Electronics Engineering Department

B. Tech. Electronics and Communication Engineering

Scheme

SEMESTER – III

Sr. No.	Subject	Code	Scheme	Credit	Examination Scheme				
					Theory Marks	Tutorial Marks	Term work Marks	Practical Marks	Total Marks
1.	Engineering Mathematics-III *	MA 217	3-1-0	04	100	25	-	-	125
2.	Core-1 – Electronic Circuits	EC 201	3-1-2	05	100	25	25	25	175
3.	Core-2 – Digital Logic Design	EC 203	3-1-2	05	100	25	25	25	175
4.	Core-3 – Signals and Systems	EC 205	3-1-0	04	100	25	-	-	125
5.	Interdisciplinary Subject 1– Network Analysis and Synthesis	EE 207	3-1-0	04	100	25	-	-	125
		Total	**15-5-4=24**	**22**	**500**	**125**	**50**	**50**	**725**

SEMESTER – IV

Sr. No.	Subject	Code	Scheme	Credit	Examination Scheme				
					Theory Marks	Tutorial Marks	Term work Marks	Practical Marks	Total Marks
1.	Core-4 - Statistical Signal Analysis	EC 202	3-1-0	04	100	25	-	-	125
2.	Core-5 – Principles of Communication Systems	EC 204	3-1-2	05	100	25	25	25	175
3.	Core-6 – Microprocessors and Microcontrollers	EC 206	3-1-2	05	100	25	25	25	175
4.	Core-7 - Linear IC Applications	EC 208	3-1-2	05	100	25	25	25	175
5.	Interdisciplinary Subject 2 – Core-8 – Control Systems	EE 214	3-1-0	04	100	25	-	-	125
		Total	**15-5-6=26**	**23**	**500**	**125**	**75**	**75**	**775**

ELECTRONIC CIRCUITS

L	T	P	Credit
3	1	2	05

EC 201 **Scheme**

1. **Course Outcomes (COs):**

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

CO1	**Describe** single stage / multistage amplifiers and its frequency response characteristics.
CO2	**Apply** the concept of current sources / sinks in the differential amplifiers.
CO3	**Analyze** different amplifiers configurations by deploying negative feedback therein.
CO4	**Evaluate** the criterion for the stability of analog circuits.
CO5	**Design** solid state power amplifiers.

2. **Syllabus:**

- **HIGH FREQUENCY AMPLIFIERS:** **(10 Hours)**

  Classification of Amplifiers, Distortion in Amplifiers, Frequency Response of An Amplifier, Bode Plots, Step Response of Amplifiers, CE Short Circuit Current Gain, High Frequency Response of a CE Stage, Gain Bandwidth Product, Emitter Follower at High Frequencies, Common Source and Common Drain Amplifier at High Frequencies. Analysis of Multistage Amplifier, Design of Two Stage Amplifier, Frequency Response of Multistage Amplifier, Two Pole Analysis.

- **DIFFERENTIAL AMPLIFIERS** **(10 Hours)**

  Differential amplifiers, AC/DC Analysis of Various Differential Amplifiers using BJT/MOSFET, CMRR and I/O Resistances, Active Load Differential Amplifiers, Current Mirrors using MOSFET, Widlar Current Source, Cascaded Differential Amplifier Stages and Level Translator.

- **FEEDBACK AMPLIFIERS:** **(10 Hours)**

  Representation of Amplifiers, Feedback Concept, Transfer Gain with Feedback, Characteristics of Negative Feedback Amplifiers. I/O Impedance in Feedback Amplifiers, Analysis of Amplifiers having Voltage Series, Current Series, Current Shunt and Voltage Shunt Feedback, General Analysis of Multistage Feedback Amplifiers, Effect of Negative Feedback on Bandwidth, Frequency Response of Feedback Amplifiers.

- **OSCILLATORS:** **(06 Hours)**

  Stability Criterion, Sinusoidal Oscillators, Barkhausen Criterion, Analysis and design of RC phase shift (FET/ BJT) Oscillator, Wien Bridge Oscillators. Resonant Circuit Oscillators, General form of Oscillator Circuit (Hartley and Colpitts), Crystal Oscillators, Non-Sinusoidal Signal Generators using BJT/FET.

- **POWER AMPLIFIERS:** **(06 Hours)**

  Class A, B, AB, and C Power Amplifiers, Push – Pull and Complementary Symmetry Push-Pull Amplifier, Heat Sinks, Power Output, Efficiency, Crossover Distortion and Harmonic Distortion, Tuned Amplifiers.

- **TUTORIALS** **(14 Hours)**

(Total Contact Hours : 56)

3. Practicals:

Practicals are to be performed using breadboard and SPICE Simulators.

1. Study and design a single stage RC coupled amplifier and obtain its frequency response curve.
2. Study and design a double stage RC coupled amplifier and obtain its frequency response curve.
3. Study and design a differential amplifier and measure its differential and common mode output voltages.
4. Study and design Voltage Series Feedback amplifier and obtain its frequency response characteristics with and without feedback.
5. Study and design Current Series Feedback amplifier and obtain its frequency response characteristics with and without feedback.
6. Study and design RC phase shift oscillator using BJT/FET/Op-Amp.
7. Study and design Wein Bridge oscillator using BJT/FET/Op-Amp.
8. Study and design Hartley/Colpitt oscillator using BJT/FET.
9. Study and design Push-Pull Amplifier and obtain its efficiency.
10. Mini Project.

