THIRD SEMESTER

SI. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1.	22LES306	Circuit Theory	ES	40	60	100	3	1	0	4
2.	22LES307	Data Structures (Common to EEE, ECE & CSE Branches)	ES	40	60	100	3	0	0	3
3.	22LPC301	Signals and Systems	PC	40	60	100	3	1	0	4
4.	22LPC302	Analog Circuits	PC	40	60	100	3	0	0	3
5.	22LPC303	Digital Circuits Design	PC	40	60	100	3	0	0	3
6.	22LPC304	Electromagnetic Waves and Waveguides	PC	40	60	100	3	0	0	3
PRACTICAL										
7.	22LES308	Data Structures Laboratory (Common to ECE & CSE Branches)	ES	60	40	100	0	0	3	1.5
8.	22LPC305	Electronic Circuits and Simulation Laboratory	PC	60	40	100	0	0	3	1.5
TOTAL				**360**	**440**	**800**	**18**	**2**	**6**	**23**

FOURTH SEMESTER

SI. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1.	22LBS408	Probability and Random Process	BS	40	60	100	3	1	0	4
2.	22LPC406	Analog Integrated Circuits	PC	40	60	100	3	0	0	3
3.	22LPC407	Analog Communication	PC	40	60	100	3	0	0	3
4.	22LPC408	Digital Signal Processing	PC	40	60	100	3	0	0	3
5.	22LPC409	Networks and Transmission Lines	PC	40	60	100	3	0	0	3
	THEORY WITH PRACTICAL COMPONENT									
6.	22LPC410	Microprocessor and Microcontroller	PC	50	50	100	3	0	2	4
PRACTICAL										
7.	22LES409	Engineering Exploration	ES	60	40	100	0	0	3	1.5
8.	22LPC411	Analog and Digital IC Laboratory	PC	60	40	100	0	0	3	1.5
9.	22LPC412	Digital Signal Processing Laboratory	PC	60	40	100	0	0	3	1.5
TOTAL				**480**	**440**	**800**	**18**	**1**	**11**	**24.5**

22LES306	CIRCUIT THEORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	1	0	4

Course Objectives	To understand the DC and AC circuit analysis and Network topology of electrical circuits.	
UNIT – I	**DC CIRCUIT ANALYSIS**	**12 Periods**
Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff's Current Law, Kirchoff's voltage law, Single Node, Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.		
UNIT – II	**NETWORK THEORY AND DUALITY**	**12 Periods**
Superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits. Analysis using dependent current sources and voltage sources		
UNIT – III	**SINUSOIDAL STEADY STATE ANALYSIS**	**12 Periods**
Sinusoidal Steady State analysis , Characteristics of Sinusoids, The Complex Forcing Function, Phasor, Phasor relationship for R, L, and C, Impedance and Admittance, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, Apparent Power and Power Factor, Complex Power.		
UNIT – IV	**TRANSIENTS AND RESONANCE IN RLC CIRCUIT**	**12 Periods**
Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, RL,RC&RLC Circuits driven by unit step function, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.		
UNIT – V	**COUPLED CIRCUITS AND TOPOLOGY**	**12 Periods**
Magnetically Coupled Circuits, mutual Inductance, Linear Transformer, Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK

1	*Sudhakar and Shyammohan S Palli "**Circuits and Networks Analysis and Synthesis**"McGraw Hill Publishing Company 2017.*
2	*Joseph Edminister and MahmoodNahvi, "**Electric Circuits**", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.*

REFERENCES

1	*David Bell, "**Fundamentals of Electric Circuits**", Oxford University press, 7thEdition, 2009.*
2	*John O Mallay, Schaum's Outlines "**Basic Circuit Analysis**", The McGraw Hill companies, 2nd Edition, 2011*
3	*Charles K. Alexander & Mathew N.O.Sadiku, "**Fundamentals of Electric Circuits**", McGrawHill, 2nd Edition, 2003.*
4	*AbhijitChakrabarti,"**CircuitTheoryAnalysis&Synthesis**",7th RevisedEdition,DhanpathRai&Sons, NewDelhi,2018*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Explain the basic concepts of circuit analysis such as Kirchoff's laws, mesh current and node voltage analysis of electric circuits.	K2
CO2	To apply suitable network theorems and analyze the electrical circuits	K3
CO3	To analyse sinusoidal steady state response of R, L and C circuits	K4
CO4	To analyse the transient response for of RC, RL and RLC circuits and frequency response of parallel and series resonance circuits.	K4
CO5	Explain the coupled circuits and network topologies	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	1	3	2	-	-	-	-	-	-	-	3	-	-
CO4	3	3	1	3	2	-	-	-	-	-	-	-	3	-	-
CO5	3	3	1	3	2	-	-	-	-	-	-	-	3	-	-
22LES306	3	3	1	3	2	-	-	-	-	-	-	-	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1
CO2	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,3.3.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4,5.1.1,5.1.2,5.2.2
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4,5.1.1,5.1.2,5.2.2
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4,5.1.1,5.1.2,5.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total 100 %**
CAT1	10	40	10	40			100
CAT2	10	40	10	40			100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	10	40	10	40			100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	10	40	10	40			100
ESE	10	40	10	40			100

22LES307	DATA STRUCTURES *(Common to EEE, ECE & CSE Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C	ES	3	0	0	3

Course Objectives	The objective of the course is to enable the students to analyze the time complexity of an algorithm, Understand and Use List, Stack, Queue, Tree and graph Data structures and effectively use sorting and searching Techniques.	
UNIT – I	**INTRODUCTION AND ABSTRCT DATATYPES**	**9 Periods**
Algorithm Analysis: Calculation of Running Time – Abstract Data Type- List ADT: Array implementation of List, Linked Lists, Doubly Linked List, Circularly Linked Lists- Cursor implementation of Linked List		
UNIT – II	**STACK AND QUEUE ADT**	**9 Periods**
Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls – Queue ADT: Queue Model, Implementation of Queues, Applications.		
UNIT – III	**TREE ADT**	**9 Periods**
Preliminaries – Implementation of Trees – Tree Traversals – Binary Tree: Implementation, Expression Tree – Search Tree ADT – AVL Trees - BTrees – Red Black Trees.		
UNIT – IV	**GRAPH ALGORITHMS**	**9 Periods**
Definitions – Representation of Graphs – Traversal- Topological sort – Shortest Path Algorithms: Dijkstra's Algorithm – Network Flow Problem – Minimum Spanning Tree: Prim's and Kruskal's algorithm.		
UNIT – V	**SORTING AND SEARCHING**	**9 Periods**
Sorting: Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – Bucket Sort – External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge – Searching : Linear Search – Binary Search – Hashing : Hash Functions– Collision Resolution: Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		
Contact Periods: **Lecture: 45 Period Tutorial:0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Mark Allen Weiss "Data Structures and Algorithm Analysis in C" Second Edition, Pearson Education Limited, 2002.*

REFERENCES

1	*Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, PHI learning Pvt. Ltd., 2011.*
2	*SartajSahni, "Data Structures, Algorithms and applications in C++", Second Edition, Universities Press, 2005.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Analyze the time complexity of various algorithms	K4
CO2	Define and use list, stack and queue Data Structures	K3
CO3	Define and use Tree Data Structure	K3
CO4	Define and use Graph Data Structure	K4
CO5	Use appropriate sorting and searching Techniques	K4

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1								1	3	3	2
CO2	2	2	2	2	2	2				1		1	3	3	2
CO3	2	2	2	2	2	2				1		1	3	3	2
CO4	2	2	2	2	2	2				1		1	3	3	2
CO5	2	2	1	1								1	3	3	2
22LES307	2	2	2	2	2	2				1		1	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.3.1, 1.4.1,2.1.2, 2.2.2, 2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1, 11.2.1, 12.1.1,12.2.2,12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	30	50				100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	30	50				100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	30	50				100
ESE	20	30	50				100

