SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV- Semester
(ELECTRONICS AND TELECOMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	ES 305 ET	Signals and Systems	3	1	-	4	30	70	3	4
2	PC 403 ET	Analog Electronic Circuits	3	-	-	3	30	70	3	3
3	PC 404 ET	Computer Organization and Architecture	3	-	-	3	30	70	3	3
4	PC 405 ET	Electromagnetic Theory and Transmission Lines	3	-	-	3	30	70	3	3
5	PC 406 ET	Pulse and Linear Integrated Circuits	3	-	-	3	30	70	3	3
6	PC 407 ET	Electronic Measurements and Instrumentation	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7	PC 453 ET	Analog Electronic Circuits Lab	-	-	2	2	25	50	3	1
8	PC 454 ET	Pulse and Linear Integrated Circuits Lab	-	-	2	2	25	50	3	1
Total			**18**	**1**	**4**	**23**	**230**	**520**		**21**

PC: Professional Course **ES:** Engineering Science

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

ET: Electronics and Tele Communication Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

SIGNALS AND SYSTEMS

ES 305 ET

Instruction: 3+ 1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 4

Objectives:

1. Analyze basic concepts related to continuous time signals and systems, mathematical representation of periodic signals. Familiarize with basic operations on signals and mathematical representation of a periodic signals using Fourier and Laplace transform.
2. Analyze basic concepts related to discrete time signals and systems, mathematical representation discrete time signals.
3. Describe the concept of Z- Transform and its properties and illustrate their applications to analyze systems. Define convolution, correlation operations on continuous and discrete time signals.

Outcomes: On successful completion of the course, the students would be able to

1. Define and differentiate types of signals and systems in continuous and discrete time.
2. Apply the properties of Fourier transform for continuous time signals.
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs.
4. Apply Z-transforms for discrete time signals to solve Difference equations.
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation.

UNIT – I
Definitions and classifications: Classification of signals. Elementary continuous time signals, Basic operations on continuous-time signals. ***classification of continuous-time systems:*** Continuous time & discrete time systems, lumped-parameter & distributed –parameter systems, static & dynamic systems, causal & non-causal systems, Time-invariant & time-variant systems, stable & unstable systems.
UNIT – II
Representation of Continuous-time signals: Analogy between vectors and signals, orthogonality and completeness. ***Fourier series Analysis of Continuous-time signals*:** Fourier series – Existence of Fourier series, Trigonometric and Exponential Fourier series, computational formulae, symmetry conditions, complex Fourier spectrum.
UNIT – III
Continuous-time Fourier Transform (FT)*:* The direct and inverse FT, existence of FT, Properties of FT, FT of standard signals, properties of FT, The Frequency Spectrum. ***Linear Convolution of continuous time signals***: Graphical interpretation, properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, properties of correlation.

Laplace Transform (LT) Analysis of signals and systems**:** The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, system transfer function.
UNIT – IV
Discrete-time signals and systems*:* Sampling, Classification of discrete-time signals, Basic operations on discrete time signals, Classification of discrete time systems, properties of systems. ***Linear Convolution of discrete time signals*****:** Graphical interpretation, properties of discrete convolution. ***Fourier analysis of discrete-time signals:*** Discrete-time Fourier transform (DTFT), properties of DTFT, Transfer function, Discrete Fourier transform properties of DFT
UNIT – V
Z-Transform analysis of signals & systems**:** The direct Z transform, Region of convergence, Z-plane and S-plane correspondence. Inverse Z transform, Properties of Z-transforms. Solution to linear difference equations, Linear constant coefficient systems, System transfer function.

Suggested Readings:

1	B. P. Lathi, "*Linear Systems and Signals",* Oxford University Press, 2/e, 2009.
2	Alan V Oppenheim, A. S. Wlisky, "*Signals and Systems",* 2/e, Prentice Hall
3	Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, "*Signals and Systems",* 4/e, Pearson 1998.
4	Douglas K. Linder, "*Introduction to Signals and Systems",* McGraw Hill, 1999.
5	P. Ramesh babu, R Ananada Natarajan, "S*ignals and Systems",* SCITECH, 3/e, 2009.

