School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Credit Definition

Type	Duration (in Hour)	Credit
Lecture (L)	1	1
Tutorial (T)	1	1
Practical (P)	2	1

Total Credit

Year	Semester	hrs./Week	Credit
1st	1st	27	21
	2nd	30	23
2nd	3rd	27	23
	4th	29	23
3rd	5th	27	24
	6th	26	21
4th	7th	24	21
	8th	27	16
Total			**172**

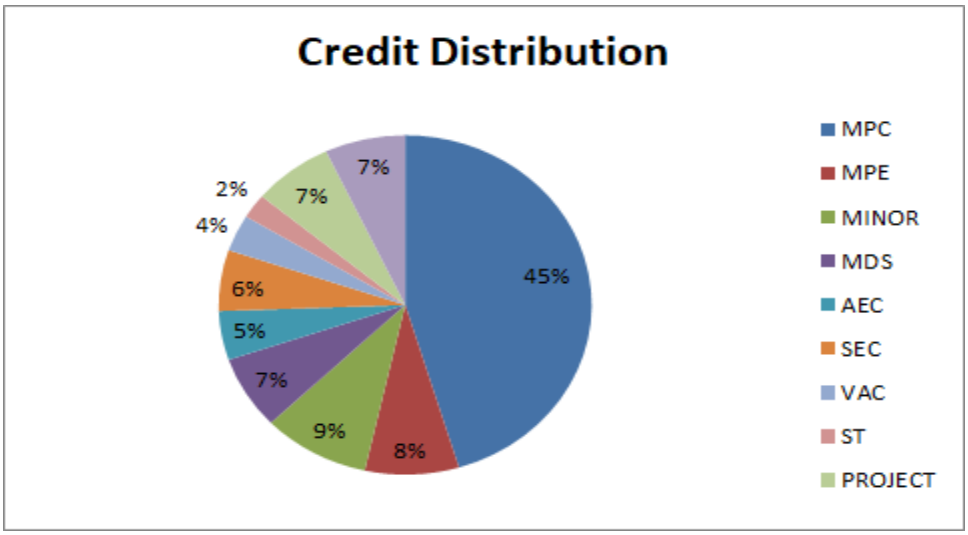
Category Codification with Credit Break up

Definition of Category	Code	No	Credit
Major Program Core Course	MPC	1	78
Major Program Elective Course	MPE	2	14
Minor Course	MN	3	16
Multidisciplinary Course	MDC	4	12
Skill Enhancement Course	SEC	5	10
Ability Enhancement Course	AEC	6	8
Value Aided Course	VAC	7	6
Summer Training	ST	8	4
Project	PR	9	12
Vocational Course	Voc	10	12
Total			**172**

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Category wise Credit Distribution



SEMESTER: I

Mandatory Induction Program – Duration 3 weeks

Physical Activity Creative Arts Universal Human Values Literary Proficiency Modules Lectures by Eminent People Visits to Local Areas Familiarization to Department/Branch & Innovations

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Sl No.	Course Name	Course Type	Course Code	Credit	Type			
					L	T	P	
1	Engineering Physics	MDS		3	3	0	0	
2	Engineering Mathematics	MDS		3	3	0	0	
3	Basic Electrical and Electronics Engineering	MPC		3	3	0	0	
4	Engineering Graphics -I	SEC		1	0	0	2	
5	Programming for problem Solving using C	MPC		3	3	0	0	
6	Physics Lab	MDS		1	0	0	2	
7	Basic Electrical and Electronics Engineering Lab	MPC		1	0	0	2	
8	Programming for problem Solving using C Lab	MPC		1	0	0	2	
9	Communicative English I	AEC		2	2	0	0	
10	NCC/YOGA	Voc NM1		1	0	0	2	
11	Vocational-Soft Skill Development-I	Voc NM2		1	0	0	2	
	Total (Major-8, MDS-7, AEC-2, SEC-1, Voc-2)			20	26HR./WEEK			

Engineering Physics: Credit 3 (3-0-0)

Module-I : Oscillation and fundamental of wave optics: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple springs mass system. Resonance-definition., damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

Module-II : Basic Idea of Electromagnetisms, Maxwell's Equations: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster‟s law, double refraction.

Module III: Quantum Mechanics and Crystallography: Introduction - Planck‟s quantum theory- Matter waves, de- Broglie wavelength, Heisenberg‟s Uncertainty principle, time independent and time dependent Schrödinger‟s wave equation, Physical significance of wave function, Particle in a one dimensional potential box, Heisenberg Picture. Crystallography - Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Debye Scherrer powder method, laue method- Atomic packing factor for SC, BCC, FCC and HCP structures. Semiconductor Physics - conductor, semiconductor and Insulator; Basic concept of Band theory.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Module IV: Laser and Fiber optics: Einstein‟s theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO2 and Neodymium lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.

Module V: Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes, third law of thermodynamics.

Text & Reference books:

Text Books:

1. Beiser A, “Concepts of Modern Physics”, Fifth Edition, McGraw Hill International.
2. David Halliday, Robert Resnick, Jearl Walker, “Fundamentals of Physics”, Wileyplus.

Reference Books:

3. Ajoy Ghatak, “Optics” Fifth Edition, Tata McGraw Hill.
4. Sears & Zemansky, “University Physics", Addison-Wesley.
5. Jenkins and White, “Fundamentals of Optics”, Third Edition, McGraw-Hill.

List of practical

Practical-1: Magnetic field along the axis of current carrying coil – Stewart and Gee

Practical-2: Determination of Hall coefficient of semi-conductor

Practical-3: Determination of Planck constant

Practical-4: Determination of wavelength of light by Laser diffraction method

Practical-5: Determination of wavelength of light by Newton‟s Ring method

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Practical-6: Determination of laser and optical fiber parameters

Practical-7: Determination of Stefan‟s Constant

Engineering Mathematics: Credit 3 (3-0-0)

Module I. Matrix and Determinants

Determinants and its properties (up to 3rd order), Minors and cofactors.

Matrices: addition, multiplication and transpose of a matrix. Symmetric and skew-symmetric matrices and their properties. Adjoint, inverse matrix, rank of a matrix, solution of Linear Equations by using Gauss Elimination, LU decomposition method.

Module II. Vector spaces

Vector space; Dimension; Basis; Orthogonality; Projections; Gram-Schmidt orthogonalization.

Eigenvalues and Eigenvectors; Positive definite matrices; Linear transformations; Hermitian and unitary matrices.

Module III. Differential equations

Order, degree, formation of differential equations. First order differential equations – exact, non-exact, linear and Bernoulli's form. Second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, system of differential equations. Simple applications of differential equations.

Module IV. Complex analysis

Complex Functions, Continuity and Differentiability of Complex Valued Functions, Cauchy-Riemann equations. Analytic functions, Zeros of analytic functions. Complex integration, Jordan's Lemma. Cauchy's theorem, Cauchy integral formula, Maximum modulus principle. Analytic continuation, Laurent series. Singularities, Classification of singularities, Cauchy's residue theorem. Evaluation of some integrals, Conformal mapping, Mobius transformation.

Text Books:

1.Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers.

2.G. F.Simmons, Differential Equations, Tata Mc Graw Hill 14

3.D.A. Murray, Introductory course in Differential Equations, Orient and Longman

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

4.H.T. H.Piaggio, Elementary Treaties on Differential Equations and their applications

5.R. V. Churchill and J. W. Brown , Complex Variables and Applications: Mcgraw-Hill; New York; 1996

Reference Books:

1.Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Cengage Learning.

2. Advanced Engineering Mathematics, (Second Edition), Michael. D. Greenberg, Pearson.

3. Introduction to linear algebra, (Fifth Edition), Gilbert Strang, Wellesley-Cambridge Press.

4.Applied Mathematics (Vol. I & II), P. N. Wartikar & J. N. Wartikar, Pune Vidyarthi Griha Prakashan.

5.S. Ponnusamy , Foundation of Complex Analysis, Narosa Publishing House, ISBN: 9788173196294

Basic Electrical and Electronics Engineering: Credit 3 (3-0-0)

UNIT I - ELECTRICAL CIRCUITS
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws, Active and passive components, Steady state analysis of RLC circuits (Simple problems only), Network theorems.

