4th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-14401	Linear Control Systems	3	1	-	40	60	100	4
EC-14402	Electronics Devices & Circuits - II	3	1	-	40	60	100	4
EC-14403	Signals & Systems	3	1	-	40	60	100	4
EC-14404	Electromagnetic Field Theory	3	1	-	40	60	100	4
EC-14405	Digital Electronics	3	1	-	40	60	100	4
EC-14406	Pulse Wave Shaping and Switching	3	1	-	40	60	100	4
EC-14407	Lab Electronics Devices & Circuits - II	-	-	2	30	20	50	1
EC-14408	Lab Digital Electronics	-	-	2	30	20	50	1
EC-14409	Lab Signals & Systems	-	-	2	30	20	50	1
GF-14401	**General Fitness**				100	NA	100	1
TOTAL		**18**	**6**	**6**	**430**	**420**	**850**	**28**

COURSE NAME: LINEAR CONTROL SYSTEMS
COURSE CODE: EC-14401

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
CO1	Classify different types of control system and analyze their use in various practical applications	1(M)	1(M)
CO2	Use different techniques for mathematical modelling of various types of physical systems	1(H)	1(M)
CO3	Analyze the nature of time response of feedback control systems and find out system stability using Routh Hurwitz's criteria and root locus technique	2(H), 4(M)	1(H)
CO4	Discuss procedure for determining the stability of a control system based on sinusoidal frequency response	2(M), 4(M)	1(M)
CO5	Design a stable network meeting desired needs within realistic constraints using concept of feedback compensation	3(M)	1(M)
CO6	Demonstrate the domain knowledge of various control system components such as error detectors, synchros, potentiometers etc.	1(M)	3(L)

Syllabus: **[Total Contact Hours: 42+14(T) =56]**

Unit 1. Introductory Concepts **[7+2=9]**

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 **[6+2=8]**

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 **[6+2=8]**

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 **[6+2=8]**

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 **[7+2=9]**

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 **[5+2=7]**

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

Unit 7. Control Components **[5+2=7]**

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:

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.

E books and online learning materials:

1. http://www.ece.mcmaster.ca/~davidson/EE3CL4/slides/Feedback_handout.pdf.
2. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108101037/3.
2. http://nptel.ac.in/courses/108101037/15

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:

CO	Definition	POs	PSOs
CO1	Comprehend and categorize amplifiers on the basis of coupling and tuning concepts.	1(H)	1(M)
CO2	Analyze the behavior of different large signal amplifiers and evaluate their efficiency.	1(H), 2(H)	1(L)
CO3	Apply different feedback topologies to amplifier and examine its impact on circuit performance.	1(H), 2(H)	1(M)
CO4	Select suitable oscillator type for applications under specific frequency range.	1(H), 5(M)	1(L)
CO5	Comprehend the operation of transistors at high frequencies.	1(H)	1(L)
CO6	Engage in self-study to demonstrate applications of electronic circuits.	1(H), 2(H), 3(M), 12(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Multistage Amplifiers **[9+3=12]**
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 **[9+3=12]**
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 [7+2=9]

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 [7+2=9]

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 [7+3=10]

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:

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.

E books and online learning materials:

1. https://lecturenotes.in/subject/429/electronic-devices-and-circuits-edc
2. https://hristotrifonov.files.wordpress.com/2012/10/electronic-devices-9th-edition-by-floyd.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114103063/20
2. http://nptel.ac.in/courses/114103063/33

COURSE NAME: SIGNALS AND SYSTEMS
COURSE CODE: EC-14403

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
CO1	Apply various operations on the signals and classify continuous and discrete time signals and systems.	1(M)	1(L)
CO2	Make use of Fourier series and Fourier transform tools for the analysis of continuous and discrete time signals.	1(H), 2(H), 5(H)	1(M)
CO3	Analyze various techniques to classify LTI systems and develop solutions for mathematical representation of systems.	1(H), 2(H), 3(M), 5(M)	1(M)
CO4	Predict the behavior of random signals using probability theory.	1(H), 2(M), 5(M)	1(M)
CO5	Examine the effect of noise sources on system performance.	1(H), 2(M)	1(M)
CO6	Test real-time systems using self-study and engage in life-long learning.	1(H), 2(H), 4(M), 12(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Classification of Signals and Systems [11+3=14]

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 [12+3=15]

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 [5+2=7]

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

Unit 4. Random Signal Theory [6+2=8]

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 [5+3=8]

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:

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.