ANALOG ELECTRONIC CIRCUITS

PC 403 ET

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1.Analyse frequency response of Amplifiers in different frequency ranges and Familiarize with concept and effect of negative feedback.
2.Study positive feedback and Design different types of oscillators.
3.Design Power Amplifiers and calculate their efficiencies and Familiarize with concept of tuned Amplifiers.

Outcomes: On successful completion of the course, the students would be able to

1. Design and analyse low frequency, mid frequency and high frequency response of small signal Single stage and Multistage RC coupled and Transformer Amplifiers using BJT and FET.
2. Identify the type of negative feedback, analyse and design of negative feedback amplifiers.
3.Design Audio Frequency and Radio Frequency oscillators.
4.Distinguish between the classes of Power Amplifiers and their design considerations.
5. Compare the performance of single and double tuned amplifiers.

UNIT – I
Small Signal Amplifiers: 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
Feedback 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 C, Class D and Class-AB operations.
UNIT – V
***RF 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 & uni-laterisation, introduction to staggered tuned amplifiers.

Suggested Readings:

1	Jacob Millman, Christos C. Halkias, and Satyabrata Jit, "*Electronic Devices and Circuit"*", 3/e, McGraw Hill Education, 2010.
2	David A. Bell, "*Electronic Devices and Circuits"*, 5/e, Oxford University Press, 2009.
3	S Salivahanan, N Kumar, and A Vallavaraj, '*Electronic Devices and Circuits'*, 2/e, McGraw Hill Education, 2007.
4	Jacob Millman, Christos Halkias, Chetan Parikh, "*Integrated Electronics"*, 2/e, McGraw Hill Education (India) Private Limited, 2011.
5	Donald L Schilling & Charles Belove, "*Electronics Circuits, Discrete & Integrated",* 3/e, McGraw Hill Education (India) Private Limited, 2002.

COMPUTER ORGANIZATION AND ARCHITECTURE

PC 404 ET

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Implement the fixed-point and floating-point addition, subtraction, multiplication & Division.
2. Describe the basic structure and operation of a digital computer and Discuss the different ways of communicating with I/O devices and standard I/O interfaces
3. Analyze the hierarchical memory system including cache memories and virtual memory. Understand issues affecting modern processors.

Outcomes: On successful completion of the course, the students would be able to

1. Perform mathematical operations on fixed and floating point digital data.
2. Illustrate the operation of a digital computer.
3. Understand I/O interfacing of a computer.
4. Interface microprocessor with memory devices.
5 Understand latest trends in microprocessors.

UNIT – I
***Data representation and Computer arithmetic*:** Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth’s algorithm and Division using restoring and non-restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.
UNIT – II
***Basic Computer organization and Design*:** Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and micro program sequencer.
UNIT – III
***Central Processing Unit*:** General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.
UNIT – IV
***Input-output Organization*:** I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output

Processor, CPU-IOP communication, I/O channel.
UNIT – V
Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory: mapping functions, Virtual memory: address mapping using pages, Memory management.

Suggested Readings:

1	Morris Mano, M., "*Computer System Architecture*", 3/e, Pearson Education, 2005.
2	William Stallings, "*Computer Organization and Architecture: Designing for performance*", 7/e, Pearson Education, 2006.
3	John P. Hayes, "*Computer Architecture and Organization*", 3/e, TMH, 1998.
4	Govindarajalu, "*Computer Architecture and Organization*", TMH.
5	Hebbar, "*Computer Architecture*", Macmillan, 2008.

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

PC 405 ET
Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Analyse fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications to describe the relationship between Electromagnetic Theory and circuit theory. Formulate the basic laws of static electricity and magnetism and extend them to time varying fields to define the Maxwell's equations in differential and integral form.
2.Derive the wave equations for conducting and di-electric mediums to analyse the wave propagation characteristics of Uniform Plane Waves (UPW) in normal and oblique incidences and analyse fundamental concepts of Transmission lines and to formulate the basic relationship between distortion less transmission lines & applications.
3.To understand the concepts of RF Lines and their characteristics, Smith Chart and its applications, acquire knowledge to configure circuit elements, QWTs and HWTs and to apply the same for practical problems.

