers - Introduction, Polyglycolic acid - synthesis, degradation and uses.
Practice:

1. Preparation of a polymer (Bakelite).
2. Determination of molecular weight of polymer using Ostwald's viscometer.

UNIT- II

Electrochemistry and Applications:
Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, Electrochemical sensors: potentiometric sensors with examples, amperometry sensors with examples.
Primary cells – Zinc-air battery, Secondary cells –Ni-Cd and, Lead-Acid battery, lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, Methanol-Oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC)

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with example (Glucose Electrochemical sensor)

Practice:
1. Conductometric titration of strong acid vs strong base.
2. Potentiometric titration of red-ox.
3. P^H-metric titration of Acid-Base.
4. Determination of Glucose by Electrochemical Sensor.

UNIT- III

Computational Chemistry
Computational Quantum Chemistry and its applications, Prediction of Molecular Properties using Computational Chemistry, Molecular Modelling and Structure - molecular Modelling today: overview of problems, tools, and solution analysis. Techniques for Conformational Sampling-Monte Carlo, global Optimization etc.
Practice:

1. Molecular docking to predict the interaction energy between molecules.

UNIT-IV

Nano and Smart Materials
Introduction to nanomaterials and general applications, basic chemical methods of preparation (top down and bottom-up approach) - Sol-gel method. Applications of Carbon nano tubes and Fullerenes, Graphene (water treatment and drug delivery). Characterisation of nano materials by SEM and TEM (only Principle). Smart materials and their engineering applications. Shape memory materials- Poly L-Lactic acid. Thermo response materials – Poly acryl amides, Poly vinyl Amides
Practice:

1. Preparation of nano particles by Green synthesis.
2. Characterization of nanoparticles (SEM & TEM).

UNIT- V

Water Treatment & E-Waste Management

Water treatment: Introduction, hardness of water, types, determination of hardness by EDTA method, disadvantages of hard water, removal of hardness by Zeolite and ion exchange method, Desalination of water – reverse osmosis and Electrodialysis.

E-Waste: Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products; Recycling: Recycling of Li-Ion batteries. Extraction of copper from E-waste.

Practice:

1. Determination of Hardness of a ground water sample.
2. Determination of Chloride content in given water sample.
3. Estimation of dissolved oxygen in given water sample.

Text Books:

1. Engineering Chemistry, Prasanta Rath, S. Aruna Kumari, CENGAGE Learning, ISBN 978-93-5350-651-3, ISBN 93-5350-651-4.
2. Engineering Chemistry Fundamentals and Applications, Shikha Agarwal, Cambridge, 2nd Edition, ISBN 978-1-108-72444-9.

Reference Books:

1. Engineering Chemistry, Uppal M.M, Jain and Jain, Khanna Publishers, 35th Edition.
2. A Textbook of Engineering Chemistry, Dr.S.S.Dara, Dr.S.S.Umare, S.Chand Publication, 2022, ISBN 978-817-409-2625.
3. Molecular Modelling Principles and applications, Andrew R. Leach, Prentice Hall, II Edition, ISBN 978-935-501-2585.

Web Links:

1. https://archive.nptel.ac.in/courses/104/106/104106096/
2. https://archive.nptel.ac.in/courses/104/105/104105124/
3. https://archive.nptel.ac.in/courses/104/106/104106137/
4. https://nptel.ac.in/courses/118102003

Modern Physics

(Common to EEE, ECE, CSE, IT, AIML & CSE (DS))

	L	T	P	C
Course Code: 241PH002	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the Course, Student will be able to:

- **CO1**: Apply the principles of interference and diffraction to design and enhance the resolving power of grating.
- **CO2**: Familiarize the concepts of LASER's and Optical fibers with applications.
- **CO3**: Explain the fundamental concepts of Quantum behavior of matter.
- **CO4**: Differentiate various electron theories to understand the properties of solids.
- **CO5**: Explain the basic concepts of Semiconductors and identify the type of semiconductors using Hall effect.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1						1	1		
CO2	2	1						1	1		
CO3	2	1						1	1		
CO4	2	1						1	1		
CO5	2	1						1	1		

UNIT–I

Wave Optics

Interference: Introduction - Principle of Superposition - Interference of light- Conditions for sustained Interference- Interference in thin films (reflected geometry) – Colours in thin films – Newton's Rings (reflected geometry) – Determination of wavelength and refractive index – Applications.

Diffraction: Introduction – Fresnel and Fraunhofer Diffraction - Diffraction due to Single slit (quantitative), Double slit (qualitative) - N–Slits Intensity distribution curves (qualitative) – Grating spectrum–Rayleigh's criterion - Resolving powers of grating (qualitative) - Applications.

Practice:

1. Determination of Radius of curvature of a plano-convex lens using Newton's Rings.

2. Measurement of Width or thickness of a thin wire by forming interference fringes.
3. Determination of Wavelength of light source using Diffraction grating by normal incidence method.
4. Resolving power of grating.
5. Determination of wavelength of light by using prism.

UNIT –II

Lasers & Optical Fibers

Lasers: Introduction - Characteristics of Lasers – Spontaneous and Stimulated emission of radiation – population inversion- Einstein's coefficients – Relation - significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser - Applications.

Optical Fibers:

Introduction- Principle of propagation in Optical Fiber, Angle of acceptance, Expression for Numerical Aperture and condition for propagation – Classification of Optical fibers - Applications.

Practice:

1. Determination of Wavelength of He-Ne laser source by using diffraction grating.

UNIT –III

Quantum Mechanics

Introduction – Matter waves – de Broglie's hypothesis – Davisson and Germer Experiment - Heisenberg's Uncertainty Principle – interpretation of wave function – Schrödinger Time dependent and Time Independent wave equations– Particle in a potential box.

UNIT –IV

Free electron Theory

Free Electron Theory: Introduction–Classical free electron theory (merits and demerits only) -Quantum Free electron theory – Electrical conductivity- Fermi energy state–Fermi Dirac distribution function - Temperature dependence – Density of states.

Band theory of solids: Bloch Theorem – Origin of energy bands in crystalline solids – classification of crystalline solids.

Practice:

1. Study the variation of magnetic field along the axis of a circular coil carrying current by using Stewart and Gee's apparatus.
2. Determination of Frequency of electrically maintained tuning fork by Melde's apparatus.

UNIT –V

Semiconductor Physics

Introduction – Intrinsic semiconductors – density of charge carriers – Electrical conductivity –Fermi level - extrinsic semiconductors - P-type & N-type semiconductors-Density of charge carriers (Qualitative) - Dependence of Fermi energy on carrier concentration and temperature– Hall effect-Hall coefficient - Applications of Hall effect–Drift and Diffusion currents - Einstein's equation – Working of PN junction diode – Zener diode

Practice:

1. Determination of V-I characteristics and Breakdown voltage of a Zener diode.
2. Determination of Energy band gap of a semiconductor by using P-N junction diode.
3. Study the relation between Temperature and resistance and finding the constants A & B of a thermistor.
4. Determine the resistivity of a semiconductor by four probe method.

Text books:

1. Engineering Physics by M N Avadhanulu & T.V.S. Arun Murthy, S Chand &Company Ltd, 1st Edition 2024, ISBN: 978-93-5870-932-3.
2. Engineering Physics by Satyendra Sharma and Jyotshna Sharma, Pearson publications, ISBN: 978-81-3151-178-7.

Reference Books:

1. Concepts of Modern Physics by Authur Beiser, Shobhit Mahajan and S Rai Choudhary, McGraw Hill, ISBN: 9789351341857.
2. Engineering Physics by M.R. Srinivasan, New Age international publishers, ISBN: 978-1848290501.
3. Optics by Ajoy Ghatak, McGraw Hill Education, 6th Edition, ISBN: 978-9390113590.

Web Links:

1. http://nptel.ac.in/courses/122107035/11
2. http://nptel.ac.in/courses/115102023/-
3. https://phet.colorado.edu/en/simulations/category/physics
4. http://physicsgecg.blogspot.in/p/reading-materials.html

Programming for Problem Solving using C

(Common to CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT&Min.E)

	L	T	P	C
Course Code: 241CS001	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Demonstrate basics of computer, algorithm and flow chart for problem solving.
CO2: Make use of an appropriate control structures to solve given problems.
CO3: Solve complex problems using arrays and strings.
CO4: Develop modular programming using functions and dynamics memory allocations using pointers.
CO5: Demonstrate file handling using file operations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3	2	1	3			2			1
CO2	2	3	2	1	3			2			1
CO3	2	3	2	1	3		1	2			1
CO4	2	3	2	1	3		1	2			1
CO5	2	3	2	1	3		1	2			1

UNIT – I

Introduction to Programming and Problem Solving

Introduction to Programming Languages, Basics of a Computer Program- Algorithms, Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms. flowcharts (Using Dia Tool), pseudo code.

Structure of C Program Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, operators, keywords, identifiers, Type Conversion, and Casting.

Practice:

1.
   a. Basic linux environment and its editors like Vi,Vim & Emacs etc.
   b. Exposure to turbo C, gcc
   c. Explore to hacker rank or any other Online coding platform and compiler environment.
   d. “Hello world” in C
   e. Objective: Learn about the syntax of reading from stdin and writing to stdout. https://www.hackerrank.com/challenges/hello-world-c/problem?isFullScreen=true e

Write a simple program to read int, float, char and string using scanf() and display using printf() in all the above given platforms.

2. Basics and Operators
   a. Sum and Difference of 2 numbers
      Objective: Learn int and float data types.
      https://www.hackerrank.com/challenges/sum-numbers-c/problem?isFullScreen=true
   b. Playing with Characters
      Objective: Learn how to take a character, a string and a sentence as input in C.
      https://www.hackerrank.com/challenges/playing-with-characters/problem?isFullScreen=true
   c. Bitwise Operators
      Objective: Learn how to work with bits (0,1) and bitwise operators.
      https://www.hackerrank.com/challenges/bitwise-operators-in-c/problem?isFullScreen=true
   d. Conversion of Fahrenheit to Celsius and vice versa.
   e. Distance travelled by an object.
   f. Calculate Simple interest and compound interest.

