DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Scheme of Instruction
and
Syllabi of

B.E. III & IV - SEMESTERS

2016-2017

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD – 500 007, TELANGANA

SCHEME OF INSTRUCTION

B.E. (ECE)

III - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 301 EC	Analog Electronics - I	3	1	0	4	30	70	3
2	PC 302 EC	Circuit Analysis	3	2	0	5	30	70	4
3	PC 303 EC	Probability Theory and Stochastic Process	3	2	0	5	30	70	4
4	PC 304 EC	Pulse and Digital Circuits	3	2	0	5	30	70	4
5	BS 901MT	Mathematics -III	3	1	0	4	30	70	3
6	HS 901BT	Environmental Science	3	0	0	3	30	70	3
Practicals									
7	PC 351 EC	Pulse and Digital Circuits Lab	0	0	2	2	25	50	1
8	ES 341 EE	Electrical Engineering Lab	0	0	2	2	25	50	1
		Total	**18**	**8**	**4**	**30**	**230**	**520**	**23**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
HS : Humanities and Social Sciences

BE SCHEME OF INSTRUCTION
(SERVICE COURSES OFFERED TO OTHER DEPARTMENTS)

SEMESTER - III

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	ES 321 EC	Basic Electronics Engineering (CSE)	3	1	0	4	30	70	3
2	ES 322 EC	Applied Electronics (ME)	3	0	0	3	30	70	3
3	ES 323 EC	Electronics Engineering – II (EEE)	3	0	0	3	30	70	3
4	ES 324 EC	Electronic Circuits (BME)	3	0	0	3	30	70	3
5	ES 325 EC	Circuit Analysis (BME)	3	1	0	4	30	70	3
Practicals									
6	ES 341 EC	Applied Electronics Lab (ME)	0	0	2	2	25	50	1
7	ES 342 EC	Basic Electronics Lab (CSE)	0	0	2	2	25	50	1
8	ES 343 EC	Electronics Engineering Lab (EEE)	0	0	2	2	25	50	1
9	ES 344 EC	Electronic Circuits Lab (BME)	0	0	2	2	25	50	1
		Total	**15**	**2**	**8**	**25**	**250**	**550**	**19**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
ES : Engineering Sciences

PC 301 EC

Analog Electronics-I

Credits:3

Instruction : (3L + 1T) hrs per week | *Duration of SEE : 3 hours*
CIE : 30 Marks | *SEE : 70 Marks*

Course Objectives:

- *To understand the design concepts of Small signals amplifiers.*
- *To study the design concepts Low Frequency transistor amplifiers.*
- *To understand the design concepts of transistor amplifiers at high frequency.*
- *To understand the design concepts of multi stage amplifiers.*
- *To have a basic knowledge of Operational-Amplifiers.*

Course Outcomes:

Student will be

- *Able to learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors; Become adept at using various methods of circuit analysis.*
- *Gain an intuitive understanding of the role of power flow and energy storage in electronic circuits; Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.*
- *Identify and Analyze where and how analog components are used.*
- *Locate and select analog devices using component specifications based on circuit requirements.*

UNIT – I

Small Signal – Low Frequency Transistor Model: Two Port Devices and Hybrid Model, h-Parameters and Measurement. Conversion Formulas for the Parameters of the Three Transistor Configurations. Analysis of Transistor Amplifier Circuit using h-parameters. Comparison of CB, CE and CC Amplifier Configurations. Linear Analysis of a Transistor Circuit with Appropriate Model. The FET Small Signal Model, Common Source and Common Drain Amplifier Circuits.

UNIT – II

Transistor at high frequencies: High frequency T-model, Miller theorem, the CB Short circuit current Frequency Response, The Alpha cutoff frequency, the CE Short circuit current Frequency Response, Hybrid PI model CE short circuit current gain obtained with the Hybrid-Pi model and resistive load. Transistor amplifier response with source resistance, Gain-Bandwidth product.

UNIT – III

Multistage Amplifiers: Classification of amplifiers, Distortion in amplifiers, frequency response of RC-coupled, single stage, Transformer coupled amplifier and their analysis. Step response of amplifier, rise time, tilt, slag, square wave testing, interacting and non interacting stage, effect of emitter by pass capacitor on low frequency response.

UNIT – IV

Low frequency transistor amplifier circuits: cascading transistor amplifiers, n-stage cascaded amplifier, the decibel, high input resistance transistor circuits, cascode transistor reconfiguration.

UNIT – V

Operational Amplifiers: Classification of Integrated Circuits, Operational Amplifier Block Diagram, Ideal and practical characteristics of Op-Amps, Op-Amp features and parameters. Op-Amp measurements, input and output offset voltages and currents, Slew rate, CMRR, PSRR, frequency response.

Suggested Readings:

1. Millman J., Halkias C.C. and Satyabrata Jit, *Electronic Devices and Circuits,* 3rd edition, Tata McGraw-Hill, 2011.
2. Millman J., Halkias C.C. and Parikh C, *Integrated Electronics,* 2nd edition, Tata McGraw-Hill, 2009.
3. Salivahanan, Suresh Kumar and Vallavaraj, "*Electronic Devices and Circuits,*" 2nd edition, Tata McGraw-Hill, 2010.
4. Ramakanth A. Gayakwad, "*Op-amps and Linear Integrated Circuits*", 3rd Edition, Prentice-Hall of India private Limited, New Delhi, 1995.

PC 302 EC

Circuit Analysis

Credits:4

Instruction : (3L + 2T) hrs per week — *Duration of SEE : 3 hours*
CIE : 30 Marks — *SEE : 70 Marks*

Course Objectives:

- *To introduce basic circuit elements, their terminal characteristics , DC Circuit analysis techniques, RMS Average values of periodic signals, Network Theorems.*
- *To find zero input, zero state total time response for RL, RC RLC Circuits.*
- *To introduce the concepts of impedance, phase, phasor, resonance, complex frequency, poles, zeros, sinusoidal steady state response various powers of ac Circuits.*
- *To understand Laplace transforms of signals their Properties to apply them to find transient response of networks.*
- *To introduce the principles of two port network parameters topologic description of networks.*

Course Outcomes:

Student will be

- *Able to Learn how to develop and employ circuit models for elementary electronic components and to adapt using various methods of circuit analysis, including simplified methods such as Series-parallel reductions, voltage and current dividers, and the node method.*
- *Able to appreciate the consequences of linearity, in particular the principle of superposition and Thevenin-Norton equivalent circuits etc.*
- *Able to Learn how to calculate frequency response curves and to interpret the salient features in terms of poles and zeros of the system function.*
- *Able to analyze small RLC circuits by hand. Analyze the frequency response of circuits containing inductors and capacitors. Apply the Laplace transform to linear circuits and systems.*
- *Able to analyze the topologic description of networks. Ability to Solve Circuits using Tree, Node, Branch , Cut set ,Tie Set Methods.*

UNIT – I

Network Theorems: Circuit Elements, Dependent Independent Sources, Passive Elements, R, L C, Energy Stored in L C, Kirchhoff's laws, Integro-Differential Equations, RMS Average Values of Periodic Signals, Superposition, Thevenin's, Norton's, Millman's Maximum Power Transfer Theorem.

UNIT – II

Response of RC, RL ,RLC Circuits: First Order Second Order Differential Equations, Initial Conditions, Step Response, Impulse Response, Zero-State Zero-Input Response, Steady State Transient Response.

UNIT – III

Response of R, L, C Networks: Response to Exponential Excitation, Quality factor, Damping Ratio, Bandwidth of Resonant Circuits, Sinusoidal Excitation, Steady State Response, Impedance Admittance Functions, Responses related to S-Plane Location of Roots.