E books and online learning materials:

1. http://www.di.univr.it/documenti/OccorrenzaIns/matdid/matdid744681.pdf
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-notes/

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114104074/1
2. http://nptel.ac.in/courses/114104074/2

COURSE NAME: ELECTROMAGNETIC FIELD THEORY
COURSE CODE: EC-14404

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
C01	Apply the Maxwell's equations to solve boundary conditions in different media	1(H), 5(H)	2(H)
C02	Demonstrate the concept of electromagnetic wave propagation and its sinusoidal variation in different media	1(H) ,12(H)	2(H)
CO3	Analyze the characteristics of guided waves in parallel planes	1(H), 11(H),12(H)	1(H)
CO4	Explain the propagation of waves in rectangular and circular waveguides	1(H), 3(H), 11(H),12(H)	1(H)
CO5	Describe and analyze parallel plane transmission lines with Smith charts	1(H), 3(H), 11(H),12(H)	1(H)
CO6	Use knowledge of waveguides and transmission lines to design communication mediums.	1(H), 4(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Introduction to Time varying fields **[4+2=6]**

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

Unit 2. Electromagnetic Waves **[9+3=12]**

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 [9+3=12]

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 [9+3=12]

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 [8+2=10]

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.

E books and online learning materials:

1. https://www.calvin.edu/~pribeiro/courses/engr315/EMFT_Book.pdf
2. https://www.photonics.ethz.ch/fileadmin/user_upload/Courses/EM_FieldsAndWaves/Intro.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106073/3
2. http://nptel.ac.in/courses/108106073/5

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:

CO	Definition	POs	PSOs
CO1	Apply the knowledge of number systems, codes, minimization techniques like Boolean Algebra, K-Map and Q.M. method to analyze and design digital circuits.	1 (H)	
CO2	Identity, formulates, and solves engineering problems in the area of digital electronics.	2 (H) & 3 (H)	
CO3	Apply appropriate techniques to design digital circuits with minimum hardware components to meet the desired application within realistic constraints.	5 (M)	
CO4	Identify and use the appropriate type of analog to digital converters and digital to analog converters for the specified design problems.	4 (M)	
CO5	Apply domain knowledge to select the relevant semiconductor memories to meet the design specifications.	3 (M)	
CO6	Apply reasoning informed by the contextual knowledge to assess the merit and demerits of different logic families for optimal and sustainable circuit design.	3 (M)	

Syllabus: **[Total Contact Hours: 40+13(T) =53]**

Unit 1. Number Systems and Binary Codes **[7+2=9]**

Introduction, Binary, Octal and hexadecimal number system. Binary operations–addition, Subtraction, Multiplication and division, Signed binary numbers, Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Gray code, Octal code, BCD code and BCD additions.

Unit 2. Minimization of Logic Function [7+2=9]

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 [6+2=8]

Introduction, Combinational circuit design, multiplexer, Implementation of Combinational circuit using multiplexer, Dewsmultiplexer, 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, Pin diagram and description of ICs (74150, 74154, 7483, 74147, 74148, 7442, 74184, 74180, 7485, 7447).

Unit 4. Sequential Circuits [6+2=8]

Introduction, Flip-flops, Flip-flop types, Applications of Flip-flops, Shift Registers. Types of Shift Registers, circuit diagram, timing wave form and applications, Counters, counter types, counter design with state equation and state diagrams, Pin diagram and description of ICs of Flip-flops, Shift Registers, and Counters.

Unit 5. D/A and A/D Converters [5+2=7]

Introduction, Digital to Analog Converters (DACs), Types and Specifications of DACs, Analog to Digital Converters (ADCs), Types and Specifications of ADCs.

Unit 6. Semiconductor Memories [5+2=7]

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 [4+1=5]

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

Text Books:

1. R. P. Jain, **Modern Digital Electronics**, Tata McGraw–Hill Education Pvt. Limited, New Delhi.
2. Thomas L. Floyd, **Digital Fundamentals**, Pearson Education, New Delhi, 2003.

Reference books:

1. Morris Mano, **Digital Design**, Prentice Hall of India Pvt. Ltd

2. Donald P. Leach and Albert Paul Malvino, **Digital Principles and Applications**, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
3. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, **Digital System-Principles and Applications**, Pearson Education.

E books and online learning materials:

1. https://www.nodia.co.in/image/catalog/2015/08/Digital-Electronics-sample-chapter.pd
2. https://www.cl.cam.ac.uk/teaching/0708/DigElec/Digital_Electronics_pdf.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114106086/3
2. http://nptel.ac.in/courses/114106086/7

COURSE NAME: PULSE WAVE SHAPING AND SWITCHING
COURSE CODE: EC-14406

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
C01	Apply the knowledge of engineering fundamentals for the concept of Basic Elements and Waveforms	1(H)	1(H)
C02	Illustrate the switching characteristic of different devices.	2 (H) 1(M)	2(M)
CO3	Understand the negative resistance behavior of semiconductor devices.	2(M)	2(M),
CO4	Design the system component for clipping and clamping circuits.	3(H)	2(H)
CO5	Analyze the RC circuits for low and high pass filtering	2(H)	1(H)
CO6	Analyze voltage and current sweep circuits and identify methods to mitigate sweep errors.	2(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Introduction to Basic Elements and Waveforms **[5+3=8]**

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 **[8+2=10]**

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 [8+2=10]

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 [7+2=9]

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 [6+2=8]

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 [5+2=7]

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.