22LPC301	SIGNALS AND SYSTEMS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

Course Objectives	To analyze the Continuous Time signals and systems using Fourier and Laplace Transforms and Discrete Time signals and systems using DTFT and Z-Transforms	
UNIT – I	**INTRODUCTION TO SIGNALS AND SYSTEMS**	**12 Periods**
Introduction to Continuous Time (CT) signals and Discrete Time (DT) signals - step, ramp, impulse, exponential, sinusoidal signals, Representation of DT signals by impulses- signal operations- classification of CT and DT signals –periodic and aperiodic signals, random signals, energy and power signals, even and odd signals- linear time invariant CT systems and DT systems-basic system properties: linear time invariant, causality, BIBO stability.		
UNIT – II	**ANALYSIS OF CONTINUOUS TIME SIGNALS**	**12 Periods**
Fourier series analysis- spectrum of Continuous Time signals- properties of continuous time Fourier series, Fourier transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform. Fourier and Laplace Transforms in signal Analysis.		
UNIT – III	**LINEAR TIME INVARIANT–CONTINUOUS TIME SYSTEMS**	**12 Periods**
Differential Equation- CT system representations by differential equations -Block diagram representation-impulse response, convolution integrals- Frequency response of systems characterized by Differential Equations- Fourier and Laplace transforms in analysis of LTI systems.		
UNIT – IV	**ANALYSIS OF DISCRETE TIME SIGNALS**	**12 Periods**
Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signal, Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform (DTFT) – Properties – Z Transforms-properties.		
UNIT – V	**LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS**	**12 Periods**
Difference Equations-Block diagram representation-ImpulseResponse-Convolution sum -DTFT and Z Transform analysis of Recursive & Non-Recursive systems – Frequency response of systems characterized by Difference –Equations.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK:

1	*Alan V.Oppenheim, Alan S.Willsky and S.HamidNawab, "**Signals & Systems**", Prentice-Hall of India, Second Edition, 2011*
2	*Simon Haykin and Barry Van Veen, "**Signals and Systems**", Wiley India, New Delhi, 2010*

REFERENCES

1	*1. H P Hsu, RakeshRanjan, "**Signals and Systems**", Tata McGraw Hill, 7th Reprint, 2010*
2	*Edward W. Kamen, Bonnie S. Heck, "**Fundamentals of Signals and Systems Using the Web and MATLAB**", Pearson Prentice Hall, 2007*
3	*John Alan Stuller, "**An Introduction to Signals and Systems**", Thomson, 2008*
4	*M.J.Roberts,"**Signalsand Systems, Analysis Using Transform Methods and MATLAB**", Tata McGraw Hill (India), 2nd Edition, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply various operations on signals and understand the System properties.	**K3**
CO2	Analyze frequency components of CT signals and understand the Importance of frequency domain analysis.	**K4**
CO3	Apply convolution integral and differential equation in Analyzing CT LTI systems	**K3**
CO4	Analyze the effect of sampling and frequency content of DT signals through DTFT and Z transform.	**K4**
CO5	Apply convolution Sum and difference equation in analyzing DT LTI systems	**K3**

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

Cos/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	1
CO 3	3	1	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 4	3	3	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	1
22LPC301	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1,3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1, 3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4,3.1.4
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.2, ,2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3,2.4.4,3.1.4,3.1.6
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1,2.3.2, 2.4.1, 3.1.1, 3.1.4,3.3.2,3.4.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	20	40	20			100
CAT2	20	20	40	20			100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	40				100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	30	40				100
ESE	20	30	40	10			100

22LPC302	ANALOG CIRCUITS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
SEMICONDUCTOR PHYSICS	PC	3	0	0	3

Course Objectives	To understand the characteristics functions and frequency response of basic Electronic circuits	
UNIT – I	**BJT AND FET AMPLIFIER**	**9 Periods**
Small Signal Hybrid π equivalent circuit of BJT, Early effect, Analysis of CE, CC and CB amplifiers, - AC Load Line Analysis- Darlington Amplifier - Bootstrap technique - Cascade, Cascode configurations. FET AMPLIFIERS Small Signal Hybrid π equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiers- BiCMOS circuits.		
UNIT – II	**FREQUENCY RESPONSE OF BJT AND FET AMPLIFIERS**	**9 Periods**
General Frequency Considerations- Low and High Frequency response of BJT and FET amplifiers – short circuit current gain - cut off frequency – fα, fβ and unity gain bandwidth – Miller Effect Capacitance-Multistage Frequency Effects.		
UNIT – III	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**9 Periods**
Feedback Concepts– effect of feedback on gain stability, distortion, bandwidth, input and output impedances. Types of feedback amplifiers-stability, Gain and Phase margins-Frequency compensation. OSCILLATORS: Barkhausen criterion for oscillation, Hartley and Colpitt’s oscillators, Clapp oscillator, Ring oscillators and crystal oscillators.		
UNIT – IV	**TUNED AMPLIFIERS AND WAVE SHAPING CIRCUITS**	**9 Periods**
Small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier, double tuned amplifier and effect of cascading single tuned and double tuned amplifiers on bandwidth, Stagger tuned amplifiers , Stability of tuned amplifiers – Neutralization. WAVE SHAPING CIRCUITS: Pulse circuits –RC integrator and differentiator circuits – diode clampers and clippers - UJT Oscillator.		
UNIT – V	**POWER SUPPLIES AND POWER AMPLIFIERS**	**9 Periods**
Linear mode power supply – Half wave and Full wave Rectifiers, Filters, Voltage regulators. Over voltage protection - Switched mode power supply (SMPS) - Regulated DC Power Supply, Power amplifiers- Class A, Class B, Class AB, Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Robert L. Boylestad and Louis Nasheresky, “**Electronic Devices and Circuit Theory**”, 11th Edition, Pearson Education, 2013.*
2	*Floyd, **Electronic Devices**, Ninth Edition, Pearson Education, 2012.*

REFERENCES

1	*Donald. A. Neamen*, ***Electronic Circuits Analysis and Design***, *3rd Edition, McGraw Hill Education (India) Private Ltd., 2010.*
2	*Millman J, Halkias.C.andSathyabradaJit,* ***Electronic Devices and Circuits***, *4th Edition, McGraw Hill Education (India) Private Ltd., 2015.*
3	*Salivahanan and N. Suresh Kumar,* ***Electronic Devices and Circuits***, *4th Edition, ,McGraw Hill Education (India) Private Ltd., 2017.*
4	*David A. Bell,* ***Electronic Devices & Circuits***, *5th Edition, Oxford University Press, 2008.*
5	*Anwar A. Khan and Kanchan K. Dey,* ***A First Course on Electronics***, *PHI, 2006.*
6	*Rashid M,* ***Microelectronics Circuits***, *Thomson Learning, 2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the Working principles, characteristics and applications of BJT and FET amplifiers.	K2
CO2	Explain the Frequency response characteristics of BJT and FET amplifiers	K2
CO3	Describe the performance of Feedback Amplifiers and Oscillators	K2
CO4	Analyze the operation of Tuned Amplifiers and Wave Shaping circuits	K4
CO5	Evaluate the working principles of Power supplies and Power Amplifiers.	K5