UNIT – IV

Circuit Analysis using Laplace Transforms: Basic Theorems of Laplace Transforms, Laplace Transforms of Periodic Signals, Unit, Step, Ramp, Impulse Functions, Initial Final Value Theorems, Solutions using Laplace Transforms.

UNIT – V

Network Topology: Graph, Tree, Tie set cut set matrix, Impedance matrix formulation of node loop equations using tie set cut set, schedule quality.

Suggested Readings:

1. Van Valkenberg M.E, *Network Analysis,* 3rd edition*,* Prentice Hall of India, 1996.
2. Hayt W H, Kemerly J E Durbin, *Engineering Circuit Analysis,* 7th edition, Tata McGraw-Hill, 2006.
3. A. Sudhakar Shyammohan, *Circuits Networks: Analysis Synthesis*, 4th edition, Tata McGraw-Hill, 2010.

PC 303 EC

Probability Theory and Stochastic Processes

Credits:4

Instruction : (3L + 2T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand different types of rom variables their density distribution functions.*
- *To learn one rom variable characteristic functions of different variables using their density functions.*
- *To learn the concepts of sequences of rom variables, Properties of Rom vectors.*
- *To understand elementary concepts of the Rom Processes or distribution functions.*
- *To understand the functions of two rom variables probability density distribution of the joint rom variables.*

Course Outcomes:

Student will be

- *Able to solve using an appropriate sample space by the concepts of probabilities and understand multiple random variables ,relate the same through examples to real problems.*
- *Able to Understand the usefulness of stochastic processes in their professional area.*
- *Able to Characterize the response of LTI systems driven by a stationary random process using autocorrelation and power spectral density functions.*
- *Able to Application of these principles in areas where presence of noise is a serious challenge.*

UNIT-I

Concepts of Probability Rom Variable: Definitions, Probability Induction, Causality versus Romness, Review of Set Theory, Probability Space, Conditional Probability. Repeated Trials Combined Experiments, Bernoulli Trials, Bernoulli's Theorem Games of Chance. Rom Variable: Definition, Distribution Density Functions, Specific Rom Variables their probability density distribution functions: Normal, Exponential, Gamma, Chi-Square, Raleigh, Nakagami-m, Uniform, Beta, Cauchy, Laplace Maxwell, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial Conditional Distributions, Asymptotic Approximations for Binomial Rom Variable.

UNIT-II

Functions of One Rom Variable: Function of a rom Variable $g(\mathbf{x})$, The Distribution of $g(\mathbf{x})$, Mean, Variance, Moments Characteristic Functions of rom variables with the above distributions.

UNIT -III

Two Rom Variables: Bi-variate Distributions, One Function of Two Rom Variables, Two Functions of Two Rom Variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values.

UNIT-IV

Sequences of Rom Variables: General Concepts, Conditional Densities, Characteristic Functions, Normality, Mean Square Estimation, Stochastic Convergence Limit Theorems**.** Rom Numbers**:** Meaning, Generation of rom sequence pseudo rom binary sequence. Applications of rom numbers.

UNIT-V

Stochastic Processes: General elementary concepts definitions of stationary, ergodic, rom processes independence, spectral density, white color noise, response to linear systems stochastic inputs, Markov Processes.

Suggested Readings:

1. A Papoulis, S.U. Pillai, "*Probability, Rom Variables Stochastic Processes"*, 4th edition, Tata McGraw-Hill, 2008.
2. Peyton Z Peebles, "*Probability, Rom Variables & Rom Signal Properties*", 4th edition, Tata McGraw-Hill, 2001.
3. Carl Helstrom, "*Probability Stochastic Processes for Engineers"*, Macmillan Publishing Company, 1984.
4. Richard H. Williams, " *Probability, Statistics, Rom Processes for Engineers*", Thomson Learning, 1st edition, 2003.

PC 304 EC

Pulse and Digital Circuits

Credits:4

Instruction : (3L + 2T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand linear wave shaping circuits.*
- *To study various non-linear wave shaping circuits.*
- *To study the types of multi-vibrators.*
- *To study the features of voltage time-base generators.*
- *To understand the importance of current time base generators.*

Course Outcomes:

Student will be

- *Understand the various linear and non-linear wave shaping circuits.*
- *Understand the design of multi-vibrators and time-based circuits.*
- *Determining the time-based generator wave form and knowing about the basic principles of Miller & Bootstrap circuits.*

UNIT-I
Wave Shaping: High pass RC circuit (step, pulse, square wave, exponential and ramp inputs), the high pass RC circuit as a differentiator, double differentiator, Low pass RC circuit (step, pulse, square wave, exponential and ramp inputs), the low pass RC circuit as an integrator, RL circuits. Compensated Attenuator.

UNIT-II
Non- Linear Diode wave shaping circuits: Diode Clipper, Transistor Clipper, Clipping at two independent levels, comparators, Clamping, Clamping Circuit Theorem, Practical Clamping Circuits Transistor as a switch.

UNIT-III
Multivibrator Circuits: Bistable Multivibrators: The stable states of multivibrator, Fixed bias transistor bistable multivibrator, self biased transistor bistable multivibrator, commutating capacitors, methods of improving resolution, asymmetric triggering of the bistable multivibrator, triggering asymmetrically through a unilateral device, symmetrical triggering, a direct-connected bistable multivibrator, Schmitt Trigger circuit, an emitter-coupled bistable multivibrator, Collector Coupled (C.C) Astable and Monostable Multivibrators, applications, hysteresis.

UNIT-IV

Voltage Time - base generators: General features of a time - base signal, Methods of generating a time base waveform, Exponential Sweep Circuit, Negative resistance Switches, Sweep Circuit Using a Transistor Switch, A Fixed- Amplitude sweep, A transistor constant current sweep, Miller and Bootstrap Time- Base Generators, The Transistor Miller Time-Base Generator, Bootstrap Time-Base Generators, The Transistor Bootstrap Time-Base Generator.

UNIT-V

Current Time-Base Generators: A simple current sweep, Linearity Correction Through adjustment of driving waveform, A Transistor Current Time - Base Generator, Coil Capacitance, Effect of the Omission of the Impulse Component of Current, Methods of Linearity Improvement, Illustrative Current Sweep Circuits.

Suggested Readings:

1. Jacob Millmann and Herbert Taub, *"Pulse, Digital and Switching waveforms",* 2nd Edition, Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2007.

2. David A.Bell, *"Solid State pulse circuits",* 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2000.

3. Anand Kumar A, *"Pulse and Digital Circuits"*, Prentice-Hall of India private Limited, New Delhi, 2007.

BS 901 MT

Mathematics-III

Credits:3

Instruction : (3L + 1T) hrs per week — *Duration of SEE : 3 hours*
CIE : 30 Marks — *SEE : 70 Marks*

Course Objectives:

- *To introduce the concept of functions of complex variables and their properties.*
- *To formulate and to introduce a few methods to solve linear and non-linear partial differential equations.*
- *To study Fourier series and its applications to partial differential equations.*

Course Outcomes:

Student will be

- *Determine the analyticity of a complex functions and expand functions as Taylor and Laurent series.*
- *Evaluate complex and real integrals using residue theorem.*
- *Expand function as a Fourier series.*
- *Find solutions of first order and second order partial differential equations.*

UNIT – I

Functions of Complex Variables: Limits and continuity of function, differentiability and analyticity, necessary & sufficient conditions for a function to be analytic, Cauchy- Reimann equations in polar form, harmonic functions, complex integration, Cauchy's integral theorem, extension of Cauchy's integral theorem for multiply connected regions, Cauchy's integral formula, Cauchy's formula for derivatives and their applications.

UNIT-II

Residue Calculus: Power series, Taylor's series, Laurent's series, zeros and singularities, residues, residue theorem, evaluation of real integrals using residue theorem, bilinear transformation, conformal mapping.

