SCHEME OF INSTRUCTION
BE (ELECTRONICS & COMMUNICATION ENGINEERING)
Proposed from the Academic year 2017-18

BE: SEMESTER – IV

S.No.	Course Code	Course Title	L	T	P	Hrs/ Wk	Scheme of Examination		Credits
							CIE	SEE	
1.	PC 401 EC	Analog Electronic Circuits	3	1	-	4	30	70	3
2.	PC 402 EC	Pulse, Digital and Integrated Circuits	3	1	-	4	30	70	3
3.	PC 403 EC	Probability Theory and Stochastic Processes	3	1	-	4	30	70	3
4.	PC 404 EC	Electromagnetic Theory and Transmission Lines	3	1	-	4	30	70	3
5.	BS 405 MT	Applied Mathematics	3	1	-	4	30	70	3
6.	ES 406 CE	Environmental Studies	3	-	-	3	30	70	3
PRACTICALS									
7.	PC 451 EC	Analog Electronic Circuits Lab	-	-	2*	2	25	50	1
8.	PC 452 EC	Pulse, Digital and Integrated Circuits Lab	-	-	2*	2	25	50	1
Total			**18**	**5**	**4**	**27**	**230**	**520**	**20**

Note: 1) Each contact Hour is a Clock Hour
*2) The Practical Class can be of Two and Half Hour (Clock Hours) duration as per the requirement of the particular Laboratory.

With effect from academic year 2017-2018

Course Code	Course Title						Core/Elective
PC 401 EC	ANALOG ELECTRONIC CIRCUITS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	30	70	3
Purpose: To learn and design electronic circuits							
Course Objectives: 1. Analyze frequency response of Amplifiers in different frequency ranges. 2. Familiarize with concept and effect of Negative Feedback 3. Study positive feedback and Design different types of oscillators. 4. Design Power Amplifiers and calculate their efficiencies. 5. Familiarize with concept of tuned Amplifiers.							

UNIT-I

Small Signal Amplifiers:

Introduction to Hybrid-pi model, relationship between hybrid-pi & h-parameter model; Classification of amplifiers, mid-frequency, Low-frequency and high frequency analysis of single and multistage RC coupled amplifier with BJT and FET. Analysis of transformer coupled amplifier in mid frequency, Low frequency and high frequency regions with BJT.

UNIT-II

Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations, Local Versus global feedback.

UNIT-III

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator.

Regulators: Transistorized series and shunt regulators

UNIT-IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations.

UNIT-V

R.F. Voltage Amplifiers: General consideration, Analysis and design of single tuned and double tuned amplifiers with BJT, Selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization & unilaterisation, introduction to staggered tuned amplifiers.

Suggested Readings:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, *Electronic Devices and Circuits*, 3rd ed.,McGraw Hill Education, 2010.
2. David A. Bell, *Electronic Devices and Circuits,* 5th ed., Oxford University Press, 2009.
3. S Salivahanan, N Kumar, and A Vallavaraj, *Electronic Devices and Circuits*, 2nd ed., McGraw Hill Education, 2007.

With effect from academic year 2017-2018

Course Code	Course Title						Core/Elective
PC 402 EC	PULSE, DIGITAL AND INTEGRATED CIRCUITS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EDC, BCA & STLD	3	2	-	-	30	70	4
Purpose: To learn Pulse & Digital Circuits							

Course Objectives:

1. To analyze linear wave shaping circuits and plot the response for various input waveforms.
2. To design and analyze non-linear circuits like clippers and clampers.
3. To analyze and design transistor multivibrators, time base generators and sweep circuits using discrete components and analyze voltage and current sweep circuits and identify methods to mitigate sweep errors.
4. To classify different ICs, calculate IC characteristics and analyze basic gates with DTL, TTL, ECL, logic family and design their interfacing circuits.
5. To build basic gates with MOS and CMOS logic family and design their interfacing circuits.

UNIT I: Linear wave shaping:

High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, RL and RLC circuits and their response for step input.

UNIT II: Non-linear wave shaping:

Diode clippers, Transistor clippers, clipping at two independent levels, Transfer chracteristics of clippers, Emitter coupled clipper, Comparators,Applications of voltagecomparators, clamping operation,Clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, Transfer characteristics of clampers. Transistor as a switch, Design of transistor switch, transistor-switching times.

UNIT III: Multivibrators:

Design and Analysis of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors,

Time base generators: General features of a time base signal, Speed, transmission and displacement errors. Analysis and Design of Sweep circuits using UJT and SCR.