3. Operators and Expressions, Variables and Type conversions
   a. Evaluate the following expressions
      i. a/b*c-b+a*d/3
      ii. j = (i++) + (++i)
   b. Square root of a given number.
   c. Find the area of circle, square, rectangle and triangle.
   d. Find the maximum of three numbers using conditional operator.
   e. Take marks of 5 subjects in integers, find the total in integer and average in float.

UNIT – II

Control Structures

Simple sequential programs Conditional Statements (if, if-else, else if ladder, switch), Loops (for, nested for loop, while, do-while) break and continue, goto statement

Practice:

1. Conditional Statements
   1. Objective: Understand if and else Conditional statements in C.
      https://www.hackerrank.com/challenges/conditional-statements-in-c/problem?isFullScreen=true
   2. Roots of a Quadratic Equation.
   3. Generate electricity bill.
   4. Simulate a calculator using switch case.
   5. Find the given year is a leap year or not.
2. Loops
   a. Objective: Learn the usage of the for loop in C.
      https://www.hackerrank.com/challenges/for-loop-in-c/problem?isFullScreen=true
   b. Sum of the digits of a 5-digit number.

Objective: Learn the usage of while loop and usage of operators - % and /. https://www.hackerrank.com/challenges/sum-of-digits-of-a-five-digit-number/problem?isFullScreen=true

c. Given number is a prime or not. (Also Prime numbers between a given range.)
d. Armstrong Number or not.
e. Palindrome or not.
f. Objective: Print a pattern of numbers using Loops. https://www.hackerrank.com/challenges/printing-pattern-2/problem?isFullScreen=true
g. Construct a Pyramid pattern.

UNIT – III

Arrays indexing, Accessing programs with array of integers, two dimensional arrays, Introduction to Strings, string handling functions.
Sorting techniques: bubble sort, selection sort.
Searching Techniques: linear, Binary search.

Practice:

1. Arrays
   a. Objective: Print the sum and free the memory where the array is stored. https://www.hackerrank.com/challenges/1d-arrays-in-c/problem?isFullScreen=true
   b. Objective: Working with indices in array https://www.hackerrank.com/challenges/reverse-array-c/problem?isFullScreen=true
   c. Search an element in array (Linear Search)
   d. Find min and max elements in array
   e. Insert an element into array
   f. Eliminate duplicate elements from array
   g. Sorting of elements in an array using Bubble sort
2. Arrays
   a. Sum of two 2-D arrays
   b. Multiplication of two 2-D arrays
   c. Transpose of a Matrix
   d. Trace of a Matrix
   e. Lower Triangular Matrix
3. Hacker Rank
   a. Objective: print each word of the sentence in a new line. https://www.hackerrank.com/challenges/printing-tokens- /problem?isFullScreen=true
   b. Count number of alphabets (lowercase, uppercase, consonants, vowels) and digits Lowercase to Uppercase, Uppercase to Lowercase, Toggle case, Sentential case
   c. Objective: Digit Frequency Objective: find the frequency of each digit in the given string. https://www.hackerrank.com/challenges/frequency-of-digits-1/problem?isFullScreen=true
   d. Find string length, concatenate 2 strings, reverse a string using built-in and without built-in string functions.

UNIT – IV

Functions: Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, arrays as parameters, Scope and Lifetime of Variables, storage class, recursion, functions & pointers, functions and arrays.

Practice:

Functions in C

1. Objective: Learn simple usage of functions. https://www.hackerrank.com/challenges/functions-in-c/problem?isFullScreen=true
2. Objective: Fibonacci Numbers using recursive function. https://www.hackerrank.com/challenges/ctci-fibonacci-numbers/problem
3. Objective: N^{th} factorial using recursion. https://www.hackerrank.com/contests/ccc-veltech-practice-set-ende/challenges/factorial-using-recursion-1
4. Objective: Find the super digit of the integer. https://www.hackerrank.com/challenges/recursive-digit-sum/problem
5. Implement LCM
6. Objective: Calculate the Nth term of series. https://www.hackerrank.com/challenges/recursion-in-c/problem?isFullScreen=true

UNIT – V

Introduction to Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, modifying parameters inside functions using pointers, Command line Arguments, Dynamic memory allocation, Null Pointer, generic pointer, dangling pointer.

File Handling: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Practice:

1. Pointers
   a. Objective: learn to implement the basic functionalities of pointers in C. https://www.hackerrank.com/challenges/pointer-in-c/problem?isFullScreen=true
   b. Objective: Learn using Pointers with Arrays and Functions https://www.hackerrank.com/challenges/students-marks-sum/problem?isFullScreen=true
   c. Objective: sort a given array of strings into lexicographically increasing order or into an order in which the string with the lowest length appears first. https://www.hackerrank.com/challenges/sorting-array-of-strings/problem?isFullScreen=true
   d. Find the sum of a 1D array using malloc()
   e. Swap two numbers using functions and pointers - call by value and reference.
   f. Objective: Dynamic Handling requests by a Librarian to place the books in the shelves. https://www.hackerrank.com/challenges/dynamic-array-in-c/problem?isFullScreen=true

2. File handling concepts
   a) Write text into and read text from a file.
   b) Write text into and read text from a binary file using fread() and fwrite().

c) Copy the contents of one file to another file.
d) Merge two files into the third file using command-line arguments
e) Find no. of lines, words and characters in a file.

Additional Practice:

1. Variadic functions in C
   Objective: Understanding variable number of arguments
   https://www.hackerrank.com/challenges/variadic-functions-in-c/problem?isFullScreen=true
2. Small Triangles, Large Triangles
   Objective: Print sorted by their areas
   https://www.hackerrank.com/challenges/small-triangles-large-triangles/problem?isFullScreen=true
3. Permutations of Strings
   Objective: print all strings permutations in strict lexicographical order
   https://www.hackerrank.com/challenges/permutations-of-strings/problem?isFullScreen=true

Text Books:

1. Programming in C, Rema Theraja, Oxford, 2nd Edition. ISBN 93-5497-9.
2. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall. ISBN: 9780131103627.

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education. ISBN: 9352604172.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill. ISBN: 0071367993.
3. Let Us C Yashwanth, Kanetkar, Eighth edition, BPB Publications. ISBN:1934015253.
Programming in C A-Practical Approach Ajay Mittal. Pearson Education. ISBN: 9788131729342.
4. R G Dromey How to Solve It by Computer (Prentice-Hall International Series in Computer Science, ISBN: 978-0134340012.

Web Links:

1 https://www.hackerrank.com/
2 https://onlinecourses.nptel.ac.in/noc22_cs40/preview
3 https://archive.nptel.ac.in/courses/106/104/106104128/

IT & AI Skills

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

	L	T	P	C
Course Code: 241IT001	**0**	**0**	**2**	**2**

Course Outcomes:

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

- **CO1:** Utilize Excel and Power BI for data analysis, visualization, and reporting.
- **CO2:** Apply various data analysis techniques in Excel and Power BI to extract meaningful insights from datasets
- **CO3:** Create clear and compelling visualizations using Excel and Power BI to communicate data-driven insights.
- **CO4:** Develop data models in Power BI to organize and analyze data efficiently.
- **CO5:** Design interactive dashboards in Power BI to facilitate data exploration and decision-making.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2			2				1	1	1
CO2	2	3			2				1	1	2
CO3	2	2			2				1	1	2
CO4	1	2	1		2				1	1	2
CO5	1	2	1		2				1	1	2

Practice:

1. Introduction to Excel

a. Overview of Excel and its capabilities for data analysis
b. Basics of Excel: Navigating the interface, entering data, formatting cells
c. Introduction to functions and formulas: SUM, AVERAGE, IF, VLOOKUP, etc.
d. Importing data into Excel from different sources: CSV, text files.

2. Data Analysis with Excel

a. Data manipulation techniques: Sorting, filtering, and grouping data
b. Advanced functions and formulas: INDEX/MATCH, SUMIFS, COUNTIFS, etc.
c. Data visualization with Excel: Creating charts and graphs
d. Using PivotTables for data summarization and analysis

3.Advanced Excel Features

a. Introduction to Excel tables and structured references
b. Working with named ranges and dynamic ranges
c. Excel data validation techniques

4. Introduction to Power BI

a. Overview of Power BI and its advantages over Excel for large datasets

b. Installing Power BI Desktop
c. Understanding the Power BI interface: Navigation, ribbons, and panes
d. Importing data into Power BI Desktop from various sources

5. Data Preparation in Power BI

a. Introduction to Power Query for data transformation
b. Cleaning, shaping, and filtering data in Power Query Editor

6. Data Preparation in Power BI

a. Combining data from different sources
b. Loading data into Power BI model.

7. Data Modeling in Power BI

a. Understanding relationships between tables
b. Creating calculated columns and measures using DAX

8. Data Modeling in Power BI

a. Introduction to DAX functions: CALCULATE, FILTER, RELATED, etc.
b. Working with date and time functions in DAX

9. Visualization Basics in Power BI

a. Creating basic visualizations: Bar charts, line charts, pie charts, etc.
b. Customizing visualizations: Formatting, titles, legends, etc.

10. Visualization Basics in Power BI

a. Using slicers and filters to interact with visualizations
b. Adding drill-down capabilities to visualizations

11. Advanced Visualizations and Dashboards in Power BI

a. Exploring advanced visualizations: TreeMap, Waterfall chart, KPIs, etc.
b. Creating custom visuals from the marketplace

12. Advanced Visualizations and Dashboards in Power BI

a. Designing effective dashboards: Layout, arrangement, and organization
b. Adding interactivity with bookmarks and drill-through

Additional Practice:

1. **Basic Data Analysis:** Import a dataset into Excel and perform basic data analysis tasks such as sorting, filtering, and creating simple charts to visualize the data.
2. **Expense Tracker:** Create a spreadsheet to track your expenses. You can have columns for date, item description, category, and amount. Use formulas to calculate totals and analyze your spending habits.
3. **Data modeling and extracting statistics from dataset:** Connecting Power BI to local data files and cloud servers (COVID19 dataset will be imported into the Power BI for visualization).