4. Books Recommended:

1. Millman Jacob, Halkias Christos C. and Parikh C., "Integrated Electronics", 2nd Ed., McGraw-Hill, 2017.
2. Sedra and Smith, "Microelectronic Circuits", 5th Ed., Oxford University Press, 2005.
3. Md.Gausi, “Electronic circuits”, 1st Ed., John Wiley, 2014.
4. A. S. Sedra & K. C. Smith, “Micro Electronic Circuits”, 4th Ed., Oxford press, 1998.
5. Boylestad Robert L. and Nashlesky Louis, "Electronics Device & Circuits and Theory", PHI, 10th Ed., 2009.

5. Reference Book:

1. Schilling Donald L. and Belove E., "Electronics Circuits - Discrete and Integrated", 3rd Ed., McGraw-Hill, 1989, Reprint 2008.

DIGITAL LOGIC DESIGN

L	T	P	Credit
3	1	2	05

EC 203 **Scheme**

1. Course Outcomes (COs):

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

CO1	**Describe** combinational logic problems and solve using truth table. Optimize using K-map and other equivalent techniques.
CO2	**Apply** various options for implementing sequential synchronous logic.
CO3	**Analyze** operation of synchronous sequential circuit, counters, registers and memory.
CO4	**Evaluate** RTL (register transfer language) statements to describe complex digital hardware. Derive or infer logic circuit from RTL Description.
CO5	**Design** circuits for ALU and Shifter. Design and investigate various Control unit architecture (Hardwired, Microprogram, PLA etc.) to control and sequence hardware operations.

2. Syllabus:

- **BOOLEAN ALGEBRA AND SIMPLIFICATION** **(08 Hours)**
  Basic Logic Operation and Logic Gates, Truth Table, Basic Postulates and Fundamental Theorems of Boolean Algebra, Standard Representations of Logic Functions- SOP and POS Forms, Simplification of Switching Functions-K-Map and Quine-Mccluskey Tabular Methods, Synthesis of Combinational Logic Circuits

- **COMBINATIONAL LOGIC CIRCUITS** **(08 Hours)**
  Binary Parallel Adder, BCD Adder, Encoder Priority Encoder, Decoder, Multiplexer and Demultiplexer Circuits, Implementation of Boolean Functions using Decoder and Multiplexer, Arithmetic and Logic Units, BCD-To-Segment Decoder, Common Anode and Common Cathode, 7-Segment Displays, Random Access Memory, Read Only Memory and Erasable Programmable ROMs, Programmable Logic Arrays(PLA) and Programmable Array Logic(PAL)

- **LATCHES AND FLIP-FLOPS** **(06 Hours)**
  Cross Coupled SR Flip-Flop Using NAND or NOR Gates, Clocked Flip-flops, D-Types and Toggle Flip-flops, Truth Tables and Excitation Tables for Flip-flop. Master Slave Configuration, Edge Triggered and Level Triggered Flip-flop, Flip-flop with Preset and Clear

- **SEQUENTIAL LOGIC CIRCUIT** **(06 Hours)**
  Introduction to State Machine, Mealy and Moore Model, State Machine Notation, State Diagram, State Table, Transition Table, Table Excitation, Table and Equation, Basic Concepts of Counters and Register, , Shift Left and Right Register, Registers with Parallel Load, Serial-in-Parallel-Out(SIPO) and Parallel-In-Serial-Out(PISO), Register Using Different Types of Flip-flop, Binary Counters, BCD Counters, Up Down Counter, Johnson Counter, Module-N Counter, Design of Counter using State Diagrams and Tables, Sequence Generators

- **REGISTER TRANSFER LOGIC** **(04 Hours)**
  Arithmetic Logic and Shift Micro-Operation, Conditional Control Statements, Fixed-Point and Floating-Point Data, Arithmetic Shifts, Instruction code and Design of Simple Computer

- **PROCESSOR DATA PATH AND CONTROL UNIT** **(06 Hours)**
  Processor Organization, Design of Arithmetic Logic Unit (ALU), Design of Accumulator, Control Organization, Hard-Wired Control, Micro Program Control, Control of Processor Unit, PLA Control

- **INTRODUCTION TO VHDL** **(04 Hours)**
  Introduction, Gate-Level Modeling, Data Type, Operators, Operands, Process and Behavioral Modeling, Timing Controls, Structural modeling, Registers, Flip-flop, Counter, Multiplexer, Adder/Subtracters, Tri-State Buffers

- **TUTORIALS** **(14 Hours)**

(Total Contact Hours: 56)

3. Practicals:

(Following practicals are to be performed using discrete components)

1. Introduction to variety of logic gates and digital ICs
2. Flip-flops using NAND/ NOR Gate.
3. Half-Adder/ Half-subtarctor Circuits using a serial Input.
4. Full-Adder/ Full-subtarctor Circuits using a serial Input.
5. Parity checker and parity generator circuit
6. 4-Bit Gray To Binary/ Binary To Gray Code convertor using Select input.