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	1	3	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	1	3	-	-	-	-	-	-	-	-	3	-	-
22LPC302	3	3	1	3	-	-	-	-	-	-	-	-	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,4.1.2,4.1.4,4.2.1,4.3.1
CO2	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,3.3.1,4.1.1,4.1.2,4.1.3,4.1 .4, 4.2.1,4.3.1
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.3.1,2.3.1,2.4.1,2.4.2,3.1.6,3.2.3,4.1 .1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1 .1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.3,2.2.1,2.2.2,2.2.3,2.3.12.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1. 1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total 100%**
CAT1		50	10	20	20		100
CAT2		50	10	20	20		100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1		50	10	20	20		100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2		50	10	20	20		100
ESE		50	10	20	20		100

22LPC303	DIGITAL CIRCUIT DESIGN	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	To introduce the theoretical and circuit aspects of Digital Electronics which is the backbone for the basics of the hardware aspects of Digital system	
UNIT – I	**DIGITAL FUNDAMENTALS**	**9 periods**
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Min terms and Max terms, Karnaugh map Minimization and Quine-McCluskey method of minimization. Introduction to Verilog HDL.		
UNIT – II	**COMBINATIONAL CIRCUIT DESIGN**	**9 periods**
Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Binary Multiplier, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.		
UNIT – III	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	**9 periods**
Flip flops – SR, JK, T, D, Master/Slave. FF operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters: Binary, BCD, Modulo n, Up/Down counters-Counter for Random Sequence - Shift registers: -UniversalShiftRegister–Synchronouscounters-Ringcounter–Johnsoncounter.		
UNIT – IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	**9 periods**
Analysis and Design of Asynchronous Sequential Circuits-Reduction of Flow Tables- Stable and Unstable states, state reduction, output specifications, cycles and races, race free assignments, Hazards: Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits- Clock skews.		
UNIT – V	**MEMORY AND PROGRAMMABLE LOGIC DEVICES**	**9 periods**
Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL,CPLD's. TTL and CMOS Logic families.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*M.MorrisR.ManoandMichaelD.Ciletti,"**DigitalDesign**"4thEdition,PearsonEducation,2011.*
2	*M.MorrisR.ManoandMichaelD.Ciletti,"**DigitalDesign:WithanIntroductiontotheVerilogHDL**", 5thEdition,PearsonEducation,2013.*

REFERENCES :

1	*Charles H.Roth."**Fundamentals of Logoc Design**", 6th Edition,Thomson Learning, 2013*
2	*Thomas L. Floyd, "**Digital Fundamentals**",10th Edition,Pearson Education Inc,2011*
3	*S.Salivahanan and S.Arivazhagan"**Digital Electronics**", Ist Edition, Vikas Publishing House pvt Ltd,2012.*
4	*Anil K.Maini "**Digital Electronics**", Wiley, 2014.*
5	*Soumitra Kumar Mandal" **Digital Electronics**", McGraw Hill Education Private Limited,2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand number Systems and digital fundamentals.	K2
CO2	Design Combinational circuits used in digital systems.	K3
CO3	Design Synchronous sequential circuits in digital system.	K3
CO4	Analyze and design Explain Asynchronous sequential circuits in digital system.	K4
CO5	Describe memory device and implement the combinational circuits using programmable logic devices.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	2	-	3	3	-	-	-	-	-	3	1	-
CO2	3	3	2	3	-	-	-	-	-	-	-	-	3	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	3	1	3	-	-	-	-	-	-	-	-	3	1	-
CO5	3	3	1	3	3	-	-	-	-	-	-	-	3	-	-
22LPC303	3	3	1	3	3	-	-	-	-	-	-	-	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.2.1,1.3.1,1.4.1,2,1.1,2.1.3,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,4.1.2,4.1.4,4.2.1,4.3.1
CO2	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.4,2.4.1,2.4.2,3.2.2,3.3.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1, 4.3.1
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.1,2.4.1,2.4.2,3.1.6,3.2.3, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	30	10			
CAT2	30	30	30	10			100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	30	30	10			100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	30	30	10			100
ESE	30	30	30	10			100

22LPC304	ELECTROMAGNETIC WAVES AND WAVES GUIDES	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	To Gain knowledge in static electric and magnetic field principles and related laws governing them, the concepts of Electromagnetic wave propagation in free space and media , and analyze the characteristics of wave propagation in parallel plate, rectangular and circular waveguides.	
UNIT – I	**ELECTROSTATIC FIELDS**	**9 Periods**
Vector analysis- Orthogonal co-ordinate systems-Coulomb's Law-Electric field intensity-Field due to continuous Volume charge distribution-Field due to line charge-Field due to sheet of charge-Electric flux-Gauss law-Application of Gauss law- Divergence theorem-Electric scalar potential-Equipotential surface-Poisson's and Laplace equations-Capacitance of parallel plate-Capacitance of Coaxial cable-Parallel wire capacitance-Boundary conditions-Energy stored in electric field-Energy density.		
UNIT – II	**STEADY MAGNETIC FIELDS**	**9 Periods**
Biot-Savat's Law-Ampere's circuital law-Magnetic flux and flux density-Scalar and Vector potential-Force on a moving charge and differential current element-Magnetic Boundary conditions-Magnetic circuit-Faraday's law of electromagnetic inductance-Inductance and Mutual inductance-Inductance of transmission line-Energy stored in magnetic field-Energy density.		
UNIT – III	**ELECTROMAGNETIC WAVES**	**9 Periods**
Displacement current-Maxwell's equation-Equation of continuity-Inconsistency of Ampere's law-Wave motion in free space- Uniform plane waves-Sinusoidal time variations-Conductors and Dielectrics-Propagation in good conductors and Good dielectrics-Skin effect-Polarization-Reflection and Refraction of plane waves-Reflection by a conductor –Normal and Oblique incidence-Reflection by a Dielectric-Reflection at the surface of a conducting medium-Surface impedance-Poynting Theorem- power loss in a plane conductor.		
UNIT – IV	**GUIDED WAVES AND RECTANGULAR WAVEGUIDES**	**9 Periods**
General solutions for TE and TM waves-Waves between parallel planes of perfect conductors-Velocities of wave propagation- Attenuation in parallel plate waveguide-Wave impedance of TE and TM waves in a parallel plate waveguide-Types of waveguides-Mode theory of a Rectangular waveguide(TE and TM waves)-Characteristics of TE and TM waves-Impossibility of TEM waves in rectangular waveguides-Dominant mode -Wave impedances of TE and TM waves - Characteristic impedance of a waveguide-Attenuation factor -Excitation of various modes-Quality Factor.		
UNIT – V	**CIRCULAR WAVEGUIDES, CAVITY RESONATORS AND WAVEGUIDE COMPONENTS**	**9 Periods**
Bessel functions-TE and TM modes in circular Waveguides-Wave impedances-Dominant mode-Field configuration- Comparison of Circular and Rectangular waveguides-Excitation of modes-Microwave cavity resonators-Rectangular and Circular cavity resonators-Q factor of a cavity resonator for the TE 101 mode-Cavity excitation and tuning-Applications- TEM wave in co-axial lines-Waveguide components.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*William H.Hayt,"**Engineering Electromagnetics**", Tata McGraw-Hill,2011.*
2	*Edward.C.Jordan, Keith.G.Balmai,, "**Electromagnetic Waves and Radiating Systems**", Prentice Hall of India,1995*

REFERENCES:

1	*S.Baskaran, "**Transmission Lines and Waveguides**", Scitech Publications(India) PVT.LTD,Chennai,2011*
2	*David K.Cheng , "**Field and Wave Electromagnetics**"', Pearson Edition ,1999.*
3	*UmeshShinha,"**Electromagnetic Theory and its Applications**",Satya Prakashan,1996.*
4	*Gangadhar.K.A,"**FieldTheory**"Khanna Publishers,2002.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the knowledge to the solutions of problems relating to Electric field	K3
CO2	Apply the knowledge of static magnetic field principles to the solutions of problems relating to magnetic field.	K3
CO3	Understand the concepts of Electromagnetic wave propagation in free space and media.	K2
CO4	Compare the characteristics of wave propagation in parallel plate, rectangular and circular waveguides.	K2
CO5	Explain the concepts of cavity resonators.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	1
CO 3	3	1	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 4	3	3	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	1
22LPC304	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1,3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1, 3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4,3.1.4
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.2, ,2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3,2.4.4,3.1.4,3.1.6
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1,2.3.2, 2.4.1, 3.1.1, 3.1.4,3.3.2,3.4.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20				100
CAT2	40	40	20				100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	40	40	20				100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	40	40	20				100
ESE	40	40	20				100

22LES308	DATA STRUCTURES LABORATORY *(Common to ECE & CSE Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PROGRAMMING IN C LABORATORY	**ES**	**0**	**0**	**3**	**1.5**

Course Objectives	The objective of the course is to Implement linear data structures and nonlinear data structures, use appropriate data structures and implement appropriate sorting and searching techniques.