Text Books:

1. Learn Power BI - Second Edition: A comprehensive, step-by-step guide for beginners to learn real-world business intelligence 2nd Edition, ISBN: 9781801811958.
2. Power BI Beginner: Zero to Hero in Power BI Desktop by Philip Seamark, ISBN 1691641227.

Reference Books:

1. Power BI Quick Start Guide: Build dashboards and visualizations to make your data come to life by Devin Knight and Siddharth Mehta.
2. Learn Power BI: A Beginner's Guide to Analyzing Data and Creating Reports with Power BI by Murilo Miranda.

Web Links:

1. https://learn.microsoft.com/en-us/power-bi/
2. https://support.microsoft.com/en-us/excel
3. https://cce.sydney.edu.au/course/MSE1
4. https://cce.sydney.edu.au/course/PBBA

Engineering Graphics

(CCE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT&Min.E)

	L	T	P	C
Course Code: 241ME001	**1**	**0**	**2**	**3**

Course Outcomes:

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

- **CO1:** Apply the principles of engineering drawing to construct Engineering curves.
- **CO2:** Construct projections ofpoints and lines.
- **CO3:** Demonstrate visualization skills of projections of planes.
- **CO4:** Demonstrate visualization skills of projections of solids and development of surfaces.
- **CO5:** Construct isometric and orthographic views of simple solids.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1		2			1	1		
CO2	3	2	1		2			1	1		
CO3	3	2	1		2			1	1		
CO4	3	2	1		2			1	1		
CO5	3	2	1		2			1	1		

Practice:

1. **Introduction to Engineering Graphics**
   Introduction to AutoCAD, Dimensioning, elements of dimensioning, system of dimensioning, and Conventions in Drawing.

2. **Construction of Cycloids and Involutes**
   a) Construction of Cycloid, Epicycloid and Hypocycloid
   b) Involute of a pentagon and circle

3. **Introduction to Orthographic Projection**
   a) Principles of Projection
   b) Orthographic Projection – Four Quadrants.
   c) First angle & Third angle Projection with examples, reference plane, importance of reference lines or Plane.
   d) Projections of a point situated in any one of the four quadrants.

4. **Projection of straight lines-I:**
   a) Projections of straight lines parallel to both reference planes.

b) Projections of straight lines perpendicular to one reference plane and parallel to other reference plane
c) Projections of straight line parallel to one plane & inclined to another plane

5. Projection of straight lines-II:
a) Projections of straight line inclined to both reference planes

6. Projection of planes:
a) Regular planes perpendicular to both reference planes, Parallel to one reference plane and inclined to the other reference plane
Ex: Rectangle, Pentagon, Hexagon and Rhombus

7. Projection of planes
a) Projections of Planes inclined to both reference planes Ex: Rectangle, Pentagon, Hexagon and Rhombus.

8. Projection of solids
a) Axis Perpendicular to H.P and Axis Perpendicular to V.P
Ex: Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone
b) Axis Parallel to H.P and V.P
Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone

9. Projection of solids
a) Projection of Solids with axis inclined to one reference plane and parallel to another plane
Ex: Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone

10. Development of Surfaces
a) Development of Prisms and Cylinder simple cases

11. Development of Surfaces
a) Development of Pyramids and Cone simple cases

12. Conversion of Isometric views to Orthographic views
a) Practice figure - 1
b) Practice figure – 2

Additional Practice:

1. Conversion of Isometric views to Orthographic views
a) Practice figure - 3
b) Practice figure – 4

2. Conversion of Orthographic views to Isometric views
a) Practice figure - 1
b) Practice figure - 2

Text Books:

1. Engineering Drawing, N. D. Bhatt, Charotar Publishing House, 54th Edition, 2024, ISBN : 9789385039706.
2. Engineering Drawing and Graphics , Venugopal, New Age Publications, 2nd Edition, 2019, ISBN: 9788122415452.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2021, ISBN: 978-9385983177.
2. Computer Aided Engineering Graphics, T. Jeyapoovan,Vikas Publishing house, New Delhi, 1stEdition, 2023, ISBN : 9789356743199.

Web Links:

1. https://nptel.ac.in/courses/112103019/
2. https://academy.autodesk.com/authenticated-home-user
3. https://www.sciencedirect.com/book/9780080108391/engineering-drawing-from-thebeginning

Engineering Workshop

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

	L	T	P	C
Course Code: 241ME003	**0**	**0**	**1**	**1**

Course Outcome:

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

- **CO1:** Prepare various wooden joints.
- **CO2:** Demonstrate various sheet metal models.
- **CO3:** Develop the basic knowledge of house wiring.
- **CO4:** Develop the basic knowledge of plumbing.
- **CO5:** Practice various welded joints.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	1				1	1	2	1		1
CO2	1	1				1	1	2	1		1
CO3	2	2				1	1	2	1		1
CO4	1	2				1	1	2	1		1
CO5	2	2				1	1	2	1		1

Practice:

1. To make a T-Lap joint from the given wooden workpieces.
2. To make a dovetail lap joint from the given wooden workpieces.
3. To make a taper tray using the given sheet metal.
4. To make a funnel using the given sheet metal.
5. To make a square tin using the given sheet metal.
6. To connect three bulbs by using series and parallel connections.
7. To give connection to a bulb by using staircase wiring.
8. To prepare wiring for a tube light with switch control.
9. To prepare a PVC pipe joint by using the given circuit1.
10. To prepare a PVC pipe joint by using the given circuit2.
11. To make a butt joint using the given M.S pieces by arc welding.
12. To make a lap joint using given M.S pieces by arc welding

Additional Practice:

1. To make a crosslap joint from the given wooden workpieces.
2. To make an open scoop using the given sheet metal.
3. To make a T-joint using given M.S pieces by arc welding.

Text Books:

1. Work shop Manual, P.Kannaiah & K.L.Narayana/ SciTech Publishers, 2nd Edition, ISBN: 978-8183711302.
2. Elements of Workshop Technology, VolI by S.K. Hajra Choudhury, S.K. Hajra. Choudhury & Nirjhar Roy, Media Promoters and Publishers Pvt Limited, 14th Edition, ISBN: 8185099146.

Reference Books:

1. Workshop Technology, Part 1, W.A.J. Chapman, 5thEdition, ISBN 9780415503020.
2. Engineering Practices Lab Manual, T. Jeyapoovan & M. Saravanapandian, Vikas Publishing House Pvt Limited, 4thEdition, ISBN: 8125929037.
3. Engineering Practices Laboratory Manual, Ramesh Babu.V., VRB Publishers Private Limited, Chennai, Revised Edition, 2019-20, ISBN: 978-81-935993-8.

Web Links:

1. https://bharatskills.gov.in
2. https://www.gopracticals.com/basic-engineering/workshop/

Basic Electrical & Electronics Engineering

(Common to CE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

L	T	P	C
2	0	2	4

Course Code: 241EE001

Course Outcomes:

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

- **CO 1:** Analyze the concepts associated to AC and DC circuits.
- **CO 2:** Explain the operating principles of motors, generators and measuring instruments.
- **CO 3:** Analyze the Different Energy Resources and Equipment Safety Measures.
- **CO 4:** Explain the concept and the applications of semiconductor Diodes.
- **CO 5:** Analyze the Basic Electronic Circuits and interpret numeric information in different code formats.

Mapping of course outcomes with program outcomes:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	1		1				2	2	
CO2	2	3	1						2	2	
CO3	3	2	1						2	2	
CO4	3	2	1						2	2	
CO5	3	2	1						2	2	

Mapping of course outcomes with program Specific Outcomes:

CO\PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	1	
CO5	1	

UNIT-I

DC and AC Circuits:

DC circuits: Ohm's and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits excited by independent voltage sources for R, L, C parameters, current division, voltage division

AC circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form, and peak factors. Real power, reactive power, apparent power, and Power factor.

Practice:

1. Verification of Ohm's Law.
2. Verification of KCL and KVL.
3. Verification of KCL, KVL and ohm’s law using simulation.

UNIT-II

Machines and Measuring Instruments: Principles and operation of DC machines, Transformers – Synchronous Machines - three Phase and single phase induction motors - Moving coil and moving iron instruments, Wheatstone bridge and Megger.

Practice:

1. To study Magnetisation Characteristics of DC shunt generator.
2. Measurement of Power and Power factor using Single-phase wattmeter.
3. Measurement of Resistance using Wheat stone bridge.
4. Measurement of Earth Resistance using Megger.

UNIT-III

Energy Resources, Electricity Bill &Safety Measures

Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Thermal, Solar &Wind power generation. Calculation of electricity bill for domestic appliances. Working principle of Fuse and Miniature circuit breaker (MCB). Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Practice:

1. Calculation of Electrical Energy for Domestic Premises.

UNIT-IV

Semiconductor Devices

Intrinsic semiconductors, Extrinsic semiconductors, P type and N type, P-N junction characteristics of P N Junction Diode, Zener Effect, Zener Diode and its Characteristics. working of simple Zener Voltage Regulator and Amplifier. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics.

Practice:

1. Sketch the V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Sketch the V-I characteristics of Zener Diode and its application as voltage Regulator.
3. Plot Input & Output characteristics of BJT in CE and CB configurations.
4. Obtain Frequency response of CE amplifier.

UNIT-V

Basic Electronic Circuits

Block diagram description of a dc power supply, working of a half and full wave, bridge rectifier, filters.

Digital Electronics

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders.

