

4TH SEMESTER

COURSE NAME: LINEAR CONTROL SYSTEMS

COURSE CODE: EC-14401

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 50%-60%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Recognize and explain different types of control system.
- CO2 Find the transfer function of a control system using block diagram and signal flow graph techniques.
- CO3 Analyze the time domain behaviour of second and higher order systems.
- CO4 Find out system stability using Routh Hurwitz's criteria and root locus technique.
- CO5 Analyse the frequency domain behaviour of the system using bode plot and Nyquist criteria.
- CO6 Use compensating techniques to design stable network.
- CO7 Explain the working of various control system components such as error detectors, synchros, potentiometers etc.

Syllabus:

Unit 1. Introductory Concepts

Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant & invariant, continuous and sampled data control systems, Block diagrams, some illustrative examples.

Unit 2. Modelling

Formulation of equation of linear electrical, mechanical, thermal, pneumatic, hydraulic system, electrical, mechanical analogies, Transfer function, Block diagram representation, Signal flow graphs and associated algebra, characteristics equation.

Unit 3. Time domain analysis

Typical test-input signals, Transient response of first and second order systems, Time domain specifications, Dominant closed loop poles of higher order system, Steady state error and coefficients, pole- zero location and stability, Routh-Hurwitz Criterion.

Unit 4. Root Locus Technique

The extreme points of the root loci for positive gain, Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain, sketch of the root locus plot.

Unit 5. Frequency Domain Analysis

Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems, Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

Unit 6. Compensation

Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead- compensation.

Unit 7. Control Components

Error detectors – potentiometers and synchros, servo motors, ac and dc techno generators, magnetic amplifiers.

Text Books

1. B. S. Manke, “Linear Control Systems”, Khanna Publishers, 11th Edition, 2012.
2. I. J. Nagrath and M. Gopal, “Control System Engineering”, Wiley Eastern Ltd, 3rd Edition, 2000.

Reference Books and Other Resources

1. R. C. Dorf and R. H. Bishop, “Modern Control System”, Addison –Wesley, Pearson Education, 8th Edition, 2004.
2. K. Ogata, “Modern Control Engineering”, Prentice Hall, 5th Edition, 2010.
3. B. C. Kuo, “Automatic Control System”, Prentice Hall, 7th Edition, 2000.
4. S. Janardhanan and Y. Singh, “Modern Control Engineering”, Cengage Learning, 2010.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Unit 1	H	M	L	-	-	-	-
Unit 2	L	H	L	-	-	-	-
Unit 3	L	L	H	L	-	-	-
Unit 4	-	L	M	H	-	-	-
Unit 5	-	L	-	-	H	H	-
Unit 6	-	L	L	-	H	H	-
Unit 7	-	L	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	K	l
CO1	M	-	-	-	-	-	-	M	-	-	-	M
CO2	H	-	-	-	H	-	-	-	-	-	-	H
CO3	H	-	-	-	H	-	-	-	-	-	-	H
CO4	H	-	H	-	H	-	-	M	-	-	-	H
CO5	H	-	-	-	H	-	-	-	-	-	-	H
CO6	H	-	H	-	H	-	-	M	-	-	-	H
CO7	L	-	-	-	-	-	-	-	-	-	-	L

COURSE NAME: ELECTRONICS DEVICES & CIRCUITS-II

COURSE CODE: EC-14402

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Comprehend the significance of transistor coupling and explain various coupling techniques.
- CO2 Explain the concept of tuned amplifiers.
- CO3 Classify power amplifiers and calculate efficiency of each amplifier.
- CO4 Analyze effect of feedback in amplifiers.
- CO5 Describe working of various RC and LC oscillators.
- CO6 Analyze operation of transistor in terms of T and Pi model at high frequency.

Syllabus:

Unit 1. Multistage Amplifiers

Coupling of transistor amplifiers, frequency response of coupled amplifiers, Types of coupling: RC coupling, Transformer coupling, direct coupling, Cascode amplifier, Darlington amplifier. Tuned Amplifiers: single tuned, double tuned and stagger tuned amplifiers.

Unit 2. Large Signal Amplifiers

Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic distortion, variation of output power with load, push-pull amplifiers, operation of Class A push-

pull amplifier, Class B push-pull amplifier, crossover distortion, Class AB push-pull amplifier, Transistor phase inverter, Complementary- symmetry amplifier.

Unit 3. Feedback in Amplifiers

Types of feedback, effect of negative feedback on gain, input impedance, output impedance, bandwidth, stability, distortion and frequency response, voltage series, current series, voltage shunt, current shunt feedback circuits and their analysis.

Unit 4. Oscillators

Sinusoidal oscillators, Criterion for oscillation, Different types of oscillators: RC Phase Shift, Wien Bridge, Hartley, Colpitt, Crystal Oscillators and Derivation of frequency for these oscillators.

Unit 5. High Frequency Transistor

High frequency T model, common base short circuit current frequency response, alpha cutoff frequency, common emitter short circuit current frequency response, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters, CE short circuit current gain obtained with hybrid pi model, current gain with resistive load.

Text Books:

1. J. Millman, C. Halkias and C. D. Parikh, "Integrated Electronics: Analog and Digital Circuits and Systems", McGraw Hill Education, 2nd Edition, 2010.
2. R. Boylested and L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall of India, 10th Edition, 2009.

Reference books and other resources:

1. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2011.
2. A. Malvino and D. J. Bates, "Electronic Principles", Tata McGraw-Hill, 7th Edition, 2007.
3. T. L. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012.
4. J. Millman, C. C. Halkias and S. Jit, "Electronic Devices and Circuits", Tata McGraw-Hill, 3rd Edition, 2010.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
UNIT 1	H	H	-	-	-	-
UNIT 2	-	-	H	-	-	-
UNIT 3	-	-	-	H	-	-
UNIT 4	-	-	-	-	H	-
UNIT 5	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	K	l
CO1	H	-	-	-	H	-	-	-	-	-	M	H
CO2	H	-	-	-	H	-	-	L	-	-	M	H
CO3	H	-	-	-	H	-	-	L	-	-	-	H
CO4	H	-	-	-	H	-	-	L	M	-	M	H
CO5	H	-	-	-	H	-	-	L	-	-	-	H
CO6	H	-	-	-	H	-	-	-	M	L	M	H

COURSE NAME: SIGNALS AND SYSTEMS

COURSE CODE: EC-14403

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 40%-50%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Classify signals and systems & perform basic operations like scaling, shifting, folding etc. on them.
- CO2 Represent continuous-time and discrete-time signals in the form of Fourier series and Fourier Transform.
- CO3 Calculate the response of Continuous-time Linear Time Invariant Systems.
- CO4 Explain the behavior of random signals in terms of probability functions.
- CO5 Comprehend different noise sources and analyze their impact on system performance

Syllabus:

Unit 1. Classification of Signals and Systems

Introduction, Elementary signals in continuous and discrete domain, Operations on Signals: scaling, shifting and folding. Classification of Continuous-time and Discrete-time signals, Classification of Continuous-time and Discrete-time systems.