E books and online learning materials:

1. http://www.introni.it/pdf/Millman%20%20Taub%20%20Pulse%20and%20Digital%20Switching%20Waveforms%201965.pdf
2. http://www.kau.edu.sa/files/0001893/files/35053_31214a.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/122106025/3
2. http://nptel.ac.in/courses/122106025/11

COURSE NAME: LAB ELECTRONICS DEVICES & CIRCUITS-II
COURSE CODE: EC-14407

	L	T	P
Internal Marks: 30			
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:

CO	Definition	POs	PSOs
CO1	Demonstrate various coupling techniques for transistor circuits.	1(H), 2(M), 4(H), 5(H)	1(L)
CO2	Conduct experiments to observe the response of power amplifiers.	1(H), 2(M), 4(H), 5(H)	1(L)
CO3	Analyze the output waveforms of LC and RC oscillators for different oscillation frequency.	1(H), 2(H), 3(H), 4(H), 5(M)	1(L)
CO4	Assess the influence of feedback on amplifier.	1(H), 2(H), 4(H), 5(M)	1(L)
CO5	Apply the knowledge to interpret the experimental results of large signal amplifiers and tuned amplifiers.	1(H), 2(H), 4(H), 5(M)	1(M)
CO6	Work in a team to demonstrate applications of analog circuits by engaging in self-learning.	1(H), 2(H), 4(H), 5(H), 9(M), 12(H)	1(H)

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.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114103063/16
2. http://nptel.ac.in/courses/114103063/23

COURSE NAME: LAB DIGITAL ELECTRONICS
COURSE CODE: EC-14408

	L	T	P
Internal Marks: 30			
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:

CO	Definition	POs	PSOs
CO1	Demonstrate operation of basic and universal gates.	1(H), 2(M), 4(H), 5(H)	1(L)
CO2	Design and verify the standard combinational circuits.	1(H), 2(M), 4(H), 5(H)	1(L)
CO3	Analyze and verify the operation of different types of Flip-Flops.	1(H), 2(H), 3(H), 4(H), 5(M)	1(L)
CO4	Verify the working of shift registers.	1(H), 2(H), 4(H), 5(M)	1(L)
CO5	Apply the knowledge to Design counters using Flip-Flops for given count sequence.	1(H), 2(H), 4(H), 5(M)	1(M)
CO6	Work in a team to demonstrate applications of digital circuits by engaging in self-learning.	1(H), 2(H), 4(H), 5(H), 9(M), 12(H)	1(H)

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.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114106086/14
2. http://nptel.ac.in/courses/114106086/21

COURSE NAME: LAB SIGNALS & SYSTEMS
COURSE CODE: EC-14409

	L	T	P
Internal Marks: 30			
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:

CO	Definition	POs	PSOs
CO1	Make use of MATLAB tool to compute and represent data in various formats.	1(L), 5(H)	1(L)
CO2	Develop code to process the given data in continuous and discrete time domain.	1(M)	1(L)
CO3	Apply mathematical tools for given problem statement.	1(H), 5(M)	1(M)
CO4	Self-learning on enhanced topics using online help of mathworks®.	5(H), 12(H)	1(H)
CO5	Examine simulated data to estimate the behavior of systems.	1(H), 2(M), 4(M)	1(L)
CO6	Construct a project in a team or individual for given problem using MATLAB features.	1(H), 3(M), 5(H), 9(M), 12(M)	1(H)

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.

Reference Books and Other Resources:

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.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114104074/3
2. http://nptel.ac.in/courses/114104074/4

5th Sem

5th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-14501	Antenna and Wave Propagation	3	1	-	40	60	100	4
EC-14502	Analog Communication Systems	3	1	-	40	60	100	4
EC-14503	Digital Signal Processing	3	1	-	40	60	100	4
EC-14504	Linear Integrated Circuits	3	1	-	40	60	100	4
EC-14505	Microprocessors & Interfacing	3	1	-	40	60	100	4
DEEC-145XX	Department Elective-I	3	1	-	40	60	100	4
EC-14510	Lab Linear Integrated Circuits	-	-	2	30	20	50	1
EC-14511	Lab Analog Communication Systems	-	-	2	30	20	50	1
EC-14512	Lab Microprocessors & Interfacing	-	-	2	30	20	50	1
EC-14513	Lab Digital Signal Processing	-	-	2	30	20	50	1
TR-14501	**Industrial Training-I***				60	40	100	2
TOTAL		**18**	**6**	**8**	**420**	**480**	**900**	**30**

***The marks will be awarded on the basis of 06 weeks industrial/institutional training conducted after 4th Semester**

Department Elective-I

DEEC-14506 Intellectual Property Rights
DEEC-14507 Business Analytics
DEEC-14508 Software Project Management
DEEC-14509 Total Quality Management