Practice:

1. Implementation of half wave and full wave rectifiers.
2. Design Half Adder and Full Adder circuits.
3. Verification of truth table for Logic gates using ICs.

Text Books:

1. Basic Electrical and Electronics Engineering, Salivahanan, S,Tata McGraw Hill Education (India) Private Limited, New Delhi, ISBN: 9789389691801.
2. Principles of Electrical Engineering, V. K. Mehta, R. Mehta, S. Chand & Company Ltd., New Delhi, ISBN-13: 9788121930888.
3. Digital Fundamentals, Thomas Floyd, Prentice Hall, 10th Edition, ISBN: 9780132737968.

Reference Books:

1. Electronic Devices & Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson, 11thEdition, ISBN: 9780135026496.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, ISBN: 9788177000207.

Web Links:

1. https://nptel.ac.in/courses/108/101/108101091/ (NPTEL Video by Dr.Mahesh B. Patil from IIT Bombay)
2. https://nptel.ac.in/courses/117/106/117106108/ (NPTEL Video by Prof. Nagendra Krishnapura from IITMadras)

Network Analysis

	L	T	P	C
Course Code: 241EC002	**3**	**1**	**0**	**4**

Course Outcomes:

At the end of the course student will be able to:

CO1: Apply mesh and nodal analysis to DC and AC circuits.
CO2: Analyze the circuit using network theorems.
CO3: Analyze transient behaviour of RL,RC and RLC circuits with DC excitation.
CO4: Outline the characteristics of resonant circuits.
CO5: Model a two port network in terms of Z, Y, h & T parameters.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	3	2								1
CO2	3	2	2								1
CO3	2	3	2								1
CO4	3	2	2								1
CO5	2	3	2								1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	2	
CO5		2

UNIT – I

D.C.Circuits: Types of circuit elements, Types of Sources and Source Transformation, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also, principle of Duality with examples.
Steady State Analysis of A.C Circuits: Impedance concept, phase angle and phasor notation for series R-L, R-C, and R-L-C circuits, mesh and nodal analysis,Star-Delta conversion, problem solving.

UNIT – II

Network Theorems: Superposition theorem, Thevenin‘s theorem, Norton‘s theorem, Maximum power transfer theorem, Millman’s theorem, Reciprocity theorem, Tellegen‘s theorem.

UNIT – III

Transient Analysis: Introduction, Initial & Final conditions for basic passive elements, Transient response of Source free series RL and RC circuits, Transient response of series RL and RC circuits for DC excitation, Transient response of series RLC circuits for DC excitation.

UNIT – IV

Resonance: Introduction, Series resonance -Impedance, Resonant frequency, Quality factor, Bandwidth, Parallel resonance-Condition for maximum impedance, Current, Bandwidth, and General case resistance present in both branches.

UNIT – V

Two-Port Networks: Introduction to two port networks, Z-parameters, Y-parameters, ABCD-parameters, h-parameters, Reciprocity and Symmetry in two port network, Relationship between Parameters, Interconnection of two port networks.

Text Books:

1. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition, 2020, ISBN: 978-9390185139.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, 7th Edition, ISBN: 978-1260011968.

Reference Books:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019, ISBN: 978-9353433123.
2. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education, 7th Edition, 2022, ISBN: 978-9355320162.

Web Links:

1. https://www.falstad.com
2. https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/
3. www.allaboutcircuits.com
4. https://nptel.ac.in/courses/117106108/ Prof. Gajendranath Chowdary /IIT Madras.
5. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html

Digital Electronics & Logic Design

(Common to EEE & ECE)

	L	T	P	C
Course Code: 241EC001	**2**	**0**	**2**	**4**

Course Outcomes:

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

- **CO1:** Interpret number representation in different code formats and the functionality of Logic Gates.
- **CO2:** Perform logic minimization using suitable techniques.
- **CO3:** Design various combinational logic circuits for required specifications.
- **CO4:** Implement logic functions using PLDs.
- **CO5:** Design different sequential logic circuits.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2						2	1		1
CO2	2	2						2	1		1
CO3	2	2	3	1				2	1		1
CO4	2	2	3	1				2	1		1
CO5	2	2	3	1				2	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		3
CO4		3
CO5		3

UNIT – I

Number Systems: Representation of numbers of different radix, conversion from one radix to another radix, r-1's compliment and r's compliment of signed numbers, problem solving. Binary Codes: 4bit codes, 2421, 8421. Error detection & correction codes, (parity checking, even parity, odd parity), Review of logic gates.

Practice:

1. Functional verification of logic gates.
2. Develop basic logic gates using universal gates.

UNIT – II

Boolean Algebra & Minimization Techniques: Boolean theorems, principle of complementation & duality, De-Morgan theorems, minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map up to 5 variables, tabular minimization.

Practice:

1. Verification of De-Morgan's laws.
2. Design a logic circuit for a given Boolean expression.

UNIT – III

Combinational logic circuits: Review of adders, half subtractor, full subtractor, ripple carry adder, carry look-a-head adder circuit, 4-bit binary adder/subtractor circuit, BCD adder, Decoders, encoders, multiplexers, de-multiplexers, comparators and code converters, realization of Boolean functions using decoders & multiplexers.

Practice:

1. Design Full adder circuit and verify its truth table.
2. Design a combinational logic circuit for 8 to 1 MUX.
3. Verification of functional table of 3-to-8-line Decoder/De-multiplexer.
4. Design BCD to Seven Segment Display Decoder.

UNIT – IV

Programmable Logic Devices: Introduction to PLDs: PROM, PAL, PLA-Basics structures, realization of Boolean function with PLDs, programming tables of PLDs, merits & demerits of PROM, PAL, PLA comparison, realization of Boolean functions using PROM, PAL, PLA.

UNIT – V

Sequential Circuits: Latches and flip flops, truth tables and excitation tables, flipflop with reset and clear, Conversion of flip-flops. Design of registers - shift register, bi-directional shift register, universal shift register, Design of ripple counters, design of synchronous counters, Johnson counter, ring counter.

Practice:

1. Verify the truth tables of Basic Flip-flops.
2. Design an 8-bit right shift register using D Flip-flop and verify the truth table.

Additional Practice:

1. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer. using LEDs for outputs
2. Design BCD Adder Circuit and Test the Same using Relevant IC.
3. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.

Text Books:

1. Switching and Finite Automata Theory, ZviKohavi& Niraj K.Jha, 3rdEdition, ISBN: 978-0521857482.
2. Digital Design, Morris Mano, Pearson, 3rd Edition, ISBN: 978-8178085555.

Reference Books:

1. Modern Digital Electronics, RP Jain, Tata Mc Graw Hill, 5thEdition, 2022, ISBN: 978-9355321770.
2. Fundamentals of Logic Design, Charles H. Roth Jr., Jaico Publishers, ISBN: 978-0534378042.

Web Links:

1. http://nptel.ac.in/courses/117/106/117106086/ (By Prof. Goutam Saha, Electronics & Electrical Communication Engineering Dept, IIT Kharagpur)
2. www.nptelvideos.in/2012/12/digital-circuits-and-systems.html(By Prof. Santanu Chattopadhyay, Electronics & Electrical Communication Engineering Dept, IIT Kharagpur).
3. https://www.smartzworld.com/notes/switching-theory-and-logic-design-stld/.

Electronic Devices & Circuits

	L	T	P	C
Course Code: 241EC003	**2**	**0**	**2**	**4**

Course Outcomes:

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

- **CO1:** Interpret the characteristics of semiconductor diodes.
- **CO2:** Compare the characteristics of rectifiers with and without filters.
- **CO3:** Explain the characteristics of BJT and FET in different configurations.
- **CO4:** Apply biasing methods for stabilization of BJT and FET amplifiers.
- **CO5:** Construct a small signal low frequency equivalent model of BJT and FET.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2						2	1		1
CO2	3	2		1				2	1		1
CO3	3	2						2	1		1
CO4	2	2		2				2	1		1
CO5	2	3	1	2				2	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		3
CO2		3
CO3		2
CO4		2
CO5		2

UNIT – I

Junction Diode Characteristics: Introduction to semiconductors, energy band structure of open circuited PN junction, forward and reverse bias of PN junction, current components in PN junction diode, drift and diffusion currents, law of junction, diode current equation, temperature dependence of V-I characteristics, Breakdown mechanisms, diffusion and transition capacitances.

Special Semiconductor Devices: LED, Photo diode, Tunnel Diode, Varactor Diode and UJT.

Practice:

1. V-I characteristics of LED
2. Draw the V-I characteristics of UJT and Identify the negative resistance region.

UNIT – II

Diode applications: Types of rectifiers and their operation, input and output waveforms, derivations of parameters of rectifiers. Filters: Inductor filter, Capacitor filter, L-section filter, π-section filter, multiple L-section and multiple π- section filters, clipper and clamper circuits.

Practice:

1. Non Linear wave shaping – Series Clippers.
2. Non Linear wave shaping – Clampers.

UNIT – III

Transistor Characteristics: BJT: Construction and operation of a transistor, transistor current components, transistor current equation, transistor as a switch and amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, transistor parameters, relation between and , comparison of BJT transistor configurations. FET: Construction, operation, characteristics and parameters of JFET, depletion and enhancement mode MOSFETs, comparison between JFET and MOSFET.

Practice:

1. Transistor as a switch.
2. Determine h-parameters of CE Configuration from Input and Output Characteristics.
3. Obtain the Drain and Transfer Characteristics of FET-CS Configuration also find μ, gm and rd.

UNIT – IV

Transistor Biasing and Thermal Stabilization: Need for biasing, load line analysis, basic stability and stability factors (S, S', S''), BJT biasing methods, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic0 and β, Bias compensation, FET voltage divider biasing method.