UNIT II - BASIC ELECTRONICS
Conductor, semiconductor, insulator- band diagrams, Semiconductor Materials: Silicon & Germanium. Intrinsic and extrinsic semiconductors, charge carriers, excess carriers in semiconductor, PN junction

UNIT III - DIGITAL ELECTRONICS
Review of number systems, binary codes, boolean algebra, Logic gates, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT IV- MEASUREMENTS AND INSTRUMENTATION
Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Oscilloscope

Text and Reference Books

1. Kothari DP and I. J. Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. Ben G. Streetman and Sanjay Banerjee "Solid State Electronic Devices", PHI Learning Private Ltd.
3. S. K. Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
4. Millman & Halkias – Integrated Electronics, Tata McGraw Hill
5. Sedra & Smith -Microelectronics Engineering-Oxford

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

6. Boyelstad & Nashelsky - Electronic Devices & Circuit Theory – PHI
7. R. P. Jain—Modern Digital Electronics, 2/e ,McGraw Hill
8. D. RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
9. A. K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Basic Electrical and Electronics Engineering Lab: Credit 1 (0-0-2)

List of Experiments

1. Identification of components, series and parallel connections

2. Verification of Ohms and Kirchhoff's Laws.

3. Response of RC, LC and RLC circuits

4. Characteristics of PN junction Diodes

5. Study of Logic Gates

6. Universal gates

7. Implementation of boolean expressions

8. Study of DSO

Engineering Graphics I: Credit 1(0-0-2)

Introduction to Technical Drawing Standard: Technical Drawing, ISO Standard, Paper Size, Layout, Line, Scale, Title Block, Application of lines, drawing folding, view, projection, auxiliary view.

Section and Dimension: Section and hatch, type of hatch. Coordinate and dimension, Chain dimension, Parallel dimension, Combined dimension, Coordinates dimension, Chord, Arc, Angle, Chamfer, Countersink, Dimension of Cylinder part, cubical part, sheet metal part.

Tolerance: Classification of tolerance, Linear tolerance, Angular Tolerance, Special tolerance. Tolerance indication. Bilateral and Unilateral tolerance, tolerance and fit, geometrical tolerance.

Parts, Welding and Assembly: Introduction standard parts, part drawing. Introduction to welding, welding symbols and indication to drawing, assembly drawing.

TYPES OF LINES, LETTERING & DIMENSIONING: Demonstrate and explain the use of various types of lines. Demonstrate the principle of single stroke, gothic lettering & numerals as per BIS.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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SCALES Significance of scales in drawing; different scales. Define and draw plain sale and diagonal sale.

CURVES Explain Conic sections with illustration, Explain terms like focus, vertex, directrix and eccentricity. Draw conics sections by eccentricity method – Ellipse, Parabola and Hyperbola. Draw Ellipse by concentric circle method sand arc of circle method. Draw parabola by Rectangle Method and Tangent Method.

SYMBOLIC REPRESENTATION – DIFFERENT SYMBOLS USED IN THE TRADES:

Fastener (Rivets, Bolts and Nuts), Bars and profile sections, Weld, Brazed and soldered joints, Electrical and electronics element, Piping joints and fitting

FREE HAND DRAWING: Lines, polygons, ellipse etc., Geometrical figures and blocks with dimension, Transferring measurement from the given object to the free hand sketches. Solid objects – Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone with dimensions. Free hand drawing of hand tools and measuring tools, simple fasteners (nuts, bolts, rivets etc.) trade related sketches.

Text Books:

1. "Technical Drawing", Authors: Giesecke, Mitchell, Spencer, Hill, Dygdon, Novak, Publisher: Pearson, Prentice Hall, ISBN:0-13-178446-3

2. "Technical Drawing", Publisher: ISO Standard Handbook, ISBN: 178446 – 3

Fundamentals of Computer Sc. & Problem Solving using C: Credit 3 (3-0-0)

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.

Number Systems: Binary, Octal, Decimal, and Hexadecimal.

Problem Solving approach: Algorithm, structure of algorithm, running time, formulate simple algorithm for arithmetic and logical problems.

Imperative languages: Introduction to python programming language; syntax and constructs of a specific language.

Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes, Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation.

Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else statement, Loops: while, do-while, for. Concept of break, continue and pass statement.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, Block structure, Initialization, Recursion and return types. Concept of module and packages.

Basic concepts of tuple, list, dictionary and string. Linear and Binary Search, Selection and Bubble Sort. File handling

Text Books:

1. Byron S Gottfried "Programming with C" Second edition, Tata McGrawhill, 2007, (Paper back)

2. R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.

3. Kanetkar Y, "Let us C", BPB Publications, 2007.

4. Hanly J R & Koffman E.B, "Problem Solving and Programm design in C", Pearson

Education, 2009.

Reference Books:

1. E. Balagurusamy, "Programming with ANSI-C", Fourth Edition,2008, Tata McGraw Hill.

2. Venugopal K. R and Prasad S. R, "Mastering 'C'", Third Edition, 2008, Tata McGraw Hill.

3. B.W. Kernighan & D. M. Ritchie, "The C Programming Language", Second Edition, 2001,

Pearson Education

4. ISRD Group, "Programming and Problem Solving Using C", Tata McGraw Hill,2008.

5. Pradip Dey , Manas Ghosh, "Programming in C", Oxford University Press, 2007

List of practical

Practical-1: Algorithm and flowcharts of small problems like GCD

Practical-2: Structured code writing with: Small but tricky codes

Practical-3: Proper parameter passing

Practical-4: Command line Arguments

Practical-5: Variable parameter

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Practical-6: Make file utility

Practical-7: Multi module program

Communicative English I: Credit 2(2-0-0)

Grammar:

Noun and Pronoun (Types and Functions), Verbs (Lexical and Auxiliary), Verb Tenses, Adjectives and Adverb, Article and Preposition, Conjunction, Phrases, Clause (Noun, Adjective, Adverb), Sentence Types (Simple, Compound and Complex), Transformations (Active-Passive, Direct-Indirect)

Vocabulary:

One-word Substitution, Homophones, Proverbs, Synonyms and Antonyms

Phonetics:

Air-stream Mechanism, Vowel and Consonant Sounds, Intonation

Communication Theory:

Definition of Communication, Types of Communication (Verbal & Non-Verbal; Formal & Informal; Intra- personal, Inter-personal, Extra-personal, Group, Mass), Flows of Communication (Vertical, Horizontal and Diagonal), Barriers of Communication

Comprehension:

Reading and Comprehension, Objective and Subjective Questions.

Text Books:

1. Intermediate English Grammar- Cambridge University Press
2. High School English Grammar- Wren and Martin

Reference Books:

3. English vocabulary in use – Alan Mc‟carthy and O‟dell

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

4. APAART: Speak Well 1 (English language and communication)

5. APAART: Speak Well 2 (Soft Skills)

SEMESTER: II

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Engineering Chemistry	MDS		3	3	0	0
2	Numerical Analysis and Optimisation Technique	MPC		3	3	0	0
3	Electronic Devices	MPC		3	3	0	0
4	Engineering Graphics -II	SEC		1	0	0	2
5	Introduction to Python	MPC		3	3	0	0
6	Chemistry Lab	MDS		1	0	0	2
7	Numerical Analysis and Optimisation Technique Lab	MPC		1	0	0	2
8	Electronic Devices Lab	MPC		1	0	0	2
9	Introduction to Python Lab	MPC		1	0	0	2
10	Communicative English II	AEC		2	2	0	0
11	Environmental Science	VAC		2	2	0	0
12	Vocational-Soft Skill Development-II	VocNM3		1	0	0	2
13	NCC/YOGA	Voc NM4		1	0	0	2
	Total (Major-8, MSD-4, AEC-2, SEC-5, VAC-2,Voc -2)			23			30Hrs./Week

Engineering Chemistry: Credit 3 (3-0-0)

Thermodynamics of Chemical Processes: Concept of entropy, Chemical potential, Equilibrium conditions for closed systems, Phase and reaction equilibria, Maxwell relations, Real gas and real solution.

Electrochemical Systems: Electrochemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and pH, corrosion.