Unit 2. Analysis of Continuous-time and Discrete-time signals

Representation of Continuous-time and discrete-time signals using Fourier series: Trigonometric Fourier series, Polar Form of Fourier series and Exponential Fourier Series, concept of negative

frequency, Properties of Fourier Series, Aperiodic Continuous-time and discrete-time signal representation using Fourier Transform, Properties of Fourier Transform, Fourier Transform of Periodic Power Signals, Power Spectral Density, Energy Spectral Density, Parseval's Theorem and correlation.

Unit 3. Continuous-Time Linear Time Invariant Systems

Definitions and Properties of LTI Systems, Impulse and step response, Convolution integral, Transfer function.

Unit 4. Random Signal Theory

Introduction to Probability Theory, Definitions, Probability of Random Events, Joint and Conditional Probability, Probability Mass Function, Probability Density Function, Statistical Averages, Examples of Probability Density Functions, Transformation of Random Variables, Random Process: Stationary and Non-stationary, Ergodicity.

Unit 5. Signal Transmission through Systems

Sampling Theorem, Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure, Experimental determination of Noise Figure, Matched Filter.

Text Books:

1. S. Haykins and B. V. Veen, "Signals and Systems", John Wiley & Sons, 2nd Edition, 2008.
2. S. Haykin, "Communication Systems", John Wiley & Sons, 3rd Edition, 2008.

Reference books and other resources:

1. H. P. Hsu, "Signals and Systems", McGraw Hill Education Pvt. Ltd., 2nd Edition, 2008.
2. A. V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and Systems", Pearson Education, 2007.
3. M. J. Roberts, "Signals and Systems: Analysis using Transform Methods and MATLAB", Tata McGraw-Hill, 2nd Edition, 2012.
4. D. Sundararajan, "A Practical Approach to Signals and Systems", John Wiley & Sons, 2008.

5. S. Ghosh, "Signals and Systems", Pearson Education, 2006.
6. W.V. Etten, "Introduction to Random Signals and Noise", John Wiley & Sons, 2005.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
UNIT 1	H	-	-		-
UNIT 2	-	H	-	-	-
UNIT 3	-	-	H	-	-
UNIT 4	-	-	-	H	-
UNIT 5	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	-	-	-	M	-	-	-	-	-	-	H
CO2	H	-	-	-	M	-	-	-	-	-	M	H
CO3	H	-	-	-	M	-	-	-	-	-	-	H
CO4	H	-	-	-	M	-	-	-	M	M	M	H
CO5	H	-	-	-	M	-	-	L	M	M	-	H

COURSE NAME: ELECTROMAGNETIC FIELD THEORY

COURSE CODE: EC-14404

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Apply the Maxwell's equations to solve boundary conditions in different media.
- CO2 Describe the concept of electromagnetic wave propagation and its sinusoidal variation in different media.
- CO3 Analyze the characteristics of guided waves in parallel planes.
- CO4 Explain the propagation of waves in rectangular and circular waveguides.
- CO5 Describe and analyze parallel plane transmission lines with Smith charts.

Syllabus:

Unit 1. Introduction to Time varying fields

Maxwell's equations in differential and integral forms, Concept of displacement current and conduction current, Boundary conditions.

Unit 2. Electromagnetic Waves

Wave equation and its solution in different media, Plane wave, Sinusoidal time variations, Polarization, Reflection of waves by perfect dielectrics and by perfect insulators, Surface impedance, Poynting theorem and Poynting vector.

Unit 3. Guided Waves

Waves between parallel planes, TE, TM waves and their characteristics, TEM waves, Velocities of propagation, Attenuation in parallel plane guides, Wave impedance.

Unit 4. Wave Guides

Rectangular and circular wave guides, TE and TM waves in rectangular waveguides, Impossibility of TEM wave in wave guides, Wave impedance and Characteristic impedance, Transmission line analogy for wave guides, Attenuation factor of wave guides.

Unit 5. Transmission Lines

Circuit representation of parallel plane transmission lines, Parallel plane transmission line with losses, Lossless line, Low loss RF and UHF transmission lines, Distortionless line, Transmission line charts-impedance matching.

Text Books:

1. E. C. Jordan & K. G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd edition , PHI ,2011
2. P. V. Gupta, Introductory Course In Electromagnetic Fields, 3rd edition, Dhanpat Rai & Sons Company Limited.

Reference Books / Study material:

1. W. H. Hayt & J.A. Buck, Engineering Electromagnetics, 8th edition, TATA McGraw-Hill, 2014.
2. W. H. Hayt & J.A. Buck, Problem and solutions in Electromagnetics, 8th edition TATA McGraw-Hill, 2014.
3. John Krauss, Electromagnetics and applications, 4th edition ,TATA McGraw-Hill, 2010.
4. Matthew, N. O. Sadiku, Elements of Engineering Electromagnetics, 4th edition, Oxford University Press, 2007.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
Unit 1	H	-	-	-	-
Unit 2	-	H	-	-	-
Unit 3	-	-	H		-
Unit 4	-	-	-	H	-
Unit 5	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	-	-	-	H	-	-	-	L	-	-	-
CO2	H	-	-	-	-	-	-	-	-	-	-	L
CO3	H	-	-	-	-	-	-	-	-	-	L	L
CO4	H	-	H	-	-	-	-	-	-	-	L	L
CO5	H	-	H	-	-	-	-	-	-	-	L	L

COURSE NAME: DIGITAL ELECTRONICS

COURSE CODE: EC-14405

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 40%-50%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Convert binary number from one system to another.
- CO2 Describe the working of logic gates & circuits.
- CO3 Minimize the logical expressions by choosing the appropriate method.
- CO4 Design the combinational and sequential circuits for the given requirements.
- CO5 Describe working of ADC and DAC.
- CO6 Explain the characteristics & applications of semiconductor memories.
- CO7 Describe the operation of various logic families.

Syllabus:

Unit 1. Number Systems and Binary Codes

Introduction, Number Systems: binary, octal and hexadecimal; Binary Operations: addition, Subtraction, multiplication and division; Signed binary numbers, Subtractions using 1's and 2's compliment, Binary Codes: BCD code and BCD additions, Excess 3 code, Gray code, ASCII code.

Unit 2. Minimization of Logic Function

Logic Gates: OR, AND, NOT, NOR, NAND, EX-OR; Pin diagram and description of ICs of logic gates, Boolean algebra, Basic theorem of Boolean algebra, Minimization using Boolean algebra, Standard representations of logic functions, K-map representation of logic functions, Minimization using K-map and Q-M method, Incompletely specified functions/Don't care Conditions.

Unit 3. Combinational Logic Circuits

Introduction, Combinational circuit design, Multiplexer, Implementation of combinational circuit using multiplexer, Demultiplexer, Use of demultiplexer in combinational logic design, Adders, Subtractors, use of adders as subtractors, Adder with look-ahead carry, Encoder, Decoder, Code converters, Parity generator/checker, Digital comparators, BCD-to-7 segment display decoder/driver.

Unit 4. Sequential Circuits

Introduction, Flip-Flops: working principles, types, applications; Shift registers: types, circuit diagram, timing wave form and applications; Counters: types, working principles, design of asynchronous and synchronous counter, counter design using state equations and state diagrams.

Unit 5. D/A and A/D Converters

Introduction, Digital to Analog Converters (DACs): types, working principles, specifications; Analog to Digital Converters (ADCs): types, working principles, Specifications.

Unit 6. Semiconductor Memories

Introduction, Memory organization and operation, Classification and characteristics of memories, Read-only memory, Read-Write memory, Content addressable memory, Charged coupled device memory.