Practice:

1. Transistor biasing- Design of self-bias circuit

UNIT – V

Small Signal Analysis of Transistor Amplifiers at Low Frequency: Transistor as a two-port network, Transistor hybrid model, determination of h-parameters, generalized analysis of

transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis.
FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers.

Practice:

1. Obtain the frequency response of CC amplifier using BJT.
2. Obtain the frequency response of CS Amplifier using FET.

Additional Practice:

1. Implementation of half wave and full wave rectifiers with π filter.
2. Determine the Q point of given voltage divider bias circuit.
3. Non Linear wave shaping – Shunt Clippers with reference voltage.
4. Non Linear wave shaping – Double ended Clipping with reference voltage.

Text Books:

1. Electronic Devices and Circuits, J. Millman, Christos C. Halkias, Satyabrata Jit, Tata McGraw Hill, 4th Edition, ISBN: 978-9339219543.
2. Electronic Devices and Circuits, David A. Bell, Oxford University Press, 5th Edition, 2018, ISBN: 978-0195693409 .

Reference Books:

1. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, Pearson Publications, 10th Edition,2020, ISBN: 9788131727003.
2. Electronic Devices and Circuits, GK Mithal, Khannan Publishers, 23rd Edition, ISBN: 978-8174091772.
3. Electronic Circuits, D. A. Neamen, Tata McGraw Hill Education, ISBN: 978-0070634336 .

Web Links:

1. https://www.electronics-tutorials.ws/diode/diode_2.html
2. http://fourier.eng.hmc.edu/e84/lectures/ch4/node3.html
3. http://nptel.ac.in/courses/117103063/11 by Dr. Chitralekha Mahanta, IIT Guwahati
4. https://nptel.ac.in/courses/122106025/ by Prof. T. S. Natarajan, IIT Madras.
5. https://www.circuitlab.com/editor/#?id=6syafk
6. https://www.falstad.com/circuit/circuitjs.html

Random Variables & Stochastic Processes

	L	T	P	C
Course Code: 241EC004	**3**	**1**	**0**	**4**

Course Outcomes:

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

- **CO1:** Summarize the properties of random variables
- **CO2:** Infer the characteristics of multiple random variables.
- **CO3:** Interpret the characteristics of random process in time domain.
- **CO4:** Interpret the characteristics of random process in frequency domain.
- **CO5:** Summarize the types and characteristics of Noise

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									1
CO2	3	2									1
CO3	3	2									1
CO4	3	2									1
CO5	2	2									1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Single Random Variable: Definition, Discrete and Continuous Random variables, Distribution and density function of random variable and their properties, Expected value of Function of random variable, Moments, Mean and Variance and their properties, Binomial, Poisson, Uniform, Exponential, Gaussian distributions, Transformation of random variable.

UNIT – II

Multiple Random Variables: Joint Distribution and density function of multiple random variables, Joint Moments,Marginal and conditional distributions, Covariance, Correlation ,

Sum of independent random variables, Central limit theorem, statistic independence of random variables.

UNIT – III

Random Processes-Temporal characteristics: Random process – Definition, Types of Random process, First-Order,Second-order, Strict Sense Stationary random process, Wide sense stationary and Ergodic processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Random Signal Response of Linear Systems: Linear Time Invariant System,System Response – Convolution, Mean and Mean-squared Value of System Response.

UNIT – IV

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

UNIT – V

Noise Sources: Definitions, Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Spectral characteristic of system response for Noise, Narrow Band Noise, Quadrature representation of Narrow Band Noise & its properties.

Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH Publications, 4th Edition, ISBN:978-0-07-047428-4.
2. Probability-Random Variables and Stochastic Processes, Athanasios Papoulis and S. Unnikrisha, PHI Publications, 4th Edition, ISBN:978-0070486584.

Reference Books:

1. Probability Theory and Stochastic Processes, Y. Mallikarjuna Reddy, Universities Press (India) Pvt. Ltd.,4th Edition, ISBN:9788173718878.
2. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, International Edition, ISBN:9780131784574.

Web Links:

1. http://nptel.ac.in/courses/117105085/ - by Prof.M.Chakraborthy, IIT Khargpur
2. https://ocw.mit.edu/courses/18-445-introduction-to-stochastic-processes-spring-2015/ - Offered by MIT

Signals & Systems

	L	T	P	C
Course Code: 241EC014	**2**	**0**	**2**	**4**

Course Outcomes:

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

CO1: Analyze signal classifications and Fourier series representations of periodic signals.
CO2: Analyze the spectral characteristics of signals using Fourier analysis.
CO3: Apply Laplace and Z-transform techniques on signals.
CO4: Utilize the concept of convolution and sampling theorem in signal processing.
CO5: Analyze the response of continuous time LTI system.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2			3			1	1		1
CO2	2	3			2			1	1		1
CO3	3	2			2			1	1		1
CO4	2	3			2			1	1		1
CO5	2	2			2			1	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	3	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Signals: Definitions of a signal , Classification of signals, Elementary signals, Basic operations on signals.

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

Practice :

1. Generation of various signals such as unit impulse, unit step, ramp, exponential and sinewave.

2. Perform Operations on signals such as Addition, Multiplication, Scaling, Shifting, and Folding.
3. Perform Fourier synthesis of square wave.

UNIT – II

Fourier Transform: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrarysignals, Fourier transform of standard signals, Fourier transform of periodic signals, Properties of Fourier transforms

Practice:

1. Calculate the Fourier Transform and Inverse Fourier Transform of a given continuous time signal.

UNIT – III

Laplace Transform: Bilateral and unilateral Laplace Transforms, Region of convergence and its properties, Constraints on ROC for various classes of continuous time signals, Properties of Laplace Transform, Inverse Laplace Transform.

Z-Transform: Concept of Z- Transform of a Discrete Sequence, Region of convergence in Z-Transform, Constraints on ROC for various classes of discrete time signals, Properties of Z-Transform, Inverse Z-Transform.

Practice:

1. Obtain Laplace Transform and inverse Laplace Transform of a given continuous time signal.
2. Calculate the Z-Transform and Inverse Z-Transform of a given discrete time signal.

UNIT – IV

Convolution of Signals: Convolution and it's properties, Graphical representation of convolution, Convolution of signals through transforms.

Sampling: Introduction to Sampling , Sampling theorem, Nyquist rate, Nyquist duration, Types of Sampling, Reconstruction of signal from its samples, Effect of under sampling,

Practice:

1. Perform convolution of given continuous time signals.
2. Generate oversampled,Nyquist and undersampled discrete time signals for the given Analog signal

UNIT – V

Signal Transmission Through LTI Systems: Definitions of a system, Classification of Systems, Transfer function of a LTI system, Impulse response and step response of LTI systems, Distortion less transmission through a system, Ideal LPF, HPF,BPF and BSF characteristics, Signal bandwidth, System bandwidth.

Practice:

1. Obtain Impulse and step response of given LTI system.

Additional Practice:

1. Finding the even and odd parts, real and imaginary parts of signal.

2. Analyze the effect of increasing the number of terms in the Fourier series on the Gibbs phenomenon.
3. Verification of linearity and time invariance properties of a given system.

Text Books:

1. Signals & Systems by Simon Haykin and Van Veen, Wiley, 2nd Edition, ISBN: 978-8126512652.
2. Signals and Systems by A.V. Oppenheim, A.S. Willsky, and S.H. Nawab, PHI, 2nd Edition, Reprint, ISBN: 978-7560509709.

Reference Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, ISBN:978-8178000169.
2. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, Reprint, ISBN: 978-0070702219.
3. Signals and Systems – A. Anand Kumar, PHI, 3rd Edition, 2022,ISBN: 978-8120348400.
4. Signals & Systems by Tarun Kumar Rawat, Oxford Publication, 1st Edition, ISBN: 978-0198066798.
5. Signals & Stochastic Processes by Y Mallikarjuna Reddy and Giri Babu Kande, The Orient Blackswan Publication, 1st Edition, ISBN: 978-9386235312.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc21_ee28/preview
2. http://acl.digimat.in/nptel/courses/video/108106163/L16.html
3. https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/pages/lecture-notes/

Electromagnetic Waves & Transmission Lines

	L	T	P	C
Course Code: 241EC005	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the course student will be able to:

CO1: Interpret the properties of electric fields and magnetic fields.
CO2: Infer the Maxwell's equations for electric fields and magnetic fields.
CO3: Analyze the characteristics of uniform plane waves.
CO4: Interpret the fundamentals of transmission lines.
CO5: Apply impedance matching techniques for the transmission lines.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	1									
CO5	2	2									

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Electrostatics: Review of Co-ordinate Systems and Vector Calculus**,** Coulomb's Law, Electric Field Intensity, Electric Flux Density, GaussLaw and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Convection and Conduction Currents, Dielectric Constant, Continuity Equation, Capacitance, Energy Density in Electrostatic Fields.

UNIT – II

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications,Magnetic Flux Density, Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductance, Magnetic Energy.
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 Differential, Integral, Final Forms and Word Statements.

UNIT – III

EM Wave Characteristics-I: Uniform Plane Waves – Definition, Wave equations for Conducting and Perfect Dielectric media, Wave propagation in Lossy dielectrics, Lossless dielectrics and Free space, Wave propagation in good conductors, Skin depth, Polarization & Types.
EM Wave Characteristics-II: Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total internal reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

UNIT – IV

Transmission lines-I: Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, Distortion less lines.

UNIT – V

Transmission lines-II: SC and OC Lines, Reflection Coefficient, VSWR, Impedance Transformations of λ/4, λ/2, λ/8 Lines, Smith Chart-Construction and Applications, Quarter wave transformer, Stub Matching-single & double.

Text Books:

1. Principles of Electromagnetics, Matthew N.O. Sadiku, and S.V. Kulkarni, Oxford University Press, 6th Edition,ISBN: 978-0199461851.
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, ISBN: 978-9332551770.