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 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:

CO	Definition	POs	PSOs
CO1	Comprehend the fundamental principles of antenna theory.	1(H)	1(M)
CO2	Apply the concepts & properties of Electro-magnetism to obtain parameters of wave propagation.	1(H)	1(H)
CO3	Design different types of antenna arrays.	3(H)	1(H)
CO4	Analyse the antenna arrays on the basis of their properties and characteristics.	4(M)	1 (H)
CO5	Illustrate the characteristics of radio-wave and their propagation in the atmosphere.	2(H)	1(M)
CO6	Understand practically the knowledge of Antenna using Antenna design softwares.	5(M)	1(M)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit1.Introduction **[4+2=6]**
Types of Antennas, Radiation Mechanism in single, two wire and dipole, Current Distribution on a Thin Wire Antenna.

Unit 2. Fundamental parameters of antennas **[7+3=10]**
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.

Unit3. Linear Wire Antennas **[6+2=8]**

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 **[7+2=9]**

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 **[7+2=9]**

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 **[8+2=10]**

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.

E books and online learning materials:

1. http://www.crectirupati.com/sites/default/files/lecture_notes/AWP%20Lecture%20Notes-final.pdf
2. https://khasimgriet.files.wordpress.com/2016/07/harish-a-r-_-sachidananda-m-antennas-and-wave-propagation-oxford-university-press-2007.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108101092/4
2. http://nptel.ac.in/courses/108101092/14

COURSE NAME: ANALOG COMMUNICATION SYSTEMS
COURSE CODE: EC-14502

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
CO1	Develop basic understanding of different functional blocks in an analog communication system.	1(H),2(L)	1(L)
CO2	Discuss fundamental theory of modulation.	1(M),2(L),3(M)	1(L)
CO3	Analyze mathematically the different analog modulation techniques and solve related numerical problems.	1(L), 2(H),3(M)	1(H)
CO4	Apply analog communication techniques to generate and detect various analog modulation schemes.	4(M), 5(H)	1(H)
CO5	Construct a super-heterodyne AM receiver and define its significant performance metrics.	2(H), 3(H)	1(M)
CO6	Explain generation and detection methods for various pulse modulation techniques.	1(M),3(M)	1(M)

Syllabus: **[Total Contact Hours: 42+14=56]**

Unit 1. Analog Modulation Techniques **[6+3=9]**

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 [12+4=16]

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 [10+3=13]

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 [8+2=10]

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 [6+2=8]

Introduction, Sampling theorm, 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.

E books and online learning materials:

1. http://web.eecs.utk.edu/~roberts/ECE342/AnalogCommunicationSystems.pdf
2. http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114102059/6
2. http://nptel.ac.in/courses/114102059/7

COURSE NAME: DIGITAL SIGNAL PROCESSING
COURSE CODE: EC-14503

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
CO1	Apply the knowledge of convolution sum method, difference equations, z-transforms and DFT to analyze digital signal processing systems.	1(H)	
CO2	Identity, formulate, and solve engineering problems in the area of digital signal processing.	2 (H) & 3 (H)	1 (H)
CO3	Apply appropriate methods to design and synthesize digital filters to meet the designed specifications within given constraints.	5 (M)	1 (H)
CO4	Identity and use the appropriate type of structure for the efficient development of DSP systems.	4 (M)	1 (H)
CO5	Apply the domain knowledge to demonstrate the applications of DSP in societal and environmental contexts.	3 (M) & 7 (M)	
CO6	Apply reasoning informed by the contextual knowledge to assess the architecture & characteristics of various digital signal processors.	3 (M)	3 (L)

Syllabus: **[Total Contact Hours: 40+13(T) =53]**

Unit 1. Introduction **[1+1=2]**

Basic elements of DSP system, Advantages and disadvantage of DSP over analog processing, Application of Digital signal processing.

Unit 2. Discrete-Time Signal and Systems **[8+2=10]**

Elementary discrete-time signals, Classification of discrete-time signals, Manipulation of discrete-time signals, Input-Output Description of 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 [7+2=9]

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) [7+2=9]

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 [6+2=8]

Structures for Realization of Discrete-Time Systems, Direct Form, Cascade Form, and Lattice Form Structures for FIR Systems, Direct Form, Transposed Form, Cascade Form, Parallel Form and Lattice Form Structures for IIR Systems,

Unit 6. Design of Digital Filters [7+2=9]

Types of 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 [4+2=6]

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. Digital Signal Processing: J.G. Proakis and D. G. Manolakis ; Pearson Education, New Delhi.