Outcomes: On successful completion of the course, the students would be able to

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charges and to formulate the capacitance for different capacitors.
2. Learn basic magneto-statics concepts and laws such as Biot-Savarts law and Amperes law, their application in finding magnetic field intensity, inductance and magnetic boundary conditions.
3. Distinguish between the static and time-varying fields, establish the corresponding sets ofMaxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
4. Determine the Transmission Line parameters to characterize the distortions and estimate the characteristics for different lines.
5. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.

UNIT – I
***Electrostatics*:** Review of coordinate systems. Coulomb's Law, Electric field due to various Charge distributions 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

Magnetostatics**:** 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
Electromagnetic Waves: Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Power, Poynting theorem, Surface Impedence. ***Reflection and Refraction*****:** Normal and Oblique incidence on dielectric and conducting medium.
UNIT – IV
Transmission Lines 1: Overview of T and π networks. Two wire Transmission 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
Transmission Lines 2: Impedance of a transmission line, RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection coefficient and VSWR. Matching: Stub matching. Smith chart and its applications.

Suggested Readings:

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

PULSE AND LINEAR INTEGRATED CIRCUITS

PC 406 ET

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1.Discuss the behavior of Linear and non-linear wave shaping circuits.
2. Describe the design of Multivibrators.
3. Explain the functionality of OP-AMP, 555 timer and PLL with applications to Data convertors.

Outcomes: On successful completion of the course, the students would be able to

1. Construct different linear networks and analyse their response to different input signals
2. Understand, Analyse and design multi vibrators and sweep circuits using transistors.
3. Analyse DC and AC characteristics for single/Dual input Balanced/Unbalanced output configurations using BJTs and OP-AMP.
4. Distinguish various linear and nonlinear applications of OP-AMP.
5. Demonstrate the various applications of 555 Timer and analyse the operation of the D/A and A/D converters.

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, its applications in CRO probe. **Non-Linear Wave Shaping:** Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, applications of voltage comparators. Clamping operation, clamping circuit taking Source and Diode resistances into account, Clamping circuit theorem.
UNIT – II
Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors. **Time Base Generators:** General features of a time base signal, methods of generating voltage time base waveform.
UNIT – III
Differential amplifiers: Classification, DC and AC Analysis of Single/Dual input Balanced and Unbalanced output configurations using BJTs. Level Translator. **Operational Amplifier**: OP AMP Block diagram, ideal Opamp characteristics, Opamp and its features, Opamp parameters and Measurements, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and Compensation Techniques.
UNIT – IV
OPAMP Applications: Inverting and Non-Inverting Amplifiers, Integrator and differentiator,

summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop. Log and Anti Log Amplifiers.
UNIT – V
555 Timer: Functional Diagram, Monostable, Astable and Schmitt Trigger Applications. Fixed and variable voltage regulators, PLL and its Applications. **Data Converters**: Digital-to-analog converters (DAC): Weighted resistor, inverted R-2R ladder, Analog-to-digital converters (ADC): dual slope, successive approximation, flash, Specifications.

Suggested Readings:

1	J. Millman and H. Taub, "*Pulse, Digital and Switching Waveforms"* - McGraw-Hill, 1991.
2	David A. Bell, "*Solid State Pulse circuits"* - PHI, 4/e, 2002.
3	Ramakanth A. Gayakwad, "*Op-Amps and Linear Integrated Circuits",* Pearson, 4/e, 2018.
4	D.Roy Chowdhury, Shail B.Jain, "*Linear Integrated Circuits"*, 4/e, New Age International (P) Ltd., 2008.
5	Anand Kumar A, "*Pulse and Digital Circuits*", Prentice-Hall of India private Limited, New Delhi, 2007.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

PC 407 ET
Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Understand the different standards of measurements.
2. Study different types of transducers, Sensors and their measuring techniques
3. Learn about various types of biomedical instrumentation equipment.