(Following practicals are to be performed on CPLD/FPGA kit using VHDL)

7. Logic expression with the Help of MUX IC 74153.
8. (a) Modulo-7 Ripple Counter with synchronous reset.
   (b) 4-bit up/down ripper counter with asynchronous reset
9. 4-Bit Shift Left/Right Register.
10. Sequence Generator using LFSR method.
11. Excess-3 BCD Adder/ Subtractor with Select Input.

4. Books Recommended:

1. Mano Morris, "Digital Logic and Computer Design", 4th Ed., Pearson Education, 2006.
2. Anand Kumar, "Fundamentals of Digital Circuits", 4th Ed., PHI, 2016.
3. Jain R. P. and Anand M. H. S., "Digital Electronics Practices using Integrated Circuits", 1st Ed., TMH, 2004.
4. Lee Samual, "Digital Circuits and Logic Design", 1st Ed., PHI, 1998.
5. Floyed Thomas L. and Jain R. P., "Digital Fundamentals", 8th Ed., Pearson Education, 2006.

5. Reference Book:

1. Brown S. and ZvonkoVranesic, "Fundamental of Logic with Verilog Design", 1st Ed., Tata McGraw Hill, 2003.

SIGNALS AND SYSTEMS

L	T	P	Credit
3	1	0	04

EC 205 **Scheme**

1. **Course Outcomes (COs):**

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

CO1	**Describe** Discrete Time Signal, System, Z-Transform and Sampling
CO2	**Apply** Frequency domain Analysis of Linear Time-Invariant system.
CO3	**Analyze** Discrete Time Fourier Transform and Discrete Fourier Transform
CO4	**Design** Signal Flow graph.

2. **Syllabus:**

- **INTRODUCTION** **(04 Hours)**
  Classification of Signal, Concept of Frequency in Continuous-Time and Discrete-Time Signal.

- **DISCRETE TIME SIGNAL AND SYSTEM** **(06 Hours)**
  Discrete-Time Signals, Discrete Time Systems, Linear Time-Invariant Systems, Properties of LTI Systems, Causal LTI Systems Described by Difference equations, Frequency Domain Representation of Discrete-Time Signals and Systems, Representation of sequences by Fourier Transforms and its properties.

- **Z-TRANSFORM** **(06 Hours)**
  Z-transform, Properties of Region of convergence, Inverse Z-transform, properties of Z-transform.

- **SAMPLING** **(06 Hours)**
  Sampling theorem, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of a Bandlimited Signals, Discrete-Time Processing of Continuous-Time Signals, Continuous the Sampling Processing of Discrete-Time Processing.

- **FREQUENCY DOMAIN ANALYSIS OF LINEAR TIME-INVARIANT SYSTEMS** **(08 Hours)**
  Frequency Response of LTI Systems, Systems characterized by Linear Constant Coefficient Differential Equations, Frequency Response for Rational systems Functions, Relationship between Magnitude and Phase, Time domain and Frequency domain aspects of ideal and non-ideal filters.

- **DISCRETE TIME FOURIER TRANSFORM (DTFT) and DISCRETE FOURIER TRANSFORM (DFT)** **(08 Hours)**
  Representation of Periodic Sequence: The Discrete Fourier, Properties of the Discrete Fourier Series, Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete Fourier Transform, Properties of the Discrete Fourier Transform.

- **SIGNAL FLOWGRAPHS** **(04 Hours)**
  Impulse Response and Transfer function of linear Systems, Block diagrams, Signal flow graphs, Basic properties of SFG, SFG Terms, SFG Algebra, Gain formula, Application of gain formula to block diagrams

- **TUTORIALS** **(14 Hours)**

(Total Contact Hours: 56)

3. Books Recommended:

1. Barry Van Veen Simon Haykin, "Signals and Systems", 2nd Ed., Wiley, 2007
2. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "Signals and Systems Prentice Hall India", 2nd Ed., Pearson, 2009.
3. B.P. Lathi, "Principles of Linear Systems and Signals", 2nd Ed., oxford, 22 Jul 2009
4. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", 4th Ed., PHI, 2007.
5. Robert A. Gable, Richard A. Roberts, "Signals & Linear Systems", 3rd Ed., John Wiley, 1995.

NETWORK ANALYSIS AND SYSNTHESIS

L	T	P	Credit
3	1	0	04

EE 207 **Scheme**

1. **Course Outcomes (COs):**

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

CO1	**Identify** a mathematical model (differential equations) of a given electric circuit and solve it using technique of domain transformation.
CO2	**Solve** AC and DC Transients Analysis**.**
CO3	**Analyze** various parameters of two-port network and inter relationship between them.
CO4	**Evaluate** filter circuits for given specifications.
CO5	**Create** the electrical network from the given transfer function

2. **Syllabus:**

- **GRAPH THEORY AND ITS APPLICATIONS** **(06 Hours)**
  Fundamental concepts, definitions of a graph and various related terms, cut sets and tie sets, matrices of oriented graphs, properties and inter relationships of incidence, tie set and cut set matrices, complete circuit analysis using tie set and cut set techniques

- **LAPLACE TRANSFORMATION** **(06 Hours)**
  Laplace transform properties and theorems, Laplace transform of standard functions, Laplace transforms for periodic functions, initial and final value theorems, Inverse Laplace transform using partial fraction expansion, Waveform synthesis.