LIST OF EXPERIMENTS

1. Implementation of Stack Operations using array and Linked List
2. Implementation of Queue operations using array and Linked List
3. Application of stacks in Recursion and Infix to postfix conversion
4. Application of Queue in Simulation of FCFS and Round Robin Scheduling
5. Implementation of Linear list, circularly linked list and Doubly linked list.
6. Application of Linked List in Polynomial Manipulations
7. Implementation of binary tree operations
8. Implementation of Tree Traversal Algorithms
9. Implementation of Graph Traversal Algorithms
10. Implementation of Minimum Spanning Algorithms
11. Implementation of hashing techniques.
12. Implementation of sorting techniques.
13. Implementation of searching techniques.

Contact Periods:
Lecture: 0 Period Tutorial:0Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Implement queue and stack data structures using arrays and Linked Lists	K5
CO2	Implement Tree Data structure and perform tree traversals.	K5
CO3	Implement traversal on Graph Data structure.	K5
CO4	Implement hashing Techniques	K6
CO5	Implement sorting and searching Techniques.	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	2	3	3	-	-	-	-	-	-	1	-	2	-
CO2	3	2	2	3	3	2	-	-	-	2	-	2	-	2	-
CO3	3	2	2	3	3	2	-	-	-	2	-	2	-	2	-
CO4	3	2	2	3	3	2	-	-	-	2	-	2	-	2	-
CO5	3	2	2	3	3	-	-	-	-	-	-	1	-	2	-
22LES308	3	2	2	3	3	2	-	-	-	2	-	2	-	2	-

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.3.1, 1.4.1,2.1.2, 2.2.2, 2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2.
CO2	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO3	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO4	1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2
CO5	1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1,11.2.1, 12.1.1,12.2.2,12.3.2

22LPC305	ELECTRONIC CIRCUITS AND SIMULATION LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
1.ANALOG CIRCUITS	PC	0	0	3	1.5

Course Objectives	To gain hands on experience in designing electronic circuits and simulation
DESIGN AND ANALYSIS THE FOLLOWING EXPERIMENTS	
1	Diode and Transistor Characteristics
2	Half wave and Full wave Rectifier
3	Stability of Q point
4	Single stage RC Coupled CE amplifier
5	Wave Shaping Circuits
6	Characteristics of FET
7	RC phase shift oscillator
8	Colpitt's Oscillator
9	Characteristics of UJT
10	Characteristics of SCR
11	Schmitt Trigger circuit
12	Multivibrator
13	MOS CS amplifier with resistive load, diode connected load, current source load
14	MOS current mirrors

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understanding stability of amplifier circuits	K2
CO2	Analyze various types of amplifier circuits	K2
CO3	Design of oscillators and power amplifiers	K3
CO4	Design of Multivibrators and Schmitt Trigger circuit	K3
CO5	Design and simulate MOS amplifiers and current mirrors	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	1	1
CO2	3	2	1	3	-	-	-	-	-	-	-	-	3	1	1
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	1	1
CO4	3	3	1	3	-	-	-	-	-	-	-	-	3	1	1
CO5	3	3	1	3	2	-	-	-	-	-	-	-	3	1	1
22LPC305	3	3	1	3	2	-	-	-	-	-	-	-	3	1	1
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1
CO2	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.2.3,2.2.4,2.4.1,2.4.2,3.2.2,3.3.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1, 4.1.2,4.1.3,4.2.1,4.3.3,4.3.4
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,3.1.6,3.2.3,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.3.3,4.3.4,5.2.1,5.3.1,5.3.2

22LBS408	PROBABILITY AND RANDOM PROCESS	SEMESTER IV

PREREQUISITES :	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	To provide students with the foundations of probability, random variables, statistical methods and analysis techniques used in various applications in engineering and science problems of process and predictions based on processes.	
UNIT – I	**PROBABILITY AND RANDOM VARIABLES**	**12 Periods**
Probability: Probability Axioms-Conditional Probability-Independent Events-Total Probability-Baye's Theorem. Random variables: Distribution Functions-Expectation and Moments-Moment Generating Function.		
UNIT – II	**SPECIAL PROBABILITY DISTRIBUTIONS**	**12 Periods**
Binomial Distribution, Poisson Distribution, Geometric Distribution, Exponential Distribution, Uniform Distribution, Erlang Distribution, Normal Distribution, Functions of Random Variables.		
UNIT – III	**MULTIPLE RANDOM VARIABLES**	**12 Periods**
Joint Probability Distribution-Marginal Probability Distribution-Conditional Probability Distribution-Covariance-Correlation and Regression-Transformation of Random Variables-Central Limit Theorem		
UNIT – IV	**RANDOM PROCESS**	**12 Periods**
Classification of Random Process-Strict Sense Stationary Process-Wide Sense Stationary Process-Ergodic Random Process-Poisson Process-Markov Chains-Transition Probabilities		
UNIT – V	**LINEAR SYSTEM WITH RANDOM INPUTS**	**12 Periods**
Power Spectral Density Function-Properties-Wiener-Khinchine Theorem. Linear System-Properties-Linear System with Random Inputs-Unit Impulse Response of the System.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOK :

1	***Veerarajan T**., "**Probability-Statistics and Random Processes**",McGraw Hill Education (India)Pvt Ltd., New Delhi, Third Edition,2017.*
2	***Fundamentals of Applied Probability and Random Process, Oliver C. Ibe**A Print of Elsevier Second Edition*

REFERENCES

1	*Gupta S.C and Kapoor V.K., "**Fundamentals of Mathematical Statistics**", Sultan Chand & Sons, New Delhi, 2015.*
2	*Hwei Hsu, "Schaum's**outline series of Theoryand Problems of Probability andRandom***