Unit 7. Digital Logic Families

Characteristics of Digital ICs, RTL, DCTL, DTL, TTL, ECL, CMOS logic families and their types, Comparison of logic families.

Text Books:

1. R. P. Jain, “Modern Digital Electronics”, Tata McGraw–Hill, 4th Edition, 2010.

Reference books and other resources:

1. T. L. Floyd, “Digital Fundamentals”, Pearson Education, 7th Edition, 2002.
2. M. Mano, “Digital Design”, Pearson Education, 4th Edition, 2008.
3. D. P. Leach and A. P. Malvino, “Digital Principles and Applications”, Tata McGraw Hill, 5th Edition, 2003.
4. R. J. Tocci, N. S. Widmer, G. L. Moss, “Digital System-Principles and Applications”, Pearson Education, 2002.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6	CO7
Unit 1	H	-	-	-	-	-	-
Unit 2	-	H	H	-	-	-	-
Unit 3	-	-	-	H	-	-	-
Unit 4	-	-	-	H	-	-	-
Unit 5	-	-	-	-	H	-	-
Unit 6	-	-	-	-	-	H	-
Unit 7	-	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	-	-	-	L	-	-	-	-	-	-	H
CO2	H	-	-	-	L	-	-	-	-	-	-	H
CO3	M	-	-	-	M	-	-	-	-	-	-	H
CO4	M	-	H	-	M	-	-	-	-	-	M	H
CO5	H	-	-	-	-	-	-	-	-	-	-	M
CO6	H	-	-	-	-	-	-	-	-	-	-	M
CO7	H	-	-	-	-	-	-	-	-	-	-	H

COURSE NAME: PULSE WAVE SHAPING AND SWITCHING

COURSE CODE: EC-14406

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Describe the working of different series and parallel RLC circuits.

CO2 Analysis the RC circuits for low and high pass filtering

CO3 Analyze the characteristics of clipping and clamping circuits.

CO4 Illustrate the switching characteristic of different devices.

CO5 Understand the negative resistance behavior of semiconductor devices.

CO6 Analyze voltage and current sweep circuits and identify methods to mitigate sweep errors.

Syllabus:

Unit 1. Introduction to Basic Elements and Waveforms

Passive and Active circuit elements, AC through inductor and capacitor, AC through Resistor-inductor and resistor-capacitor in series, Series and parallel resonance circuit, Different input signals, Average and RMS value.

Unit 2. Linear Wave Shaping

High pass and low pass circuits, Response to sine, step, pulse, square, exponential and ramp inputs with different time constants, High pass as a differentiator, Low pass as an integrator, Attenuators- response to step input, Compensated attenuator.

Unit 3. Non-Linear Wave Shaping

Diode clippers, Transistor clippers and two level clippers, Clamping circuits using diodes, Practical clamping circuit, Clamping theorem, Comparators, Diode- differentiator comparator.

Unit 4. Switching Circuits

Diode and transistor as electronic switch, Switching times in diode and transistor, Bistable, Monostable and Astable Multivibrators (both collector and emitter coupled), Symmetrical and Unsymmetrical triggering, Schmitt trigger Circuits.

Unit 5. Negative Resistance Switching Circuits

Voltage controlled and current controlled negative resistance circuits, Negative-resistance characteristics, Monostable, Bistable and Astable operations, Applications using tunnel diode and UJT.

Unit 6. Sweep Circuits.

General features of a time base signal, Linearization of sweeps, Methods of generating time base waveform, Bootstrap and Miller sweep circuits, principle of current sweeps.

Text Books:

1. Wave Generation and Shaping by L. Strauss, 3rd Edition, TMH, 1995.
2. Pulse and Switching Circuits by Sanjeev Kumar, Dhanpat Rai & Company.

Reference books and other resources:

1. Pulse and Digital Switching Circuits by Milliman, Taub, Tata Mcgraw Hill.
2. Pulse and Digital Circuits by Mothiki S. Prakash Rao, Tata Mcgraw Hill.
3. Pulse & Digital Circuits, by Rao K, Pearson Education.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Unit 1	H	-	-	-	-	-
Unit 2	-	H	-	-	-	-
Unit 3	-	-	H	-	-	-
Unit 4	-	-	-	H	-	-
Unit 5	-	-	-	M	H	-
Unit 6	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	-	-	M	-	-	-	M	M	-	M
CO2	H	-	-	-	H	-	-	-	M	M	M	M
CO3	H	-	-	-	M	-	-	M	M	M	L	M
CO4	H	-	-	-	H	-	-	M	M	H	M	M
CO5	H	M	-	-	M	-	-	-	M	M	M	M
CO6	H	-	-	-	M	-	-	-	-	M	M	M

COURSE NAME: LAB ELECTRONICS DEVICES & CIRCUITS-II

COURSE CODE: EC-14407

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Analyze effect of different coupling techniques on the performance of transistor amplifier.

CO2 Comprehend frequency response of tuned amplifier.

CO3 Observe the operation of various power amplifiers like Class A, B, AB Push pull and complementary symmetry and conclude on the basis of their efficiency.

CO4 Observe effect of negative feedback on amplification factor.

CO5 Demonstrate working of various RC and LC oscillators along with frequency of oscillation.

Syllabus:

- Experiment 1.** To demonstrate RC coupling technique for transistor amplifier.
- Experiment 2.** To demonstrate Transformer coupling technique for transistor amplifier.
- Experiment 3.** To demonstrate direct coupling technique for transistor amplifier.
- Experiment 4.** To plot frequency response of a tuned amplifier.
- Experiment 5.** To observe the operation of Class A amplifier direct coupled and Transformer coupled with resistive load and calculate efficiency.
- Experiment 6.** To plot the characteristics of Class A push pull amplifier and calculate efficiency.
- Experiment 7.** To observe crossover distortion in Class B push pull amplifier and calculate efficiency.
- Experiment 8.** To plot the characteristics of Class AB push pull amplifier and calculate efficiency.
- Experiment 9.** To plot the characteristics of complementary symmetry amplifier.

- Experiment 10.** To analyze the effect of negative feedback on amplifier gain.
- Experiment 11.** To observe the response of RC phase shift oscillator and determine frequency of oscillation.
- Experiment 12.** To observe the response of Hartley oscillator and determine frequency of oscillation.
- Experiment 13.** To observe the response of Colpitts oscillator and determine frequency of oscillation.
- Experiment 14.** To observe the response of Wien Bridge oscillator and determine frequency of oscillation.

Reference Books and Other Resources:

Lab manuals available in lab.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
Experiment 1	H	-	-	-	-
Experiment 2	H	-	-	-	-
Experiment 3	H	-	-	-	-
Experiment 4	-	H	-	-	-
Experiment 5	-	-	H	-	-
Experiment 6	-	-	H	-	-
Experiment 7	-	-	H	-	-
Experiment 8	-	-	H	-	-
Experiment 9	-	-	H	-	-
Experiment 10	-	-	-	H	-
Experiment 11	-	-	-	-	H

Experiment 12	-	-	-	-	H
Experiment 13	-	-	-	-	H
Experiment 14	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	L	-	H	-	-	L	-	-	H	L
CO2	H	H	-	-	M	-	-	L	-	-	H	L
CO3	H	H	L	-	H	-	-	L	-	-	H	-
CO4	H	H	L	-	H	-	-	L	L	-	H	L
CO5	H	H	L	-	H	-	-	L	-	-	H	L

COURSE NAME: LAB DIGITAL ELECTRONICS

COURSE CODE: EC-14408

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Verify the operation of basic and universal gates.
- CO2 Design and verify the standard combinational circuits.
- CO3 Verify the operation of different types of Flip-Flops.
- CO4 Verify the working of shift registers.
- CO5 Design counters using Flip-Flops for given count sequence.