Reference Books:

1. Engineering Electromagnetics, William H. Hayt, John A. Buck, Jaleel M. Akhtar,

TMH, 9th Edition, 2020,ISBN: 978-9353169725.
2. Transmission Lines and Networks, UmeshSinha and Satya Prakashan, Technical India Publications, 2nd Edition,ISBN: 8176841889.
3. Electromagnetic Waves and Transmission Lines, Y Mallikarjuna Reddy, Universities Press, 1st Edition, ISBN: 978-8173719776 .

Web Links:

1. https://nptel.ac.in/courses/108106157 NPTEL Course on "Transmission lines and Electromagnetic Waves", IIT Madras, Dr. Ananth Krishnan.
2. https://www.damtp.cam.ac.uk/user/tong/em.html Lectures on "Electromagnetism", by David Tong, University of Cambridge, London.
3. https://nptel.ac.in/courses/117103065 NPTEL Course on "Electromagnetic fields" , IIT Guwahati, Dr. Ratnajit Bhattacharjee.

Analog Electronics

	L	T	P	C
Course Code: 241EC006	**2**	**0**	**2**	**4**

Course Outcomes:

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

CO1: Build the high frequency transistor amplifier circuits.
CO2: Analyze the frequency response of multi stage circuits.
CO3: Summarize the performance metrics of feedback amplifiers.
CO4: Construct low and high frequency oscillators for given specifications.
CO5: Analyze theperformance of power and tuned amplifiers.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1					2	1		1
CO2	3	2						2	1		1
CO3	3	2						2	1		1
CO4	3	2	1					2	1		1
CO5	3	2						2	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	1	
CO5	1	

UNIT – I

Small Signal Analysis of Transistor Amplifiers at High Frequency: Two-Port network Approach, The transistor pi Model, Hybrid- π common emitter transistor model, Hybrid π conductance, Hybrid π-capacitances, validity of hybrid π model, CE short circuit current gain, current gain with resistive load, cut-off frequencies.
FET: Analysis of common Source and common drain Amplifier circuits at high frequencies.
Practice :

1. Introduction to OrCAD Software.

UNIT – II

Multistage Amplifiers: Classification of amplifiers, methods of coupling, analysis of CE amplifier, two stage RC coupled amplifier, cascode amplifier, High input resistance circuits: Darlington pair amplifier, Boot-strap emitter follower.

Practice:

1. Construct a two stage RC coupled amplifier to obtain frequency response, voltage. Gain and Bandwidth. (OrCAD Software).
2. Construct a two stage RC coupled amplifier to obtain frequency response, voltage gain and bandwidth.

UNIT – III

Feedback Amplifiers: Feedback concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of voltage and current series feedback amplifiers.

Practice:

1. Construct voltage series feedback amplifier to obtain frequency response, voltagegain and bandwidth. (OrCAD Software.
2. Construct voltage series feedback amplifier to obtain frequency response, voltage gain and bandwidth.

UNIT – IV

Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wein bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators with BJT and FET and their analysis, Frequency and amplitude stability of oscillators.

Practice:

1. Construct a RC phase shift oscillator using BJT to generate a sinusoidal signal.(OrCAD Software)
2. Construct a RC phase shift oscillator using BJT to generate a sinusoidal signal.

UNIT – V

Power Amplifiers: Classification of amplifiers, Class A power Amplifiers and their analysis, Harmonic Distortions, Class B Push-pull amplifiers and their analysis, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Class-D power amplifier.

Tuned Amplifiers: Introduction, Q-Factor, single tuned amplifier, double tuned amplifiers, staggered tuned amplifiers.

Practice:

1. Construct a class-A power amplifier to obtain power efficiency. (OrCAD Software)
2. Construct a class-A power amplifier to obtain Q-point and power efficiency using Hardware.
3. Construct a single tuned amplifier to obtain frequency response, voltage gain and bandwidth. (OrCAD Software)
4. Construct a single tuned amplifier to obtain frequency response, voltage gain and bandwidth.

Additional Practice:

1. Construct three stage RC coupled amplifier and compare with two stage RC coupled amplifiers.
2. Construct Darlington pair amplifier to obtain frequency response, voltage gain and bandwidth.
3. Construct a Colpitt's oscillator using BJT to generate a sinusoidal signal.

Text Books:

1. Electronic Devices and Circuits , Jacob Millman & Christos. C. Halkias, Satyabrata Jit, Tata McGraw Hill, 4th Edition, ISBN: 9789352601080.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, Pearson Publications, 10th Edition, 2020, ISBN: 9788131727003_U.

Reference Books:

1. Electronic Devices & Circuits, David A. Bell, Prentice Hall of India/Pearson Education, 5thEdition, 2018, ISBN: 019569340X.
2. Electronic Devices and Circuits, Anil Kumar Maini, Varsha Agrawal, John Wiley & Sons, ISBN: 9788126578085.
3. Electronic Circuit Analysis and Design, Donald A. Neaman, McGrawHill, ISBN: 9780072409574.

Web Links:

1. http://onlinecourses.nptel.ac.in/noc21_ee89/preview by By Prof. Shouribrata Chatterjee, IIT, Delhi.
2. http://nptel.ac.in/courses/108/102/108102095 by Prof. S.C.Dutta Roy, IIT, Delhi.
3. http://www.iitg.ac.in/apvajpeyi/ph218.html
4. http://nptel.ac.in/courses/108/102/108102095 by Prof. S.C.Dutta Roy, IIT, Delhi.

Integrated Circuits & Applications

	L	T	P	C
Course Code: 241EC007	**2**	**0**	**2**	**4**

Course Outcomes:

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

- **CO1:** Construct Op-Amps using the differential amplifier and related circuitry.
- **CO2:** Illustrate the parameters related to measurement of Op-Amp characteristics.
- **CO3:** Construct the circuits for linear and non-linear applications using Op-Amp.
- **CO4:** Build the data conversion circuits and construct the circuits for filtering applications using Op-Amp.
- **CO5:** Analyse 555 Timer circuits and Phase Locked Loops.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									1
CO2	3	1									1
CO3	3	2	1								1
CO4	3	2	1								1
CO5	3	2									1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Introduction to Integrated Circuits: Integrated Circuits: Basic Concepts, Package Types, Temperature ranges and it's Power supplies. Differential Amplifier- DC and AC analysis of differential amplifier configurations, Cascaded Differential Amplifier Stages and Level translator.

UNIT – II

Characteristics of Op-Amps: Block Diagram, Pin diagram and Equivalent Circuit of an Op-Amp, Ideal and practical characteristics of an Op-Amp, DC and AC characteristics, Op-Amp Configurations: Inverting, Non-inverting and Difference amplifiers.

Practice:

1. Construct basic Applications of Op-Amp – Adder, and Subtractor Circuits.

UNIT – III

Linear and Non-Linear Applications of Op- Amps: Linear Applications - Integrator and Differentiator, Instrumentation amplifier, AC amplifier, Non-Linear Applications-Comparators, Schmitt trigger, Waveform Generators: Sine wave generator - RC phase shift oscillator, Free-running Oscillator, One-shot Multivibrators, Triangular wave and Sawtooth wave generators, Logarithmic Amplifiers, Precision rectifiers.

Practice:

1. Design Integrator and Differentiator Circuits using Op-Amp 741.
2. Construct Waveform Generator using single Op-Amp with variable duty cycle.
3. Design Schmitt Trigger Circuits using Single OP-Amp with Reference voltage.
4. Design a Function Generator using Op-Amp 741.

UNIT – IV

D-A and A-D Converters: Introduction, Basic DAC techniques: Weighted Resistor DAC, R-2R and Inverted R-2R ladder DAC, Basic ADC techniques: Parallel Comparator type, Successive Approximation type and Dual Slope ADC. Active Filters: Introduction, Butter worth filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and All pass filter.

Practice:

1. Design an Active Filters1 – LPF, HPF (First order) using Op-Amp 741.
2. Design an Active Filters 2 – BPF and Band Reject (First order) filters using Op-Amp 741.

UNIT – V

Timers & Phase Locked Loops: Introduction to IC 555 timer, Functional diagram, Monostable and Astable operations and applications, PLL - Introduction, Block schematic, Principles and Description of individual blocks, IC 565 PLL and its Applications, IC 566 VCO Internal Diagram and Applications.

Practice:

1. Construct Astable multivibrator using IC 555 Timer.
2. Construct Mono stable multivibrator using IC 555 Timer.
3. Evaluate Capture range and Lock range using PLL IC565

Additional Practice:

1. Design a 4-bit R-2R Ladder network with Op-Amp Buffer and Measure the output waveform for various input combinations.
2. Design and Construct DC Power Supply using three terminal Voltage Regulators 78XX and 79XX
3. Construct Precision half-wave rectifier and full-wave rectifier using Op-Amp 741.

Text Books:

1. Op-Amps and Linear Integrated Circuits, Ramakant A. Gayakwad, Pearson Education, 4th Edition, ISBN: 978-9332549913.
2. Linear Integrated Circuits, D. Roy Chowdhury and Shail B. Jain, New Age International Ltd, 4th Edition, 2021, ISBN: 9788122472127.

Reference Books:

1. Design with Operational Amplifiers & Analog Integrated Circuits, Sergio Franco, McGraw Hill, 4th Edition, ISBN: 978-9352601943.
2. Op-Amps and Linear Integrated Circuits: Concepts and Applications, James M Fiore, Cengage Learning India Ltd, 1st Edition, ISBN: 978-8131512340.

Web Links:

1. http://nptel.ac.in/courses/117108038/Prof.Gunashekaran M.K/IISc Bangalore
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-3-circuits/op-amps
3. http://www.creativeworld9.com/2011/02/learn-linear-ic-applications

Linear Control Systems

	L	T	P	C
Course Code: 241EC008	**2**	**1**	**0**	**3**

Course Outcomes:

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

- **CO1:** Develop the overall transfer function using block diagram algebra and signal flow graphs.
- **CO2:** Identify time response specifications, error constants of second order systems.
- **CO3:** Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.
- **CO4:** Analyze the stability of LTI systems using frequency response methods.
- **CO5:** Develop state models for physical systems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1	3								1
CO2	2	3	1								1
CO3	2	3	2								1
CO4	2	3	2								1
CO5	2	2	3								1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	3	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Mathematical Modeling of Control Systems: Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor.