UNIT-III

Fourier series: Fourier series, Fourier series expansions of even and odd functions, convergence of Fourier series, Fourier half range series.

UNIT-IV

Partial differential equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT-V

Fourier series applications to partial differential equations: Classification of linear second order partial differential equations, separation of variables method (Fourier method), Fourier series solution of one dimensional heat and wave equations, Laplace's equation.

Suggested Readings:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publication, 4th Edition 2014.
2. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
3. Gupta & Kapoor, *Fundamentals of Mathematical statistics*, Sultan chand & sons, New Delhi, 2014.
4. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, 2012.
5. James Brown and Ruel Churchill, *Complex variables and Applications*, 9th Edition,2013.

HS 901 BT

Environmental Science

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To know the natural resources and their benefits to the public.*
- *To study the concept of ecosystems and biodiversity.*
- *To understand the types of pollutions, social issues and disaster management.*

UNIT-I

Environmental studies: Definition, scope and importance, need for public awareness.

Natural resources: Water resources; use and over utilization of surface and ground water, Floods, drought, conflicts over water, dams-benefits and problems. Effects of modern Agriculture, Fertilizer-pesticide problems, water logging and salinity.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Energy resources: Growing energy needs renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

UNIT-III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and solid waste management. Environmental protection act: Air, water, forest and wild life Acts, enforcement of Environmental legislation.

UNIT-V

Social issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Disaster management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology, disaster management cycle, and disaster management in India.

Suggested Readings:

1. De A.K., "*Environmental Chemistry"*, Wiley Eastern Ltd.,
2. Odum E.P., "*Fundamentals of Ecology"*, W.B. Sunders Co., USA.
3. Rao M.N and Datta A.K., "*Waste Water Treatment"*, Oxford and IBK Publications.
4. Benny Joseph, "*Environmental studies"*, Tata McGraw Hill, 2005
5. Sharma V.K., "*Disaster Management"*, National Centre for Disaster management, IIPE, Delhi,1999.

PC 351 EC

Pulse and Digital Circuits Lab

Credits:1

Instruction : 2 hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To understand how a low pass and high pass circuit behaves.*
- *To study the output for clipping and clamping circuits.*
- *To understand the design concepts of multi-vibrators.*
- *To study the characteristics of a Schmitt trigger.*
- *To verify the output of sweep circuits.*

Course Outcomes:

Student will be

- *Able to demonstrate the linear wave shaping of RC, RL and RLC ckts.*
- *Able to design clamping, pulse generator ckts such as multi-vibrators and time-based generators.*
- *Able to understand switching characteristics of devices, realization of logic gates using diodes and transistors.*

List of Experiments:

1. Low Pass and High pass RC circuits.
2. Two level clipping circuits.
3. Clamping circuits.
4. Collector coupled Astable Multivibrators.
5. Collector coupled Monostable Multivibrators.
6. Collector coupled Bistable Multivibrators.
7. Schmitt Trigger Circuit.
8. Bootstrap and Miller voltage sweep circuits.
9. Logic gates and interfacing different logic gate functions.
10. Realization of various flip flops using NAND gates.

Suggested Readings:

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.

ES 341 EE

Electrical Engineering Lab

Credits:1

Instruction : 2 hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To learn practical electric AC & DC circuits.*
- *To learn operation and performance characteristics of electrical machines by conducting various tests practically.*

Course Outcomes:

Student will be

- *Able to conduct experiments on Kirchoff's law, Thevenin's & Norton's Theorems.*
- *Able to study the characteristics of RLC ckts, DC generator, 1-phase, 3-phase transformers.*
- *Able to load test on single-phase transformer & three-phase Induction motor.*

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of Thevenin's & Norton's Theorems.
3. Study of Three-Phase Balanced Circuits.
4. Measurement of Power by Two-Wattmeter Method.
5. Study of Single-Phase RLC Series Circuits.
6. Magnetization Curve of a Separately Excited DC Generator.
7. Load Characteristics of Shunt Generator.
8. Performance Characteristics of Shunt Motor.
9. Speed Control of DC Shunt Motor.
10. O.C & S.C Tests on Single-Phase Transformer.
11. Load Test on Single-Phase Transformer.
12. Load Test on Three-Phase Induction Motor.

Note*: At least 10 experiments should be conducted in the Semester.*

SERVICE COURSES

ES 321 EC

Basic Electronics Engineering (CSE)

Credits:3

Instruction : (3L+1T) hrs per week — *Duration of SEE : 3 hours*
CIE : 30 Marks — *SEE : 70 Marks*

Course Objectives:

- *To analyze the behavior of semiconductor diodes in Forward and Reverse bias.*
- *To design of Half wave and Full wave rectifiers with L,C, LC & CLC Filters.*
- *To explore V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.*
- *To explain feedback concept and different oscillators.*
- *To analyze Digital logic basics and Photo Electric devices.*

Course Outcomes:

Students will be

- *Able to learn about forward biased and reversed biased circuits.*
- *Able to plot the V-I Characteristics of diode and transmission.*
- *Able to design combinational logic circuits and PLDs.*

UNIT-I

Semi Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semiconductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications.
Rectifiers: Half wave and Full wave Rectifiers (Bridge, center tapped) with and without filters, ripple regulation and efficiency. Zener diode regulator.

UNIT-II

Bipolar Junction Transistor: BJT, Current components, CE, CB, CC configurations, characteristics, Transistor as amplifier. Analysis of CE, CB, CC Amplifiers (qualitative treatment only) .
JFET: Construction and working, parameters, CS, CG, CD Characteristics, CS amplifier.

UNIT-III

Feedback Concepts – Properties of Negative Feedback Amplifiers, Classification, Parameters .
Oscillators – Barkhausen Criterion, LC Type and RC Type Oscillators and Crystal Oscillators. (Qualitative treatment only).

UNIT-IV

Operational Amplifiers – Introduction to OP Amp, characteristics and applications –Inverting and Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier.

Digital Systems: Basic Logic Gates, half, Full Adder and Subtractors.

UNIT-V

Data Acquisition Systems: Study of transducer (LVDT, Strain gauge, Temperature, and Force). Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics only.
Display Systems: Constructional details of C.R.O and Applications.

Suggested Readings:

1. Jocob Millman, Christos C. Halkias and Satyabrata Jit, *Electronics Devices and Circuits,* 3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2. Rama Kanth A. Gaykward, *Op-AMPS and Linear Integrated Circuit*, 4th Edition Prentice Hall of India, 2000.
3. M. Morris Mano, *Digital Design*, 3rd Edition, Prentice Hall of India, 2002.
4. William D Cooper, and A.D. Helfrick, *Electronic Measurements and Instrumentations Techniques*, 2nd Edition, Prentice Hall of India, 2008.
5. S. Shalivahan, N. Suresh Kumar, A. Vallava Raj, *Electronic Devices and Circuits*, 2nd Edition., McGraw Hill Education (India) Private Limited, 2007.

ES 322 EC

Applied Electronics (ME)

Credits:3

Instruction : (3L) hrs per week	*Duration of SEE : 3 hours*
CIE : 30 Marks	*SEE : 70 Marks*

Course Objectives:

- *To understand the characteristics of diodes and transistor configurations.*
- *To understand the design concepts of biasing of BJT and FET.*
- *To understand the design concepts of feedback amplifiers and oscillators.*
- *To study the design concepts of OP Amp and data converters.*

Course Outcomes:

Students will be

- *Able to study and analyze the rectifiers and regulator circuits.*
- *Able to study and analyze the performance of BJTs, FETs on the basis of their operation and working.*
- *Able to analyze & design oscillator circuits.*
- *Able to analyze different logic gates & multi-vibrator circuits.*
- *Able to analyze different data acquisition systems.*

UNIT-I

Characteristics of PN Junction: Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications.