Syllabus:

- Experiment 1.** To verify the truth-tables of OR, AND, NOT, XOR, NAND and NOR logic gates.
- Experiment 2.** To realize the OR, AND, NOT and XOR functions using universal gates.
- Experiment 3.** To realize the Half Adder and Full Adder circuits using logic gates.
- Experiment 4.** To realize the Half Subtractor and Full Subtractor using logic gates.
- Experiment 5.** To design 4-Bit Binary-to-Gray Code Converter using logic gates.
- Experiment 6.** To verify the truth-table of 16:1 Multiplexer and 1:16 Demultiplexer.
- Experiment 7.** To design and test S-R flip-flop using NAND/NOR gates.
- Experiment 8.** To verify the truth-tables of J-K, D, and T flip-flops.
- Experiment 9.** To realize SIPO, SISO, PIPO, and PISO shift register circuits using D flip-flops.
- Experiment 10.** To design MOD-10 synchronous up-counter using D flip-flops.
- Experiment 11.** To operate the counters (using ICs 7490/7493/74192) and verify the frequency division at each stage. With a low frequency clock (say 1 Hz) display the count on LEDs.

Experiment 12. To study shift-register operations using IC 7495 chip.

Experiment 13. To verify the truth table of decoder driver 7447/7448 and operate a 7-segment LED/LCD display.

Reference Books and Other Resources:

Lab manuals available in lab.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
Experiment 1	H	-	-	-	-
Experiment 2	H	-	-	-	-
Experiment 3	-	H	-	-	-
Experiment 4	-	H	-	-	-
Experiment 5	-	H	-	-	-
Experiment 6	-	H	-	-	-
Experiment 7	-	-	H	-	-
Experiment 8	-	-	H	-	-
Experiment 9	-	-	-	H	-
Experiment 10	-	-	-	-	H
Experiment 11	-	-	-	-	H
Experiment 12	-	-	-	-	H
Experiment 13	-	H	-	-	-

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	-	M	-	-	M	-	-	-	M	M
CO2	H	H	M	M	-	-	M	-	-	-	M	M
CO3	H	H	-	M	-	-	M	-	-	-	M	M
CO4	H	H	-	M	-	-	M	-	-	-	M	M
CO5	H	H	M	M	-	-	M	-	-	-	M	M

COURSE NAME: LAB SIGNALS & SYSTEMS

COURSE CODE: EC-14409

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Comprehend applications of MATLAB and perform basic mathematical operations on signals.
- CO2 Generate plots of elementary signals in continuous and discrete domain through the use of M-files.
- CO3 Perform operations on signals like shifting, scaling, folding etc.
- CO4 Compute Fourier and inverse Fourier Transform of any signal and calculate correlation and convolution of signals.
- CO5 Create random sequences for various distributions and plot its probability density function.
- CO6 Calculate the behavior of LTI system for given input.

Syllabus:

- Experiment 1.** Introduction to MATLAB and computation of basic mathematical quantities.
- Experiment 2.** To create arrays and perform arithmetic and trigonometric operations on them.
- Experiment 3.** To generate 2D and 3D plots.
- Experiment 4.** To create script and function files.
- Experiment 5.** To develop a program to generate unit step and unit impulse signal in continuous and discrete domain.
- Experiment 6.** To develop a program to plot exponential and ramp signal in continuous and discrete domain.

- Experiment 7.** To develop a program module to perform operations on continuous-time signals like addition, multiplication, shifting, folding and scaling.
- Experiment 8.** To compute Fourier transform and inverse Fourier Transform of the given function.
- Experiment 9.** To develop a program to compute correlation between continuous-time signals.
- Experiment 10.** To develop a program to perform continuous-time convolution.
- Experiment 11.** To generate random sequences for the following distribution and calculate mean and variance:
- Rayleigh Distribution
 - Uniform distribution
 - Gaussian distribution.
- Experiment 12.** To plot probability density function for Rayleigh, Uniform and Gaussian Distributed random variables.
- Experiment 13.** To develop a program for finding response of the LTI system described by given differential equation.

Suggested Readings/ Books:

1. R. Pratap, “Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers”, Oxford University Press, 2010.
2. Luis F. Chaparro, “Signals and Systems using MATLAB”, Elsevier, 2nd Edition, 2015.
3. Lab manuals available in lab.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Experiment 1	H	-	-	-	-	-
Experiment 2	H	-	-	-	-	-
Experiment 3		H	-	-	-	-
Experiment 4	-	H	-	-	-	-
Experiment 5	-	H	-	-	-	-

Experiment 6	-	H	-	-	-	-
Experiment 7	-	-	H	-	-	-
Experiment 8	-	-	-	H	-	-
Experiment 9	-	-	-	H	-	-
Experiment 10	-	-	-	H	-	-
Experiment 11	-	-	-	-	H	-
Experiment 12	-	-	-	-	H	-
Experiment 13	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	-	-	M	-	-	L	-	-	H	-
CO2	H	M	-	-	M	-	-	L	-	-	H	-
CO3	H	M	-	-	M	-	-	L	-	-	H	-
CO4	H	M	-	-	M	-	-	L	-	-	H	-
CO5	H	M	-	-	M	-	-	L	M	M	H	-
CO6	H	M	-	-	M	-	-	L	-	-	H	-

5TH SEMESTER

COURSE NAME: ANTENNA AND WAVE PROPAGATION

COURSE CODE: EC-14501

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 20%-30%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes:

The students should be able to:

CO1 Comprehend the fundamental principles and parameters of antenna theory.

CO2 Comprehend basic and practical configurations, such as linear dipoles; arrays, aperture patches etc.

CO3 Design antenna arrays.

CO4 Understand various types of wave propagation.

Syllabus:

Unit 1. Introduction

Types of Antennas, Radiation Mechanism in single, two wire and dipole, Current Distribution on a Thin Wire Antenna.

Unit 2. Fundamental parameters of antennas

Radiation Pattern, Radiation Power Density, Radiation intensity, Directivity, Gain, Antenna efficiency, Bandwidth, Polarisation, Antenna Input Impedance, Antenna Vector Effective length and equivalent areas, Maximum Directivity and Maximum Effective Area, Return Loss, Friis Transmission equation and Radar range Equation, Effective aperture, Antenna Temperature.

Unit 3. Linear Wire Antennas

Retarded potential, Infinitesimal dipole, Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Unit 4. Antenna Arrays

Array of two point sources, Array factor, n-element linear array with uniform amplitude and spacing, Analysis of Broadside array, Ordinary end-fire array, Hansen-woodyard end fire array, n-element linear array with non-uniform spacing, Analysis of Binomial and Dolph-Tschebyscheff array, Scanning Array, Superdirective array.