UNIT IV:

Manufacturer's designations for integrated circuits, Integrated circuit package types, Pin identifications and temperature ranges, IC characteristics, Logic Families: DTL, TTL logic family, TTL series, output configuration: Open collector, Totem pole, Tri state logic. ECL logic Family

UNIT V:

MOS logic Family (PMOS and NMOS), CMOS logic family and characteristics, CMOS transmission gate (bilateral switch) and its applications, CMOS open drain and high impedance output, CMOS inverter, NAND and NOR gates, Interfacing CMOS and TTL, Comparison of TTL, CMOS and ECL logic families.

Suggested reading

1. J. Millman, H. Taub and S Rao, *Pulse, Digital and Switching Waveforms*, 3rd edition, McGraw-Hill, 2014.
2. David A. Bell, *Pulse, Switching and Digital Circuits*, 5th edition, Oxford University Press, 2015.
3. R. P Jain, *Modern Digital Electronics,*4th ed., McGraw Hill Education (India) Private Limited, 2003

With effect from academic year 2016-2017

Course Code	Course Title						Core/Elective
PC 403 EC	PROBABILITY THEORY AND STOCHASTIC PROCESSES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	30	70	3

Course objectives:

1. To understand different types of Random variables their density distribution functions
2. To learn one Random variable characteristic functions of different variables using their density functions
3. To learn the concepts of sequences of Random variables, Properties of Random vectors
4. To understand elementary concepts of the Random Processes or distribution functions
5. To understand the functions of two Random variables probability density distribution of the joint Random variables

UNIT-I: Probability and Random Variable

Probability: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events.

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables.

UNIT -II: Distribution & Density Functions and Operation on One Random Variable – Expectations

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, Properties.

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

UNIT-III: Multiple Random Variables and operations

Multiple Random Variables: Joint Distribution Function and its Properties Joint Density Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (Proof not expected), Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables:
Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties.

UNIT-I : **Random Processes – Temporal Characteristics:**
The Stochastic Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, Nth Order and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross-Correlation Functions, Gaussian Random Processes, Poisson Random Process.

UNIT-V: Random Processes – Spectral Characteristics:

The Power Density Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum and its Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Some Noise Definitions and Other Topics: White Noise and Colored Noise, Product Device Response to a Random Signal. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Spectral Density of Input and Output of a Linear System.

SUGGESTED READINGS:

1. Peyton Z. Peebles, *Probability, Random Variables & Random Signal Principles*, 4th edition, Tata McGraw Hill, 2001.
2. Athanasius Papoulis and S. Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, 4th edition, McGraw Hill, 2006.
3. Henry Stark and John W. Woods, *Probability and Random Processes with Application to Signal Processing*, 3rd edition, Pearson Education, 2014.
4. P. Ramesh Babu, *Probability Theory and Random Processes*, 1st edition, McGraw Hill Education (India) Private Limited, 2015.

With effect from academic year 2017-2018

Course Code	Course Title						Core/Elective
PC 404 EC	Electromagnetic Theory and Transmission Lines						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	30	70	3
Purpose: To learn Electromagnetic theory and transmission line concepts							

Course Objectives:

1. Analyze fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications
2. Describe the relationship between Electromagnetic Theory and circuit theory
3. Formulate the basic laws of static electricity and magnetism and extend them to time varying fields
4. Define the Maxwell's equations leading to the wave equations in various media
5. Define wave propagation characteristics.
6. Analyze fundamental concepts of Transmission lines
7. Formulate the basic relationship between distortion less transmission lines & applications.
8. Analyze the various transmission lines and their characteristics.

Unit – I

Review of coordinate systems. Coulomb's Law, Electric field due to various Charge configurations and Electric flux density. Gauss's Law and its applications. Work, Potential and Energy, The dipole. Current and Current density, Laplace and Poisson's equations. Calculation of capacitance for simple configurations.

Unit – II

Steady magnetic-Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varying fields.

Unit – III

Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Poynting theorem and its applications. Reflection: Normal incidence on dielectrics and conducting medium. Reflection: Oblique incidence on dielectrics and conducting medium,

Unit – IV

Concept of symmetrical network-T and π networks. Types of Transmission Lines-Two wire lines. Primary and secondary constants. Transmission Line equations. Infinite line and characteristic impedance- Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.

Unit – V

Impedance at any point on the transmission line- Input impedance. RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection and VSWR. Matching: Stub matching. Smith chart and its applications.

Suggested books:

1. Matthew N.O. Sadiku, *Principles of Electro-magnetics*, 6th edition, Oxford University Press, 2016
2. William H. Hayt Jr. and John A. Buck, *Engineering Electromagnetics*, 7th edition, Tata McGraw Hill, 2006
3. John D. Ryder, *Networks Lines and Fields*, 2nd edition, Pearson, 2015
4. E.C. Jordan and K.G. Balmain, *Electromagnetic Waves and Radiating Systems*, 2nd edition, Pearson, 2015
5. K.D.Prasad, *Antennas and Wave Propagation*, Khanna Publications.