UNIT-II

Bipolar and Field Effect Transistors : Biasing FET , small signal model, h-parameter equivalent circuits, basic amplifier circuits-CB,CE,CC configurations of BJT and CG,CS and CD configurations of FETs, RC-coupled amplifier and its frequency response.

UNIT-III

Feedback Concepts: Types of negative feedback-modification of gain, bandwidth, input and output impedances-applications; Oscillators: RC phase shift, Wien bridge, LC and Crystal Oscillators.

UNIT-IV

Operational Amplifier: Characteristics, applications, Differential amplifiers, logic gate circuits-Introduction to Digital Systems-AND,NAND,NOR,XOR gates, Binary half wave adder, full adder, Multi-vibrators-Bi-stable, Mono-stable and Astable Multi-vibrators (Qualitative treatment only),Schmitt trigger.

UNIT-V

Data Acquisition Systems: Construction and Operation of transducers-Strain gauge LVDT, Thermocouple, Instrumentation Systems, Magnetic tape recorders, FM recording, Digital recording, Digital to Analog and Analog to Digital conversions.

Suggested Readings:

1 Robert Boylestad L. and Louis Nashelsky, *Electronic Devices and Circuit Theory*, Prentice Hall of India , 2007.

2 Helfrick D and David Cooper, *Modern Electronic Instrumentation and Measurements Techniques,* 1st edition, Prentice Hall of India, 2006.

3 Salivahanan, Suresh Kumar and Vallavaraj, *Electronic Devices and Circuits,* 2nd edition, Tata McGraw-Hill, 2010.

ES 323 EC

Electronics Engineering – II (EEE)

Credits:3

Instruction : (3L) hrs per week | *Duration of SEE : 3 hours*
CIE : 30 Marks | *SEE : 70 Marks*

Course Objectives:

- *To understand the concept of feedback amplifiers and Oscillators.*
- *To understand the design concepts of active filters.*
- *To study the concepts of power amplifiers and wave shaping circuits.*

Course Outcomes:

Students will be

- *Able to design feedback amplifiers circuits with its applications.*
- *Able to analyze and design various oscillators.*
- *Able to design power amplifier for various applications.*
- *Able to design various filters required.*
- *Able to design clipping and clamping circuits and various multi-vibrators.*

UNIT-I

Feedback Amplifiers: Concept of Feedback, Feedback Amplifier Configurations, Circuits, Advantages of Negative feedback, Analysis of Simple feedback amplifiers using BJT and FET.

UNIT-II

Oscillators: Barkhausen Criterion, RC Oscillators: Wien Bridge, Phase shift, LC Oscillators: Hartley and Colpitt's Oscillators, Crystal Controlled Oscillators (analysis of oscillators using BJTs only), stability of oscillators, Non-Sinusoidal oscillators (using Op-Amps).

UNIT-III

Butterworth Filters: Active Low pass filter, High Pass Filter, Band Pass Filter, Notch Filter, Design of Second, fourth and sixth order Filters using Op-Amps.

UNIT-IV

Carrier Amplifier: Chopper Amplifier, Principles and Applications. Phase sensitive Detector. Classification of Power Amplifiers, Analysis of Class A and Class B Power amplifiers: Distortion in Amplifiers, Push-Pull Amplifiers, Complementary Symmetry, IC Power Amplifiers.

UNIT-V

Wave Shaping Circuits: RC Low pass and High pass circuits, Response to Step, Pulse, Ramp and Square wave inputs, Differentiator and Integrator, Clipping circuits for single level and two level, clamping circuits and applications. Multivibrator circuits: Astable, Monostable and Bistable circuits using Op-Amp and 555 Timer, Schmitt Trigger circuit.

Suggested Readings:

1. Millman Jacob, Taub Herbert and Prakash Rao M., *Pulse, Digital and Switching waveforms,* 3rd Edition, Tata McGraw-Hill, 2007.
2. Millman J., Halkias C.C. and Satyabrata Jit, *Electronic Devices and Circuits,* 3rd edition, Tata McGraw-Hill, 2011.
3. Millman J., Halkias C.C. and Parikh C, *Integrated Electronics,* 2nd edition, Tata McGraw-Hill, 2011.

ES 324 EC

Electronic Circuits (BME)

Credits:3

Instruction : (3L) hrs per week | *Duration of SEE : 3 hours*
CIE : 30 Marks | *SEE : 70 Marks*

Course Objectives:

- *The course facilitates the students to study the principle and operation of Op-Amps.*
- *Exposure towards the applications of the Op-Amps.*
- *To know about the linear wave shaping circuits.*
- *The students also learn about Voltage regulators and SMPS.*

Course Outcomes:

Students will be

- *Ability to analyze and design basic electronic circuits, particularly with application to diodes, BJTs, MOSFETs, Operational amplifiers.*
- *Ability to understand Operational amplifiers and their internal devices, including BJT and MOSFET transistors.*
- *Able to design linear wave shaping circuits and higher order filters.*
- *Understand the basic concept of Power supply and SMPS.*

UNIT-I

Sinusoidal Oscillators: Condition for oscillations – LC Oscillators – Hartley, Colpitts, Frequency and amplitude stability of oscillators – Crystal Oscillators – RC Oscillators – RC phase shift and Wien bridge oscillators.

UNIT-II

Operational Amplifiers: Concept of Direct Coupled Amplifiers. Differential Amplifier-Calculation of common mode Rejection ratio, Differential Amplifier supplied with a constant current source, Normalized Transfer Characteristics of a differential Amplifier. Ideal Characteristics of an operational Amplifier, and Parameters of an Op-Amp.

UNIT-III

Applications of Operational Amplifier: Inverting and Non-inverting Amplifiers, Summing, scaling and Averaging amplifiers, Integrators, Differentiators, Logarithmic Amplifiers, Instrumentation Amplifiers, Rail-to-Rail op-amps, Voltage to Current and Current to Voltage Converters, Precision Rectifiers, Peak Detectors. Comparators, Schmitt trigger, Multivibrators, Sinewave oscillators (phase-shift and wein bridge), Waveform generators (triangular and saw tooth), 555 Timers.

UNIT-IV

Linear wave shaping circuits & Filters: Clipping circuits for single level and two level, Clamping circuit and applications

Butterworth Filters: Active low pass Filter, High pass filter, Band pass filter, Band elimination filter & Notch filter. Higher order Filters and their Comparison. Design of second, fourth and sixth order filters using op-amps. Switched Capacitance Filters.

UNIT-V

Voltage Regulators & SMPS: Linear power supply (voltage regulators); Basic Transistorized regulators, Three pin regulators, switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode.

Working principle of SMPS, Block Diagram of SMPS, Design criteria for SMPS, comparison of linear & switching power supply.

Suggested Readings:

1. Ramakanth A Gayakwad, *Op-Amps and Linear ICs*, 4th Edition, PHI, EE Edition, 2013.

2. R.F Coughlin and F.F Driscoll, *Op-Amps and Linear Integrated Circuits*, PHI, EE Edition, 4th Edition.2001.

3. JB Gupta, *Electronic Devices and Circuits*, S.K Kataria & sons, 5th Edition, 2012.

ES 325 EC

Circuit Analysis (BME)

Credits:3

Instruction : (3L+1T) hrs per week — *Duration of SEE : 3 hours*
CIE : 30 Marks — *SEE : 70 Marks*

Course Objectives:

- *Students are exposed to analysis of physical circuits through the use of Kirchhoff's laws and ideal circuit element models. Strong emphasis is placed on the formulation of nodal equations for linear circuits as a foundation Transient analysis of second order circuits with unit step inputs and switched dc sources is emphasized to promote understanding of time-domain linear circuit response. Finally, students will master concepts of coupled inductors and transformers.*

Course Outcomes:

Students will be

- *To learn how to develop and employ circuit models for elementary electronic components and to adapt using various methods of circuit analysis, including simplified methods such as Series-Parallel reductions, voltage and current dividers, and the node method.*
- *To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin-Norton equivalent circuits etc.*
- *Able to analyze small RLC circuits by hand. Analyze the frequency response of circuits containing inductors and capacitors. Apply the Laplace transform to linear circuits and systems.*

UNIT-I

Circuit elements, Dependent and independent sources, passive elements, R,L and C, Energy stored in L and C, Kirchoff’s laws, integro-differential equations, RMS and average value of periodic signals, Network theorems: Superposition, Thevenin’s, Norton’s, Millman’s and Maximum transfer theorem.