UNIT – II

Time Response Analysis: Standard test signals, Time response of first and second order systems, Time domain specifications, Steady state errors and error constants, Effects of proportional derivative, proportional integral systems.

UNIT – III

Stability and Root locus Technique: The concept of stability, Routh's stability criterion, limitations of Routh's stability, Root locus concept, construction of root loci.

UNIT – IV

Frequency Response Analysis: Introduction to Frequency domain specifications-Bode diagrams- transferfunction from the Bode Diagram-Phase margin and Gain margin stability Analysis from Bode Plots, Polar Plots,Nyquist Stability criterion, Lag, Lead, Lag-Lead compensators.

UNIT – V

State Space Analysis of LTI Systems: Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- 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.Nagarath and M.Gopal, Newage International Publications, 7th Edition, 2021, ISBN: 978-8195175581.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 7th Edition, ISBN: 978-8120309685.

Reference Books:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition, ISBN: 978-0071333269.
2. Control Systems, Manik Dhanesh N, Cengage publications, 4th Edition, ISBN: 978-8131518120.
3. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India, 5th Edition, ISBN: 978-9332550162.

Web Links:

1. https://www.electrical4u.com/state-space-analysis-of-control-system
2. https://nptel.ac.in/courses/107/106/107106081 by Dr.Ramkrishna Pasumarthy

Analog & Digital Communications

	L	T	P	C
Course Code: 241EC009	**2**	**0**	**2**	**4**

Course Outcomes:

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

CO1: Interpret the modulation and demodulation techniques of AM.
CO2: Explain the concepts of Angle modulation and demodulation.
CO3: Interpret the transmitter and receiver sections.
CO4: Infer Pulse analog modulation and demodulation Techniques.
CO5: Inspect the characteristics of Pulse Digital Modulation Techniques.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2						2	1		1
CO2	3	2						2	1		1
CO3	3	2						2	1		1
CO4	3	2						2	1		1
CO5	3	2						2	1		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Switching modulator, Envelope detector, DSBSC modulation - time and frequency domain description, Balanced Modulator, Coherent detection, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination, Demodulation of SSB Waves, Vestigial Side Band modulation and Demodulation.

Practice:

1. Generate amplitude modulated signal,determine the percentage modulation anddemodulate the modulated signal using envelope detector.

2. Generate AM-DSBSC modulated signal and demodulate the modulated signal.

UNIT – II

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone Frequency modulation, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Direct method- Reactance Modulator, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM, Concept of Pre-emphasis and de-emphasis.

Practice:

1. Generate frequency modulated signal, determine the modulation index and bandwidth, also demodulate the frequency modulated signal.
2. Plot the frequency response of pre-emphasis and de-emphasis circuits.

UNIT – III

Transmitters and Receivers: Classification of Transmitters, AM Transmitters, FM Transmitters Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superheterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

Practice:

1. Verify the characteristics of mixer.
2. Experimentally study the characteristics of a given AGC circuit.

UNIT – IV

Pulse Modulation: Types of Pulse modulation- Generation and Reconstruction of PAM, PWM and PPM.

Pulse Code Modulation: PCM Generation and Reconstruction, Non- Uniform Quantizationand Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM.

Practice:

1. Analyze the process of pulse amplitude modulation and demodulation.
2. Analyze the process of pulse position modulation and demodulation.

UNIT – V

Digital Modulation Techniques: ASK, FSK, BPSK and QPSK Modulators and Detectors, Differential PSK, QAM, Baseband Signal Receiver, Optimum Receiver, Calculation of Probability of Error.

Practice:

1. Observe the process of Frequency Shift Keying Modulation and Demodulation.

2. Verify the process of Phase ShiftKeying Modulation and Demodulation.

Additional Practice:

1. Verify the characteristics of receiver.
2. Verify the process of Differential Pulse Code Modulation andDemodulation.

Text Books:

1. Modern digital and analog communication systems by B.P.Lathi, Zhi Ding, oxford, 4thEdition, ISBN: 978-0199476282.
2. Introduction to Analog and Digital Communications by Simon Haykin, Wiley,2nd Edition, ISBN: 978-0-471-43222-7.
3. Analog and Digital Communication – K. Sam Shanmugam, Willey, 2018, ISBN: 9788126509140.

Reference Books:`

1. Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam Saha, McGraw-Hill, 4th Edition, ISBN: 978-1259029851.
2. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, Pearson, 5th Edition, 30 August 2019, ISBN: 978-0130494924.

Web Links:

1. https://archive.nptel.ac.in/courses/117/105/117105143/
2. https://onlinecourses.nptel.ac.in/noc21_ee74/preview
3. https://archive.nptel.ac.in/courses/108/102/108102096/
4. https://archive.nptel.ac.in/courses/117/101/117101051/

Digital Signal Processing

	L	T	P	C
Course Code: 241EC010	**2**	**0**	**1**	**3**

Course Outcomes:

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

- **CO1:** Summarize discrete time signals and systems in time and frequency domain.
- **CO2:** Compute the DFT using FFT algorithms.
- **CO3:** Design IIR filters using different techniques.
- **CO4:** Design FIR filters using different techniques.
- **CO5:** Extend the concept of single-rate signal processing to multi-rate signal processing.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2		1	2			2	2		1
CO2	3	2		1	2			2	2		1
CO3	3	2	3	1	2			2	2		1
CO4	3	2	3	1	2			2	2		1
CO5	3	2		1	2			2	2		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

UNIT – I

Introduction: Introduction to Digital Signal Processing: Discrete-time signals & sequences, Classification of discrete-time systems, stability and causality of LTI systems. Discrete-time Fourier Transform (DTFT), Frequency domain representation of discrete-time signals and systems. Linear Convolution, System function.

Practice:

1. Generation of basic signals (impulse,step,ramp,exponential,sine square,triangle).
2. Perform addition of two or more sinusoidal signals with different frequencies.

UNIT – II

Discrete Fourier Series & Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT)-Radix-2 decimation-in-time and decimation-in-frequency FFT Algorithms, Inverse FFT, Linear Convolution using Circular Convolution.

Practice:

1. Calculate the Discrete Fourier Transform (DFT) and Inverse Discrete FourierTransform (IDFT) of a given discrete signal.
2. Perform circular and linear convolution using DFT.

UNIT – III

Design of IIR Digital Filters & Realizations: Analog filter approximations-Butterworth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Direct form -I, Direct form -II, Cascade form and Parallel form realization of IIR systems.

Practice:

1. Obtain frequency response of IIR Low Pass Butterworth filters.
2. Obtain frequency response of IIR Low Pass Chebyshev filters.

UNIT – IV

Design of FIR Digital Filters & Realizations: Characteristics of FIR Digital Filters, Frequency response, Design of FIR Digital Filters using Window technique, Comparison of IIR & FIR filters, Direct form, Cascade form and Parallel form realization of FIR systems.

Practice:

1. Obtain frequency response of FIR Low Pass filter using Rectangular Window.
2. Obtain frequency response of FIR Low Pass filter using Hamming Window.

UNIT – V

Multirate Digital Signal Processing: Introduction, Decimation, Interpolation Sampling rate conversion, Implementation of Sampling rate converters, Applications: Sub-band Coding of Speech Signals, Implementation of Digital Filter Banks, Trans-multiplexers.

Practice:

1. Perform decimation and interpolation on signals.
2. Perform Sampling rate conversion on signals.

Text Books:

1. Digital Signal Processing, Principles, Algorithms and Applications, John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, ISBN: 978-9332535893.
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press, 1st Edition, ISBN: 978-0198081937.

Reference Books:

1. Discrete Time Signal Processing, A. V. Oppenheim and R. W. Schaffer, PHI, ISBN: 978-0131988422.
2. Multirate Systems and Filter Banks, P.P.Vaidyanathan, Pearson, 1st Edition, ISBN: 978-0136057185.

Web Links:

1. https://nptel.ac.in/courses/117/102/117102060/ (Digital Signal Processing by Prof. S.C. Dutta Roy, IIT Delhi)
2. https://nptel.ac.in/courses/117/102/117102060/(Digital Signal Processing - Video course, Coordinator BY Prof. S.C. Dutta Roy Department of Electrical Engineering IIT Delhi).
3. http://www.dspguide.com/pdfbook.htm
4. http://vlabs.iitkgp.ernet.in/dsp/

VLSI Design

	L	T	P	C
Course Code: 241EC011	**2**	**0**	**1**	**3**

Course Outcomes:

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

- **CO1:** Outline the fundamental concepts related to MOS and Bi-CMOS Circuits fabrication.
- **CO2:** Analyze the electrical properties of MOS and Bi-CMOS Circuits.
- **CO3:** Make use of design rules for developing stick and layout diagrams.
- **CO4:** Infer the physical circuit parameters in terms of scaling.
- **CO5:** Interpret the issues related to subsystem design.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2									1
CO2	3	2									1
CO3	3	2									1
CO4	3	2	1								1
CO5	3	2	1								1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Introduction: Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies.

Practice:

1. Digital circuit Simulation overview.
2. Digital circuits simulation and functional response verification of basic gates.
3. V-I Characteristics of nMOSFET & pMOSFET

UNIT – II

Basic Electrical Properties Of MOS and Bi-CMOS Circuits: Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and

Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up include the CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits. Realizationof gates using NMOS, PMOS and CMOS technologies.

Practice:

1. Digital circuits simulation and functional response verification of combinational circuits..
2. Realization of schematics and functional response verification of complex gates.