Unit 5. Aperture and Microstrip Antennas

Field Equivalence principle, Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Reflector antenna, microstrip antennas, rectangular patch, circular patch, arrays and feed networks for microstrip antennas, introduction to antenna design softwares.

Unit 6. Wave Propagation

Free space equation, Reflection from earth's surface, Surface and Space wave propagation, Range of space wave propagation, Effective earth's radius, Duct propagation, Troposphere propagation. Structure of ionosphere, propagation of radio waves through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

Text Books:

1. Balanis C.A, "Antenna Theory", John Wiley & sons, 2005.
2. Krauss J.D, "Antenna Theory", McGraw Hill.

Reference Books:

1. Jordan E. C, "Electromagnetics and radiating systems", PHI, 2007.
2. Collins R. E., "Antenna and radio wave propagation", McGraw Hill.
3. Kennedy, G. " Electronic Communication Systems", TMH, Fourth Edition.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4
Unit 1	H	-	-	-
Unit 2	H	-	-	-
Unit 3	-	H	-	-
Unit 4	-	H	H	-
Unit 5	-	H	-	-
Unit 6	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	-	-	-	-	-	-	-	-	-	-	M
CO2	M	-	H	-	M	-	-	-	-	H	-	H
CO3	-	-	H	-	M	-	-	-	-	-	-	H
CO4	H	-	-	-	-	-	-	-	-	-	-	M

COURSE NAME: ANALOG COMMUNICATION SYSTEMS

COURSE CODE: EC-14502

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 20% -30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Describe a Communication system & explain the basic theory of Modulation.
- CO2 Perform the Mathematical analysis of different analog modulation techniques
- CO3 Describe the various methods of generation & detection of AM, FM and SSB modulation schemes
- CO4 Compare the different modulation schemes.
- CO5 Discuss the Super heterodyne receiver in detail.
- CO6 Explain the concept of Sampling and Pulse Modulation techniques

Syllabus:

Unit 1. Analog Modulation Techniques: Introduction, Elements of a Communication System, Modulation & Demodulation, Need of modulation, Types of analog modulations, theory of amplitude modulation, AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, Narrowband FM, Wideband FM, theory of phase modulation, phase modulation obtained from frequency modulation, Comparison of AM & FM, Comparison of PM & FM.

Unit 2. AM Transmission and Reception: Introduction, Low level and high level modulation, Basic principle of AM generation, AM generation using Square law modulation, Collector modulation of Class C transistor amplifiers, Balanced modulator and Ring modulator (Suppressed carrier AM generation), Product modulator; Receiver parameters: Selectivity, Sensitivity, Fidelity, Noise figure, Tuned radio frequency receiver, Super heterodyne receiver, Basic elements of AM super heterodyne receiver: RF amplifier circuit, Mixer/ Converter circuits: Self- excited mixer, Separately excited mixer, Diode mixer & Balanced diode mixer, Local oscillator Tracking, Choice of IF frequency, IF amplifier circuit, Image frequency & its rejection, AM detection: Envelope or diode detector, Principle of Simple AGC, AM detector with AGC, Distortion in diode detectors, Double hetero-dyne AM receivers, AM receiver using Phase locked loop.

Unit 3. FM Transmission and Reception: FM allocation standards, generation of FM by direct methods: Varactor diode modulator, Reactance modulator, Phase locked loop direct FM transmitter; Indirect generation of FM: Armstrong method; Frequency stabilized reactance FM transmitter; Frequency demodulators: Balanced Slope detector, Foster Seeley discriminator, Ratio detector; FM detection using PLL, Pre-emphasis & De-emphasis, Limiter circuit, FM capture effect, FM Receiver.

Unit 4. SSB Transmission and Reception: Introduction, Advantages of SSB transmission, Generation of SSB: Filter method, Phase shift method, Third Method, Pilot carrier SSB systems, Independent Sideband (ISB) Transmitter, Vestigial Sideband (VSB) transmission. SSB Product demodulator, Balanced modulator as SSB demodulator, Pilot carrier SSB Receiver, ISB Receiver.

Unit 5. Pulse Modulation Transmission and Reception: Introduction, Sampling theorem, Pulse Amplitude Modulation(PAM), Natural PAM, Frequency spectra for PAM, Flat-top PAM, PAM Time Multiplexing, PAM modulator, PAM demodulator, Pulse Time Modulation:- Pulse Width Modulation (PWM) & demodulation, Pulse Position Modulation & demodulation.

Text Books:

1. G. Kennedy & B. Davis, Electronic Communication Systems, McGraw-Hill Electrical Engineering Series, 4th Edition, Glencoe Publishers,1993.
2. Wayne Tomasi, Electronic Communications Systems-Fundamental through Advanced, 5th Edition, Pearson Education,2001.

Reference Books/ Study Material:

1. Dennis Roddy & John Coolen, Electronic Communications, 4th edition, Pearson Education, 2009.
2. H. Taub & Donald L.Schilling, Principles of Communication Systems ,3rd Edition, Tata McGraw Hill Education, 2008.
3. L. W. Couch, Digital and Analog Communication Systems, 8th Edition, Pearson Education 2012.
4. K. Sam. Shanmugam, Digital and Analog Communication Systems, Student Edition, Wiley India Publications, 2006.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Unit 1	H	H	-	H	-	-
Unit 2	-	L	H	-	H	-
Unit 3	-	-	H	-	L	-
Unit 4	-	-	H	H	-	-
Unit 5	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	L	-	-	-	-	-	-	-	-	-	-	L
CO2	H	-	-	-	H	-	-	-	-	-	-	H
CO3	H	H	-	-	H	-	-	H	-	-	-	H
CO4	H	-	-	-	-	-	-	-	-	-	-	H
CO5	H	H	-	-	-	-	-	H	-	-	-	H
CO6	H	H	-	-	-	-	-	-	-	-	-	H

COURSE NAME: DIGITAL SIGNAL PROCESSING

COURSE CODE: EC-14503

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 50%-60%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Discuss the concept of discrete time signals and various manipulations on them.
- CO2 Analyze the discrete time systems using z-transform and discrete Fourier transform.
- CO3 Realize discrete time systems using various forms of structures.
- CO4 Design digital filters using the appropriate method depending upon the specific requirement.
- CO5 Analyze the effects of finite word-length on filter performance.
- CO6 Describe the architecture & characteristics of digital signal processors.

Syllabus:

Unit 1. Introduction

Basic elements of a DSP system, Advantages and disadvantages of DSP over analog processing, Applications of digital signal processing.

Unit 2. Discrete-Time Signal and Systems

Elementary discrete-time signals, Classification of discrete-time signals, Manipulation of discrete-time signals, Input-Output description of discrete-time systems, Block diagram representation of discrete-time systems, Classification of discrete-time systems, Interconnection

of discrete-time systems, Analysis of Linear Time-invariant (LTI) systems using Convolution Sum method, Causal LTI systems, Stability of LTI systems, Analysis of LTI system using Difference equation, Cross-correlation and auto-correlation of Discrete-time signals.

Unit 3. z-Transforms

Direct z-transforms and importance of ROC, Properties of z-transform, Rational z-transforms, System function of LTI Systems, Inverse z-transform methods, One sided z-transform, Analysis of LTI systems in z-domain.