UNIT-II

Response of RC,RL and RLC circuits first order and second order differential equations, initial conditions, step response, in pulse response zero state and zero-input response, steady state and transient response.

UNIT-III

Response of RLC networks to exponential excitation, quality factor, damping ratio, Bandwidth of resonant circuits, sinusoidal excitation, steady state response, impedance and admittance functions, responses related to S-Plane location of roots.

UNIT-IV

Circuit analysis using Laplace Transforms, basic theorems of Laplace transforms, Laplace transform of periodic signals, unit, step, ramp and impulse functions, initial and final value theorems, solutions using Laplace transforms.

UNIT-V

Network Topology, Graph, tree, Tie set and cut set matrix, impedance matrix formulation of node and loop equations using Tie set and cut set.

Suggested Readings:

1. Valkenberg M.E Van, *Network Analysis*, PHI, New Delhi, 1996.
2. Hayt W H, Kemerly J E and Durbin, *Engineering Circuit Analysis*, Tata McGraw-Hill-2006.
3. Choudary Roy D, *Network and Systems*, New Age India, 1999.

ES 341 EC

Applied Electronics Lab (ME)

Credits: 1

Instruction: 2 hrs per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*

Course Objectives:

- *To understand the characteristics of diodes and transistor configurations.*
- *To understand the design concepts of biasing of BJT and FET.*
- *To understand the design concepts of feedback amplifiers and oscillators.*
- *To study the design concepts of OP Amp and data converters.*

Course Objectives:

Students will be

- *Able to design diode circuits & understand the application of zener diode.*
- *Able to analyze characteristics of BJTs & FETs.*
- *Able to understand the different oscillator circuits.*
- *Able to understand operation of HWR & FWR circuits with & without filters.*
- *Able to design Analog-to-Digital converters & Digital-to-Analog converters.*

List of Experiments:

1. CRO-Applications, Measurements of R, L and C using LCR meter, Color code method and soldering practice.
2. Characteristics of Semiconductors diode (Ge, Si and Zener)
3. Static Characteristics of BJT-Common Emitter
4. Static Characteristics of BJT-Common Base
5. Static Characteristics of FET
6. RC-Phase Shift Oscillator
7. Hartley and Colpitts Oscillators
8. Common Emitter Amplifier
9. Astable Multi-vibrator
10. Full-wave rectifier with and without filters using BJT
11. Operational Amplifier Applications
12. Strain Gauge Measurement
13. Analog-to-Digital and Digital to Analog Converters

Suggested Readings:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India, 2001.

ES 342 EC

Basic Electronics Lab (CSE)

Credits:1

Instruction: 2 hrs per week | *Duration of SEE: 3 hours*
CIE: 25 marks | *SEE: 50 marks*

Course Objectives:

- *To understand the diode characteristics.*
- *To study the input and out characteristics of different Transistor configurations.*
- *To understand the design concepts of amplifier and Oscillator circuits.*
- *To understand the design concepts of feedback amplifiers.*

Course Objectives:

Students will be

- *Able to design diode circuits.*
- *Able to understand the applications of zener diode.*
- *Able to understand the operation of HWR & FWR circuits with & without filters.*
- *Able to analyze the characteristics of BJTs and FETs.*
- *Able to analyze the performance of operation amplifier.*
- *Able to operate laboratory equipment and analyze the results.*
- *Able to design logic gates using BJTs.*

List of Experiments:

1. CRO Applications.
2. Characteristics of semiconductor diodes (Ge, Si and Zener).
3. Static Characteristics of BJT (CE).
4. Static Characteristics of BJT (CB).
5. Ripple and Regulation characteristics of Half-wave rectifiers with and without filters.
6. Ripple and Regulation characteristics of Full-wave rectifiers with and without filters
7. Transistor as an amplifier.
8. Operational Amplifier Applications.
9. Emitter follower and source follower.
10. Static characteristics of CS configuration of FET.
11. BJT biasing.
12. Finding h-parameters for a two port network (transistor in CB configuration).
13. Simulations of above experiments must also be carried using P-Spice Software.

Suggested Readings:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India, 2007.

ES 343 EC

Electronics Engineering Lab (EEE)

Credits:1

Instruction: 2 hrs per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*

Course Objectives:

- *To understand the diode characteristics.*
- *To study the input and out characteristics of different Transistor configurations.*
- *To understand the design concepts of amplifier.*
- *To understand the design concepts of Combinational and Sequential circuits.*
- *To understand the design concepts of OP-Amp.*

Course Objectives:

Students will be

- *Able to design diode circuits.*
- *Able to understand the applications of zener diode.*
- *Able to understand the operation of HWR & FWR circuits with & without filters.*
- *Able to analyze the characteristics of BJTs and FETs.*
- *Able to analyze the performance of operation amplifier.*
- *Able to operate laboratory equipment and analyze the results.*
- *Able to design logic gates using BJTs.*

List of Experiments:

1. Characteristics of Semiconductor Diodes(Si, Ge and Zener).
2. Characteristics of BJT (CB,CE).
3. Rectifiers: Half Wave Rectifier, Full Wave Rectifier with and without series and Shunt Regulators.
4. CRO and its Applications.
5. Characteristics of FET.
6. Transistors as an Amplifier.
7. Inverting, Non-Inverting and Differential Amplifier using Op amp.
8. Realization of Logic Gates Using Diode transistor Logic.
9. Half Adder and Full Adder Circuits.
10. Integration and Differentiation using Op-amp.
11. Transistor Biasing.

Suggested Readings:

1. David Bell A., *Operational Amplifiers and Linear ICS,* Prentice Hall of India, 2005.
2. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.

ES 344 EC

Electronic Circuits Lab (BME)

Credits:1

Instruction : (2P) hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

1. RC Coupled Amplifiers (Frequency response of BJT & FET)
2. Oscillators:
   a) Wein Bridge Oscillator
   b) RC Phase Shift Oscillator
   c) Hartley Oscillator
   d) Colpitts Oscillator
3. Op-Amps based Filters
   a) Active Low Pass Filters
   b) Active High Pass Filters
   c) Band Pass Filters
   d) Notch Filters
4. Wave Shaping Circuits using operational amplifiers:
   a) Differentiator
   b) Integrator
   c) Clipper
   d) Clamper
5. Differential amplifier
6. Instrumentation amplifier (INA112 & 3 Op-amp)
7. 555 Timer Applications:
   a) Astable Multivibrator
   b) Monostable Multivibrator
   c) Bistable Multivibrator
8. Current Sources
   a) Precision DC Current sources
   b) Voltage to Current Converters (AC & DC)
   c) High Frequency Current sources

SCHEME OF INSTRUCTION

B.E. (ECE)

IV - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 401 EC	Analog Electronics - II	3	1	0	4	30	70	3
2	PC 402 EC	Network Theory	3	1	0	4	30	70	3
3	PC 403 EC	Logic and Switching Theory	3	1	0	4	30	70	3
4	PC 404 EC	Signal Analysis and Transform Techniques	3	1	0	4	30	70	3
5	PC 405 EC	Electromagnetic Theory	3	1	0	4	30	70	3
6	BS 404MT	Applied Mathematics	3	1	0	4	30	70	3
Practicals									
7	PC 451 EC	Analog Electronics Lab	0	0	2	2	25	50	1
8	PC 452 EC	Networks Lab	0	0	2	2	25	50	1
9	PW461EC	Mini-project	0	0	2	2	50	00	2
Total			**18**	**6**	**6**	**30**	**280**	**520**	**22**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences
PC : Professional Core
PW : Project Work