Outcomes: On successful completion of the course, the students would be able to

1. Describe characteristic of an instrument and state different Standards of measurements
2. Identify and explain different types of Transducers
3. Draw and Interpret types of transducers.
4. Design and analyse the digital voltmeters and prioritize the instruments.
5. Identify and classify types of Biomedical instruments.

UNIT – I
Electronic Measurement fundamentals: Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Standards of measurement, classification of standards, IEEE standards.
UNIT – II
Transducers: Classification, factors for selection of a transducer, transducers for measurement of velocity, acceleration. Passive electrical transducers- Strain gauges and strain measurement, LVDT and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo electric, photo conductive, photo voltaic and photo emissive transducers.
UNIT – III
Electronic Sensors: Characteristics of sound, pressure, power and loudness measurement. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermo couples.
UNIT – IV
Measuring instruments: Block diagram, specification and design considerations of different types of DVMs. Spectrum analysers. The IEEE488 or GPIB Interface and protocol. Delayed time base oscilloscope and Digital storage oscilloscope. Introduction to virtual instrumentation, SCADA. Data acquisition system block diagram.
UNIT – V
Biomedical Instrumentation: Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders – ECG, EEG, EMG, X- ray machines and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Suggested Readings:

1.	Albert D. Helfric, and William D. Cooper, "*Modern Electronic Instrumentation and Measurement Techniques*", PHI, 2010.
2.	H S Kalsi, "*Electronic Instrumentation*", 3/e, TMH, 2011.
3.	Robert A Witte, "*Electronic Test Instruments: Analog and Digital Measurements*", 2/e, 2002
4.	Nakra B.C, and Chaudhry K.K., "*Instrumentation, Measurement and Analysis*", TMH, 2004
5.	Khandpur. R.S., "*Handbook of Bio-Medical Instrumentation*", TMH, 2003

ANALOG ELECTRONIC CIRCUITS LAB

PC 453 ET
Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1.Design and analyse BJT, FET amplifiers, multivibrators
2.Analyse Oscillator circuits
3.Understand Op-Amp. Applications and filter circuits

Outcomes: On successful completion of the course, the students would be able to

1.Calculate gain and bandwidth of BJT, FET
2.Study multivibrator circuits
3. Study oscillator circuits.
4.Demonstrate filter circuits
5. Demonstrate power amplifier and Op-Amp. Circuits

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier
6. RC Phase Shift Oscillator.
7. Hartley & Colpitt Oscillators
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. m-Derived low pass & high pass filters.
11. Series and Shunt Voltage Regulators
12. RF Tuned Amplifier

SPICE:

13. Two Stage RC Coupled CS FET amplifier.
14. Voltage Series Feedback Amplifier
15. Current Shunt Feedback Amplifier

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

PULSE AND LINEAR INTEGRATED CIRCUITS LAB

PC 454 ET
Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1.To implement high pass and low pass circuit, clipping and clamping circuits and study it`s performance
2.To design and test bi-stable, mono-stable multi-vibrators
3.To study the characteristics of a Schmitt trigger and to build sweep circuits and study it`s performance

Outcomes: On successful completion of the course, the students would be able to

1. Design and analyse linear and non-linear wave shaping circuits.
2. Design and analyse clipping and clamping circuits.
3. Design and analyse multivibrator circuits.
4.Design and analyse Schmitt trigger circuit
5. Develop various applications of OP-AMP

List of Experiments

1. Low Pass and High Pass RC Circuits
2. Two level Clipping Circuit
3. Clamping Circuit
4. Transistor Switching Times
5. Collector Coupled Bistable Multivibrators
6. Collector Coupled Monstable Multivibrators
7. Collector Coupled Astable Multivibrators
8. Schmitt Trigger Circuit
9. Measurement of OPAMP Parameters
10. Inverting and Non-inverting OPAMP Voltage follower
11. Integrator and Differentiator using OPAMP
12. Active filters
13. Astable and Mono stable multi vibrator using NE555 IC
14. Astable and Monostable multivibrator using OPAMP
15. Miller Sweep Circuit
16. UJT Relaxation Oscillator

Note: A minimum of 10 experiments should be performed