Reference books and other resources:

1. Digital Signal Processing-A.V. Oppenheim & R. W. Schafer, Pearson Education, New Delhi.
2. Digital Signal Processing : E. C. Ifeachor and B.W. Jervis, Pearson Education, New Delhi.
3. Digital Signal Processing : S. Salivahanan, A. Vallavaraj, and C. Gnanapriya; Tata Mc-Graw Hill, New Delhi.

E books and online learning materials:

1. https://users.dimi.uniud.it/~antonio.dangelo/MMS/materials/Guide_to_Digital_Signal_Process.pdf
2. https://www.cl.cam.ac.uk/teaching/0809/DSP/slides-2up.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114102060/5
2. http://nptel.ac.in/courses/114102060/7

COURSE NAME: LINEAR INTEGRATED CIRCUITS
COURSE CODE: EC-14504

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
CO1	Comprehend various configurations of differential amplifiers along with their DC and AC analysis	1(M)	1(M)
CO2	Interpret data sheets, characteristics and performance parameters of an operational amplifier	4(M)	1(M)
CO3	Apply the knowledge of various performance parameters of an operational amplifier for designing different linear and non-linear applications	3(H)	1(M)
CO4	Design circuits like Integrator, Differentiator. Active filters satisfying desired needs within realistic constraints	3(H)	1(H)
CO5	Summarize the working principle of multivibrators using application specific IC555 and general purpose operational amplifier	1(L)	1(M)
CO6	Illustrate the function of application specific ICs such as voltage regulators, PLL and its applications in communication	1(M)	1(M)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Differential and Cascade Amplifiers **[10+4=14]**

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 [10+4=14]

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 [10+3=13]

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 [9+2=11]

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, "Operatinal 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.

E books and online learning materials:

1. https://www2.mvcc.edu/users/faculty/jfiore/OpAmps/OperationalAmplifiersAndLinearICs_3E.pdf
2. https://www.scribd.com/document/356463964/Linear-Integrated-Circuit-2nd-Edition-D-Roy-Choudhary-pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106068/4
2. http://nptel.ac.in/courses/108106068/10

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:

CO	Definition	POs	PSOs
C01	Analyze the architecture, features and functioning of microprocessors	2(H)	3(M)
C02	Apply the knowledge of instruction set for performing various operations on microprocessors.	1(M)	3(H)
CO3	Compare and contrast the role of different interrupts.	2(M)	3(L)
CO4	Utilize the peripheral devices in any of the applications.	1(M)	3(L)
CO5	Describe the interfacing of various devices with microprocessor.	3(L), 4(L)	1(L), 3(M)
CO6	Work in a team to demonstrate an application of microprocessors by engaging in self-learning	4(H), 9(H), 10(H)	1(M), 3(M)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Basic Architecture **[7+3=10]**
8085 Architecture, Arithmetic and Logic Unit, Flags, Clock, buses, 8085 Pin configuration, Timing diagrams.

Unit 2. Instruction Set **[7+3=10]**
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 **[7+2=9]**

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

Unit 4. Peripheral Devices **[6+2=8]**

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

Unit 5. Interfacing **[6+2=8]**

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 **[6+1=7]**

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.

E books and online learning materials:

1. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/notused/Microprocessors%20and%20Microcontrollers/Learning%20Material%20%20Microprocessors%20and%20microcontrollers.pdf
2. https://www.tutorialspoint.com/microprocessor/microprocessor_tutorial.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108107029/35
2. http://nptel.ac.in/courses/108107029/49

COURSE NAME: INTELLECTUAL PROPERTY RIGHTS
COURSE CODE: DEEC-14506

	L	T	P
Internal Marks: 40			
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:

CO	Definition	POs	PSOs
C01	Understand the fundamental legal principles relating to to each of the areas of intellectual property.	7(H), 8(H),9(L)	1(M), 2(M), 3(M)
C02	Facilitate understanding about Cybercrimes, Ethical Hacking, cyber security and cyber laws	2(M),3(M),4(H),5(M), 6(H),7(M),8(H),9(M)	2(H)
CO3	Explain the basic concepts of patenting systems and applications.	4(L),6(M),7(M), 8(L),9(L)	2(L)
CO4	Analyze the issue related to protection of copyrights.	4(L),6(M),7(M), 8(L),9(L)	2(L)
CO5	Analyze the issue related to protection of design rights.	4(L),6(M),7(M), 8(L),9(L)	2(L)
CO6	Explain the basic function and selection of trademarks.	4(L),6(M),7(M), 8(L),9(L)	2(L)

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Unit 1. Introduction to Intellectual Property **[8+3=11]**

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 [8+3=11]

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 [8+3=11]

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 [8+2=10]

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 [7+2=9]

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.