Kinetics of Chemical Reactions: Reversible, consecutive and parallel reactions, Steady state approximation, Chain reactions, Photochemical kinetics.

Bonding Models in Inorganic Chemistry: Molecular orbital theory, Valence-bond theory, Crystal field theory.

Fundamentals of Microwave, IR and UV-VIS Spectroscopy: Basic concepts of spectroscopy, Selection rule, Determination of molecular structure.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Coordination Chemistry: Coordination numbers, Chelate effect, Coordination complexes and application, Bio-inorganic chemistry: Metal ions in Biological systems, environmental aspects of Metals, NOx, CO, CO2.

Organic Reaction Mechanism: Mechanisms of selected organic, bio-organic, polymerization and catalytic reactions. Stereochemistry of Carbon Compounds: Selected Organic Compounds: Natural products and Biomolecules (Amino acids/nucleic acids/proteins).

Laboratory Component:

Surface tension and parachor, Measurement of the coefficient of viscosity: CMC of a surfactant, Conductometric titration, pH-metric/potentiometric titration, Solubility product, Kinetics of ester hydrolysis, Estimation of Fe2+, EDTA titration, Estimation of base content and acid content of commercially available antacid and vitamin C respectively, Synthesis of Mohr‟s salt, Synthesis of aspirin, Demonstration of a few important physico-chemical processes. (e.g. Gel electrophoresis, Oscillatory reactions)

Text Books:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi

2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell

Reference Books:

4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, M. S. Krishnan

5. Physical Chemistry, P. C. Rakshit, Sarat Book House

Numerical Analysis and Optimisation Technique: credit 3 (3-0-0)

Module I

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

Module II

Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Module III

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.

Module IV

INTRODUCTION : Concept of optimization – classification of optimization

Module V

LINEAR PROGRAMMING: Examples of linear programming problems –formulation simplex methods variable with upper bounds – principle duality –dual simplex method - sensitivity analysis – revised simplex procedure – solution of the transportation problem – assignment – network minimization – shortest route problem.

Module VI

QUEUING THEORY: Queuing Model, poison and exponential distributions –Queues with combined arrivals and departures-random and series queues.

Module VII

UNCONSTRAINED OPTIMIZATION: Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convegence – unibariate search – steepest and descent methods

Unit VIII

CONSTRAINED OPTIMIZATION: Necessary and sufficient condition – equality constraints, inequality constraints -kuhu – tucker conditions – gradient projection method.

Text Books:

1. C.Xavier: C Language and Numerical Methods.

2. Dutta & Jana: Introductory Numerical Analysis.

3. J.B.Scarborough: Numerical Mathematical Analysis.

4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

5. Rao S.S,"Optimization Theory and applications", Wiley Easter Ltd., 1979.

6. David G.Luerbeggan, "Introduction to Linear and Non Linear

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Programming", Addison Wesley Publishing Co. 1973.

References:

1. Balagurusamy: Numerical Methods, Scitech.

2. Baburam: Numerical Methods, Pearson Education.

3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.

5. Srimanta Pal: Numerical Methods,

6. Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970

List of Experiments

1. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica

2. Assignments on Newton forward /backward, Lagrange's interpolation.

3. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule.

4. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.

5. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.

6. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.

7. Verify the descent conditions for a given search direction for unconstrained optimization problem and calculate step size along search direction using Equal Interval Search method numerically and verify results by using MATLAB

8. Solve nonlinear optimization problems by using numerical optimization methods (indirect) steepest-descent and verify the results by using MATLAB

9. Solve LPP by two-phase simplex method numerically and verify the results by using MATLAB

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Electronic Devices: Credit 3 (3-0-0)

Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams.

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors

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

Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model.

MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor.

LED, photodiode and solar cell.

Text /Reference Books:

1. Ben G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson, 2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991. 5. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press, 2011.

Laboratory Experiments:

1. CHARACTERISTICS OF PN JUNCTION DIODE

a) To Plot the Volt Ampere Characteristics of PN Junction Diode under Forward and Reverse Bias Conditions.
b) To find the Cut-in voltage, Static Resistance, Dynamic Resistance for Forward Bias & Reverse Bias

2. CHARACTERISTICS OF ZENER DIODE & LOAD REGULATION

a) To Obtain the Forward Bias and Reverse Bias characteristics of a Zener diode.
b) Find out the Zener Breakdown Voltage from the Characteristics.
c) To Obtain the Load Regulation Characteristics.

3. COMMON BASE BIPOLAR TRANSISTOR CHARACTERISTICS

a) To plot the Input and Output characteristics of a transistor connected in Common Base Configuration

4. COMMON EMITTER BIPOLAR TRANSISTOR CHARACTERISTICS

a) To plot the Input and Output characteristics of a transistor connected in Common Emitter

5. JFET DRAIN & TRANSFER CHARACTERISTICS (COMMON SOURCE)

a) Drain characteristics

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

b) Transfer Characteristics.
c) To find rd, gm, and μ from the characteristics.

6. Study Characteristics of Photo transistor
7. Study Characteristics of LED & LDR

Engineering Graphics II

OTHOGRAPHIC PROJECTIONS: Demonstrate the principles of 1st angle and 3rd angle projections with the help of models and draw symbols.

PROJECTION OF POINTS AND LINES: Draw projection of points, Draw projection of straight line (parallel to both planes, parallel to one and perpendicular to other, parallel to one and inclined to other and inclined to both reference planes).

PROJECTION OF PLANES: Draw plane figure such as squares, rectangles, triangles, circle, Pentagon and hexagon (perpendicular to one plane and inclined to other).

PROJECTIONS OF SOLIDS: Draw projections of solids such as prism, cylinder, cone, tetrahedron and pyramid in simple position (with axis parallel to one reference plane and perpendicular to other reference plane).

ISOMETRIC PROJECTIONS Draw isometric view & Isometric projection of prism, pyramid, cone & cylinder with axis horizontal and vertical with construction of isometric scales.

PRACTICES ON AutoCAD Introduction-Settings, Limits etc. Auto CAD commands: Draw commands (Line, circle, are polygon, ellipse, rectangle). Edit command, Dimension commands and Modify Commands for two dimensional drafting only. Exercise for practice using Auto CAD.

Orthographic projections of lines, planes sand solids as per previous chapter, Isometric projection.

Books Recommended
1. Machine Drawing by Basudeb Bhattacharya, Oxford University Press.
2. A Text Book of Engineering Drawing by Dr. R.K. Dhawan.
3. A Text Book of Engineering Graphics & Auto CAD by K Venugopal.
4. A Text book of Engineering Drawing by N.D. Bhatt.
5. Engineering Drawing by P.S. Gill.
6. An Introduction to Auto CAD – 2012 by George Omura, Willey India Publishers.

Introduction to Python 3(3-0-0)

Introduction, Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit()

Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling.

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods

Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things.
Manipulating Strings - Working with Strings, Useful String Methods.

Pattern Matching with Regular Expressions: Finding Patterns of Text without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching,
Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re.IGNORECASE, re .DOTALL, and re .VERBOSE.

Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function.
Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module.

Web Scraping: Project: MAPIT.PY with the web browser Module, Downloading Files from the Web with the requests Module, Saving
Downloaded Files to the Hard Drive, HTML.
Working with Excel Spreadsheets: Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts.

Text Book:

1. Al Sweigart, “Automate the Boring Stuff with Python”, William Pollock, 2015, ISBN: 978-1593275990.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Laboratory Experiments:

A) Write a program to create a menu with the following operations

1. TO PERFORM ADDITITON

2. TO PERFORM SUBSTRACTION

3. TO PERFORM MULTIPICATION

4. TO PERFORM DIVISION

Accepts users input and performs the operation accordingly. Use functions with arguments.

B) Write a python program to check whether the given string is palindrome or not.

C) Write a python program to find factorial of a given number using functions

D) Write a Python function that takes two lists and returns True if they are equal otherwise false

1. Write a program to double a given number and add two numbers using lambda()?

2. Write a program for filter() to filter only even numbers from a given list.

3. Write a program for map() function to double all the items in the list?

4. Write a program to find sum of the numbers for the elements of the list by using reduce()?

5. A) Demonstrate a python code to implement abnormal termination?

   B) Demonstrate a python code to print try, except and finally block statements

   C) Write a python program to open and write “hello world” into a file

6. A) Write a python program to get python version.

   B) Write a python program to open a file and check what are the access permissions acquired by that file using os module?