BE SCHEME OF INSTRUCTION
(SERVICE COURSES OFFERED TO OTHER DEPARTMENTS)

SEMESTER - IV

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	ES 421 EC	Signals and Systems (CSE)	3	0	0	3	30	70	3
2	ES 422 EC	Digital Electronics (BME)	3	1	0	4	30	70	3
Practicals									
3	ES 441 EC	Digital Electronics Lab (BME)	0	0	2	2	25	50	1
TOTAL			**6**	**1**	**2**	**9**	**85**	**190**	**7**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
ES : Engineering Sciences

PC 401 EC

Analog Electronics-II

Credits:3

Instruction : (3L + 1T) hrs per week — *Duration of SEE : 3 hours*
CIE : 30 Marks — *SEE : 70 Marks*

Course Objectives:

- *To learn the design concepts of feedback amplifiers and oscillators.*
- *To understand the design concepts of power amplifiers.*
- *To study the design concepts of tuned amplifiers.*
- *To understand the various applications of Op-Amp like waveform generators, oscillators.*

Course Outcomes:

Student will be

- *Able to use basic circuit building blocks to create more advanced circuits within the scope and to the extent of the information presented.*
- *Able to demonstrate an understanding of operational amplifiers and their internal devices, including BJT and MOS FET transistors, DC biasing techniques and small signal modeling.*
- *Able to determine the stability of feedback amplifiers and their steady state performance.*
- *Able to analyze and design basic electronic circuits, particularly with application to diodes, MOS field-effect transistors, bipolar junction transistors, operational amplifiers.*

UNIT-I

Feedback Amplifiers: The feedback concept, general characteristics of negative feedback amplifier, effect of negative feedback on gain, Sensitivity to gain variations, distortion, noise, bandwidth, input and output impedances, Configurations of feedback amplifiers: Voltage series and shunt, Current series and shunt, examples of each configuration.

UNIT-II

Oscillators: Condition for self excitation (Barkhausen Criteria), RC Oscillators: Wien-Bridge and RC phase shift Oscillators, LC or Tuned Oscillators: Hartley, Colpitts, Clapps, and Crystal Oscillators.

UNIT-III

Power Amplifiers: Classification, Class A, B and AB, Push Pull and complementary- Symmetry push-pull amplifiers – power output and efficiency, crossover and harmonic distortion, linear analysis of class B tuned power amplifiers and class C tuned RF voltage amplifiers.

UNIT-IV

Tuned Amplifiers: Single, double and staggered tuned amplifiers – inter stage design- stability considerations-class B, neutralization techniques.

UNIT-V

Operational Amplifier Applications: Inverting and non-inverting amplifiers with ideal and non-ideal op-amps, voltage followers, Difference Amplifier, Summing amplifiers, ideal and practical Integrator, Differentiator, Voltage to current and current to voltage converters. Instrumentation amplifier, Sample and Hold circuit, peak detector, Log and Antilog amplifiers, precision Rectifiers.

Suggested Readings:

1. Millman J., Halkias C.C. and Satyabrata Jit, *Electronic Devices and Circuits,* 3rd edition, Tata McGraw-Hill, 2011.

2. Millman J., Halkias C.C. and Parikh C, *Integrated Electronics,* 2nd edition, Tata McGraw-Hill, 2009.

3. Salivahanan, Suresh Kumar and Vallavaraj, "*Electronic Devices and Circuits,"* 2nd edition, Tata McGraw-Hill, 2010.

4. Ramakanth A. Gayakwad, "*Op-amps and Linear Integrated Circuits*", 3rd Edition, Prentice-Hall of India private Limited, New Delhi, 1995.

PC 402 EC

Network Theory

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Concepts of Two Port networks, study about the different two port parameter representations.*
- *Concepts about the image impedance a different networks, design of attenuators, matching networks.*
- *Design concepts of different LC filters.*
- *Design concepts of different active filters , equalizers.*
- *Design concepts of network synthesis.*

Course Outcomes:

Student will be

- *Able to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits and how they are used in real time applications.*
- *Able to learn how to calculate frequency response curves and to interpret the salient features in terms of poles and zeros of the system functions and design of attenuators.*
- *Able to design different types of filters using active and passive elements.*
- *Able to design of equalizers.*
- *Able to synthesize the RL, RC & RLC networks Foster and Cauer Forms.*

UNIT-I

Two port networks: Z, Y, h, g, ABCD parameters, equivalence of two ports, T-PI transforms, inter connection of two ports, Brune's test for inter connections. Driving point transfer functions.

UNIT-II

Networks: Image impedance, Image transfer constant, symmetrical asymmetric T PI sections .Properties of L, T PI sections, Attenuation phase functions, design of attenuators, impedance matching networks system functions, poles zeroes of network functions, frequency response from poles zeroes.

UNIT-III

Properties of LC networks: Fosters reactance theorems, image parameter filter theory, constant K filters, LP, HP -BPF design, m-derived composite filter design, lattice filters.

UNIT-IV

Equalizers: amplitude phase equalization, all pass filters, b rejection notch filters, biquad transfer functions, Butterworth Tchebyshev approximations design of filters up to 2nd order.

UNIT-V

Positive real functions Hurwitz polynomials: Driving point synthesis with LC, RC RL networks, Foster Cauer forms, Properties of RC RL Networks**.**

Suggested Readings:

1. Ryder J.D, *Network Lines Fields*, 2nd edition, Prentice Hall of India,1991.
2. A. Sudhakar Shyammohan, *Circuits Networks: Analysis Synthesis*, 4th edition, Tata McGraw-Hill, 2010.
3. Van Valkenburg M.E, *Introduction to Modern Network Synthesis,* Wiley Eastern 1994.

PC 403 EC

Logic and Switching Theory

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiar with concepts of Boolean Algebra.*
- *To understand minimization techniques of Boolean functions.*
- *To understand design concepts of combinational.*
- *To understand the structural properties of switching functions.*
- *To understand the design concepts of sequential circuits.*

Course Outcomes:

Student will be

- *Able to know the theory of Boolean algebra.*
- *Able to use the concepts of Boolean algebra for the design & analysis of various combinational & sequential logic circuits.*
- *Able to design various logic circuits starting from simple ordinary gates to complex programmable logic devices & arrays.*
- *Able to optimize combinational and sequential logic circuits.*

UNIT-I

Boolean Algebra: Axiomatic Definition of Boolean Algebra, Basic Theorems Properties of Boolean Algebra, Boolean Functions, Canonical Forms Stard Forms, Other Logical Operations, Digital Logic Gates, Simplification of Switching Functions using Theorems. Functional Properties Functionally Complete Operations, Isomorphic Systems, Series-Parallel Switching Circuits.

UNIT-II

Minimization of Switching Functions: The Map Method (K-Map), Minimal Functions Their properties. Quine-McCluskey Tabular Method, Prime Implicants Essential Prime Implicants.

UNIT-III

Combinational Logic Design: Single Output Multiple Output Combinational Logic Circuit Design, -OR, OR- N/NOR Realizations, Exclusive-OR Equivalence Functions. Binary Adders, Subtractors, Code Conversion, Relay Contacts Analysis Synthesis of Contact Networks,
Hazards: Static Hazards, Design of Hazard - Free Switching Circuits.

UNIT-IV

Functional Decomposition: Symmetric Networks: Properties of Symmetric Functions, Symmetric Relay Contact Networks, Identification & Realization of Symmetric Functions. Various Types of Flip-Flops their Excitation Tables, Flip-Flop conversions, Shift Registers.