- **AC AND DC TRANSIENTS** **(06 Hours)**
  Initial and final conditions of networks and their S-domain equivalent circuits , R-L, R-C and R-L-C DC transients, two mesh transients, R-L, R-C and R-L-C sinusoidal transient analysis using Laplace transform methods, two mesh AC transients, complete response of RL, RC and RLC circuits to step, sinusoidal, exponential, ramp, impulse and the combinations of these excitations.

- **TWO PORT NETWORK ANALYSIS** **(06 Hours)**
  Two port network concepts, impedance, admittance, hybrid and transmission line parameters for two port networks and their interrelationship. Bridged T, Parallel T and Lattice network.

- **TWO TERMINAL PAIR REACTIVE NETWORKS (FILTERS)** **(06 Hours)**
  Ladder network and its decomposition into tee, pie, and L sections, image impedance, image transfer function and applications to LC networks, attenuation and phase shift in symmetrical Tee and Pie networks, constant K-filters, m-derived filters, problems of terminations

- **NETWORK FUNCTIONS** **(06 Hours)**
  Poles and zeros of a function, physical and analytical concepts, terminals and terminal pairs, driving point immittances, transfer functions, restrictions on locations of poles and zeros in S-plane. time domain behavior from pole zero locations in the S plane, procedure for finding network functions for general two terminal pair network

- **NETWORK SYNTHESIS** **(06 Hours)**
  Two-terminal network synthesis. Properties of Hurwitz polynomial and Positive real function. Synthesis of LC, RC and RL Networks, Foster Forms and Cauer Forms.

- **TUTORIALS** **(14 Hours)**

(Total Contact Hours: 56)

3. Books Recommended:

1. M.E.Van Valkenburg, "Network Analysis", 3rd Ed., Prentice Hall, India, 2002.
2. Charles K. Alaxander, Matthew N.O. Sadiku, "Fundamentals of electric circuits", 5th Ed., Tata McGraw Hill, 2013.
3. Edminister Joseph A., "Electrical circuits", Schaum's outline series, 2nd Ed., McGraw hill, 1983.
4. Hayt W. H., Kemmerly J. E, Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw Hill, 2006.
5. Raymond A. Decarlo, Pen-Min Lin, "Linear Circuit Analysis", 2nd Ed., Oxford University Press, 2003.

4. Reference Books:

1. J. David Irwin, Robert M. Nelms., "Engineering Circuit Analysis", 10th Ed., Wiley India, 2013.
2. A.Chakrabarti, "Circuit Theory", 6th Ed., Dhanpat Rai & Co., 2012.
3. Wadhwa C.L., "Network Analysis & Synthesis", 3rd Ed., New Age International, Revised 2007.

ENGINEERING MATHEMATICS-III

L	T	P	Credit
3	1	0	4

MA 217 **Scheme**

1. **Course Outcomes (COs):**

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

CO1	**Describe** the convergence and divergence of infinite series.
CO2	**Apply** a Fourier series for periodic functions in different cases.
CO3	**Analyze** the Fourier integral and Fourier transform of a function.
CO4	**Evaluate** the basic properties of matrices, eigenvalue and eigenvectors with applications.
CO5	**Develop** basic concept of the linear algebra to electronics engineering problems.

2. **Syllabus:**

- **INFINITE SERIES** **(07 Hours)**

  Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe's test, Logarithmic test, Integral test, Gauss's test, Series with arbitrary terms, Rearrangement of terms

- **FOURIER SERIES** **(06 Hours)**

  Definition, Fourier Series with Arbitrary Period, In Particular Periodic Function With Period 2π. Fourier Series of Even and Odd Functions, Half Rang Fourier Series.

- **FOURIER INTEGRAL AND TRANSFORM** **(07 Hours)**

  Fourier Integral Theorem, Fourier Sine and Cosine Integral Complex Form Of Integral, Inversion Formula For Fourier Transforms, Fourier Transform of derivative of a Functions.

- **MATRICES** **(08 Hours)**

  Properties of matrices, Non-singular Matrices, Reduced Row-Echelon form, Systems of linear equations, Solution of system of linear equations,LU Decomposition Method.

- **EIGENVALUES AND EIGENVECTORS** **(07 Hours)**

  Eigen values and eigenvectors, Characteristic polynomials, Minimal polynomials, Diagonalizability, Triangularization, Rational canonical form, Jordon canonical form, Positive Define Matrices, Singular Value Decomposition.

- **VECTOR SPACE AND SUBSPACES** **(07 Hours)**

  Fields, Vector spaces over a field, subspaces, Linear independence and dependence, coordinates, Bases and dimension,Gram-Schmidt orthonormalization, Orthonormal basis, Orthogonal projection.