E books and online learning materials:

1. http://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo_pub_450.pdf
2. http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th_07.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/109105112/1
2. http://nptel.ac.in/courses/109105112/10

COURSE NAME: BUSINESS ANALYTICS
Course CODE: DEEC-14507
Internal Marks: 40 **L T P**
External Marks: 60 **3 - -**
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:

CO	Definition	POs	PSOs
CO1	Integrate information technologies with data science methods to extract value from data sets	1(M),2(L),4(H) 5(M)	_
CO2	Think critically about the business implications, meaningfulness and applicability of observed data patterns and analytical inferences	1(M),2(M),3(H),	_
CO3	Identify opportunities, needs and constraints for data analytics within organizational contexts	1(M),2(M),4(M)	_
CO4	Select appropriate analytic tools for specific managerial issues	1(M),4(M),5(H)	_
CO5	Compose data-analytic tools and concepts to create innovative data-analytic solutions	1(M),2(M),3(H), 4(H),5(H)	_
CO6	Demonstrate proficiency with several data-analytic tools	1(M),4(H),5(H)	_

Syllabus: **[Total Contact Hours: 39]**

Unit 1. Business Intelligence **[5]**
Introduction, Definition, History and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Business Intelligence Applications, Types of Business Intelligence, Roles of Business Intelligence in Modern Business- Challenges of BI.

Unit 2. Architecting the Data **[4]**
Introduction, Types of Data, Enterprise Data Model, Enterprise Subject Area Model, Enterprise Conceptual Model, Enterprise Conceptual Entity Model, Granularity of the Data, Data Reporting and Query Tools, Data Partitioning, Metadata, Total Data Quality Management (TDQM).

Unit 3. Data Mining **[6]**

Introduction, Definition of Data Mining, Data mining parameters, How Data Mining works?, Types of relationships, Architecture of Data Mining, Kinds of Data which can be mined, Functionalities of Data Mining, Classification on Data Mining system, Various risks in Data Mining, Advantages and disadvantages of Data Mining, Ethical issues in Data Mining, Analysis of Ethical issues, Global issues. Data Mining techniques - Decision Tree-Illustrations, Neural Network, Neural Network versus Conventional Computers.

Unit 4. Data Warehousing **[6]**

Introduction, Data Warehousing, Advantages and Disadvantages of Data Warehousing, Data Warehouse, Data Mart, Aspects of Data Mart, Online Analytical Processing , Characteristics of OLAP, OLAP Tools, OLAP Data Modeling, OLAP Tools and the Internet, Difference between OLAP and OLTP, Multidimensional Data Model, Data Modeling using Star Schema and Snowflake Schema. Types of Business Models, B2B Business Intelligence Model, Electronic Data Interchange & E-Commerce Models, Advantages of E-Commerce for B2B Businesses, Systems for Improving B2B E-Commerce, B2C Business Intelligence Model, Need of B2C model in Data warehousing, Different types of B2B intelligence Models.

Unit 5. Knowledge Management **[4]**

Introduction, Characteristics of Knowledge Management, Knowledge assets, Generic Knowledge Management Process, Knowledge Management Technologies, Essentials of Knowledge Management Process.

Unit 6. Data Extraction **[3]**

Introduction to Data Extraction, Role of ETL process, Importance of source identification, Various data extraction techniques, Logical extraction methods, Physical extraction methods, Change data capture.

Unit 7. Business Intelligence Life Cycle **[7]**

Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC) Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Strategy, Objectives and Deliverables, Transformation Roadmap, Building a transformation roadmap, BI Development Stages and Steps, Parallel Development Tracks, BI Framework.

Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques, OLAP Applications, Applying the OLAP to Data Warehousing, Benefits of using OLAP, Dashboard, Advanced/Emerging BI Technologies, Future of Business Intelligence

Critical Challenges for Business Intelligence success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, Availability of Skilled Team Members, Business Intelligence Application Development methodology, Planning the BI Projects, Business Analysis and Data Standardization, affect of Dirty Data on Business profitability, Importance of Meta-Data, Silver Bullet Syndrome, Customer Pain Points, Creating Cost Effective Enterprise friendly BI solution

Unit 8.Implementing Business Intelligence **[4]**

Introduction, Business Intelligence Platform, Business Intelligence Platform Capability Matrix, BI Target Databases, Data Mart, BI Products and Vendor, The Big Four Business Intelligence vendors.

Text Books:

1. Fundamentals of Business Analytics "RN Prasad, Seema Acharya"-John Wiley 2011
2. Business Analytics "James R Evans" – Pearson Education Ltd 2016.