   C) Write a python program to display a particular month of a year using calendar module.

   D) Write a python program to print all the months of given year.

7. A) Write a python program to print date, time for today and now.

   B) Write a python program to add some days to your present date and print the date added.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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C) Write a python program to print date, time using date and time functions

D) Write a python program which accepts the radius of a circle from user and computes the area (use math module).

8. A) Write a python program to create a package (college),sub-package (alldept),modules(it,cse) and create admin and cabin function to module?

B) Write a python program to create a package(Engg), sub- package(years),modules (sem) and create staff and student function to module?

9. A) Write a python Program to display welcome toMRCET by using classes and objects.

B) Write a python Program to call data member and function using classes and objects

C) Write a program to find sum of two numbers using class and methods

D) Write a program to read 3 subject marks and display pass or failed using class and object.

10. A) Using a numpy module create an array and check the following:

1. Type of array

2. Axes of array

3. Shape of array

4. Type of elements in array

B) Using a numpy module create array and check the following:

1. List with type float

2. 3*4 array with all zeros

3. From tuple

4. Random values

C) Using a numpy module create array and check the following:

1. Reshape 3X4 array to 2X2X3 array

2. Sequence of integers from 0 to 30 with steps of 5

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B. Tech Electronics and Communication Engineering

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3. Flatten array

4. Constant value array of complex

11 A) Write a python program to concatenate the data frames with two different objects

B) Write a python code to read a csv file using the pandas module and print the first and last five lines of a file.

12. A) Write a python code to set background color and pic and draw a circle using turtle module

B) Write a python code to set background color and pic and draw a square and fill the color using turtle module

C) Write a python code to perform addition using functions with the pdb module.

Communicative English – II

Grammar:

Verbs- Gerund, Participle, Infinitives, Modal Verbs; Adjectives- Degree of Comparison, Transformation (Positive, Comparative, Superlative); Moods - Declarative, Imperative, Exclamatory, Interrogative, Subjunctive, Optative, Conditional; Prepositions- Simple, Compound, Phrase

Vocabulary:

One-word Substitution, Homophones, Figures of Speech (simile, metaphor), Business Idioms

Communication Theory:

Audience Analysis, 7 Cs of Communication, SWOT Analysis

Comprehension:

1. Reading and Comprehension, Objective and Subjective Questions

2. Understanding Visual Data- Graphs, Charts, Tables

Writing:

Business Letters- Application, Complaints, Order, Collection, Sales Promotional Letter; Notice, Memorandum, Agenda, Minutes, Advertisements.

Text Books

1. High School English Grammar by Wren and Martin

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B. Tech Electronics and Communication Engineering

2. Developing Communication Skills by Krishna Mohan and Meera Banerji

Reference Books:

3. Technical Communication- Meenakshi Raman and Sangeeta Sharma

4. Professional Communication by Ashraf Rizvi

SEMESTER: III

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Digital System Design	MPC		3	3	0	0
2	Signals & Systems	MPC		3	3	0	0
3	Network Theory	MPC		3	3	0	0
4	Probability Theory and Stochastic Process	MPC		3	2	1	0
5	Data Structure & Algorithm	SEC		3	3	0	0
6	Digital System Design Lab	MPC		1	0	0	2
7	Signals & Systems Lab	MPC		1	0	0	2
8	Data Structure & Algorithm Lab	SEC		1	0	0	2
9	Basc Management	VAC		3	3	0	0
10	Foreign Language - I - Spanish						
	Foreign Language - I - German						
	Foreign Language - I - Japanese						
	Foreign Language - I - French	AEC		2	2	0	0
11	Vocational-Soft Skill Development-III	Voc NM5		1	0	0	2
	Total (Major-14, SEC-4, AEC-2, VAC-2, Voc-1)			**24**	**28Hrs./Week**		

Digital system Design: Credit 4 (3-1-0)

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

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half andFull Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM,Algorithmic State

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

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

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

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition ,2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

Laboratory Experiments:

1. Introduction to Digital Electronics Lab- Nomenclature of Digital Ics, Specifications, Study of the Data Sheet, Concept of Vcc and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs.
2. Implementation of the Given Boolean Function using Logic Gates in Both Sop and Pos Forms.
3. Verification of State Tables of Rs, J-k, T and D Flip-Flops using NAND & NOR Gates
4. Implementation and Verification of Decoder/De-Multiplexer and Encoder using Logic Gates.
5. Implementation of 4x1 Multiplexer using Logic Gates.
6. Implementation of 4-Bit Parallel Adder Using 7483 IC.
7. Design , and Verify the 4- Bit Synchronous Counter
8. Design, and Verify the 4-Bit Asynchronous Counter.
9. Simulation of MOS Inverter with different loads using PSPICE software
10. Simulation of CMOS Inverter for different parameters Kn, Kp as a design variable in suitable circuit simulator software.
11. Design of a 4-bit Multiplexer using VHDL\Verilog
12. Design of a decade counter using VHDL\Verilog.
13. Design of a 3-input NAND gate and its simulation using suitable logic simulator

Signals and Systems Credit 3 (3-0-0)

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

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases,

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

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

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.

Laboratory Experiments:.
1.GENERATIN OF VARIOUS SIGNALS AND SEQUENCE

2. OPERATION ON SIGNALS AND SEQUENCES

3. FOURIER TRANSFORMS AND INVERSE FOURIER TRANSFORM

4. PROPERTIES OF FOURIER TRANSFORMS
5. LAPLACE TRANSFORMS
6. Z-TRANSFORMS
7.CONVOLUTION BETWEEN SIGNALS AND SEQUENCES
8.. AUTO CORRELATION AND CROSS CORRELATION
9.. GAUSSIAN NOISE
10.DISTRIBUTION AND DENSITY FUNCTIONS OF STANDARD RANDOM VARIABLES

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B. Tech Electronics and Communication Engineering

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11. WIDE SENSE STATIONARY RANDOM PROCESS.

Network Theory: Credit 3 (3-0-0)

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality.Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits. Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

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

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

Text/Reference Books
1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

Probability Theory and Stochastic Processes 3(3-0-0)

Module 1: Basic Probability: 8L
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions: 4L
Continuous random varibales and their properties, distribution functions and densities, normal, exponential and uniform distribution.

Module 3: Bivariate Distributions: 4L
Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4 : Introduction to Stochastic Process (SP) 2L
Definition and examples of SPs, classification of random processes according to state space and parameter space, types of SPs, elementary problems.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Module 5: Stationary Process: 2L
Weakly stationary and strongly stationary processes, moving average and auto regressive processes.

Module 6: Discrete-time Markov Chains: 4L
Chapman–Kolmogorov equations, classification of states, limiting probabilities, mean time in transient states, applications.

Module 7: Continuous-time Markov chains : 4L
Kolmogorov- Feller differential equations, infinitesimal generator, Poisson process, birth-death process, stochastic Petri net, applications to queueing theory and communication networks.

Module 8: Brownian Motion : 4L
Wiener process as a limit of random walk; process derived from Brownian motion, Stochastic Differential Equation(SDE). Some important SDEs and their solutions.

Text and Reference Books:
(i) Peyton Z. Peebles, Probability, Random Variables & Random Signal Principles, TMH, 4th Edition, 2001.
(ii) Donald Childers,Probability and Random Processes-Scott Miller, 2Ed,Elsevier,2012
(iii) Pradip Kumar Gosh, Theory of probability and Stochastic Processes, University Press
(iv) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
(v) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(vi) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(vii) Liliana Blanco Castaneda, Viswanathan Arunachalam and S. Dharmaraja, Introduction to Probability and Stochastic Processes with Applications, Wiley, 2012.

Data Structures & Algorithm Credit 3(3-0-0)

Basic Terminologies & Introduction to Algorithm and Data Organization: [6L]
Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction.

Linear Data Structure: [10L]

Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures.

Non-linear Data Structure: [10L]

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

.

Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations (search and traversal algorithms and complexity analysis) & Applications of Non-Linear Data Structures.