(Total Contact Hours : 42)

3. Books Recommended:

1. Malik S.C., and Arora S., "Mathematical Analysis", 5th Ed., Wiley Eastern Ltd., New Age International Publishers, 2017.
2. Kreyszig E., "Advanced Engineering Mathematics", 10th Ed., John Wiley, 2015.
3. Wiely C. R., "Advance Engineering Mathematics", 6th Ed., McGraw-Hill, 1995.
4. Gilbert Strang, "Introduction to Linear Algebra", 5th Ed., Wellesley-Cambridge Press, 2016.
5. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2nd Ed. PHI publication, 2009.

STATISTICAL SIGNAL ANALYSIS

L	T	P	Credit
3	1	0	4

EC 202 **Scheme**

1. Course Outcomes (COs):

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

CO1	**Describe** probability, random variable and random process and parameters related to them.
CO2	**Classify** different types of random variables and random processes.
CO3	**Analyze** random variables and random processes using knowledge of pdfs, cdfs, autocorrelation functions, power spectral density, etc.and LTI systems with random inputs.
CO4	**Evaluate** moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
CO5	**Design** problems based on probability, random variables and random processes.

2. Syllabus:

- **COMBINATORIAL ANALYSIS** **(03 Hours)**
  Introduction, The Basic Principle of Counting, Permutations, Combinations, Multinomial Coefficients, The Number of Integer solutions of Equations

- **PROBABILITY THEORY** **(04 Hours)**
  Scope and History, Probability as Frequency of Occurrence, Set, Fields, Sample Space and Events, Axiomatic Definition of Probability, Mutually Exclusive Events, Joint Probability, Conditional Probability and Statistical Independence, Bays Theorem.

- **RANDOM VARIABLES** **(10 Hours)**
  Continuous and Discrete Random Variables, Cumulative Distribution Function (CDF), Probability Density Function (PDF), Properties of CDF and PDF, Some Special PDFs: Uniform, Gaussian, Rayleigh, Chi-Square, Binomial, Poisson, Transformations of Random Variables, PDF of Transformed Random Variable, Mean and Variance, Chebyshev's Inequality, Moments, Characteristic Functions, Simulation Techniques in MATLAB

- **MULTIPLE RANDOM VARIABLES** **(10 Hours)**
  Bivariate Distributions, One Function to Two Random Variables, Two Function to Two Random Variables, Joint Moments, Multivariate Expectations, Mean And Variance of The Sum of Random Variables, Multivariate Gaussian Distribution, Conditional Distributions, Conditional Expected Values, Correlation Between Random Variables, Law of Large Numbers, Central Limit Theorem and its Significance, Simulation Techniques in MATLAB

- **STOCHASTIC PROCESS** **(07 Hours)**
  Definitions, Statistics of Stochastic Process, Mean, Autocorrelation, Auto covariance, Stationary Processes: Strict Sense Stationary and Wide Sense Stationary, Power Spectral Density, Joint Statistical Averages of Two Random Processes, Cross Correlation and Cross Covariance, Ergodicity, Ergodic Processes, Simulation Techniques in MATLAB

- **SOME SPECIAL PROCESSES** **(04 Hours)**
  Gaussian Processes, Poisson Processes, The Markov Processes With Examples.

- **RANDOM PROCESSES IN LINEAR SYSTEMS** **(04 Hours)**
  Transmission of a Random Process Through LTI System, Stationarity of the Output, Autocorrelation and Power Spectral Density of the Output, Examples with White Noise as the Input, Linear Shift Invariant Discrete Time System with a WSS Sequence as Input

- **TUTORIALS** **(14 Hours)**

(Total Lecture Hours : 56)

3. <u>Books Recommended:</u>

1. Papoulis A., S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th Ed., McGraw-Hill, 2006.
2. Alberto Leon-Garcia, "Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Ed., Pearson, 2007.
3. Steven Kay, "Intuitive Probability and Random Processes using MATLAB", 1st Ed., Springer, 2006.
4. Sheldon Ross, "A First Course in Probability", 9th Ed., Pearson, 2012.
5. Montgomery and Ruger, "Applied Statistics and Probability for Engineers", 1st Ed., John Wiley, 2006.

PRINCIPLES OF COMMUNICATION SYSTEMS

L	T	P	Credit
3	1	2	05

EC 204 **Scheme**

1. Course Outcomes (COs):

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

CO1	**Describe** the basic principles of communication techniques including important terminology like baseband signals, modulation, bandwidth, noise, system parameters etc.
CO2	**Explain** about sampling with ADC, signal processing and statistical aspects involved in communication with time and frequency domain fundamentals.
CO3	**Implement** analog communication systems and digital baseband preparation stage.
CO4	**Analyze** the performance of various modulation techniques, case study and problem solving as per given parameters.
CO5	**Evaluate** the various stages of analog communication link, baseband digital and point to point link performance parameters by experimentation using modern tools/simulators and hardware.
CO6	**Design** various stages of analog communication systemand digital database preparation with optimum parameter selection criteria satisfying performance requirements overcoming noise and interference.

2. Syllabus:

- **ANALYSIS AND TRANSMISSION OF SIGNALS (07 Hours)**

  Fourier Series, Fourier Transform Properties and their applications in communication systems, The Exponential Fourier Series, Aperiodic signal representation by Fourier Integral, Transmission of some useful functions, Negative frequency concepts, Signal Transmission Through a Linear System and Convolution concepts, Ideal versus Practical Filter, Channel as a filter, Signal Distortion over a Communication Channel, Signal Energy and Energy Spectral Density, Signal Power and Power spectral Density.