Unit 4. Discrete Fourier Transform (DFT)

Frequency domain sampling and reconstruction of discrete time signal, DFT, DFT as linear transformation, Relationship of DFT to other Transforms, Properties of DFT, Circular Convolution and DFT, Use of DFT in Linear Filtering, Fast Fourier Transform (FFT) Algorithms, Radix-2 Decimation-in-time FFT Algorithm, Radix-2 decimation-in-frequency FFT algorithm.

Unit 5. Implementation of Discrete-Time System

Structures for Realization of discrete-time systems, Structures for FIR systems: Direct form, Cascade form, and Lattice form; Structures for IIR Systems: Direct Form, Transposed Form, Cascade Form, Parallel Form and Lattice Form.

Unit 6. Design of Digital Filters

Types of digital filters, Steps of filter design, Linear-phase response filter, Design of FIR filter using window method, Design of IIR Filter by Impulse Invariance, Bilinear Transformation and Matched z-Transform Technique, Analog and Digital Domain Frequency Transformation, Representation of Numbers and Finite Word Length Effects.

Unit 7. Digital Signal Processors

Introduction, Computer architecture for signal processing, Difference between general and special-purpose digital signal processors, Selecting digital signal processors, Overview of ADSP 2100 and TMS320C50 processors.

Text Books:

1. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing", Pearson Education, 3rd edition, 2003.

Reference books and other resources:

1. E. C. Ifeachor and B.W. Jervis, "Digital Signal Processing", Pearson Education, 2nd edition, 2002.
2. S. Salivahanan, A. Vallavaraj, and C. Gnanapriya , "Digital Signal Processing", Tata Mc-Graw Hill, 2000.
3. A. V. Oppenheim & R. W. Schafer, "Digital Signal Processing", Pearson Education, 2002.
4. P. Ramesh Babu, "Digital Signal Processing", Scitech Publications, 4th edition, 2007.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Unit 1	H	-	-	-	-	-
Unit 2	H	-	-	-	-	-
Unit 3	-	H	-	-	-	-
Unit 4	-	H	-	-	-	-
Unit 5	-	-	H	-	-	-
Unit 6	-	-	-	H	H	-
Unit 7	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	L
CO1	M	-	-	-	L	-	-	-	-	-	-	L
CO2	M	-	-	-	L	-	-	-	-	-	-	M
CO3	M	-	M	-	L	-	-	-	-	-	-	H
CO4	M	-	H	-	M	--	-	-	-	-	-	L
CO5	M	-	-	-	L	-	-	-	-	-	-	L
CO6	M	-	-	-	-	-	-	-	-	-	-	L

COURSE NAME: LINEAR INTEGRATED CIRCUITS

COURSE CODE: EC-14504

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Describe the differential amplifiers with different configurations along with DC and AC analysis.
- CO2 Define and explain the characteristics for an Ideal & Practical operational amplifier and analyse its performance parameters.
- CO3 Describe the applications of op-amp.
- CO4 Explain working principle of IC555 Timer and its applications as Multivibrators.
- CO5 Discuss working of phase locked loop and compare different types of voltage regulators.

Syllabus:

Unit 1. Differential and Cascade Amplifiers

Introduction, Differential Amplifier, Differential Amplifier Circuit Configuration, Dual Input-Balanced output Differential Amplifier, Dual Input-Unbalanced output Differential Amplifier, Single Input-Balanced output Differential Amplifier, Single Input-unbalanced output Differential Amplifier with their DC and AC analysis, Differential Amplifier with swamping resistors, Constant current bias, Current Mirror, Cascaded differential Amplifier Stages, Level Translator, CE-CB configuration.

Unit 2. Introduction to Operational Amplifiers

Block diagram of a typical Op-Amp, Schematic symbol, integrated circuits and their types, IC package types, Pin Identification and temperature range, Interpretation of data sheets, Overview of typical set of data sheets, Characteristics and performance parameters of an Op-Amp, Ideal Op-Amp, Equivalent circuit of an Op-Amp, Ideal voltage transfer curve, Open loop configurations : Differential, Inverting & Non Inverting. Practical Op-Amp: Input offset voltage, Input bias current, Input offset current, total output offset voltage, Thermal drift, Effect of variation in power supply voltages on offset voltage, Change in Input offset voltage and Input offset current with time, Temperature and supply voltage sensitive parameters, Noise, Common Mode configuration and common mode rejection Ratio.

Unit 3. Applications of Op-Amp

Applications of Op-Amp as: DC and AC amplifiers, Peaking Amp, Summing, Scaling and Averaging Amplifier, Instrumentation Amplifier, V to I and I to V converter, Log and Antilog Amp, Integrator, Differentiator. Active filters: First order LP Butterworth filter, Second order LP Butterworth filter, First order HP Butterworth filter, Second order HP Butterworth filter, Higher order filters, Band pass filter, Band reject filters, All pass filter, Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Square wave generator, Triangular wave generator, Sawtooth wave generator, Voltage controlled oscillator, Basic comparator, Zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, Peak Detector, Sample and Hold Circuit.

Unit 4. Specialized IC Applications

IC 555 Timer: Pin configuration, Block diagram, application of IC 555 as Monostable and Astable Multivibrator., Phase Lock Loops: Operating principles & applications of IC 565, Voltage Regulators: Fixed voltage regulators, Adjustable voltage regulators, Switching Regulators.

Text Book:

1. R. Gayakwad, "Op-Amps & Linear Integrated circuits", Pearson Prentice Hall, 3rd Edition, 2006.

Reference Books and Other Resources:

1. R. F. Coughlin And F. F. Driscoll, “Operational Amplifiers & Linear Integrated circuits”, Prentice Hall, 5th edition, 1998.
2. J. M. Fiore, “OP Amps and Linear Integrated Circuits: Concepts and Applications”, Cengage Learning, 1st edition, 2010.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
Unit 1	H	-	-	-	-
Unit 2	L	H	-	-	-
Unit 3	L	M	H	-	-
Unit 4	-	-	-	H	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	-	-	-	-	-	-	-	-	-	-	M
CO2	M	-	-	-	-	-	-	-	-	-	-	M
CO3	M	-	-	-	-	-	-	-	-	M	M	M
CO4	M	-	-	-	-	-	-	-	-	M	-	M
CO5	M	-	-	-	-	-	-	-	-	M	-	M

COURSE NAME: MICROPROCESSORS AND INTERFACING

COURSE CODE: EC-14505

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 30%-40%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Explain the architecture and basic functioning of 8085 microprocessor.
- CO2 Apply the basic instructions for performing various operations on 8085 microprocessors.
- CO3 Demonstrate the role of interrupts.
- CO4 Describe the interfacing of various devices with 8085 microprocessor.
- CO5 Explain the features of 8086 microprocessor.

Syllabus:

Unit 1. Basic Architecture

8085 Architecture, Arithmetic and Logic Unit, Flags, Clock, buses, 8085 Pin configuration, Timing diagrams.

Unit 2. Instruction Set

Introduction to Basic 8085 Instructions, Addressing modes, Data transfer instructions, Arithmetic instructions, Logic instructions, Branch instructions, Conditional call and return instructions, Assembly language programming, Stack, Subroutines.

Unit 3. Interrupts

8085 interrupts, Basic interrupt processing, ISR, RST, RIM, SIM.