Searching and Sorting on Various Data Structures: **[10L]**

Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort, Introduction to Hashing

Text/Reference Books:

1. Data Structures using C and C++ by Y. Langsam, M. J. Augenstein, A.M. Tanenbaum, Prentice Hall of India
2. Classic Data Structures by D. Samanta, Prentice Hall of India

3. Data Structures by S. Lipschutz, Tata McGraw Hill

4. Introduction to Algorithms by T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Prentice Hall of India

SEMESTER: IV

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Analog Electronics	MPC		3	3	0	0
2	Analog & Digital Communication	MPC		3	3	0	0
3	Microprocessor and Microcontroller	MPC		3	3	0	0
4	Computer Organisation and Architecture	MPC		3	3	0	0
5	Database Management System (DBMS)	SEC		3	3	0	0
6	Analog Electronics Lab	MPC		1	0	0	2
7	Analog & Digital Communication Lab	MPC		1	0	0	2
8	Microprocessor and Microcontroller Lab	MPC		1	0	0	2
9	Computer Architecture Lab	MPC		1	0	0	2
10	Database Management System (DBMS) Lab	SEC		1	0	0	2
11	Foreign Language - II - Spanish	AEC		2	2	0	0
	Foreign Language - II - German						
	Foreign Language - II - Japanese						
	Foreign Language - II - French						
12	Vocational-Soft Skill Development-IV	Voc NM6		1	0	0	2
	Total (Major-16, AEC-2, SEC-4, Voc-1)			**23**	**29 Hrs./Week**		

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Analog Electronics Credit 3 (3-0-0)

Introduction to Electronic Circuits
Diode & wave shaping circuits: Different rectifier circuits, ripple factor, efficiency, TUF, PIV, power supply filters, clipper and clamper circuits, peak detector, voltage multiplier. RC filter response for non sinusoidal signals

BJT circuits: Biasing and stability analysis: fixed bias, collector to base feedback bias, emitter bias, voltage divider bias, transistor as a switch,
Hybrid Parameters, Frequency response: Low frequency and high frequency response, Miller effect,brief overview on multistage amplifier,

FET circuits: Biasing: fixed bias, self-bias, voltage divider bias, common drain, common gate configurations, AC analysis: Modeling (small signal model), expressions for input impedance, output impedance, voltage gain for different configurations like fixed bias, self-bias, voltage divider bias, common drain, common gate configurations Frequency response: low frequency and high frequency response, Miller effect .

Multistage amplifiers: Cascaded BJT and FET amplifiers, frequency response of R-C coupled multi- stage amplifier.

Feedback concepts, connection types, practical circuits, phase and frequency considerations.

OPAMP circuits: Basics, differential amplifier circuit, concept of open loop and closed loop gain, DC offset and frequency parameters, slew rate, differential and common mode operation , applica- tions: inverting and non-inverting amplifier, transresistance amplifier, transconductance amplifier, log and antilog amplifier, adder, subtractor, multiplier, divider, buffer, differentiator and integrator, active filters, Equation solver, Schmitt trigger and multivibrators, rectifier clipper and clamper circuits, peak detector.

Regulated Power Supply: Voltage regulation, Zener diode & IC regulator, regulation factor, filter circuit‘s discrete transistor voltage regulation (series and shunt), switching regulators, switch mode power supply.

Text Books:

1. J. Millman, C. Halkias and S. Jit, ‖Electronic Devices and Circuits‖, Tata McGrawHill, 4th edition, 2015.
2. Adel S. Sedra and Kenneth C. Smith, ‖Microelectronic Circuits-Theory and applications‖, seventh Edition , 2017
3. Thomas L. Floyd, David M. Buchla, ‖Fundamentals of Analog Circuits‖, Pearson, 2nd Edn

Laboratory Experiments:

1. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).
2. Design and set up the following rectifiers with and without filters and to determine ripple factor

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B. Tech Electronics and Communication Engineering

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and rectifier efficiency:
(a). Full Wave Rectifier (b). Bridge Rectifier

3. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.
4. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency
5. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances
6. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.
7. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation.
8. R-C Phase shift Oscillator/Wien Bridge Oscillator
9. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
10. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.

Analog and Digital Communication Credit 3 (3-0-0)

UNIT I ANALOG COMMUNICATION

Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems.

Generation and detection of AM and FM

UNIT II DATA AND PULSE COMMUNICATION

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System .Data Communication:

History of Data Communication – Standards, Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Data communication Hardware – serial and parallel interfaces.

UNIT III DIGITAL MODULATION

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency–

Comparison of various Digital Communication System, Pulse modulation PAM, PPM, PWM, PCM Data communication, Source and Error control coding,

UNIT IV SOURCE AND ERROR CONTROL CODING

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Entropy, Source Encoding Theorem, Shannon Fano Coding, Huffman Coding, Mutual Information, Channel Capacity, Error Control Coding, Linear Block Codes, Cyclic Codes – ARQ Techniques

Simulation of error control coding schemes.

UNIT V MULTI-USER RADIO COMMUNICATION

Global System for Mobile Communications (GSM) – Code Division Multiple Access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

Simulation of Communication link

TEXT BOOKS
1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2009.
2. B.P.Lathi,"Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press,2007.

REFERENCES
1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education,2007
3. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, PearsonEducation, 2007.
4. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002

Laboratory Experiments:

1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index an AM signal(for both DSB- & SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.
6. Study of PAM and demodulation.
7. Study of PCM and demodulation.
8. Study of line coders: polar/unipolar/bipolar NRZ ,RZ and Manchester.
9. Study of delta modulator and demodulator..
10. Study of BPSK modulator and demodulator.
11. Study of ASK modulator and demodulator.
12. Study of QPSK modulator and demodulator

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Microprocessors and Microcontrollers Credit 3 (3-0-0)

Overview of Microcomputer systems and their building blocks – Intel 8085 Microprocessor Unit (MPU) Architecture – Interfacing with Memory and I/O Devices

Introduction to 8085: Instruction Set and Assembly Language Programming (ALP), Counters and Time Delays, Stack and Subroutines

Concept of Interrupts and Direct Memory Access

Interfacing with Peripheral Devices – D/A and A/D Converters, Parallel I/O, Timer – Serial I/O and Data Communication

Application / System Level Interfacing Design, Introduction to Single-chip Microcomputer / Intel 8051 Microcontroller Architecture and Programming

Trends in Microprocessor Technology: Introduction to Intel 8086 / 8088 – Arithmetic Coprocessor , Advanced Coprocessor Architecture -286, 486, Pentium - Introduction to RISC Processors.

Keyboard Interface controller-8279

DMA Controller

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 2013/2015
2. D. A. Patterson and J H Hennessy, "Computer Organization and Design: The hardware and software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

Laboratory Experiments:

1. Familiarization with 8085 & 8051 simulator on PC.
2. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the KIT. Assignments based on above
3. Programming using kit and simulator for:
   i) Table look up
   ii) Copying a block of memory
   iii) Shifting a block of memory
   iv) Packing and unpacking of BCD numbers
   v) Addition of BCD numbers
   vi) Binary to ASCII conversion
   vii) String Matching, Multiplication using shift and add method and Booth's Algorithm

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.
5. Study of the timing diagram of an instruction on an oscilloscope..
6. Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255
7. Study of 8051 Microcontroller kit and writing programs. Write programs to interface Keyboard, DAC and ADC using the kit.
8. Serial communication between two trainer kits

Computer Organization and Architecture Credit 3(3-0-0)

Concepts Moore‘s Law, Basic Organization of a Computer and Underlying technology

Computer Performance
CPU time, Amdahl‘s Law, CPU Performance Equation.

Computer Instructions
Operations and Operands of the hardware, example conversions from C to MIPS.

ALU Design
Realization of basic arithmetic (addition, subtraction) and logical (AND, OR, NOT) operations, Faster Addition using Carry Lookahead.

Computer Arithmetic
Representation of numbers, Addition, Subtraction, Multiplication, Division operations (flowcharts, block level hardware designs).

Processor Design
CPU Design, Datapath Building, Control Unit Design using Hardwired Control and Microprogrammed Control, Overview of Parallel Processing.