Reference Books:

1."Business Analytics: Application to Consumer marketing" by Sandhya Kuruganti and Hindol Basu.
2. "Business Analytics: Data analysis and decision making" by S. Christian Albright and Wayne L. Winston

E books and online learning materials:

1. http://ptgmedia.pearsoncmg.com/images/9780133552188/samplepages/0133552187.pdf
2. http://www.iimb.ac.in/sites/default/files/u181/Business%20Analytics%20Batch%204%20_2_..pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/110106050/1
2. http://nptel.ac.in/courses/110106050/2

COURSE NAME: SOFTWARE PROJECT MANAGEMENT
COURSE CODE: DEEC-14508
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 10%-20%
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:

CO	Definition	POs	PSO's
CO1	Understand and apply the activities involved in the management of software projects	11(H)	-
CO2	Analyze the various software development environments and risk management.	11(H)	-
CO3	Develop and apply the key strategies to monitor, control and quality assurance of software projects.	11(H)	-
CO4	Select the appropriate planning and estimation models to better evaluate the software projects.	11(H)	-
CO5	Create a strong working knowledge of ethics and professional responsibility.	8(H)	-
CO6	Develop effective organizational, leadership and change skills for managing projects, teams and stakeholders.	9(H)	-

Syllabus: **[Toatal Contact Hours: 39+13(T)= 52]**

Unit 1. Project Evaluation and Planning **[7+2=9]**
Activities in Software project management, Project evaluation- Cost Benefit analysis, Cash flow forecasting, Cost-Benefit evaluation techniques, Risk evaluation. Project planning – Stepwise project planning, Software processes and process models. Project costing, COCOMO II, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb.

Unit 2.Project Scheduling and Risk Management **[9+3=12]**
Project sequencing and scheduling activities, Scheduling resources, Critical path analysis, Network planning, Risk management- Nature and types of risks, Risk planning and control, Risk

assessment, Hazard identification, Hazard analysis, PERT and Monte Carlo simulation techniques.

Unit 3. Monitoring and Control [8+3=11]

Collecting data, Review techniques, Project termination review, Visualizing progress, Cost monitoring, Earned value analysis, Change control, Software Configuration Management (SCM), Managing contracts and acceptance.

Unit 4. People Management [8+3=11]

Introduction, Understanding behaviour, Organizational behaviour, Recruitment process, Motivation, The Oldman – Hackman Job Characteristics model, Stress, Health and safety. Working in teams, Decision making, Leadership, Organization and team structures.

Unit 5. Software Quality Management [7+2=9]

ISO Standards, Process capability models, Testing and software reliability, Quality plans, Test automation, Overview of project management tools.

Text Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Royce, "Software Project Management", Pearson Education.
3. Robert K. Wysocki, "Effective Software Project Management", Wiley.
4. Ian Sommerville, "Software Engineering", Pearson Education.
5. R.S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
6. Kassem, "Software Engineering", Cengage Learning.

Reference books and other resources:

1. http://www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
2. http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf

E books and online learning materials:

1. http://www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
2. http://library.bec.ac.in/kbc/NOTES%20BEC/CSE/8%20SEM/Software%20Project%20Management.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106101061/29
2. http://nptel.ac.in/courses/106101061/15

COURSE NAME: TOTAL QUALITY MANAGEMENT
COURSE CODE: DEEC-14509

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**3**	**-**	**-**

Numerical & Design Problems Content: 0-10%

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:

CO	Definition	POs	PSOs
C01	Develop an understanding on quality management philosophies and framework	11(H)	-
C02	Comprehend the role of leadership in Quality Management	9(H) 10(M)	-
CO3	Apply ethical principles to Quality Management	8(H)	-
CO4	Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.	11(H)	-
CO5	Apply benchmarking and business process reengineering to improve management processes	11(H)	-
CO6	Determine set of indicators to evaluate performance excellence of an Organization	11(H)	-

Syllabus: **[Total Contact Hours: 39]**

Unit 1: Introduction **[8]**

Definition of Quality, Dimensions of Quality, Definition of Total Quality Management, Barriers to TQM implementation, Benefits of TQM, Total Quality Principles: Deming Philosophy and Crosby Philosophy.

Unit 2: Leadership and Ethics **[8]**

Definition of a Leader, Characteristics of good quality leader, Definition of Ethics, Reasons for unethical behavior in an organization, Core values and concepts of a TQM Framework, Startegic Planning.

Unit 3: TQM Principles **[8]**

Customer Satisfaction: Customer perception of quality, Customer feedback, Customer Retention, Employee involvement: Motivation, Empowerment, Characteristics of Successful teams, Continuous Process Improvement: Juran Trilogy, PDSA Cycle, Kaizen, Performance Measures: Basic Concepts, Strategy, Performance Measure Representation.

Unit 4: TQM Tools **[8]**

Benchmarking: Definition, Reasons to benchmark, Benchmarking Process, Quality Function Deployment (QFD): Benefits, QFD Process, Taguchi Quality Loss Function, FMEA: Stages of FMEA.

Unit 5: Quality Systems **[7]**

Concept of Quality Systems Standard, Benefits of ISO Registration, Introduction to ISO 9000 Series of Standards, Implementation of a Quality Management System, Documentation, Auditing, Introduction to ISO 14000 Series Standards.

Text Books:

1. Dale H. Besterfield, "Total Quality Management" Pearson Education, 3rd Edition.
2. James R Evans, "Total Quality Management", Cengage Learning, 2005
3. Suresh Dalela, Saurabh, " ISO 9000 a Manual for Total Quality Management, S. Chand Co.