UNIT-V

Introduction to Sequential Logic Design: Classification of Sequential Circuits, The Sequential Circuit Model. Design of Simple Synchronous Sequential Circuits such as Sequence Detector, Counters, ASM charts, Introduction to Asynchronous Machines.

Suggested Readings:

1. Zvi Kohavi, *Switching Finite Automata Theory*, 2nd edition, Tata McGraw-Hill, 2006.
2. An Kumar, *Switching Theory Logic Design,* 1st edition, Prentice Hall of India, 2012.
3. Mano M., *Digital Design,* 3rd edition, Prentice Hall of India, 2008.

PC 404 EC

Signal Analysis and Transform Techniques

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To learn basic concepts related to signals & systems.*
- *To familiarize with basic operations on signals mathematical representation of periodic aperiodic signals continuous discrete systems.*
- *To understand convolution, correlation operations on continuous signals.*
- *To analyze the response of systems on application of step, ramp inputs using Fourier & Z transforms.*

Course Outcomes:

Students will be

- *Able to differentiate signal like discrete time, continuous time, power, energy, periodic, aperiodic, even, odd.*
- *Able to define the system by an impulse response with properties: memoryless, causal, stable.*
- *Able to understand the properties of FT, Z-transform & LT.*

UNIT-I

Introduction to Signals & Systems: Analogy between Vectors signals, Signal representation by discrete Orthogonal functions, Orthonormality completeness, Operations on signals, Classification of signals & systems, Exponential and Trigonometric Fourier series, Convergence, Dirichlet's condition, the discrete spectrum.

UNIT-II

Fourier Transform: Representation of aperiodic signal, Development of Fourier transform, Convergence, Examples properties of Fourier Transform, Fourier transform of periodic signals, Singularity function, Parseval's theorem, Energy spectral density estimation of signals.

UNIT-III

Convolution & Correlation of signals: Convolution integral, Properties of convolution, Graphical method of convolution, Definition of correlation, Auto correlation Cross correlation of signals, Simple problems involving correlation, auto correlation cross correlation, Convolution of Discrete time signals.

UNIT-IV

Discrete Signals: Sampling of continuous time signals, Mathematical proof of sampling theorem, Types of discrete systems, Linear Time Invariant, stable, causal memory less system, Description of discrete system using linear constant coefficient difference equations, Frequency domain representation of signals systems, Realization of discrete time system using Direct form, Cascade parallel forms.

UNIT-V

Z Transform: Definition of Z-Transform, Properties of Z-Transform, Region of convergence of Z-Transform, Inverse Z Transform using Inspection, Partial fraction expansion, Power series expansion Contour integration methods, Parseval's relation analysis of discrete time systems using Z-Transform.

Suggested Readings:

1. Alan V. Oppenheim, Alan.S.Willsky, S Hamid Nawab, *Signals and Systems*, 2nd edition, Prentice Hall of India, 2007.
2. Lathi B.P., *Signals Systems Communications*", 1st edition, B.S. Publications, 2006.
3. Alan V. Oppenheim Ronald W. Schafer, *Discrete Time Signal Processing*, 1st edition, Prentice Hall of India, 2008.

PC 405 EC

Electromagnetic Theory

Credits:3

Instruction : (3L + 1T) hrs per week — *Duration of SEE : 3 hours*
CIE : 30 Marks — *SEE : 70 Marks*

Course Objectives:

- *To become familiar with the fundamental concepts of vector analysis, electrostatics magneto statics laws their applications.*
- *To familiar with the four Maxwell's equations used to study time varying EM or dynamic fields to apply them to solve practical EM problems.*
- *To acquaint with theoretical analysis of the characteristics of electromagnetic waves in a wide variety of Practical Mediums.*

Course Outcomes:

Students will be

- *Able to express and elaborate Maxwell's Equations in differential and integral forms and the constitutive relations between the flux densities and field intensities of the electrostatics, magneto-statics and electrodynamics fields.*
- *Able to derive the Helmholtz wave equations in its various forms and the wave nature of their solutions for time-harmonic waves in various mediums.*
- *Able to apply fundamental electromagnetic concepts in applications such as Transmission Lines and Antennas .*

UNIT-I

Fundamentals of Electrostatics: Review of Vector Calculus and Coordinate system and Transformation, Coulomb's Law, Electric Field Intensity, Electric field due to different charge distributions - Electric Field due to Line Charge, Sheet Charge, Volume Charge Distribution. Electric Flux, Flux Density, Gauss's Law and application.

UNIT-II

Electrostatics: Energy and Potential, Potential Field of a Point Charge, System of Charges, potential gradient, Energy density in Electrostatic fields, Electric Dipole and Flux lines, convection and conduction currents ,continuity equation and relaxation time, Boundary conditions in static Electric Field, Poisson's and Laplace's Equations, Uniqueness theorem, Capacitance and Capacitors.

UNIT-III

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law, Applications of Ampere's Law, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to magnetic fields, Magnetic Dipole, Magnetization, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy.

UNIT-IV

Maxwell's Equations and EM Wave Propagation: Faraday's Law, Transformer and Motional EMF's, Maxwell's Equations in Differential and Integral Forms, Time-Varying Potentials, Time-Harmonic Fields, Uniform Plane Wave, Wave Propagation in Free Space, Dielectrics, Good Conductors-Skin Effect.

UNIT-V

EM Wave Propagation: Wave Polarization-Linear, Circular and Elliptical polarizations, Poynting's Theorem and Wave Power, Poynting Vector, Instantaneous, average and complex pointing vector, Reflection of UPW at Normal incidence and Oblique incidence angles, Reflection coefficient, Transmission coefficient, power and energy calculations.

Suggested Readings:

1. Matthew N,O. Sadiku, *Principles of Electromagnetics*, Oxford University Press, 2009, 4th edition.
2. David K.Cheng, *Field and Wave Electromagnetics*, Pearson Education, 2001, 2nd edition.
3. W.H.Hayt,Jr. and J.A Buck, *Engineering Electromagnetics*, Tata McGraw-Hill, 2006, 7th edition.

BS 404 MT

Applied Mathematics

Credits:3

Instruction : (3L + 1T) hrs per week | *Duration of SEE : 3 hours*
CIE : 30 Marks | *SEE : 70 Marks*

Course Objectives:

- *To understand the concept of vector spaces and linear transformations.*
- *To understand the numerical methods to solve certain types of problems.*
- *To correlation, regression and optimization.*

Course Outcomes:

Students will be

- *Able to analyze vectors geometrically and algebraically and to represent transformation by matrices.*
- *Able to solve non linear equations, system of linear equations and ordinary differential equations numerically.*
- *Able to formulate and model a linear programming problem from a word problem and solve them using simplex method in 2 and 3 dimensions.*
- *Able to perform a regression analysis and to compute and interpret the coefficient of correlation.*

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 Publication,4th Edition, 2014.
2. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
3. Vasishtha and Gupta, *Integral Transforms*, Krishnan Prakashan Publications, 2014.
4. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, 2012.

PC 451 EC

Analog Electronics Lab

Credits:1

Instruction: 2 hrs per week | *Duration of SEE: 3 hours*
CIE: 25 marks | *SEE: 50 marks*

Course Objectives:

- *To understand the design concepts of transistor amplifiers at high frequency.*
- *To understand the design concepts of multi stage amplifiers.*
- *To understand the design concepts of feedback amplifiers.*
- *To understand the design concepts of oscillators.*
- *To study the design concepts of power tuned amplifiers.*

Course Outcomes:

Students will be

- *Able to design amplifiers, Oscillators.*
- *Able to implement amplifier and oscillators.*

List of Experiments:

1. Design, Analysis testing of frequency response of multistage stage RC coupled amplifier using BJT and FET.
2. Design, Analysis testing of frequency response of transformer coupled amplifier.
3. Verification of Miller's Theorem
4. Design, analysis testing of Darlington Bootstrap amplifier
5. Voltage Series Voltage Shunt Feedback Amplifier
6. Current Series Current Shunt Feedback Amplifier
7. RC Phase Shift Oscillator, Wien Bridge Oscillator
8. Colpitts Hartley Oscillators,
9. Tuned Collector Oscillator
10. IF RF tuned Amplifier
11. Class 'A' Amplifier
12. Class 'B' Push Pull Amplifier.