UNIT – III

MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General Observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form

Practice:

1. Layout extraction of basic gates
2. Layout Extraction of combinational circuits

UNIT – IV

Basic Circuit Concepts: Sheet Resistance, Sheet Resistanceconcept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance,The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches,

Practice:

1. Performing DRC for basic gates and combinational circuits.
2. Performing LVS / Netlist extraction for logic gates

UNIT – V

Scaling Of MOS Circuits: Scaling models, Scaling factors for device parameters, Limits due to sub-threshold currents, current density limits on logic levels, and supply voltage due to noise. Subsystem Design: Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, general considerations of subsystem design processesand an illustration of design processes.

Practice:

1. Performing LVS / Netlist extraction for complex gates and combinational circuits.
2. PEX estimation for the given logic circuits

Additional Practice:

1. Layout design for specific constraints (delay, power dissipation)
2. DRC / LVS / PEX verification of Multiplexer.
3. DRC / LVS / PEX verification of a given SOP(Z= (AB+C)D)'.

Text Books:

1. Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, ISBN:978-8120327726.
2. VLSI Design-Black Book By Dr. K.V.K.K. Prasad, Kattula Shyamala, Kogent Learning Solutions Inc, ISBN: 978-9350048047.

Reference Books:

1. VLSI Design, A. AlbertRaj & T. Latha, PHI Learning Private Limited, ISBN:978-8120334311.
2. VLSI Design, A.Shanthi and A. Kavita, New Age International Private Limited,First Edition, ISBN:978-8122418668.
3. VLSI Design By Debaprasad Das, Oxford University Press, ISBN: 978-0198067665.

Web Links:

1. https://www.southampton.ac.uk/~bim/notes/cad/
2. http://www.ece.utep.edu/courses/web5392/Lab_7.html
3. http://www.ece.utep.edu/courses/web5392/Notes.html
4. http://www.ittc.ku.edu/~jstiles/312/handouts/
5. https://www.mepits.com/tutorial/384/vlsi/steps-for-ic-manufacturing

Microprocessors & Microcontrollers

	L	T	P	C
Course Code: 241EC012	**2**	**0**	**1**	**3**

Course Outcomes:

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

CO1: Interpret the architecture of microcomputer systems.
CO2: Develop assembly language program for 8086.
CO3: Demonstrate the interfacing of peripherals to microprocessor.
CO4: Infer the architecture of 8051 microcontroller.
CO5: Demonstrate the interfacing of peripherals to 8051 microcontrollers.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	2	1	1			1	2		1
CO2	3	2	2	1	2			1	2		1
CO3	3	2	2	1	2			1	2		1
CO4	3	1	2	1	2			1	2		1
CO5	3	1	2	1	2			1	2		1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		2
CO2		2
CO3		2
CO4		2
CO5		2

UNIT – I

Introduction: Overview of microcomputer systems and their building blocks, Basic Microprocessor architecture, 8086 Microprocessor, Main features, 8086 internal architecture, Register Organization of 8086.Memory Segmentation.Pin description of 8086, Physical Memory Organization, system timing, minimum mode and maximum mode configuration, interrupt structure and Interrupt Vector table.

Practice:

1. Introduction to MASM Software.

UNIT – II

8086 Programming: Instruction set, addressing modes, assembler directives, writing programs with an assembler, assembly language program development tools.

Practice:

1. Write an Assembly language program to perform Arithmetic operations on 8 bit data.
2. Write an Assembly language program to perform Multi byte addition and subtraction.
3. Write an Assembly language to sort the given numbers in an ascending order.
4. Write an Assembly language program to move block of data.
5. Write an Assembly language program to compare the given strings.

UNIT – III

8086 Interfacing: Memory Interfacing: Semiconductor memories interfacing (RAM, ROM).

I/O Interfacing: 8255 programmable peripheral interface- Interfacing of switches and LEDS, keyboard interfacing, Interfacing of stepper motor, Interfacing of A/D and D/A converters. 8237 DMA controller, 8259 programmable interrupt controller.

Practice:

1. Interface DAC to 8086 using 8255 to generate square wave and triangular wave.
2. Interface stepper motor to 8086 using 8255 to rotate clockwise and anti clock wise directions.

UNIT – IV

Intel 8051 Microcontroller: Features, pin description, architecture, external memory connection, counters and timers, serial data input/output ports, interrupts,instruction set, addressing modes, programs.

Practice:

1. Introduction to KEIL Software.
2. Write an ALP to find Number of 1's and number of 0's in a given 8-bit.
3. Write an ALP to generate square wave using Timer control.

UNIT – V

8051 Interfacing: Interfacing of A/D and D/A converters, keyboard, displays (LED, 7-segment display unit and LCD) and Stepper motor.

Practice:

1. Interface 7-Segment Display to 8051using proteus software.

Text Books:

1. Microprocessors & Interfacing, Douglas V Hall, McGraw Hill, Revised 3rd Edition, ISBN: 978-1259006159.
2. The 8051 Micro Controller Architecture, Programming and Applications, Kenneth J Ayala, Thomson Publishers, 2nd Edition, ISBN: 978-0314201881.

Reference Books:

1. Advanced Microprocessors and Interfacing, K.M. Bhurchandi, A.K. Ray, Tata McGraw Hill, 3rd Edition, ISBN: 978-1259006135.
2. The 8051 Microcontrollers and Embedded systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2nd Edition, ISBN: 978-8131758991.

Web Links:

1. https://archive.nptel.ac.in/courses/108/103/108103157/
2. https://archive.nptel.ac.in/courses/106/108/106108100/

Antenna & Microwave Engineering

	L	T	P	C
Course Code: 241EC013	**2**	**0**	**2**	**4**

Course Outcomes:

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

- **CO1:** Make comment on various antenna performance parameters.
- **CO2:** Infer the fields and patterns of different antennas.
- **CO3:** Explain the behavior of different RF and Microwave antenna structures.
- **CO4:** Explain the characteristics of wave guide structures and its performance.
- **CO5:** Apply different measurement techniques at Microwave range on Active and Passive devices todetermine their properties.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1					1	1		
CO2	3	2	1					2	2		
CO3	2	2						2	2		
CO4	3	2		1				1	1		
CO5	3	2	1					1			1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	3	
CO2	2	
CO3	3	
CO4	2	
CO5	2	

UNIT – I

Antenna Fundamentals: Introduction, Radiation Mechanism, Single wire and Two wire antenna, Half wave dipole, Basic Antenna Parameters, Radiation Pattern, Beam width, Radiation Intensity, Directivity and Gain, Antenna aperture, Beam efficiency, Effective antenna height, Antenna bandwidth, Input impedance, Antenna temperature and FRIIS transmission equation.

Practice:

1. Measurement of radiation pattern of an antenna.

UNIT – II

Antenna Arrays: Introduction-2-element arrays – different cases, Principle of Pattern Multiplication, N-element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity (no derivations).

UNIT – III

VHF, UHF and Microwave Antennas: Folded Dipoles and their characteristics, Arrays with Parasitic Elements, Yagi - Uda Arrays. Helical Antennas – Significance, Geometry, Design Parameters; Parabolic Reflector Antenna, Horn Antennas–Types and analysis.**Antenna Measurements:** Set up, Pattern measurement, Impedance measurement, Directivity and Gain measurements.

Practice:

1. Measurement of gain of an antenna

UNIT – IV

Microwave transmission lines: History of microwaves, Microwave Frequency bands, Characteristics, advantages, disadvantages and applications, Analysis of Microwave Transmission Lines- Rectangular waveguide.

Multiport networks: Overview on wave guide discontinuities-Irises, Tuning Screws, Posts and Matched loads. S-Matrix calculations and analysis for E-plane and H-plane Tees, Magic Tee and Directional Coupler.

Practice:

1. Measurement of Directional Coupler characteristics.
2. Measurement of Circulator characteristics.

UNIT – V

Microwave Tubes: Limitations and Losses of conventional tubes at microwave frequencies, Two Cavity Klystron - Velocity Modulation and Applegate Diagram, Bunching Process. Reflex Klystron - Applegate Diagram and Principle.

Microwave Measurements: Measurement of Power, Impedance, Attenuation, and VSWR.

Practice:

1. S/N & C/N measurement by using Satellite Tx. and Rx. Set up.
2. Frequency Measurement by using Doppler RADAR Set up.

3. Measurement of VSWR using microwave bench.
4. Measurement of Reflex Klystron Characteristics.
5. Measurement of Attenuation of a given RF Slot.
6. Measurement of GUNN Diode (TED) V-I Characteristics.

Additional Practice:

1. Measurement of waveguide parameters.
2. Measurement of antenna parameters by using Antenna Trainer.
3. Measurement of transmission/reception characteristics by using Satellite Tx. and Rx. Set up.
4. Measurement of transmission/reception characteristics by using Satellite Tx and Rx Set up.

Text Books:

1. Antenna Theory analysis and design, Constantine A. Balanis, John Wiley publication, 4th Edition, ISBN: 978-1118642061.
2. Microwave Devices and circuits, Samuel Y. Liao, PHI, 3rd Edition, ISBN: 978-8177583533.

Reference Books:

1. Antenna & Wave Propagation, K. D. Prasad, Khanna Publication, Revised and enlarged Edition, 2021, ISBN: 978-8176840255.
2. Antennas and Wave Propagation, John D. Kraus and Ronald J. Marhefka, TMH, 5th Edition, ISBN: 978-9352606184.
3. Microwave Engineering, Sushrut Das, Oxford University Press, ISBN: 9780198094746.
4. Microwave Engineering, David M Pozar, John Wiley, 4th Edition, ISBN: 978-1119770619.

Web Links:

1. http://www.amanogawa.com/antenna.html
2. http://nptel.ac.in/courses/117107035/byDr. Amalendu Patnaik
3. http://www.radio-electronics.com/info/antennas/
4. http://www.radartutorial.eu/index.en.html