Memory Design
Memory Hierarchy, Basics of Cache, Cache Performance, Different Cache Designs - direct mapped, fully associative and set associative caches, virtual memory.

I/O Organization
Basics, Programmed I/O –memory-mapped I/O and I/O mapped I/O.

Text/Reference Books:

1. D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software Interfacell, Morgan Kaufman.
2. J. P. Hayes, —Computer Organization and Architecturell, McGraw Hill.

Laboratory Experiments:

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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1. HDL introduction.
2. Basic digital logic base programming with HDL
3. 8-bit Addition, Multiplication, Division
4. 8-bit Register design
5. Memory unit design and perform memory operations.
6. 8-bit simple ALU design
7. 8-bit simple CPU design
8. Interfacing of CPU and Memory.

Database Management System: Credit 3(3-0-0)

Module 1 Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Module 2: Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Module 3: Storage strategies: Indices, B-trees, hashing.

Module 4: Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Module 5: Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Module 6: Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text books:
1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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SEMESTER: V

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Digital Signal Processing	MPC		3	3	0	0
2	Electromagnetic Theory	MPC		3	3	0	0
3	Control System	MPC		3	3	0	0
4	Introduction to IC Fabrication Technology	MPC		3	0	0	0
5	VLSI Design	MPC		3	3	0	0
6	Slot for minor	Minor/OE		4	3	0	2
7	Digital Signal Processing Lab	MPC		1	0	0	2
8	VLSI Design Lab	MPC		1	0	0	2
9	Minor Project/Mentor Seminar	Voc NM7		2	0	0	4
10	Vocational-Soft Skill Development-V	Voc NM8		1	0	0	2
	Total (Major-17, Minor-4, Voc-3)						
				24	**27 hours/ week**		

Digital Signal Processing: Credit 3(3-0-0)
Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

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

Effect of finite register length in FIR filter design.Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP.

Text/Reference Books:
1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall,
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992. 6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Laboratory Experiments:

Simulation Laboratory using standard Simulator:

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B. Tech Electronics and Communication Engineering

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1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands verification of the properties of convolution.
3. Z-transform of various sequences - verification of the properties of Z-transform.
4. Twiddle factors - verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap -add and Overlap-save methods.
8. Butterworth filter design with a different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Electromagnetic theory: Credit 3(3-0-0)

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

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

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

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

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

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Radiation hazards to humans, Various issues of EMC, EMC Testing categories, EMC Engineering Application.

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

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall
5. Clayton Paul, "Introduction to Electromagnetic Compatibility", Wiley Interscience, 2006.

Control System: Credit 3(3-0-0)

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

Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feedforward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion.

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

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

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

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

Text/Reference Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Introduction to IC Fabrication Technology: Credit (3-0-0)

UNIT I –

CRYSTAL GROWTH

Introduction to Semiconductor Manufacturing and fabrication, Clean Room types and Standards, Physics of the Crystal growth, wafer fabrication and basic properties of silicon wafers.

UNIT II –

LITHOGRAPHY AND RELATIVE PLASMA ETCHING

The Photolithographic Process, Photomask Fabrication, Comparison between positive and negative photoresists, Exposure Systems, Characteristics of Exposure Systems, E-beam Lithography, X- ray lithography.Feature Size control and Anisotropic Etch mechanism, relative Plasma Etching techniques and Equipments,

UNIT III- Thermal Oxidation

The Oxidation Process, Modeling Oxidation, Masking Properties of Silicon Dioxide, Technology of Oxidation, Si-SiO2 Interface.

UNIT IV - DIFFUSION, ION IMPLANTATION

The Diffusion Process , Mathematical Model for Diffusion, Constant- ,The Diffusion Coefficient , Successive Diffusions, Diffusion Systems, Implantation Technology, Mathematical Model for Ion Implantation, Selective Implantation, Channeling, Lattice Damage and Annealing, Shallow Implantation.

UNIT V - Contacts, packaging and yield

Metal Interconnections and Contact Technology, Silicides and Multilayer-Contact Technology, Copper Interconnects and Damascene Processes, Wafer Thinning and Die Separation, Die Attachment, Wire Bonding, Packages, Yield

UNIT VI- VLSI PROCESS INTEGRATION

NMOS IC Technology – CMOS IC Technology – MOS Memory IC technology - Bipolar IC Technology – IC Fabrication.

TEXT and REFERENCES

1. S.M.Sze, “VLSI Technology”, McGraw Hill, 2nd Edition. 2008.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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2. James D. Plummer, Michael D. Deal, Peter B.Griffin, "Silicon VLSI Technology: fundamentals practice and Modeling", Prentice Hall India, 2009.

3. S.A. Campbell, The science and engineering of microelectronics fabrication, Oxford University Press, UK, Second Edition, 2012.

4. Wai Kai Chen, "VLSI Technology" CRC press, 2003.

VLSI Design Credit 3(3-0-0)

IC DESIGN : Introduction Discrete and Integrated Circuit: TTL, DTL, IIL, ECL, MOS and CMOS IC. Introduction to analog design, symbols, MOSFET as switch, derivation of I/V characteristics, second order effects, MOS device layout, MOS small signal model, SPICE simulation models. Single-stage amplifiers, different common-source stages, source follower, common-gate stage, cascode stage. Differential amplifiers, active diode resistors and switched capacitor resistors; current sinks and sources, current mirrors and amplifiers, voltage and current references, cascade amplifiers; operational amplifiers; design of twostate and cascade op Amp. Analogue circuits: comparators, switched capacitor amplifiers, integrators, filters; DAC and ADC circuits. MOS inverters: definition and properties, MOS and CMOS inverter, VTC characteristics, BI CMOS circuit technique BI CMOS device and technology.

VHDL and VERILOG: Basic language elements: data objects, classes and data types, operators, overloading, logical operators, VHDL representation of digital design entity, entity and architectural declarations, introduction to behavioral, dataflow and structural models.

FPGA Design and Architecture: Introduction and fundamental concepts, the origin of FPGA, FPGA architecture and design Flows.

Text/Reference Books:

1. S.M Kang and Y.Leblebici., CMOS Digital Integrated Circuits.
2. R.L.Geiger, VLSI Design Techniques for Analog and Digital Circuits,
3. Wayne Wolf , Modern VLSI Design systems on Silicon
4. J. M. Rabaey , Digital Integrated Circuits

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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SEMESTER: VI

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Embedded Systems	MPC		3	3	0	0
2	Digital switching and Computer Network	MPC		3	3	0	0
3	Microwave Theory and Technique	MPC		3	3	0	0
4	Information Theory and Coding	MPE		3	3	0	0
	Biomedical Electronics	MPE					
	Introduction to MEMS	MPE					
5	Slot for minor	Minor/OE		4	3	1	0
6	Embedded System Lab	MPC		1	0	0	2
7	VLSI Verification and Testing Lab	MPC		1	0	0	2
8	Minor Project/Mentor Seminar	Voc NM9		2	0	0	4
9	Vocational-Soft Skill Development-VI	Voc NM10		1	0	0	2
	Total (Major-14, Minor-4, Voc-3)						
	Total			**21**	**26Hrs./Week**		

Embedded Systems Credit 3 (3-0-0)

Introduction to Embedded Systems (ES), Definition, Difference between general purpose computing system and embedded system; classification of embedded systems - RISC and CISC Processors, Characteristics and Quality Attributes of Embedded Systems, Concepts of Embedded System Design, Examples of Embedded Systems Embedded Microcontroller Cores /

Designing with 8-bit Microcontroller: Architecture, Addressing modes and Instruction Set of Intel 8051 Microcontroller

Introduction to other Embedded Processors: ASIC, Digital Signal Processors, Field Programmable Gate Array, ARM - Choice of Embedded Hardware Platform Interfacing Standards – Real Time System Design Example RTOS - Hardware Software co-design, ASIC Design, Semicustomed ICs including FPGA,

Microcontroller Design

Cloud and IOT

Text / Reference Books:
1. Introduction to Embedded Systems, Shibu K V, McGraw Hill, New Delhi (2/e)

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B. Tech Electronics and Communication Engineering

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2. Embedded System Design, SantanuChattopadhyay, PHI Learning (2/e)
3. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.
4. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
5. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999

Digital Switching and Computer Network: Credit 3 (3-0-0)