Course Code	Course Title						Core/Elective
BS 405 MT	APPLIED MATHEMATICS						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
NIL	**3**	**1**	**-**	**-**	**30**	**70**	**3**
Purpose: To learn vectors and numerical methods.							
Course Objectives: • To introduce the concept of vector spaces and linear transformations • To introduce a few numerical methods to solve certain types of problems • To study correlation, regression and optimization							

UNIT- I

Linear Algebra:

Vector spaces, Subspaces, Basis and dimension, Linear transformations and their representation by matrices, Rank and Nullity of transformation.

UNIT- II

Numerical methods:

Solution of Algebraic and Transcendental equations**-**Bisection method, Regula falsi method, Newton-Raphson method, Solution of linear system of equations, Gauss elimination method, Gauss- Seidel iteration method, Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Newton's Forward and Backward difference interpolations.

UNIT- III

Numerical differentiation, Interpolation approach, Numerical solutions of ordinary differential equations Single step methods, Taylor's series method, Euler method, Picard's method of successive approximation, Runge-Kutta method of 4^{th} order, Multi step methods, Predictor-Corrector method, Euler PC method, Miline and Adams Moulton PC method.

UNIT-I V

Curve fitting:

Curve fitting by method of least squares**,** correlation and regression, types of correlations, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, equations to the lines of regression.

UNIT- V

Optimization:

Basic Concepts,Unconstrained Optimization, Linear Programming, Simplex method, Simplex Method : Difficulties.

Suggested Readings:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications,
1. 4^{th} Edition, 2014.
2. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43^{rd} Edition,2014.
3. Gupta & Kapoor, *Fundamentals of Mathematical statistics*, Sultan chand & sons, New Delhi, 2014.
4. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 9^{th} Edition, 2012.
5. S.C.Gupta and V.K.Kapoor, *Fundamentals of Mathematical Statistics,* Sultan Chand& Sons, 2014.

Course Code	Course Title						Core/Elective
PC 451 EC	ANALOG ELECTRONIC CIRCUITS LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EDC theory & Lab	-	-	-	2	25	50	1

Purpose: To acquaint with various Analog Electronic circuits Design and implementation

Course Objectives

1. Conduct experiments, take measurements and analyze the data through hands-on experience in order to demonstrate understanding of the theoretical concepts of **Analog Electronic Circuits**, while working in small groups.
2. Demonstrate writing skills through clear laboratory reports.
3. Employ graphics packages for drawing of graphs and use computational software for statistical analysis of data.
4. Compare the experimental results with those introduced in lecture, draw relevant conclusions and substantiate them satisfactorily.
5. Transfer group experience to individual performance of experiments and demonstrate effective oral communication skills.

List of Experiments

1. Two Stage R-C Coupled CE BJT Amplifier
2. Two Stage R-C Coupled CS FET Amplifier
3. Voltage Series Feedback Amplifier
4. Voltage Shunt Feedback Amplifier
5. Current Shunt Feedback Amplifier
6. RC Phase-Shift and Wein-bridge Oscillator
7. Hartley and Colpitts Oscillator
8. Design of Class-A power amplifier
9. Design of Class-B power amplifier
10. Frequency response of Tuned Amplifier
11. Transistor Regulator
12. Constant K Low Pass and High Pass Filter
13. m-Derived Low Pass and High Pass Filter

Note:

1. A minimum of 10 experiments should be performed
2. It is mandatory to simulate a any three experiments using SPICE

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, *Michael A. Miller, Basic Electronics, A Text - Lab Manual,* 7th Edition, TMH 2001.

Course Code	Course Title				Core/Elective		
PC 452 EC	PULSE, DIGITAL AND INTEGRATED CIRCUITS LAB				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EDC & STLD	-	-	-	2	25	50	1
Purpose: To acquaint with various Pulse & Digital Circuits							
Course Objectives: 1. To implement high pass and low pass circuit and study it's performance 2. To implement clipping and clamping circuits and study it's performance 3. To design and test bi-stable, mono-stable, astable multi-vibrators 4. To study the characteristics of a Schmitt trigger 5. To build sweep circuits and study it's performance							

List of experiments

1. Low Pass and High pass RC circuits
2. Two level clipping circuits
3. Clamping circuits
4. Transistor Switching timer
5. Collector coupled Bistable Multivibrators
6. Collector coupled Monostable Multivibrators
7. Collector coupled Astable Multivibrators
8. Schmitt Trigger Circuit
9. Miller sweep circuit
10. Bootstrap sweep circuit
11. Astable Blocking Oscillator
12. U.J.T. (Relaxation) Sweep Generator

Suggested Reading:

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit theory", 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2. David A.Bell, "Laboratory Manual for Electronic Devices and Circuits", 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.