- **AMPLITUDE MODULATION AND DEMODULATION (08 Hours)**

  Band-pass Signal Representation Baseband Vs Carrier Communications, DSB-C And DSB-SC Amplitude Modulation, Bandwidth Efficient AM: SSB, Vestigial Sideband (VSB) Transmission, Local Carrier Synchronization, Frequency Division Multiplexing, Phase Looked Loop and Some Applications.

- **ANGLE MODULATION AND DEMODULATION (08 Hours)**

  Nonlinear Modulation, Bessel's function, Carson's Rule, Bandwidth of Angle Modulated Waves, NBFM and WBFM, Generating FM Waves, Demodulation of FM Signals, Effects Of Nonlinear Distortion and Interferences, Phase Modulation Concepts.

- **AM/FM TRANSMITTERS AND RECEIVERS (06 Hours)**

  AM/FM Transmitter Designs, AM/FM Receiver designs, Super-Heterodyne Principle: RF front end, Local oscillator, Mixer, Intermediate frequency stage, Image Frequency, Automatic Frequency Control, Automatic Gain Control, AM/FM Receivers, FM Broadcasting System. Preemphasis and Deemphasis.

- **NOISE** **(06 Hours)**

  Various Types of Noises: Internal (Shot, Thermal, Agitation, Transit Time) Noise and External (Atmospheric, Extra-Terrestrial, Industrial) Noise, White Noise and Filtered Noise, AWGN Properties, Noise Equivalent Bandwidth Concept, Noise Sampling, Signal To Noise Ratio.AM and FM systems in presence of noise.

- **PULSE MODULATION TECHNIQUES** **(07 Hours)**

  Sampling and A to D conversion, Quantization techniques—Uniform and Non-uniform, A-law and μ-law, Pulse Code Modulation, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width modulation, Digital Telephony Example-T1/E1 carrier system, TDM, DPCM and ADPCM, Delta Modulation.

- **TUTORIAL** **(14 Hours)**

(Total Contact Hours: 56)

3. Practicals:

1. Study of the Spectrum Analyzer.
2. Study of Various Signals and their Spectrum Using MATLAB.
3. DSB-SC And DSB-C AM Transmitter and Receiver with Tone and Voice Input.
4. FM Transmission and Reception Techniques.
5. Frequency Division Multiplexing Techniques.
6. Simulation of AM and FM transceiver models.
7. AM and FM Simulation on MATLAB with AWGN Channel and Concept of SNR.
8. Study of various Pulse Modulation Techniques
9. Sampling and Pulse Code modulation Technique and ADCPM Technique.
10. Delta modulation and demodulation

4. Books Recommended:

1. Lathi B. P., and Ding Zhi, "Modern Digital and Analog Communication Systems", 4th Ed., Oxford University Press 2010/ 5th Ed., 2018.
2. Proakis J. and Salehi M., "Fundamental of Communication Systems", 1st Ed., PHI/Pearson Education-LPE, 2006.
3. Carlson Bruce A., Paul B Crilly "Communication Systems- An Introduction to Signal and Noise in Electrical Communication", 5th Ed., McGraw-Hill, 2011.
4. Leon W. Couch, II "Digital and Analog Communication Systems", 8th Ed., Pearson Education-LPE, 2013.
5. Taub Herbert, Donald Schilling, Goutam Saha "Principal of Communication Systems", 4th Ed., Tata McGraw-Hill, 2013.

MICROPROCESSOR AND MICROCONTROLLERS

L	T	P	Credit
3	1	2	05

EC 206 **Scheme**

1. **Course Outcomes (COs):**

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

CO1	**Classify** microprocessor and microcrontoller with RISC & CISC architectures.
CO2	**Describe** 8-bit/16-bit microcontroller.
CO3	**Analyze** merits of ARM controllers along with architectural features and instructions of ARM Cortex-M microcontroller.
CO4	**Elevate** the knowledge gained for Programming ARM Cortex M for different applications.
CO5	**Design** embedded system with various peripheral interfacing.

2. **Syllabus:**

- **INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLER (06 Hours)**

  Microprocessor architectures basics, 8085 as Von Neumann CISC CPU. Bus system and its operation. Memory and peripheral interfacing. Advanced Microprocessors, Von Neumann vs Harvard, CISC vs RISC architecture, Overview and features of 8051 microcontroller, Overview of the various commercially available 8-bit/16-bit Microcontrollers

- **ARM 32-BIT MICROCONTROLLER (10 Hours)**

  Architecture of ARM Cortex M0+, Various Units in the architecture, Thumb-2 technology, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence. Other Cortex series processors

- **ARM CORTEX M0+ INSTRUCTION SETS AND PROGRAMMING (12 Hours)**

  Arm & Thumb Instruction Set: Data Processing Instruction, Branch Instruction, Load Store Instruction, Special instructions, Bit-band operations and CMSIS, Assembly and C Language Programming.