	Process", *Tata McGraw Hill Publishing Co., New Delhi, 2015.*
3	*Kandasamy, Thilagavathy and Gunavathy, "**Probability, Random Variables and RandomProcess**", S.Chand& Co, Ramnagar, New Delhi, Reprint 2013*
4	*Roy D Yates, "**Probability and Stochastic Processes a friendly introduction for Electrical**and Computer engineers", John Wiley & sons, third edition 2015*
5	*Peyton Z.Peebles, Jr. "**Probability, Random Variables, and Random Signal Principles**" McGraw Hill Education (India)Pvt Ltd., New Delhi, Fourth Edition.*
6	*Athanasios Papoulis and Unnikrishna Pillai S , "**Probability, Random Variables andStochastic Processes**", Tata McGraw 38 Hill, New Delhi, 2011*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the knowledge of basic probability concepts in engineering problems	K3
CO2	Identify various standard probability distributions and apply them in real life phenomena.	K3
CO3	Find correlation and regression for two dimensional random variables	K3
CO4	Analyze engineering problems with random process when time and probability occur	K3
CO5	Evaluate the Power Spectral Density of various stationary random processes	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	2	-	-	-	-	-	-	-	1	2	-	1
CO2	3	3	-	2	-	-	-	-	-	-	-	1	2	-	1
CO3	3	3	-	2	-	-	-	-	-	-	-	1	2	-	1
CO4	3	3	-	2	-	-	-	-	-	-	-	1	2	-	1
CO5	3	3	-	2	-	-	-	-	-	-	-	1	2	-	1
22LBS408	3	3	-	2	-	-	-	-	-	-	-	1	2	-	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.3.1, 4.3.2, 4.3.3, 12.2.1
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.3.1, 4.3.2, 4.3.3, 12.2.1
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.3.1, 4.3.2, 4.3.3, 12.2.1
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.3.1, 4.3.2, 4.3.3, 12.2.1
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.3.1, 4.3.2, 4.3.3, 12.2.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	40	40				100
CAT2	20	40	40				100
Individual Assessment 1	10	40	50				100
Individual Assessment 2	10	40	50				100
ESE	20	40	40				100

22LPC406	ANALOG INTEGRATED CIRCUITS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
ANALOG CIRCUITS	PC	3	0	0	3

Course Objectives	• To understand the characteristics and applications of Operational amplifiers, data converters and operation and applications of special function ICs.	
UNIT – I	**BASICS OF OPERATIONAL AMPLIFIERS**	**9 Periods**
Differential amplifier-Differential mode gain, common mode gain and CMRR -current mirror-Widlar current mirror - Building blocks of 741 operational amplifier-I/O stages, gain stage and level translator stage of 741op-amp -Characteristics of an Ideal and practical - Operational Amplifier-Op-amp parameters, DC & AC performance characteristics- frequency response – frequency compensation.		
UNIT – II	**APPLICATIONS OF OPERATIONAL AMPLIFIERS**	**9 Periods**
Linear applications: voltage follower - inverting, non-inverting amplifiers-summing, scaling, averaging amplifiers-instrumentation amplifiers-difference amplifier **Nonlinear applications**: Integrator-differentiator-precision half wave & full wave rectifiers- peak detector-sample & hold circuit-log & anti-log amplifiers. **Open loop applications**: Comparator-zero crossing detector-Window detector-Schmitt trigger.		
UNIT – III	**OSCILLATORS AND MULTIVIBRATORS**	**9 Periods**
Barkhausen criterion- loop gain -Design of Oscillators: RC phase shift oscillator- Wien bridge oscillator-– Square wave generator - Triangular wave generator-Saw tooth wave generator - IC 555 timer: Functional block diagram and description of Astable & Mono-stable multi-vibrators using IC555 –Applications: Missing pulse detector, PWM, FSK generator, Schmitt trigger.		
UNIT – IV	**ACTIVE FILTERS AND DATA CONVERTERS**	**9 Periods**
Active filters - Sallen-Key filter structure- Design of I order and II order Butterworth filters: Low pass, High pass, Band pass filters- Switched capacitor filter- Data Converters: D/A converter – specifications - weighted resistor type, Voltage Mode and Current-Mode R 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits- A/D Converters – specifications - Flash type – Counter type - Successive Approximation type - Dual Slope type A/D converters.		
UNIT – V	**PLL AND SPECIAL FUNCTION ICS**	**9 Periods**
Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK demodulation and Frequency synthesizing -IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Voltage to Frequency converter- Audio Power amplifier IC.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*D.RoyChoudhry and Shail Jain, **“Linear Integrated Circuits”,** New Age International Pvt. Ltd.,4th Edition 2010*
2	*Ramakant A. Gayakwad, **“OP-AMPs and Linear Integrated Circuits”,** 4th Edition, Prentice Hall / Pearson Education, 2015.*

REFERENCES:

1	*Sergio Franco, **"Design with Operational Amplifiers and Analog Integrated Circuits"**, 4th Edition, Tata McGraw-Hill, 2014*
2	*Gray and Meyer, **"Analysis and Design of Analog Integrated Circuits",** Wiley International, 2009.*
3	*S.Salivahanan and V.S. Kanchana Bhaaskaran, **"Linear Integrated Circuits",** Tata McGraw Hill Publishing company Ltd, 1st Edition, 2009.*
4	*Somanathan Nair, **"Linear Integrated Circuits, Analysis, Design and Applications",** Wiley India Publishers, 1st Edition, 2009*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain DC & AC characteristics and Building blocks of OP AMP.	K2
CO2	Explain Linear, Nonlinear and open loop applications of OP AMP	K2
CO3	Design and construct oscillators and Multi-vibrators.	K3
CO4	Design and analyze active filters and data converters using OP AMP	K3
CO5	Describe the operation & applications of PLL and special function ICs	K2

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO3	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO4	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1
22LPC406	3	2	1	1	-	-	-	-	-	-	-	1	3	-	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1, 4.1.1,4.2.1,4.3.3, 12.1.1,12.2.2
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1, 4.1.1,4.2.1,4.3.3, 12.1.1,12.2.2
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1, 4.1.1,4.2.1,4.3.3, 12.1.1,12.2.2
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1, 4.1.1,4.2.1,4.3.3,12.1.1,12.2.2
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.3.1, 4.1.1,4.2.1,4.3.3,12.1.1,12.2.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20				100
CAT2	40	40	20				100
Assignment 1	20	40	40				100
Assignment 2	20	40	40				100
Quiz 1	20	40	40				100
Quiz 2	20	40	40				100
Other mode of internal assessments, if any							
ESE	40	40	20				100

22LPC407	ANALOG COMMUNICATION	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
1.SIGNALS AND SYSTEMS	PC	3	0	0	3

Course Objectives	To understand the concepts of Analog modulation schemes and to impart knowledge about baseband signal processing techniques.	
UNIT – I	**AMPLITUDE MODULATION SYSTEMS**	**9 Periods**
Need for modulation - Amplitude Modulation –DSBFC, DSBSC, SSB, VSB – Modulation index, Spectra, Power relations and Bandwidth Requirements – AM Generation and detection- DSBSC Generation and detection - SSB Generation and detection - VSB Generation –Hilbert transform, Comparison of AM systems. Block diagram of AM broadcasting transmitters- Low Level and High Level transmitters .		
UNIT – II	**ANGLE MODULATION SYSTEMS**	**9 Periods**
Phase and Frequency Modulation - Single tone, Narrow Band and Wideband FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM Generation: Direct method and Indirect method of FM Generation- Demodulation of FM Signal- Balanced Slope detector - FM Discriminator - PLL as FM Demodulator – Stereo FM- FM Transmitter.		
UNIT – III	**NOISE THEORY**	**9 Periods**
Gaussian Process - Central limit theorem – Noise sources and types – Noise Figure- Noise temperature – Noise in cascaded systems – Representation of Narrow band noise – In-phase and Quadrature components – Envelope and Phase components – Properties of Narrow band noise		
UNIT – IV	**PERFORMANCE OF CW MODULATION SYSTEMS**	**9 Periods**
Super heterodyne Radio receiver and its characteristic; SNR; Noise in DSBSC systems using coherent detection; Noise in AM system using envelope detection- Noise in FM system- Capture effect - FM threshold effect; Pre-emphasis and De-emphasis in FM; Comparison of performances, FDM.		
UNIT – V	**SAMPLING & WAVEFORM CODING**	**9 Periods**
Low pass sampling theorem – Aliasing - Signal Reconstruction-Quantization - Uniform & Non uniform quantization - quantization noise - Pulse Modulation-PAM, PPM, PDM, PCM – Prediction filtering and DPCM - Delta Modulation – Delta Sigma Modulation -ADPCM & ADM principles - Linear Predictive Coding – TDM - Digital Multiplexers.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS

1	*Simon Haykin, **"Communication Systems",**John Wiley & sons, NY, 4th Edition, 2001*
2	*Kennedy G, **"Electronic Communication systems",** Tata McGraw Hill, New Delhi, 2009.*

REFERENCES

1	*B.P.Lathi, **“Modern Digital and Analog Communication Systems”,**3rd Edition, Oxford University Press, 2007.*
2	*Dennis Roddy & John Coolen–**“Electronic Communication” (IV Ed.),** Prentice Hall of India, 2014.*
3	*H P Hsu, Schaum Outline Series - **“Analog and Digital Communications”** TMH 2006.*
4	*Herbert Taub& Donald L Schilling – **“Principles of Communication Systems” (3rd Edition) –** Tata McGraw Hill, 2008.*
5	*J.G.Proakis, M.Salehi, **“Fundamentals of Communication Systems”,** Pearson Education 2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom’s Taxonomy Mapped**
CO1	Apply transforms for signal modulation techniques.	K3
CO2	Develop the architecture of communication system for analog modulation techniques	K3
CO3	Explore the different types of noise sources	K2
CO4	Apply the concepts of random process in the analysis of performance of AM and FM systems	K4
CO5	Discuss the process of sampling, quantization and coding that are fundamentals to the digital transmission of analog signals	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

Cos /POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	1
CO 3	3	1	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 4	3	3	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	1
22LPC407	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1,3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1, 3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4,3.1.4
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.2, ,2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3,2.4.4,3.1.4,3.1.6
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1,2.3.2, 2.4.1, 3.1.1, 3.1.4,3.3.2,3.4.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total 100 %**
CAT1	20	50	30				100
CAT2	20	30	30	20			100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1			50				100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2		50	50				100
ESE	20	40	30	10			100

22LPC408	DIGITAL SIGNAL PROCESSING	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
SIGNALS AND SYSTEMS	PC	3	0	0	3

Course Objectives	To study DFT, digital filter design algorithms, finite word length effects , multi rate signal processing and architecture of Digital signal processor.	
UNIT – I	**DISCRETE FOURIER TRANSFORM**	**9 Periods**
Review of discrete-time signals and systems - DFT and its properties, FFT algorithm-Decimation in Time Algorithm - Decimation in Frequency - Computation of Inverse DFT using FFT and its application to convolution. Sectioned convolution –Overlap add and overlap save methods.		
UNIT – II	**INFINITE IMPULSE RESPONSE DIGITAL FILTERS**	**9 Periods**
Design of analog Butterworth and Chebyshev Filters – Frequency transformation in analog domain -Design of IIR digital filters - Impulse invariance technique, Bilinear transformation – Realization of IIR filters - Direct, cascade and parallel forms.		
UNIT – III	**FINITE IMPULSE RESPONSE DIGITAL FILTERS**	**9 Periods**
Symmetric and Anti-symmetric FIR filters – Linear phase FIR filters – FIR Design using Fourier series method - window method– rectangular, Hamming and Hanning windows – Frequency sampling method – Realization of FIR filters – Linear phase, Traversal structures-comparison of FIR and IIR filters.		
UNIT – IV	**FINITE WORD LENGTH EFFECTS AND MULTI-RATE SIGNAL PROCESSING**	**9 Periods**
Fixed point and floating-point number representations – Comparison – Quantization Error - Quantization Noise Power -Finite word length effects -Signal scaling - Introduction to Multi-rate signal processing-Decimation –Interpolation –multistage implementation- Applications		
UNIT – V	**DIGITAL SIGNAL PROCESSOR**	**9 Periods**
Harvard and modified Harvard architectures - architecture of C6X processors – Features of C67X processor – Internal architecture – CPU – General Purpose register files – Functional Units and operation – data paths – Control registers - Functional Units and instructions – Parallel and pipeline operations – Interrupts		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*John G Proakis and Manolakis, "**Digital Signal Processing Principles, Algorithms and Applications**", Pearson, Fourth Edition, 2007.*
2	*B. Venkataramani, M. Bhaskar, "**Digital Signal Processor Architecture, Programming and Applications**", Second Edition, 2011.*

REFERENCES

1	*Johny R. Johnson, "**Introduction to Digital Signal Processing**", PHI, 2008*
2	*E.C. Ifeachor and B.W. Jervis, "**Digital signal processing – A Practical approach**", Prentice Hall, 2011*
3	*S.K. Mitra, "**Digital Signal Processing, A Computer Based approach**", Tata McGrawHill, 2011 fourth international edition*
4	*Monson H. Hayes, "**Statistical Digital Signal Processing and Modeling**", John Wiley and Sons Inc., New York, 2006.*
5	*RulphChassaing, "**Digital Signal Processing and Applications with the C6713 and C6416DSK**", A JOHN WILEY & SONS, INC., PUBLICATION, 2005*
6	*P. P. Vaidyanathan, "**Multirate Systems and Filter Banks**", Prentice Hall, 1992.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Solve problems using DFT & FFT algorithms	K3
CO2	Design and realize digital IIR filters	K3
CO3	Design and realize digital FIR filters	K3
CO4	Understand finite word length effects and have an exposure to Multirate signal processing and its applications.	K2
CO5	Explain Digital signal Processor families and architecture	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

Cos /POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	1
CO 3	3	1	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 4	3	3	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	1
22LPC408	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1,3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1, 3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4,3.1.4
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.2, ,2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3,2.4.4,3.1.4,3.1.6
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1,2.3.2, 2.4.1, 3.1.1, 3.1.4,3.3.2,3.4.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total00 %**
CAT1	30	40	30				100
CAT2	30	40	30				100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1		50	50				100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2		50	50				100
ESE	30	40	30				100

22LPC409	NETWORKS AND TRANSMISSION LINES	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
CIRCUIT THEORY	PC	3	0	0	3

Course Objectives	• To understand the basic concepts of two port networks, synthesis network and familiarize the concepts of transmission lines	
UNIT – I	**TWO PORT NETWORKS**	**9 Periods**
Two Port Network Parameters: Z, Y, ABCD and Hybrid Parameters – Interconnection of networks: Cascade, Series, Parallel - Symmetrical networks: T and pi equivalent of two port network–characteristic impedance and propagation constant-Asymmetrical networks: Image and Iterative impedances-Image transfer constant and iterative transfer constant		
UNIT – II	**PASSIVE NETWORKS**	**9 Periods**
Constant K filters – m derived filters – Composite filters – Design procedures - Series and shunt equalizer - Symmetrical and asymmetrical attenuators - T and pi sections.		
UNIT – III	**PASSIVE NETWORK SYNTHESIS**	**9 Periods**
Hurwitz polynomials–positive real functions-Driving point function synthesis–LC immittance functions-RC impedance/admittance functions-RL admittance/impedance functions-Foster and Cauerforms of RC,RL and LC networks		
UNIT – IV	**TRANSMISSION LINE THEORY**	**9 Periods**
Line parameters and transmission constants-Transmission line equation-Physical significance of the equation-Infinite line-Input and transfer impedance-Waveform distortion-Distortion less lineLoading-Reflection phenomena-Reflection loss and insertion loss-Skin and proximity effect-T and pi equivalent of transmission lines.		
UNIT – V	**LINE AT RADIO FREQUENCIES**	**9 Periods**
Parameters of open wire line and co-axial line at high frequencies – Standing waves-Standing wave ratio- Input impedance of open and short circuited lines- Relation between VSWR and reflection coefficient-Quarter wave transformer- Single and double stub matching- Smith chart and its applications		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS

1	*Sudhahar.A, ShyammohanS.P, "**Circuits and Networks: Analysis and Synthesis**", Tata McGraw Hill, New Delhi, Fourth Edition,2010.*
2	*John D. Ryder, "**Networks, Lines and Fields**", PHI, 2nd edition, 2009.*

REFERENCES

1	*Umesh Sinha,"**Transmission Lines and Network**", Satya Prakashan Publishing Company, New Delhi,2012.*
2	*S.P. Ghosh and A.K. Chakraborty, "**Network Analysis and Synthesis**", McGraw Hill, 1st edition 2010*
3	*Roy, Choudhury D., "**Networks and Systems,**" New Age International Publishers, 2nd edition reprint , 2014*
4	*M.E. VanValkenburg,"**Network Analysis**, INDIA PEARSON,"3rd edition, 2015*
5	*G.S.N. Raju "**Electromagnetic Field theory and Transmission lines**", Pearson Education, First Edition 2005*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Compute the network parameters and recollect the symmetrical and asymmetrical networks.	K2
CO2	Design the various passive networks.	K3
CO3	Synthesize an electric network using driving point functions.	K3
CO4	Derive the transmission line equation and loading effect.	K3
CO5	Illustrate the line behaviour at radio frequencies and stub matching techniques.	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs /POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11	P O 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO 3	3	1	1	-	-	-	-	-	-	-	-	-	2	1	2
CO 4	3	3	1	-	-	-	-	-	-	-	-	-	2	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	-	-	2	2	2
22LPC409	3	2	2	1	-	-	-	-	-	-	-	-	2	2	2

b) CO and Key Performance Indicators Mapping		
CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1,3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1	
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1, 3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1	
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4,3.1.4	
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.2, ,2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3,2.4.4,3.1.4,3.1.6	
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1,2.3.2, 2.4.1, 3.1.1, 3.1.4,3.3.2,3.4.1	

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total 100 %**
CAT1	30	70					100
CAT2	30	40	30				100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1		70	30				100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2		50	50				100
ESE	30	40	30				100

22LPC410	MICROPROCESSOR AND MICROCONTROLLER	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	2	4

COURSE OBJECTIVES:	This Course deals about the basic 16-bit (8086) processor and an 8-bit (8051) controller, their architecture, internal organization and their functions, interfacing an external device with the processors/controllers.
UNIT I: 8086 PROCESSOR	9 + 6 Periods
Introduction to 8086 - Microprocessor architecture - Addressing modes -Instruction set and assembler directives -Assembly language programming- Modular Programming- Linking and Relocation- Stacks -Procedures -Macros -Interrupts and interrupt service routines - Byte and String Manipulation.	
UNIT II : 8086 BUS STRUCTURE	9 + 6 Periods
8086 signals - Basic configurations - System bus timing -System design using 8086 I/O programming- Introduction to Multiprogramming- System Bus Structure-Multiprocessor configurations-Coprocessor, Closely coupled and loosely Coupled configurations.	
UNIT III: I/O INTERFACING	9 + 6 Periods
Memory Interfacing and I/O interfacing -Parallel communication interface -Serial communication interface - D/A and A/D Interface -Timer- Keyboard /display controller -Interrupt controller-DMA controller -Programming and applications- Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.	
UNIT IV: MICROCONTROLLER	9 + 6 Periods
Architecture of 8051- Special Function Registers(SFRs) - I/O Pins, Ports and Circuits - Instruction set -Addressing modes -Assembly language Programming.	
UNIT V: INTERFACING MICROCONTROLLER	9 + 6 Periods
Programming 8051 Timers -Serial Port Programming -Interrupt Programming -LCD & Keyboard Interfacing- ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.	
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 75 Periods**	

List of Experiments for Lab Component

Intel 8086 (16 bit Micro Processor)

1.Study experiment on various Addressing modes of 8086 Microprocessor.

2.a) Block move.

b) Simple Arithmetic operations.

3.a) Choosing Smallest/ largest number from an array of binary numbers.

b) Sorting of an array of binary numbers.

4.a) Code Conversion (Eg. ASCII to Packed BCD form).

b) Addition of an array of BCD numbers stored in packed form.

5.a) Multiplying two 3x3 matrices.
b) Generation of Prime numbers.
6.Identification & displaying the activated key using DOS & BIOS function calls.

Intel 8051 (8 bit Microcontroller)
7.Detection of key closure (connected to a port line) by polling technique.
8.Delay generation using i) Nested loop ii) Timers.
9.Counting of external event occurrence through port line.
10.LCD interfacing.
11.Generation of different waveforms using DAC (0808).

Text Books:

1.	*Ramesh S. Gaonkar,"**Microprocessor Architecture Programming and Applications with 8085**", Fifth Edition, Penram International Publishing 2010.*
2.	*DoughlasV.Hall, "**Microprocessors and Interfacing, Programming and Hardware**", Tata McGraw Hill,2012.*

Reference Books:

1.	*Sunil Mathur&Jeebananda Panda, "**Microprocessor and Microcontrollers**", PHI Learning Pvt. Ltd, 2016.*
2.	*V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, "**Computer Organisation**", McGraw-Hill Inc, 2002.*
3.	*John P.Hayes, "**Computer architecture and Organisation**", Tata McGraw-Hill Third edition, 1998.*

COURSE OUTCOMES:
Upon completion of the course, the students will have:

COURSE OUTCOMES: On completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Recall and apply the basic concepts of 8086 processor and have obtained an Training in practical knowledge through Laboratory experiments.	K2
CO2	Have gained knowledge about the 8086 Bus structure and have obtained an Training in practical knowledge through Laboratory experiments.	K2
CO3	Have gained knowledge about the I/O Interfacing and have obtained an Training in practical knowledge through Laboratory experiments.	K2
CO4	An ability to demonstrate about the 8051 Microcontroller architecture and have obtained an Training in practical knowledge through Laboratory experiments.	K3
CO5	Have acquired knowledge about the Microcontroller interfacing and have obtained an Training in practical knowledge through Laboratory experiments.	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs /POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	2	2	-	3	1	-	-	-	-	-	-	-	1	-	1
CO 2	1	2	-	3	1	2	-	-	-	-	-	-	-	-	1
CO 3	2	2	-	2	1	-	-	-	-	-	-	-	-	-	1
CO 4	2	2	-	2	1	-	-	-	-	-	-	-	-	-	1
CO 5	2	2	-	2	1	-	-	-	-	-	-	-	-	-	1
22LPC410	2	2	-	3	1	1	-	-	-	-	-	-	1	-	1

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.4.1,2.4.4,4.1.1,4.1.2,4.1.4,5.1.1
CO2	1.1.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.4.1,2.4.2,2.4.4,4.1.1,4.3.1,5.1.1,5.1.2
CO3	1.1.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.3.1,2.4.2,2.4.4,4.3.1,4.3.3
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,4.1.1,4.3.4
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,4.1.1, 4.3.1,4.3.3,4.3.4,5.1.1,5.1.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total 100%
CAT1	30%	70%					100%
CAT2	20%	80%					100%
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30%	70%					100%
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2		70%	30%				100%
ESE		80%	20%				100%