Unit 4. Peripheral Devices

8255(PPI), 8279(Keyboard and display controller), 8259(PIC), 8237(DMA), RS-232.

Unit 5. Interfacing

Memory interfacing, Interfacing of Keyboard and Seven Segment LED Display, Microprocessor Controlled Temperature System(MCTS), Study of Traffic Light System, Stepper Motor Controller.

Unit 6. 8086 Microprocessors

Features, Architecture, Flags, Segment registers, Directives.

Text Books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and application with 8085, 5th Edition, Penram International Publishing, New Delhi, 2007.
2. John Uffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002.

Reference books and other resources:

1. A. K. Ray and K. M. Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000
2. M. Rafi Quazzaman, Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
3. D. V. Hall, “Microprocessor and Interfacing-Programming and Hardware”, 2nd Ed., Tata McGraw-Hill Publishing Company Limited, 2008.
4. J. Stewart ,“Microprocessor Systems- Hardware, Software and Programming”, Prentice Hall International Edition,1990
5. K. L. Short,“Microprocessors and Programmed Logic”, 2nd Ed.,Pearson Education, 2008.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
UNIT 1	H	-	-	-	-
UNIT 2	-	H	L	L	-
UNIT 3	-	-	H		-
UNIT 4	L	L	-	H	-
UNIT 5	-	L	-	H	-
UNIT 6	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	M	-	-	M	-	-	L	M	M	M	M
CO2	H	-	-	-	H	-	-	M	M	M	M	M
CO3	H	-	-	-	M	-	-	M	M	M	L	M
CO4	H	-	-	-	H	-	-	M	M	H	M	M
CO5	H	M	-	-	M	-	-	M	M	M	M	M

COURSE NAME: LAB LINEAR INTEGRATED CIRCUITS

COURSE CODE: EC-14510

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Implement various differential amplifier configurations.
- CO2 Measure frequency response of op-amp and apply op-amp as inverting and non inverting amplifiers.
- CO3 Implement amplifiers, differentiator, integrator and Butterworth filter circuits using op-amp.
- CO4 Apply op-amp as oscillator, wave generators and Schmitt Trigger circuits.
- CO5 Design phase locked loop and verify the results on SPICE.

Syllabus:

- Experiment 1.** To study differential amplifier configurations.
- Experiment 2.** To study op-amp as inverting and non inverting amplifier.
- Experiment 3.** To study frequency response of an op-amp.
- Experiment 4.** To use op-amp as summing, scaling & averaging amplifier.
- Experiment 5.** To use op-amp as instrumentation amplifier.
- Experiment 6.** To design differentiator and integrator using op-amp.
- Experiment 7.** To design low-pass, high-pass and band-pass 1st order Butterworth active filters using op-amp.
- Experiment 8.** To design Phase shift oscillator using op-amp.
- Experiment 9.** To study op-amp as Sawtooth wave generator.
- Experiment 10.** To study op-amp as Schmitt Trigger.
- Experiment 11.** To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.

Experiment 12. Introduction of SPICE software and its use for op-amp circuits.

Experiment 13. Verification of hardware results obtained using SPICE software.

Reference Books and Other Resources:

Lab manuals available in lab.

Mapping of course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5
Experiment 1.	H	-	-	-	-
Experiment 2.	-	H	-	-	-
Experiment 3.	-	H	-	-	-
Experiment 4.	-	M	H	-	-
Experiment 5.	-	M	H	-	-
Experiment 6.	-	M	H	-	-
Experiment 7.	-	M	H	-	-
Experiment 8.	-	M	-	H	-
Experiment 9.	-	M	-	H	-
Experiment 10.	-	M	-	H	-
Experiment 11.	-	-	-	-	H
Experiment 12.	-	-	-	-	H
Experiment 13.	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	-	M	-	-	M	-	-	-	M	M
CO2	H	H	-	M	-	-	M	-	-	-	M	M
CO3	H	H	-	M	-	-	M	-	-	-	M	M
CO4	H	H	-	M	-	-	M	-	-	-	M	M
CO5	H	H	-	M	-	-	M	-	-	-	M	M

COURSE NAME: LAB ANALOG COMMUNICATION SYSTEMS

COURSE CODE: EC-14511

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Generate & detect DSB-FC AM & DSB-SC AM signals.

CO2 Generate & detect SSB AM signals.

CO3 Generate & detect FM signals by using different methods.

CO4 Comprehend the working of Super heterodyne receiver & be able to measure parameters such as sensitivity, selectivity & fidelity.

CO5 Generate & detect different pulse modulation techniques.

CO6 Sample & reconstruct the signal and understand the effect of change in its Duty cycle.

Syllabus:

Experiment 1. Generation of DSB-FC AM wave and determination of its Modulation Index & generation of DSB-SC AM signal using Balanced Modulator.

Experiment 2. Detection of DSB-FC AM signal using Diode detector.

Experiment 3. Generation of SSB AM signal.

Experiment 4. Detection of SSB signal using Product detector.

Experiment 5. Generation of FM signal using Varactor diode.

Experiment 6. Generation of FM signal using Reactance modulator.

Experiment 7. Detection of FM signal using PLL.

Experiment 8. Detection of FM signal using Foster- Seeley discriminator & Ratio detector.

Experiment 9. Study of Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.

Experiment 10. Generation & detection of PAM, PWM and PPM.

Experiment 11. Sampling & Reconstruction of signal from its samples using Natural/ Flat-top sampling & Sample & Hold circuit and observe the effect of Duty cycle.

Experiment 12. Study of SIMULINK.

Experiment 13. Simulation of various modulation techniques (AM,FM,PM,DSB-SC AM, SSB)

Reference Books and Other Resources:

Lab manuals available in lab.

Mapping of Course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Experiment 1	H	-	-	-	-	-
Experiment 2	H	-	-	-	-	-
Experiment 3		H	-	-	-	-
Experiment 4	-	H	-	-	-	-
Experiment 5	-	-	H	-	-	-
Experiment 6	-	-	H	-	-	-
Experiment 7	-	-	H	-	-	-
Experiment 8	-	-	H	-	-	-
Experiment 9	-	-	-	H	-	-
Experiment 10	-	-	-	-	H	-
Experiment 11	-	-	-	-	-	H
Experiment 12	M	M	M	M	M	M
Experiment 13	M	M	M	M	M	M

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	-	-	-	L	-	-	-	-	-	H	-
CO2	H	-	-	-	L	-	-	-	-	-	H	-
CO3	H	-	-	-	L	-	-	-	-	-	H	-
CO4	H	H	-	-	L	-	-	-	-	-	H	-
CO5	H	-	-	-	L	-	-	-	-	-	H	-
CO6	H	L	-	-	-	-	-	-	-	-	H	-

COURSE NAME: LAB MICROPROCESSORS AND INTERFACING

COURSE CODE: EC-14512

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Identify various modules embedded on the kit.

CO2 Write the assembly code for various operations on 8-bit and 16-bit numbers.

CO3 Interface various devices with microprocessors.