- **EMBEDDED SYSTEM COMPONENTS (14 Hours)**

  Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Peripheral interfacing such as timers, ADC, DAC, Sensors, Actuators, LED/LCD display, Push button switches, Communication Interface standards (onboard and external), Embedded firmware, Other system components, RTOS based embedded system..

- **TUTORIALS (14 Hours)**

(Total Contact Hours: 56)

3. Practicals:

(The practical set is based on ARM Cortex-M Kit)

1. Introduce Keil ARM – MDK development flow
2. Write an program to flash simple LEDs (D0, D1, ..., D7) connected to Ports in various patterns
3. Write code to show up/down BCD count on Multiplexed 7-segment LED display updated every second. Use two keys (up & down) to change direction of counting.
4. Write a program to display “Welcome to SVNIT” as welcome message on LCD interface.
5. Interface 4x4 keypad and pressed display key on LCD
6. Establish full duplex ASCII communication between kit and PC using UART
7. Generate Sine wave/Triangle/Square wave using SPI based DAC and observe on CRO. Increase or Decrease frequency using Keys in decades.
8. Using the internal PWM module of ARM controller generate PWM and vary its duty cycle
9. Interface DC and stepper motor and demonstrate its operation
10. Demonstrate the use of an external interrupt to toggle an LED ON/OFF
11. Display digital output for given analog input using internal ADC

4. Books Recommended:

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M0/M0+ processors, 2nd Ed., Newnes, (Elsevier), 2015.
2. A.N.Sloss, D.Symes and C. Wright, “ARM System Developer’s Guide: Designing and Optimizing System Software”, Elsevier, 2004.
3. ARM Cortex M0 Technical Reference Manual. Available at:http://infocenter.arm.com/help/topic/com.arm.doc.ddi0432c/DDI0432C_cortex_m0_r0p0_trm.pdf
4. Gaonkar R. S., "Microprocessor Architecture, Programming and Applications with 8085", 5th Ed., Penram International, Indian, 2002.
5. Ram B., "Fundamental of Microprocessor & Microcomputers", 6th Ed., Dhanpat Rai Publications, 2003.

5. Reference Book:

1. Shibu K V, “Introduction to Embedded Systems”, 2nd Ed., Tata McGraw Hill, 2009

LINEAR IC APPLICATIONS

L	T	P	Credit
3	1	2	05

EC 208 **Scheme**

1. Course Outcomes (COs):

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

CO1	**Describe** an op-amp fundamentals and its specifications.
CO2	**Analyze** and design active filters and oscillators using op-amp and functional ICs.
CO3	**Classify** the working principle of data converters and selecting appropriate D/A and A/D converters for signal processing applications.
CO4	**Compare** the working of multi vibrators using special application IC 555 and general-purpose op-amp.
CO5	**Design** the linear and nonlinear applications of an op-amp using IC 741.

2. Syllabus:

- **OPERATIONAL AMPLIFIER FUNDAMENTALS (06 Hours)**
  Operational Amplifier, Basic Op-Amp Configuration, An Op-Amp with Negative Feedback, Voltage Series and Voltage Shunt Configurations, Difference Amplifiers, Instrumentation Amplifier, Specification of an Op-Amp, Offset Voltages and Currents, CMRR, Slew Rate, PSRR, Input Bias and Offset Currents, Frequency Response, GBW Product, Compensated Op-amp and Non-Compensated Op-Amp.

- **GENERAL LINEAR APPLICATIONS (06 Hours)**
  Summing, Scaling and Averaging Amplifiers, Concept of Negative Resistance, Voltage to Current Converter with Floating and Grounded Load, Current to Voltage Converter, Integrator and Differentiator, Gyrator, Frequency dependent negative resistance circuit.

- **ACTIVE FILTERS AND OSCILLATORS (12 Hours)**
  First Order Active Filters, Second-Order Active Filters, Multiple Feedback Filters (Band Pass and Band Reject Filters), All Pass Filter, Cascade design of filters, Magnitude and Frequency scaling concept, Oscillators, Phase Shift and Wien Bridge Oscillators, Square, Triangular and Saw Tooth Wave Generators.

- **NON-LINEAR CIRCUITS (05 Hours)**
  Schmitt Trigger, Voltage Comparator, Voltage Limiters and Window Detector, Concept of Clippers and Clampers Circuit using passive component, Clippers and Clampers using OpAmp, Peak Detector, Precision Rectifiers, Analog Switches.

- **MULTI-VIBRATOR CIRCUIT (05 Hours)**
  Concept of Multi-vibrator Circuit using passive component, the 555 Timer, Astable Mode operation, Monostable Mode operations, Applications of 555 Timer Circuit.

- **D/A AND A/D CONVERTERS (08 Hours)**
  Introduction, D/A Converters, Performance Parameters of D/A Converter, Basic D/A Conversion Techniques, Sources of Errors in D/A Converters, D/A Converter IC, A/D Converters, Performance parameters of A/D Converter, Counter Type A/D converter, Successive approximation Conversion, Flash A/D, Single and Dual Slope A/D, A/D Converter IC.