Telecommunication and Traffic Engineering: Introduction to voice and data communication systems, Circuit, message and packet switching, Evolution of switching systems, Basics of EPABX, Definition of traffic load, grade of service and blocking probability, definition of Markov chain, probability distribution of arrival service and termination process, Birth-Death (B-D) process, Modeling of switching system, Basics of Queueing Theory, Erlang's formula, Data transmission in PSTNs. [8]

Basics of Data Communications:Introduction of computer networks and data communication services, Goals, applications and classification of computer networks, Network topologies, Layered network architecture, OSI reference model, and Overview of TCP/IP protocol suite, Brief review of physical layer. [6]

Data Link Layer: Framing, flow and error control, error detection, Cyclic Redundancy Codes (CRC) for error detection, Internet Checksum, Flow and error control strategies, HDLC protocol. Media Access Control (MAC): Pure and Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, polling, token ring, MAC for wired and wireless Local Area Networks, Ethernet protocol, WiFi MAC protocol. [8]

Network Layer: IPv4 and IPv6 addressing, Routing algorithms, hierarchical routing, Link State and Distance Vector routing, Internet routing, RIP, OSPF, BGP, packet format, addressing, subnetting, CIDR, ARP, RARP, fragmentation and reassembly, ICMP; DHCP, NAT, routing for mobile hosts. [6]

Transport Layer: UDP, segment structure and operation; TCP, segment structure and operation; Sockets Reliable stream transport service; congestion control algorithms and connection management. [4]

Application Layer: World Wide Web and HTTP, electronic mail (SMTP), file transfer protocol (FTP), Domain Name Service (DNS). [4]

Network security: Basics of cryptographic systems, public key and private key cryptography, digital signatures, authentication, certificates, firewalls, Security for Wi-Fi systems LAN, VLAN, VPN, WLAN [4]

Text/Reference Books:

1.T. Viswanathanand M. Bhatnagar, Telecommunication Switching system and Networks, PHI.

2. B. A. Forouzan, Data Communications and Networking, TMH.

3. L. L. Peterson and B. S. Davie Computer Networks: A Systems Approach, Morgan Kaufmann Series.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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4. A. S. Tanenbaum, Computer Networks, PHI.

5. W. Stallings, Data and Computer Communications, Pearson.

6. J. F. Kurose and K. W. Ross, Computer Networking: A Top-Down Approach, Pearson.

Microwave Theory and Technique: Credit 3 (3-0-0)

Introduction to Microwaves- History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Analysis of RF and Microwave

Transmission Lines-Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line.

Microwave Network Analysis-Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

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

Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes.

Microwave Tubes: Klystron, TWT, Magnetron. Microwave Design Principles-Impedance transformation, Impedance Matching,

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

Microwave Antennas-Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Microwave Measurements-Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Microwave Systems-Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering-Effect of Microwaves on human body, Medical and Civil

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Text/Reference Books:

1.R.E. Collins, Microwave Circuits, McGraw Hill

2.K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

Information Theory and Coding: Credit 3 (3-0-0)

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources.

Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Linear And Block Codes For Error Correction

Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Cyclic Codes Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

BCH Codes Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Convolutional Codes

Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.

2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

3. R.B. Ash, Information Theory, Prentice Hall, 1970.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Bio Medical Electronics Credit 3(3-0-0)

Brief introduction to human physiology. Biomedical transducers: displacement,velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.

Bio-electrodes and biopotential amplifiers for ECG, EMG, EEG, etc. Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.

2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.

3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Introduction to MEMS: Credit 3 (3-0-0)

Introduction, Fundamentals: Material properties – electrical properties, thermal properties, mechanical properties, surface chemistry

Micro-fabrication: materials, clean-rooms, Deposition methods, Photo-lithography, Etching, Advanced tools, LIGA/electroplating, fabs, Self-assembly

Applications: MEMS sensors and actuators, accelerometers, Optical switches, micro-fluidics, micro-channels, micro-pumps, Cells and chips

Neural Implants
Text Books
May, Sze: Fundamentals of Semiconductor Fabrication
Sze: SC Sensors
Madou: Fundamentals of Microfabrication
S. Senturia, Microsystem Design, Kluwer 2000
G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill 1998

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

SEMESTER: VII

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Law for Engineers	VAC		2	3	0	0
2	Wireless and Mobile Communication	MPC		3	3	0	0
3	Wavelet Transform	MPE		3	3	0	0
	Satellite Communication						
	Digital Image Processing						
	Mixed Signal Design						
4	Slot for minor	Minor/OE		4	3	0	2
5	Wireless and Mobile Communication Lab	MPC		1	0	0	2
6	Internship	Internship		4	0	0	0
7	Project I/Audio and Speech Processing	Project		4	0	0	8
	Total (Major-7, Minor-4, VAC-2)						
	Total			**21**	**24 Hr/week**		

Law for Engineers: 2(2-0-0)

Module1

Introduction and Basic Information about Indian Constitution: Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Union Executive and State Executive: Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3

Introduction and Basic Information about Legal System: The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme ourt). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4

Intellectual Property Laws and Regulation to Information: Intellectual Property Laws- Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information-Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5

Business Organizations and E-Governance: Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Reference Books:

- Brij Kishore Sharma: Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
- Granville Austin: The Indian Constitution: Cornerstone of a Nation. 1966, Oxford Clarendon Press.
- Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
- PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
- V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
- Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, New Delhi-88
- P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
- Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, Orient Longman.
- BL Wadehra: Patents, Trademarks, Designs and Geological Indications.Universal Law Publishing - LexisNexis.
- Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)

Wireless and Mobile Communication: Cr 3 (3-0-0)

Module 1: Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE

Module 2: Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas. Wireless network planning (Link budget and power spectrum calculations)

Module 3: Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

Module 4: Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Module 5: Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

Module 6: Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

References:

· V. K. Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
· V. K. Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
· T. S. Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
· William C. Y. Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
· Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997.

Wavelet Transform Credit 3 (3-0-0)

Introduction:

Origin of wavelets and its history, Different communities of wavelet, Classification: continuous and discrete wavelet transforms, Developments in wavelet theory applications

Continuous Wavelet Transform: Introduction Continuous time wavelets, Definition of CWT, Constant Q factor filtering interpretation and Time Frequency Resolution, CWT as an operator, Inverse CWT

Introduction to the Discrete Wavelet Transform and orthogonal Wavelet decomposition: Approximations of vectors in nested linear vector subspaces, Multi-resolution Analysis of L2(R), Haar Scaling function, Haar wavelet, Haar wavelet decomposition. Haar wavelet packets and application.

MRA Ortho -normal wavelets and their relationships to filter banks:,Construction of an ortho-normal MRA, Wavelet basis for the MRA, Digital filtering interpretation, Examples of orthogonal basis generating wavelets, Interpreting ortho-normal MRA for discrete time signals, Generating scaling functions and wavelets from filter coefficients

Bi-orthogonal Wavelets: Bi-orthogonal Wavelet bases, Filtering relationship for Bi-orthogonal filters, Bi-orthogonal scaling functions and wavelets, Two dimensional wavelet, Non separable Multi-dimensional wavelet, Wavelet Packets.

Wavelength Transform and applications: Transform coding, DTWT for image compression, audio compression, Wavelet based audio coding, video coding and multi resolution Techniques, Wavelet de-noising, Speckle

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

removal, Edge detection and object isolation, Image fusion, Object detection, discrete wavelet multi-tone modulation.

Beyond Wavelet: Ridge lets and curve lets:Ridge let transform and Digital Curve let transform, Curve let construction, Properties and applications.

Reference Books:

1.RaguveerM.Rao and AjitS.Bopardikar-Wavelet Transforms –Introduction andapplications-Pearson Education, 2008

2.K.P Soman, K.I.Ramachandran –Insight into Wavelets from Theory to practice, PHI2006

Satellite Communication Credit 3 (3-0-0)

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

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

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

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

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

Text /Reference Books:

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

School of Engineering & Technology
B. Tech Electronics and Communication Engineering

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2.Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009 3.Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Digital Image Processing: Credit 3 (3-0-0)

Image Representation and Modeling :Monochrome and color representation, color ordinate systems Monochrome and Color vision Model, sampling and Quantization – Rectangular and Non rectangular Grid sampling and interlacing. Optimum Lioyd-Max quantizer, Compandor design, Practical limitations.