Syllabus

- Experiment 1.** Introduction to the 8085 microprocessor kit.
- Experiment 2.** To perform of addition of two 8-bit numbers.
- Experiment 3.** To perform of subtraction of two 8-bit numbers.
- Experiment 4.** To perform of addition of two 16-bit numbers.
- Experiment 5.** To perform of subtraction of two 16-bit numbers.
- Experiment 6.** Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
- Experiment 7.** Write a program to sort series using bubble sort algorithm using 8085.
- Experiment 8.** Write a program to copy 12 bytes of data from source to destination using 8085.
- Experiment 9.** Write a program to find maximum and minimum from series using 8085.
- Experiment 10.** Study of interfacing modules and interfacing chips required for the same.
- Experiment 11.** Write a program to interface stepper motor with 8085 microprocessor.
- Experiment 12.** Write a program to interface DC motor with 8085 microprocessor.
- Experiment 13.** Write a program for Traffic Light System.
- Experiment 14.** Write a program to perform addition of two numbers using 8086.
- Experiment 15.** Write a program to perform subtraction of two numbers using 8086.

Experiment 16. Case Study: Microprocessor based projects.

Reference Books and Other Resources:

Lab manuals available in lab.

Mapping of Course contents with CO

Contents	CO1	CO2	CO3
Experiment 1	H	-	-
Experiment 2	-	H	-
Experiment 3	-	H	-
Experiment 4	-	H	-
Experiment 5	-	H	-
Experiment 6	-	H	-
Experiment 7	-	H	-
Experiment 8	-	H	-
Experiment 9	-	H	-
Experiment 10	H	-	-
Experiment 11	-	-	H
Experiment 12	-	-	H
Experiment 13	-	-	H
Experiment 14	-	H	-
Experiment 15	-	H	-
Experiment 16	-	M	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	-	M	-	-	M	-	-	-	M	M
CO2	H	H	-	M	-	-	M	-	-	-	M	M
CO3	H	H	L	M	L	-	M	-	-	-	M	M

COURSE NAME: LAB DIGITAL SIGNAL PROCESSING

COURSE CODE: EC-14513

Internal Marks: 30

L T P

External Marks: 20

- - 2

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

On successful completion of this course, the students should be able to:

- CO1 Implement various elementary discrete time functions.
- CO2 Perform various operations on the discrete time signals.
- CO3 Calculate convolution using different transforms.
- CO4 Calculate magnitude and phase response of LTI systems.
- CO5 Design IIR filters using different methods.
- CO6 Design FIR filters using different methods.

Syllabus:

- Experiment 1.** To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
- Experiment 2.** To develop a program module to perform basic operations on sequences i.e. addition, multiplication, shifting, folding and scaling.
- Experiment 3.** To develop a program to find linear convolution and correlation of two discrete time sequences.
- Experiment 4.** To develop a program to find linear convolution using z-transforms.
- Experiment 5.** To develop program for computing inverse z- Transform.
- Experiment 6.** To develop a program module to perform DFT and IDFT operation on discrete time sequences.
- Experiment 7.** To develop a program to find circular convolution of two sequences using DFT and IDFT method.

- Experiment 8.** To develop program for finding magnitude and phase response of LTI system described by system function $H(z)$.
- Experiment 9.** To develop a program to design IIR filter with given specifications using Impulse invariance method.
- Experiment 10.** To develop a program to design IIR filter with given specifications using bilinear transformation method.
- Experiment 11.** To develop a program to design FIR filter with given specifications using
- Rectangular Window
 - Hanning Window.
- Experiment 12.** To develop a program to design FIR filter with given specifications using KAISER window.

Suggested Readings/ Books:

1. J. G. Proakis and V. K. Ingle, “A Self Study Guide for Digital Signal Processing”, Pearson Education, 2004.
2. S. K. Mitra, “Digital Signal Processing”, Tata Mc Graw Hill, 3rd edition, 2006.
3. Lab Manuals available in Lab.

Mapping of Course contents with CO

Contents	CO1	CO2	CO3	CO4	CO5	CO6
Experiment 1	H	-	-	-	-	
Experiment 2	-	H	-	-	-	-
Experiment 3	-	H	-	-	-	-
Experiment 4	-	-	H	-	-	-
Experiment 5	-	H	-	-	-	-
Experiment 6	-	H	-	-	-	-
Experiment 7	-	-	H	-	-	-

Experiment 8	-	-	-	H	-	-
Experiment 9	-	-	-	-	H	-
Experiment 10	-	-	-	-	H	-
Experiment 11	-	-	-	-	-	H
Experiment 12	-	-	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	H	H	-	M	-	-	M	-	-	-	M	M
CO2	H	H	-	M	-	-	M	-	-	-	M	M
CO3	H	H	-	M	-	-	M	-	-	-	M	M
CO4	H	H	-	M	-	-	M	-	-	-	M	M
CO5	H	H	H	M	H	-	M	-	-	-	M	M
CO6	H	H	H	M	H	-	M	-	-	-	M	M

COURSE NAME: INTELLECTUAL PROPERTY RIGHTS

COURSE CODE: DEEC-14506

Internal Marks: 40

L T P

External Marks: 60

3 1 -

Numerical & Design Problems Content: 0%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Describe and classify the different intellectual property Rights.

CO2 Explain the basic concepts of patenting systems and applications.

CO3 Analyze the issue related to protection of copyrights.

CO4 Analyze the issue related to protection of design rights.

CO5 Explain the basic function and selection of trademarks.

Syllabus:

Unit 1. Introduction to Intellectual Property

Introduction, Classification of intellectual property rights, International treaties & conventions, Acts on intellectual property rights, Domain name disputes and resolution, Cyber Crime offences and contraventions.

Unit 2. Patent System

Introduction & objective of the patent system, Patent on genetic resources, patents on chemicals, Designs, patent based on software, Business methods, Internet patent, Obtaining the patent, Exclusive rights and obligations of a Patentee, Transfer of patent rights, Infringement of a patent.

Unit 3. Copyrights and Related Rights

Nature & scope of protection, Protection of copyrights in the digital media, Defense of fair use, Moral rights of the author, Copyrights societies, Remedies for infringement of copyrights.

Unit 4. Design Rights

Nature and scope of protection of design rights, Protection of layout designs (topographies) of integrated circuits, Protection of undisclosed information, Registration of designs.

Unit 5. Trade Marks

Introduction to trademarks, Registration of trademarks, Infringement of trademarks, Passing off.

Text Books:

1. P. Narayana, “Intellectual Property Law”, Eastern Law House, 2nd edition, 2001.

Reference Books and Other Resources:

1. W. Cornish, D. Llewelyn and T. Aplin, “Intellectual Property: Patents, Copyright, Trademarks and Allied Rights”, Sweet and Maxwell, 2007.
2. R. Jacob and D. Alexander, “A Guide Book to Intellectual Property Patent trademarks, Copyrights and Designs”, Sweet and Maxwell 4th edition, 1993.

Mapping of course contents with COs

Contents	CO1	CO2	CO3	CO4	CO5
UNIT 1	H	-	-	-	-
UNIT 2	L	H	-	-	-
UNIT 3	L	-	H	-	-
UNIT 4	L	-	-	H	-
UNIT 5	L	-	-	-	H

Mapping of CO with PO

CO	PO											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	L	-	-	-	-	H	-	-	-	-	L	-
CO2	L	-	-	-	-	H	-	-	-	-	L	-
CO3	L	-	H	-	-	H	-	-	-	-	L	-
CO4	L	-	H	-	-	H	-	-	-	-	L	-
CO5	L	-	H	-	-	H	-	-	-	-	L	-