General Note: Mini Project cum Design exercise:

The student must design, rig-up test the circuits where ever possible should carry out the experiments individually.

Suggested Readings:

1. Maheshwari An, *Laboratory Experiments PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices Circuits,* Prentice Hall of India, 2001.

PC 452 EC

Networks Lab

Credits:1

Instruction: 2 hrs per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*

Course Objectives:

- *Design concepts of different theorems.*
- *Design concepts of resonance, LC filters.*
- *Generation of waveforms using MATLAB Programming.*
- *Design verification of characteristics of filters using PSPICE.*
- *Study of frequency response of analog system.*

Course Outcomes:

Students will be

- *Able to verify theorems.*
- *Able to design LPF, HPF.*

List of Experiments:

1. Thevenin's Norton's Theorems
2. Maximum Power Transfer, Superposition Millman's Theorems
3. Two-Port Parameters
4. Series Parallel Resonance
5. Constant K low pass high pass filter
6. m-derived low pass high pass filter
7. Introduction to MATLAB generating different wave forms using MATLAB
8. Convolution using MATLAB
9. Frequency response of analog system (given Transfer function as well as poles Zeros) using MATLAB
10. Verification of Thevenin's Norton's theorems using Multisim PSPICE. having more than one voltage current source
11. Design testing of constant K-low pass high pass filters using Multisim PSpice
12. Design testing of constant m-derived low pass high pass filters using Multisim PSpice
13. Verification of maximum power transfer ,superposition Millman theorems with different Components using Multisim PSPICE

General Note: Mini Project cum Design exercise:

The student must design, rig-up test the circuit where ever possible should carry out the experiments individually.

Suggested Readings:

1. David Bell A, *Laboratory Manual for Electrical Circuits,* Prentice Hall of India, 2005.
2. Pratap R., *Getting started with MATLAB*, Oxford University Press, 2003.

SERVICE COURSES

ES 421 EC

Signals and Systems (CSE)

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To learn basic concepts related to signals & systems.*
- *To familiarize with basic operations on signals mathematical representation of periodic, aperiodic signals continuous discrete systems.*
- *To understand convolution, correlation operations on continuous signals.*
- *To analyze the response of systems on application of step, ramp inputs using Fourier & Z transforms.*

Course Outcomes:

Students will be

- *Able to differentiate signal like discrete time, continuous time, power, energy, periodic, aperiodic, even, odd.*
- *Able to define the system by an impulse response with properties: memoryless, causal, stable.*
- *Able to understand the properties of FT, Z-transform & LT.*

UNIT-I

Signal Analysis: Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions, Exponential and sinusoidal signals, Concepts of Impulse function, Unit step function, Signum function.

UNIT-II

Fourier Transform: Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.

UNIT-III

Signal Transmission Through Linear Systems: Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT-IV

Convolution & Correlation of Signals: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function.Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT-V

Z-Transform: Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z- transform, properties of Z-transforms.

Suggested Readings:

1. Lathi B.P., *Signals Systems & Communications*, B.S. Publications, 1st Edition, 2006.
2. Alan V. Oppenheim, Alan.S.Willsky, S Hamid Nawab, *Signals and Systems*, Prentice Hall of India, 2nd Edition, 2007.
3. Simon Haykin and Van Veen, *Signals and Systems* , Wiley India, 2nd Edition, 2008.

ES 422 EC

Digital Electronics (BME)

Credits:3

Instruction : (3L+1T) hrs per week | *Duration of SEE : 3 hours*
CIE : 30 Marks | *SEE : 70 Marks*

Course Objectives:

- *This course facilitates the students to study the properties for Boolean algebra and simplification of Boolean equations using K-maps.*
- *The digital circuits' classification is studied and the main elements of this classification are studied. Application of these circuits to build a basic computer is discussed.*
- *The students also learn about different types of memories and how they are programmed.*
- *The course also discuss about the basic applications of digital electronics like digital clock, frequency counter.*

Course Outcomes:

Students will be

- understand the properties for Boolean algebra and simplification of Boolean equations using K-maps.
- understand about different types of memories and how they are programmed.
- understand the conversion process in ADC and DAC.

UNIT-I

Codes: BCD, ASCII code, Excess-3 code, Gray code. Error detecting and error correcting codes. Combinational Logic Design: Boolean laws & theorems. Karnaugh Map-simplification of Boolean expressions- Sum of Products (SOP) form, Product of Sums (POS) form. Realization of Boolean Expressions using universal gates.

UNIT-II

Data processing circuits: Multiplexers, De-Multiplexers, Code-converters, Encoders, Decoders.
Arithmetic Circuits: Half adder, Full adder, Half subtractors, Full subtractors.
Digital Circuit Testing tools: Logic pulser, Logic probe, Current Tracer.

UNIT-III

Sequential circuits: Flip-flops-RS, D, JK and JK Master slave. Debounce circuits.
Registers: Serial-in parallel-out, Serial-in Serial-out, parallel-in-serial-out parallel-in-parallel-out.
Counters: Asynchronous and synchronous counters, decade counters, ring counters.
Design of synchronous counters using excitation tables.

UNIT-IV

Basic computer Organization: Instruction codes, Computer registers, Timing and control, Instruction cycle, Input-output Configuration, Interrupt cycle.
Memories: Types of memories, ROM, PROM, EPROM, SRAM, DRAM, DDRAM, NVRAM, flash memory, Memory Addressing.
Applications: Digital Clock, Frequency counter, Time measurement, Displays.

UNIT-V
Introduction to DAC, ADC: Sampling, Quantization, quantization noise, aliasing and reconstruction filtering, Specifications, DAC Conversion, Binary weighted Resistor DAC, R-2R Ladder DAC, Inverted (or) Current mode DAC, Sample and hold circuits,
ADC conversion, Types of ADCs: Direct Conversion ADC/Flash type ADC, Successive approximation ADC, Integrating ADCs, Sigma-Delta ADCs, Analog Multiplexers.

Suggested Readings:

1. Donald P.Leach & Albert Paul Malvino, *Digital Principles and electronic,* 5th Ed., Tata Mc. Graw Hill Publishing Co.Ltd., New Delhi, 2003.
2. R.P.Jain, *Modern Digital Electronics,* 3rd Ed., Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2003.
3. Morris Mano M. *Computer system Architecture*, 3rd Ed, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

ES 441 EC

Digital Electronics Lab (BME)

Credits:1

Instruction : (2P) hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

I. List of Experiments:

1. Clippers and Clampers-Series and Parallel
2. Astable, Monostable and Bistable Multivibrators
3. Logic Gates-AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR
4. Half Adder, Full Adder, Half Subtractor, Full Subtractor
5. Flip Flops-SR, JK, D, T, JK-Master Slave
6. A/D and D/A converters
7. Multiplexers and Demultiplexers
8. Shift register-Series/Parallel-in to Series/Parallel-out
9. CMOS-TTL and TTL-CMOS interfacing
10. BCD-7 segment Display, DPM
11. PLL and Voltage Controlled Oscillator
12. Counters-Decade, Binary, Divide-by-N

II. Mini Project and Design exercises:

Mini project is to be executed batch-wise. Design exercises are to be carried out individually.