Image Transforms : Two dimensional Orthogonal Transforms, Basic Image, Kroneeker products and Dimensionality: proportion Algorithm etc. for D F T. Hadamard Haar, Slant, DCT and KL Transforms, SUD techniques Image Enhancement, Point operation, Histogram Modeling, Spatial operations, Transform co-operations, Image RestorationIncrease and Weian Filtering, Filtering using transforms, Least square and constrained least square restoration. Maximum Entropy Restoration.

Image Analysis and Vision : Spatial features extraction, Transform, Features, Edge detection, Boundary detection, region representation, Moment Refresevation, Structures shape, Texture, Scene Matching, Image segmentation and classification techniques.

Image Data Compression :Paxel coding: Entropy coding, Run length coding, Bit plane coding Predictive coding. Delta and DPCM techniques, Transform coding –zonal versus threshold coding. Adaptive transform coding. Vector quantization for compression

Text/Reference Books:

1. Rafale C.Gonzales& R. E. Woods, Digital Image Processing

Mixed Signal Design: Credit 3 (3-0-0)

Course content:

Unit 1

Mixed-Signal design concepts and performance measures. Switched capacitor circuit- principles and applications in filter design- design of frequency and Q tunable continuous time filters. Comparators- Characterization - Two stage comparators - open loop comparators.

Unit 2

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Sample and hold and trans-linear circuits: Performance of sample-and-hold circuits - testing sample and holds, MOS sample-and-hold basics, examples of CMOS S/H Circuits, bipolar and BiCMOS sample-and-hold, trans-linear gain cell, trans-linear multiplier.

Unit 3

Data converter fundamentals - DC and dynamic specifications - quantization noise - Nyquist rate D/A converters - decoder based converters - binary scaled converters - thermometer code converters - hybrid converters - Nyquist rate A/D converters - Successive approximation, Flash, interpolating, Folding, Pipelined, Time-interleaved converters.

Unit 4

Phase-locked loop basics; PLL dynamics; frequency synthesis; all-digital PLLs.

Mismatch Issues in Analog Layouts, Introduction to RF IC Design.

Audio and Speech Processing: Credit 3 (3-0-0)

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques - parametric, waveform and hybrid ; Requirements of speech codecs -quality, coding delays, robustness.

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution;

Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

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

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

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

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

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B. Tech Electronics and Communication Engineering

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Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis;

Generic CELP encoders and decoders; Excitation codebook search - state-save method, zero- input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search;

Low Delay CELP and algebraic CELP.

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

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students" Edition), 2004.

2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

SEMESTER: VIII

Sl No.	Course Name	Course Type	Course Code	Credit	Type		
					L	T	P
1	Fiber Optic Communication	MPE		4	3	1	0
	Neural Network and Fuzzy Logic						
	Smart Antenna						
2	Slot for minor	Minor/OE		4	3	1	0
3	Project II/RadarEngineering and Wireless Sensor Network	Project		8	0	0	16
	Total (Major-4, Minor-4, Project-8)						
				16	24 hrs/ week		

Fibre Optic Communication Credit 3 (3-0-0)

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation.

Fabrication of fibers and measurement techniques like OTDR.

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Optical sources -LEDs and Lasers, Photo-detectors-pin-diodes, APDs, detector responsivity, noise, optical receivers.

Optical link design -BER calculation, quantum limit, power penalties.

Optical switches -coupled mode analysis of directional couplers, electro-optic switches.

Optical amplifiers -EDFA,Raman amplifier.

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

Text/Reference Books

1.J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).

2.T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

3.J. Gowar, Optical communication systems, Prentice Hall India, 1987.

4.S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.

5.G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.

6.G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997

7.F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Neural Network and Fuzzy Logic Credit 3 (3-0-0)

Neural Networks and Pattern Association:

Differences between biological and artificial neural networks – Typical architecture – Common activation functions– McCulloch – Pitts neuron – Simple neural nets for pattern classification –Linear separability – Hebb net –Perceptron – Adaline – Madaline – Architecture – Algorithm and simple applications – Training algorithms forpattern association – Hebb rule and delta rule – Hetero associative – Auto associative and iterative auto associativenet – Bidirectional associative memory – Architecture – Algorithm – Simple applications.

Neural Netwroks based on Competition:

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Kohonen self organising maps – Learning vector quantization – Counter propagation –Architecture – Algorithm and applications

Adaptive Resonance and Backpropagation Neural Networks:

ART1 and ART2 – Basic operation and algorithm – Standard back propagation architecture –

Derivation of learning rules – Boltzmann machine learning – Architecture – Algorithm and

simple applications

Fuzzy sets and Membership Functions:

Properties and operations on classical and fuzzy sets – Crisp and fuzzy relations – Cardinality –

properties and operations – Composition – Tolerance and equivalence relations – Simple

problems –Features of membership function – Standard forms and boundaries – Fuzzification –

Membership value assignments – Fuzzy to crisp conversions – Lambda cuts for fuzzy sets and

relations –Defuzzification methods.

Applications of Neural networks and Fuzzy logic:

Applications of neural networks – Pattern recognition – Image compression – Communication –

Control systems

Applications of fuzzy logic – Fuzzy pattern recognition – Fuzzy image compression – Fuzzy

logic controllers

Text Book

1. Fundamentals of Neural Networks, LaureneFausett, 2004, Pearson Education.

2. Fuzzy Logic with Engineering Applications, Timothy Ross, 1998, McGraw-Hill.

Reference Book

1. Introduction to Neural Networks Using Matlab 6.0, Sivanandam, S.N., Sumathi, S. and Deepa,

S.N, 2005,TMH.

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B. Tech Electronics and Communication Engineering

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2. Fundamentals of Artificial Neural Networks, Mohammad H. Hassoun, 1st edition,2010, PHI

3. Neural Networks and Fuzzy Systems, Bark Kosko, 1st edition, PHI

Smart Antenna Credit 3 (3-0-0)

UNIT – I : Smart Antennas: Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

UNIT – II : DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Autocovariance, Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates .

UNIT – III : Beam Forming Fundamentals: Classical Beam former, Statistically Optimum Beamforming Weight Vectors, Maximum SNR Beam former, Multiple Sidelobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beamforming

UNIT – IV : Integration and Simulation of Smart Antennas: Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading, Channel, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Adhoc Networks (MANETs), Protocol, Simulations, Discussion.

UNIT – V : Space–Time Processing: Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beamforming, Intersymbol and Co-Channel Suppression, Space–Time Processing for DSCDMA, Capacity, and Data Rates in MIMO Systems, Discussion.

TEXT BOOKS:

- Constantine A. Balanis & Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers' series-2007
- Joseph C. Liberti Jr., Theodore S Rappaport, "Smart Antennas for Wireless CommunicationsIS-95 and Third Generation CDMA Applications", PTR – PH publishers, 1st Edition, 1989.

REFERENCE BOOKS:

- T.S Rappaport, "Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location", IEEE press 1998, PTR – PH publishers 1999.

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Radar Engineering: Credit 3 (3-0-0)

Basics of Radar:

Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect topulse wave form-PRF,PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems.

The Radar Equation:

Prediction of Range 'Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector - False Alarm Time and Probability, Probability of Detection, Radar Cross Section of Targets: simple targets - sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

MTI and Pulse Doppler Radar:

Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweepto Sweep subtraction and DelayLine Canceler, MI1 Radar with- Power Amplifier Transmitter, Delay Line Cancelers- Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MI1 Improvement Factor, N-Pulse Delay-Line Canceler, Digital MTI Processing-Blind phases, I and QChannels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD.

Tracking Radar:

Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two- coordinates), Phase Comparison Monopulse. Sequential Lobing, Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range,Comparison of Trackers

The Radar Antenna :

Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phase d array Antennas.

Radar Receiver:

The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver,Duplexers and Receivers Protectors, Radar Displays.

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Wireless Sensor Network Credit 3 (3-0-0)

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks,

Types of wireless sensor networks Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion;

Quality of a sensor network; Real-time traffic support and security protocols.

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1.Waltenegus Dargie ,Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011

2.Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009

3.Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004

4.Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science

5.Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009