- **TUTORIALS** **(14 Hours)**

(Total Contact Hours: 56)

3. Practicals:

1. Design and implement Zero Crossing Detector, Positive Level Detector and Negative Level Detector or inverting and non-inverting configuration using IC 741.
2. To study the effect of Loading and input impedance for Inverting and Non-inverting negative feedback amplifier using IC 741.
3. Design and implement Inverting and Non-inverting negative feedback amplifier for given gain using IC 741. Also analyze the frequency response.
4. Design and implement Summing, Averaging and Scaling amplifier. Also implement 4 input Subtractor using IC 741.
5. Design and implement Practical Integrator for given cut-off frequency using IC 741. Also analyze the frequency response.
6. Design and implement Practical Differentiator for given cut-off frequency using IC 741. Also analyze the frequency response.
7. Design and implement 1st and 2nd order Low-pass filter for given cut-off frequency using IC 741. Also analyze the frequency response.
8. Design and implement 1st and 2nd order High-pass filter for given cut-off frequency using IC 741. Also analyze the frequency response.
9. Design and implement Notch filter for given notch frequency using IC 741. Also analyze the frequency response.
10. Design and implement All pass filter for given phase difference using IC 741.
11. Design and implement RC Phase shift and Wein bridge oscillator using IC 741.
12. Design and implement Square wave Generator using IC 741.
13. Design and implement Monostable and Astable Multivibrator using 555 timer.
14. Design and implement Voltage Regulator using IC 7805. Also perform Load and Line Regulation.

4. Books Recommended:

1. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Ed., McGraw- Hill, Published: May 11, 2016.
2. Coughlin and Driscol, "Op-Amps And Linear Integrated Circuits", 6th Ed., PHI, 2003
3. GayakwadRamakant, "Op-Amps and Linear Integrated Circuits", 4th Ed., PHI, 2003.
4. Salivahanan S., "Linear Integrated Circuits", 4th Reprint, McGraw-Hill, 2010.
5. Roy Choudary D. and Shail B. Jain, Linear Integrated circuits, 4th Ed., New Age International Publishers, 2010.

5. Reference Book:

1. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, 4th Ed., Old Dominion University, Pearson Education, 2002.

CONTROL SYSTEMS

L	T	P	Credit
3	1	0	04

EE 214 **Scheme**

1. **Course Outcomes (COs):**

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

CO1	**Describe** various types of control systems and to impart knowledge of mathematical modelling of physical systems.
CO2	**Explain** the response of various control systems in the time domain.
CO3	**Demonstrate** the stability of control systems using a variety of methods.
CO4	**Analyze** the response and stability of control systems using frequency domain techniques.
CO5	**Evaluate** various control schemes for linear systems.
CO6	**Design** of P, PI, PID controllers.

2. **Syllabus:**

- **INTRODUCTION TO CONTROL SYSTEMS** **(02 Hours)**
  Open loop control and close loop control; illustrative examples of control systems.

- **MATHEMATICAL MODELS OF PHYSICAL SYSTEMS** **(10 Hours)**
  Linear and non-linear systems; equations and transfer functions for linear mechanical translational systems and linear electrical network; Force-Voltage and Force-Current analogy; Block diagram representation of control systems; Block diagram reduction; Transfer functions of armature-controlled and field-controlled DC servomotors and 2-phase AC servomotors; Signal flow graph and Mason's gain formula.

- **TIME DOMAIN ANALYSIS OF CONTROL SYSTEMS** **(06 Hours)**
  Typical test signals; Response of first-order systems; Transient response of a second order system due to step input; Time domain specifications of a second order system; Impulse and ramp response of second order system; Steady-state errors; Static error coefficients; Error series and dynamic error coefficients.

- **CONCEPTS OF STABILITY** **(08 Hours)**
  Introduction to stability, definition through impulse response function, asymptotic stability and relative stability, Routh-Hurwitz stability criterion. Basic Properties of Root Loci, Construction of Root Loci, Effects of Adding Poles and Zeros.

- **FREQUENCY DOMAIN ANALYSIS OF CONTROL SYSTEMS** **(08 Hours)**
  Steady state response of a system due to sinusoidal input; Frequency response; Logarithmic plots or Bode diagrams; Log-magnitude versus phase plots; Resonant peak and resonant frequency of a second order system; Polar plots; conformal mapping, principal of argument, Nyquist stability criterion, Stability analysis; Relative stability; Gain margin and phase margin; Closed loop frequency response.

- **DESIGN OF CONTROL SYSTEMS** **(08 Hours)**
  Introduction to phase lag, phase lead and phase lag-lead networks and their applications. P, PI, PID Controllers.

- **TUTORIALS** **(14 Hours)**

(Total Contact Hours : 56)

3. Books Recommended:

1. I.J. Nagrath, M. Gopal, "Control system engineering", New Age International Publishers, 3rd Ed., 2001.
2. K. Ogata, "Modern control system engineering", Pearson Education Asia, 4th Ed., 2002.
3. B.C. Kuo, "Automatic control system", Prentice Hall of India, 7th Ed., 1995
4. R.C. Dorf, R.H. Bishop, "Modern control system", Pearson Education Asia. 8th Ed., 2004.
5. N. S. Nice, "Control System Engineering", John willey& sons, 4th Ed., 2004.

4. Reference Book:

1. K. Dutton, S. Thompson, B. Barralough, "The Art of Control Engineering", Prentice Hall, 1997