Reference books and other resources:

1. Narayana V. and Sreenivasan N.S. , "Quality Management- Concepts and Tasks", New Age International, Delhi, 1996
2. SubburajRamaswamy, " Total Quality Management", Tata McGraw Hill, 2005

E books and online learning materials:

1. https://www.wiley.com/college/sc/reid/chap5.pdf
2. http://www.mescenter.ru/images/abook_file/Total_Quality_Management_and_Six_Sigma.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/110104080/1
2. http://nptel.ac.in/courses/110104080/6

COURSE NAME: LAB LINEAR INTEGRATED CIRCUITS
COURSE CODE: EC-14510

	L	T	P
Internal Marks: 30			
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:

CO	Definition	POs	PSOs
CO1	Implement circuits of various differential amplifier configurations	4(M), 10(H)	1(M)
CO2	Apply op-amp as inverting and non inverting amplifiers and analyze the frequency response of op-amp	4(H), 10(H)	1(M)
CO3	Design circuits like differentiator, integrator, oscillator and Butterworth filter using op-amp to meet specified needs	4(H), 10(H)	1(H), 3(M)
CO4	Demonstrate the use of op-amp as wave generators and Schmitt Trigger circuits	4(M), 10(H)	1(M)
CO5	To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL	4(M), 10(H)	1(M)
CO6	Work in a team to demonstrate an application of linear integrated circuits by engaging in self learning	4(M), 9(H), 10(H)	1(L), 3(M)

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

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106068/2
2. http://nptel.ac.in/courses/108106068/5

COURSE NAME: LAB ANALOG COMMUNICATION SYSTEMS
COURSE CODE: EC-14511

	L	T	P
Internal Marks: 30			
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:

CO	Definition	POs	PSOs
CO1	Generate & detect DSB-FC AM & DSB-SC AM signals.	1(M), 2(L), 3 (H), 4(H)	1(H)
CO2	Generate & detect SSB AM signals.	1(M), 2(L), 3 (H), 4(H)	1(H)
CO3	Generate & detect FM signals by using different methods.	1(M), 2(L), 3 (H), 4(H)	1(H)
CO4	Comprehend the working of Super heterodyne receiver & be able to measure parameters such as sensitivity, selectivity & fidelity.	1(M), 2(L), 3 (H), 4(H)	1(H)
CO5	Generate & detect different pulse modulation techniques.	1(M), 2(L), 3 (H), 4(H)	1(H)
CO6	Sample & reconstruct the signal and understand the effect of change in its Duty cycle.	1(M), 2(L), 3 (H), 4(H)	1(H)

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.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114102059/8
2. http://nptel.ac.in/courses/114102059/11

COURSE NAME: LAB MICROPROCESSORS AND INTERFACING
COURSE CODE: EC-14512

	L	T	P
Internal Marks: 30			
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:

CO	Definition	POs	PSOs
CO1	Identify and recall various components embedded on the 8085 and 8086 microprocessor kit.	2(H), 5(H), 9(H), 10(H)	3(H)
CO2	Apply the knowledge of instruction set to develop a code for arithmetic operations.	1(L), 4(M), 9(L)	1(L), 3(H)
CO3	Deduce the role and importance of interfacing modules and interfacing chips.	3(M), 9(H), 10(H)	3(H)
CO4	Illustrate the operation of motors.	1(L), 4(H), 10(H)	1(L), 3(L)
CO5	Conduct experiments using microprocessors to demonstrate the interfacing with various modules.	3(M), 4(H), 5(L), 10(H)	1(M),3(H)
CO6	Work in a team to demonstrate an application of microprocessors by engaging in self-learning	4(H), 9(H), 10(H), 12(H)	1(L), 3(M)

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.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106108100/2
2. https://www.youtube.com/playlist?list=PL0E131A78ABFBFDD0

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:

CO	Definition	POs	PSOs
CO1	Make use of MATLAB tool to implement various elementary discrete time functions.	1(L), 5(H)	1(L)
CO2	Develop code to process the given data in discrete time domain.	1(M)	1(L)
CO3	Develop code to calculate convolution using different transforms.	1(H), 5(M)	1(M)
CO4	Calculate and examine magnitude and phase response of LTI systems to estimate the behavior of systems.	1(H), 2(M), 4(M)	1(L)
CO5	Design IIR and FIR filters using window methods.	1(H), 2(M), 4(M)	1(L)
CO6	Construct a project in a team or individual for given problem using MATLAB features.	1(H), 3(M), 5(H), 9(M), 12(M)	1(H)

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.

MOOCS and Video Course:

1. http://www.nptelvideos.in/2012/12/digital-signal-processing.html
2. http://freevideolectures.com/Course/2314/Digital-Signal-Processing-IIT-Delhi