22LES309	ENGINEERING EXPLORATION	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	To provide an introduction to the engineering field for designing the basic modules of useful for everyday life.	
UNIT – I	**INTRODUCTION**	**15 Periods**
Introduction to Engineering and Engineering study: Difference between science and engineeirng, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st centuary engineer and Graduate Attribuites.		
UNIT – II	**ENGINEERING DESIGN**	**15 Periods**
Engineering Requirement, Knowledge within Engineering Disciplines, Engineering advancements, Problem definition, Idea generation through brain storming and researching, solution creation through evaluating and communicating, text/analysis, Engineering Ethics, final solution and design improvement.		
UNIT – III	**ENGINEERING DISCIPLINES**	**15 Periods**
Construction of power supply- Voltage regulators – Implementation of Modulators and Demodulators using discrete components –Implementation of Radio Receiver - Designing of ALU using digital ICs – Design of Single stage operational amplifier.		
Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**		

REFERENCES:

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser: "**Engineering Fundamentals: Design, Principles and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	*Saeed Moaveni, "**Engineering Fundamentals: An Introduction to Engineering**", Cengage learning, Fourth Edition, 2011.*

COURSE OUTCOMES On Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Explain technological and engineering development , change and impacts of engineering	K2
CO2	Complete initial steps (Define a problem list criteria and constraints , Brainstorm potential solutions and document ideas) in engineering designs	K3
CO3	Communicate possible solutions through drawings and prepare project reports.	K3
CO4	Draw sketches to a Design problem.	K3
CO5	Apply the concept of engineering fundamentals in Electronics and Instrumentation Engineering.	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		1	3	1	2		1	2	1	1	1	3		
CO2	2		1	3	1	2		1	2	1	1	1	3		
CO3	2		1	3	1	2		1	2	1	1	1	3		
CO4	2		1	3	1	2		1	2	1	1	1	3		
CO5	2		1	3	1	2		1	2	1	1	1	3		
22NES307	2		1	3	1	2		1	2	1	1	1	3		

b) CO and Key Performance Indicators mapping

CO1	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO2	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO3	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO4	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO5	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1

22LPC411	ANALOG AND DIGITAL IC LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
ANALOG CIRCUITS AND DIGITAL CIRCUITS DESIGN	PC	0	0	3	1.5

COURSE OBJECTIVES

To Design and construct analog circuits using ICs 741,723 and 555 , Digital Circuits using Logic gates, Flip Flops and MSI devices and coding digital circuits using HDL.

ANALOG IC EXPERIMENTS

1. DC and AC Characteristics of OP-AMP
2. Simple Applications of OP-AMP – Inverting and non-inverting Amplifier, Voltage Follower, Adder, Integrator and Differentiator.
3. Design and testing of Oscillators, Comparator and Schmitt Trigger Circuit.
4. Design and Testing of Voltage regulators using IC 723.
5. Design and Testing of Astable and mono-stable Multivibrator using 555 TimerIC.
6. Design and testing of Active Filters.

DIGITAL IC EXPERIMENTS

7. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
8. Design and implementation of Half/Full Adder and Subtractor using Logic Gates.
9. Design and implementation of combinational circuits using MSI devices:
10. (i) 4 – bit binary adder / subtractor(ii) Parity generator / checker (iii) Magnitude Comparator (iv) Application using multiplexers (v) Counters
11. Verification of Flip-Flops
12. Design and Testing of Shift register, synchronous and asynchronous Counters
13. Coding Combinational and Sequential circuits using HDL

Lecture: 0Periods Tutorial:0Periods Practical:45Periods Total:45Periods

REFERENCES

1	*D.RoyChoudhryandShail Jain,* ***"Linear Integrated Circuits",*** *New Age International Pvt. Ltd.,4th Edition 2010*
2	*Ramakant A. Gayakwad,* ***"OP-AMPs and Linear Integrated Circuits",*** *4th Edition, Prentice Hall / Pearson Education, 2015.*
3	*Morris Mano,****"Digital Design****",4th Edition, Pearson Education, 2011*
4	*A.Anand Kumar,* ***"Fundamentals of Digital Circuits",*** *2nd Edition, PHI Learning Pvt. Ltd, NewDelhi,2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Familiarization with characteristics and applications of Op-amp	K2
CO2	Ability to design circuits using IC 723 and IC555 Timer.	K3
CO3	Implement simplified combinational circuits using logic gates	K2
CO4	Design and Implement combinational and sequential circuits	K3
CO5	Implement combinational and sequential logic circuits using HDL	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	2	-	-	-	-	-	-	-	1	3	-	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1	3	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1	3	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1	3	-	1
CO5	3	3	2	2	3	-	-	-	-	-	-	1	3	-	1
22LPC411	3	3	2	2	1	-	-	-	-	-	-	1	3	-	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.2,3.1.6,3.2.2,3.3.1,4.1.1,4.1.4,4.2.1,4.3.3, 12.2.2
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.2,3.1.6,3.2.2,3.3.1, 4.1.1,4.1.4,4.2.1,4.3.3, 12.2.2
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.2,3.1.6,3.2.2,3.3.1, 4.1.1,4.1.4,4.2.1,4.3.3, 12.2.2
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.2,3.1.6,3.2.2,3.3.1, 4.1.1,4.1.4,4.2.1,4.3.3, 12.2.2
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.2,3.1.6,3.2.1,3.2.2,3.3.1, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1 5.1.1,5.1.2,5.2.2,5.3..1,5.3.2 ,12.2.2

22LPC412	DIGITAL SIGNAL PROCESSING LABORATORY	SEMESTER IV

PREREQUISITES:	CATEGORY	L	T	P	C
SIGNALS AND SYSTEMS	PC	0	0	3	1.5

COURSE OBJECTIVES:

- To Develop DSP algorithms for signal processing and test them using Software and implement in Digital Signal Processor.

PRACTICALS	**LIST OF EXPERIMENTS USING SOFTWARE:** 1.Genaretion of basic signals 2. Computation of FFT of a signal- Spectral Analysis 3. Linear and circular convolution 4. Design of FIR filters –windowing technique 5. Design of IIR filters – Butterworth, Chebychev using – Impulse invariance and Bilinear Transform 6. Coefficient and Quantization effects on Direct form and cascade form realization of IIR filter 7.Multirate Signal Processing **USING DIGITAL SIGNAL PROCESSOR** 1. Generation of Basic Signals 2. Implementation of convolution 3. Sampling of input signal and display 4. Computation of FFT 5. Implementation of FIR filter 6. Implementation of IIR filter

Contact Periods:			
Lecture: 0 Periods	**Tutorial: 0 Periods**	**Practical: 45 Periods**	**Total: 45 Periods**

Reference books:

1.	*John G Proakis and Manolakis, "**Digital Signal Processing Principles, Algorithms and Applications**", Pearson, Fourth Edition, 2009.*
2.	*B. Venkataramani, M. Bhaskar, "**Digital Signal Processor Architecture, Programming and Applications**", Second Edition, 2011*

COURSE OUTCOMES Upon completion of the course, the students will able to:		**Bloom's Taxonomy Mapped**
CO1	Apply convolution and FFT concepts in analyzing LTI systems through programming	K3
CO2	Write program to design IIR digital filters.	K3
CO3	Ability to write program to design FIR digital filters.	K3
CO4	Realize coefficient and quantization effects and significance of various sampling rates.	K4
CO5	Familiarization with DSP starter kit programming using simple examples	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

Cos /POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	1
CO 3	3	1	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 4	3	3	1	-	-	-	-	-	-	-	-	-	3	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	1
22LPC412	3	2	2	1	-	-	-	-	-	-	-	-	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1,3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1, 2.4.1, 3.1.1, 3.1.4,3.1.5, 3.3.2, 3.4.1, 4.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4,3.1.4
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.2, ,2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3,2.4.4,3.1.4,3.1.6
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1., 2.1.1,2.1.3, 2.2.4, 2.3.1,2.3.2, 2.4.1, 3.1.1, 3.1.4,3.3.2,3.4.1